6 ERP Systems: Portals, CRM, Procurement, and Supply Chain Management

Opening Vignette: McDonald's $170 Million ERP Fiasco

McDonald's failed ERP implementation led to a $170 million write-off. McDonald was attempting to deliver real-time information to thousands of McDonald stores around the Globe. Some of these stores are in developing countries that lacked the basic network infrastructure. An excerpt from the source article describes the objective of the project:

"In 2001, the fast-food chain conceived a project to create an intranet connecting headquarters with far-flung restaurants that would provide operational information in real time. Under the plan, dubbed Innovate, a manager in the company's headquarters (Oak Brook, Illinois), would know instantly if sales were slowing at a franchise in Orlando, Fl., or if the grill temperature at a London restaurant wasn't hot enough. McDonald's always has been tight lipped about Innovate--the company didn't return calls seeking comment for this story--but there's no doubt about its far-reaching scope. According to a white paper by Mpower, the idea of the consulting firm, which McDonald's hired for early planning and technology procurement, was to create "a global ERP application that will eventually touch every one of McDonald's stores". In other words, about 30,000 restaurants in more than 120 countries."

The key lesson learned from this case is that it is essential to better understand the risks of a major ERP project. An ROI (return on investment) analysis needs to be completed to ensure that the project cost does not exceed the benefits. After McDonald's realized that the entire cost of the project would exceed $1 billion, they decided to end it. The final cost was $170 million.

Another lesson is that efforts should be made to limit the scope of a project. If possible, a phased implementation approach should be utilized.

Source: McDougall, P., "McDonald's $170 million ERP Fiasco", InformationWeek Oct. 2006, URL: http://www.informationweek.com/story/showArticle.jhtml?articleID=193302693

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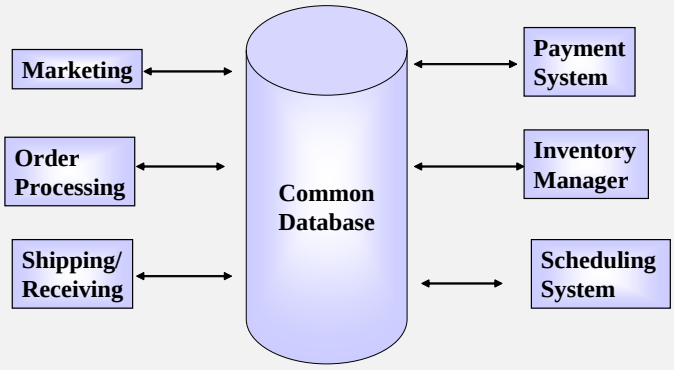
6.1 Introduction

Enterprise application architectures, introduced in the previous chapter, show the enterprise applications and how they are interconnected with each other. Enterprise resource planning (ERP) systems, the focus of this chapter, provide a collection of applications that are integrated around a common database. Thus, instead of using different applications from different vendors and then integrating them, companies can buy pre-integrated ERP systems that meet enterprise needs. Examples of ERP systems, discussed in this chapter, are enterprise portals, customer relationship management (CRM), online purchasing, electronic marketplaces and trading hubs, and supply chain management. Our objective is not to discuss detailed technologies, but to examine the ERP systems as the key enablers of the enterprise application and business architectures. Toward this goal, we will take a second look at several topics that were introduced in the previous chapter.

Chapter Highlights

- An ERP system is not one application but a family of applications that are integrated around commonly shared databases as shown in the following figure.
- Supply chain management and CRM are getting most attention in modern enterprises, because they are partner facing (B2B) and customer facing (C2B).
- ERP systems are used for online purchasing, warehousing and inventory management, human resources, and finance and accounting.
- There is a great deal of activity in B2B trade because of changing business partnerships and mergers and acquisitions.
- Modern ERPs are increasingly becoming mobile and smart.



Generic Architecture for ERP Systems

6.2 XYZCorp Case Study: Embarking on Enterprise Resource Planning

XYZCorp needs to identify the enterprise resource planning (ERP) systems, also known *as enterprise sysems*, that will support its business strategies and business architecture. XYZCorp has embarked on a major initiative to compete in the marketplace by cutting down the production time by 30% and reducing customer churn by 100%. To support this and other initiatives, you have been asked to identify between 10 to 20 ERP systems (new as well as existing) that will be critical to the corporation. You need to identify why these systems will be needed, and how they will be linked together to achieve corporate goals. Specifically, the company wants to know answers to the following questions:

- Can an online purchasing system be used for XYZCorp?
- Can an enterprise portal be developed that can be used by internal as well as external users?
- Can the portal be used for customer relationship management? Why or why not?
- Is there a need to develop large scale mobile applications? Why or why not?
- What needs to be done to improve the current supply chain?
- Will emarkets be of any value to the company? Why or why not?
- What can be outsourced and why? Can you suggest a decision table or decision tree that can be used to make the outsourcing decisions?
- How can ERP systems fit into an enterprise application architecture for XYZCorp?

The Agenda
- ERPs, Portals and CRM
- Supply Chain Management
- ePurchasing and eMarkets
- Corporate & Backoffice Systems

6.3 Enterprise Resource Planning (ERP) Systems: A Second Look

6.3.1 Overview

ERP applications support back-office operational requirements including inventory, supply chain management, order processing, and financial reporting and management. ERP applications are a key source of functionality and information for any enterprise and are playing a major role in Internet-based procurement, supply chain management, and business-to-business (B2B) commerce.

Before proceeding, we should emphasize that ERP is not one application. Instead, ERP is used to represent a family of applications that are used to support enterprise operations. These applications are integrated around commonly shared databases.

The basic idea of ERP systems is that they provide an integrated approach to manage and operate enterprise resources such as employees, materials, and services. Traditionally, enterprise resources have been managed by a multitude of independent applications in human resources, payrolls, order

processings, inventory controls, billings, and accounts payable/receivable systems. In some cases, companies have hundreds of applications that manage enterprise resources. For example, GTE (General Telephone & Electronics) is said to have about 1100 business applications. ERP systems provide a single application framework that integrates these applications together. Examples of ERP applications are SAP, Microsoft Dynamics, and Oracle Applications. See [Bradford 2015], and [Magal and Word 2011] for an extensive coverage of this topic.

Although ERPs became popular in the 1990s, they have existed in principle since the 1970s. An example from manufacturing best illustrates the evolution of ERPs. The focus of manufacturing systems in the 1960s was on inventory control. Most of the software packages then (usually customized) were designed to handle inventory based on traditional inventory concepts. In the 1970s, the focus shifted to MRP (Material Requirement Planning) systems which tied inventories to materials planning (i.e., the material suppliers were connected to the inventory systems to keep inventories at acceptable levels). In the 1980s, the concept of MRP-II (Manufacturing Resources Planning) evolved which extended MRP to shop floor and distribution management activities (i.e., the inventories were also connected to shop floor systems and distribution channels to take advantage of quantity discounts and fulfill just-in-time inventories). In the early 1990s, MRP-II was further extended to cover areas like Engineering, Finance, Human Resources, Projects Management, etc., in other words , the complete gamut of activities associated with all enterprise resources. Hence, the term ERP (Enterprise Resource Planning) was coined.

ERPs are playing an important role in the modern digital enterprises, especially as players in a supply chain of trading partners. For example, the ERP of a manufacturer must interact, directly or indirectly, with the ERP systems of material suppliers and distributors in a supply chain. The sidebar ”Strategic Supply-Chain Planning – Some Thoughts” emphasizes that the strategic direction of the company and the supply chain implementation are in alignment. Extensive discussion of ERPs is beyond the scope of this book. Key features are highlighted for the sake of completeness.

ERP systems are large and expensive systems that offer several benefits. First of all, they are pre-integrated around a common databases, thus a user does not have to go through integration hassles. Second, they are well documented and supported by vendors. However, ERP systems are difficult to manage, learn and maintain. Several case studies on advantages and disadvantages of ERP systems have been published, as discussed in the next section.

Strategic Supply-Chain Planning – Some Thoughts

Many companies with global supply chains use different flavors of strategic supply-chain planning approaches. [Sodhi 2003] suggests an approach that combines business-strategy formulation with tactical supply-chain planning. The main idea is to ensure that the strategic direction of the company and the supply chain implementation are in alignment. The need for early communication between senior business managers and supply-chain planners is stressed so that senior managers can formulate strategy to maximize shareholder value and supply-chain planners can run optimization models to minimize total supply-chain costs. This is of great value to large retail stores such as Walmart that succeed primarily based on their supply-chain model.

Source: Sodhi, M., “How To Do Strategic Supply-Chain Planning”, Sloan Management Review, Oct 14, 2003.

6.3.2 Case Study Snippets: ERP Success and Failure Stories

ERPs appeared in the marketplace in the early 1990s. Since then, many success stories as well as failures have been noted. It seems that the proportion of successful, versus failed outcomes are about fifty-fifty. Here are short examples of successes as well as failures. The reader is asked to keep the following in mind:

- Large repositories of ERP case studies are being made available by ERP vendors and ERP consulting firms. Vendor and consultant bias must be kept in mind while reviewing the case studies
- The ERPs were introduced and became popular in the 1990s and most of the experience and knowledge gained about ERPs was published in the early 2000s. Thus most of this knowledge appears to be dated at the time of this writing.

6.3.2.1 Cadbury ERP Implementation -- Success

Cadbury is more than a 100+ year-old confectioner currently owned by American snack foods conglomerate Modelez International. The company was growing fast and was facing problems meeting its production and distribution requirements. SAP was engaged to resolve these concerns and introduced significant improvements throughout its supply-chain. SAP also revamped existing warehouse, and distribution processes.

ERP implementation at Cadbury reduced overall operating costs and produced significantly better production efficiencies throughout its manufacturing chain. This ERP implementation had a major positive impact on Cadbury's business success.

6.3.2.2 Hershey's ERP Implementation -- Failure

Hershey is almost a 150 year-old confectioner, headquartered in Hershey Pennsylvania. In the late 1990s, Hershey embarked on a major upgrade of its multiple legacy systems into an integrated environment. The huge upgrade involved three major ERP systems: SAP's R/3, Manugistic's supply chain, and Siebel's CRM.

Many companies approach business challenges of this magnitude based on a well controlled iterative approach. However, Hershey decided to execute a holistic plan, involving every operating center in the company. Hershey also allocated 30 months for the conversion, despite the recommended 48 months. The main motivation was to have the new system operational in late 1999, for Y2K (year 2000) considerations.

Management problems emerged immediately. There was complete chaos, where the company was unable to conduct business, because virtually every process, policy, and operating mechanism was in flux simultaneously. Another major problem with this plan was that it coincided with Hershey's biggest sales events (Halloween and Christmas). To meet the schedule, many shortcuts were made that resulted in a major disaster during Hallowween and Christmas – Hershey could not handle $100 million worth of orders for candies even though it had the inventory to handle the orders.

The consequent result was the loss of $150 million in revenue, a 19% reduction in share price, and the loss of 12% in international market share. This is considered a classic case study in failures. The main lesson is that poor management can ruin implementation, even when the selected system is perfect.

6.3.2.3 Nestle ERP Implementation – Success

Nestle is a large international candy-maker, headquartered in Konicki Switzerland. Nestle wanted to integrate ERPs across all three of its operating companies; Nestle Switzerland, Nestle UK, and Nestle USA. The goal of complete integration was set in the late 90s, but the company delayed the initaition for several years to establish requirements and address organizational and policy issues.

Nestle management finally decided to launch a holistic approach to determine its business requirements around 2000. These requirements drove SAP to get the $200 million job done successfully on time. Specific positive business impacts included the consolidation of an outdated accounting structure, better and more efficient communications throughout its supply-chain, and a well trained workforce. Basically upfront effort of establishing requirements paid off in the long run.

6.3.2.4 4. Pacific Gas and Electric - Failure

Pacific Gas and Electric is a major energy provider in San Francisco. It launched an Oracle ERP implementation that appeared to have gone well. However, the system was not tested well.

The problem was that a manager had chosen a live information database for pre-launch testing that had sensitive information. This sensitive company information was exposed to testers who were not authorized to look at this sensitive company information. This resulted in loss of public confidence in the company's brand and created costly rework and an overall unpleasant situation. The main lesson is to brief the staff on exactly what they should do and not do.

6.3.2.5 Garrett Engine Boosting Systems -- Success

Garrett Aerospace Engine Boosting Systems (GABS) is a mid-size division of Honeywell, an industrial conglomerate, based in Torrance, CA. GABS provides a large number of complex products and services to support the aviation industry. To address its evolving complexity, GABS recognized that the older fragmented systems technology would be incapable of growing to meet the customers' demands.

Basically, the GABS employees could not effectively coordinate with the 350 suppliers to ensure timely delivery of the 90,000 components used in the factories. GABS developed and introduced a new supply chain management system by cooperating with ERP suppliers. The system provided GABS and its suppliers with standardized web based systems management procurement. By using this system GABS has increased the speed of business exponentially, decreased costs, and mitigated communication errors. Changes that would have taken several days and required an overnight delivery service before, now take seconds online.

6.3.2.6 Owens-Corning Struggles with ERP -- Failure

Owens-Corning, a Toledo, Ohio company, produces and sells building materials such as insulation, siding, and roofing. To help the company growing, the company decided to acquire other companies and embarked on a global enterprise model to coordinate the activities of all of its units in many different countries. Owens-Corning had been divided along product lines, with each unit as a distinct entity and its own information systems. The company had more than 200 isolated systems that supported different product lines. The customers had to place separate telephone calls for each product ordered–one each for roofing, siding, and insulation. The company management believed that these problems could be solved by implementing an enterprise system and chose the ERP software from SAP AG to integrate and overhaul the company operations on a global basis.

The cost to install the ERP system exceeded $100 million and took several years to complete due to several problems. First, a team transferred legacy data into the SAP system over a weekend and went live with the new system on Monday morning. This caused numerous logistical problems. Second, the new system changed the roles, responsibilities, and procedures that impacted many people. Owens-Corning employees were neither prepared nor trained for all the changes -- this resulted in numerous errors. An ironic advantage of isolated systems is that mistakes only affect one or two isolated systems. In a highly integrated system such as an ERP system, if you wrongly update one copy of data, it may cause all systems that rely on this data to crash.

The errors and slow response resulted in a sharp decline of customer service. Many customers were unhappy and some took their business elsewhere. The company had to devote a great deal of time to rebuild relations with its customers. To address the system problems and minimize errors, the company instituted a new training program that all employees had to pass before using the system. About 20 percent of the employees never passed the test and had to change jobs. This massive job shifting caused organizational disruption and incurred additional expenses.

Note: A more detailed analysis of this case study is given in a Section 6.12.

6.3.2.7 Jinan Steel Uses Integrated ERP Solution - Success

Jinan steel is one of the largest steel producers in China. In 2003 the company implemented a new enterprise wide ERP system to better compete in the marketplace. In particualr, Jinan had to keep down its costs and improve its efficiency and agility. In addition, the company management was unable to develop a coherent picture of operation from existing separate IT systems.

In 2004 Jinan implemented a new Oracle Integrated ERP solution to increase manufacturing efficiency, reduce workload on the procurement department by 60 %, and achieve a coherent view of productions, logistics and financial data.

This unified view allowed Jinan to be more agile in responding to new and changing demands of its marketplace. It also fully integrated its supply chain; thus, improving quality and cost.

6.3.2.8 Force.com Drives Business Improvements at NJ TRANSIT -- Success

NJ (New Jersey) Transit operates all New Jersey trains and buses. With a passenger load of over 250 million annually, it is one of the largest and most demanding transit operations in the world. However, NJ Transit was experiencing problems in its service and support. Workflow needed to be improved and correspondence needed to be managed.

To solve these issues NJ Transit elected to implement an ERP solutions from Sales Force. The implementation was a success. As the result, NJ Transit support staff was able to handle a 500% increase in inquires. In 2006, NJ Transit was able to address 42,000 inquiries compared to only 8,000 in 2004. At the same time the response time dropped by 35% and a better visibility into wider consumer concerns was realized.

Sources:

- Carlton, R., "Four ERP implementation case studies you can learn from", 2nd August 2017. URL: https://www.erpfocus.com/erp-implementation-case-studies.html
- Garrett Website (https://garrett.honeywell.com/), visited Jan17, 2018
- Jinan Site: http://www.oracle.com/customers/snapshots/jinan-steel-ebs-case-study.pdf
- NJ Transit Sitehttp://www.salesforce.com/assets/pdf/casestudies/pdf_cs_njtransit.pdf

- Hershey Implementation Case Study Link: http://www.pemeco.com/wp-content/uploads/2013/09/Hershey_ERP_Case_Study.pdf

6.3.3 Categories of ERP Systems

ERP systems can be categorized in terms of the enterprise resources they manage. The core ERPs manage the core resources that are common to all organizations. Examples of these resources are people, costs, and assets (e.g., finished goods and raw materials, etc.). Several ERP systems are designed to manage these resources. The familiar business process shown in figure 6-1 can be used to quickly identify different types of ERP systems in an organization. For example, starting with customer services and going clockwise:

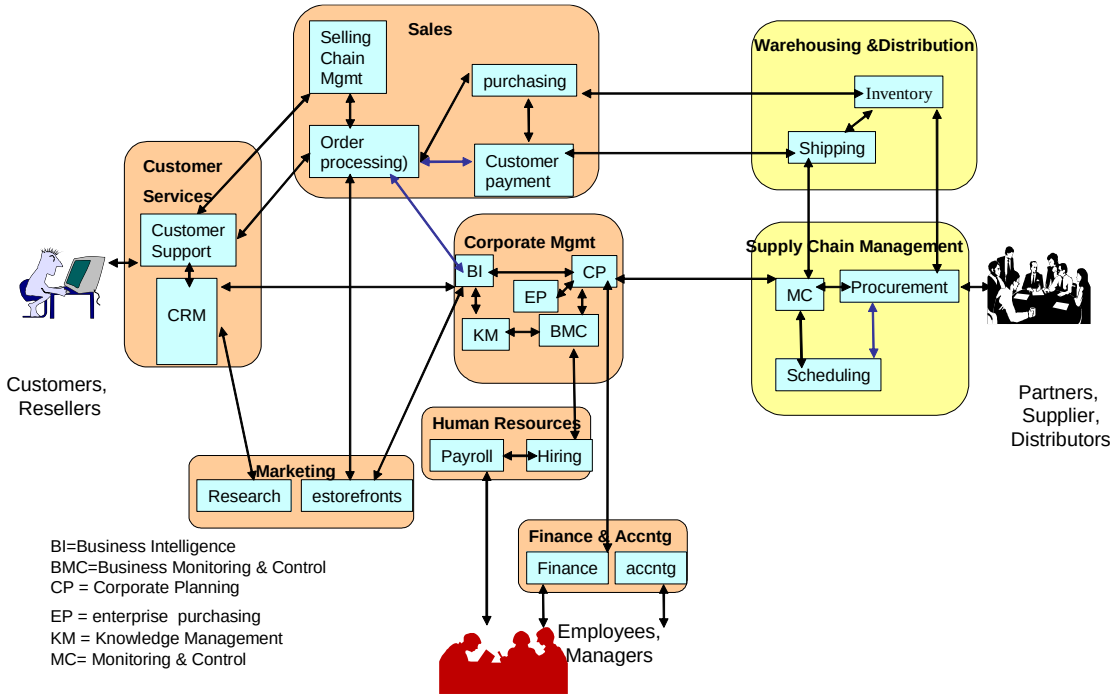


Figure 6-1: Conceptual View of ERP Systems

- Customer Relationship Management(CRM) system concentrates on managing customer resources. At the core of a CRM is a customer database that supports multiple customer related applications (e.g., sales activities, rewards programs, complaints filed, etc.).
- Sales/Purchasing system is concerned with the items/services that are sold to the customers. At the core of this system is an item database that supports multiple sales related applications.
- Supply Chain Management (SCM) system focusses on the items that are provided by the suppliers. At the core of a SCM system is a supplier/item database that supports multiple supplier related applications (e.g., discounts offered by suppliers).
- Human Resource (HR) Management system is concerned with the human resources of the enterprise. At the core of an HR system is an employee database that supports multiple employee related applications (e.g., fringe benefits, vacations).
- Finance and Accounting System concentrates on the financial resources needed by the enterprise. At the core of such a system is a financial database that supports multiple applications such as accounts payable and receivable.

- Corporate Management system manages the corporate resources (primarily knowledge) of the enterprise. At the core of a corporate management system is a "knowledge database" that supports multiple knowledge processing and business intelligence applications.

In addition to the common ERP systems mentioned above, several vertical ERPs are also available for different sectors such as health, education, and manufacturing. For example, healthcare ERPs manage patient information and consist of Electronic Health Records (EHRs) that support patient related applications such as admissions, clinical services, and health insurance systems. Similarly, Student Admission and Registration Systems abound in education, while Materials Requirement Planning (MRP) Systems are common in manufacturing.

In general, the current trend in ERPs is to manage *all* enterprise resources that include the core, vertical, and service resources in an integrated manner.

6.3.4 Requirements and Evaluation of ERP Systems

A seamless integration across a multitude of applications that participate in an "ERP supply chain" is essential to provide visibility and consistency across the enterprise. This is the main reason why ERP systems were early adopters of client/server and distributed architecture technologies. In fact the major reason for the success of SAP, a major ERP vendor, is that it consolidated multiple applications aeound a common database.

The efficiency of an enterprise depends on the quick flow of information across the complete supply chain, i.e., from the customers to manufacturers and suppliers. This place demands the ERP system to have rich functionality across all areas like planning, engineering, production, inventory management, marketing, purchasing, accounts receivable/payable, quality management, distribution planning and external transportation. EDI (Electronic Data Interchange) has been an important tool in speeding up communications with trading partners. ERP systems should be supported/augmented by a strong EIS (Enterprise Information System) with extensive drill down capabilities for the top management to get a high level view of the their organization, and help them analyze performance in key areas.

ERP systems are large scale expensive software packages. At present, many companies provide ERP as an Application Service Provider (ASP) so that the customers do not have to purchase and install their own ERPs. If you have to choose your own ERP, the following important points should be kept in mind while evaluating ERP software:

- Fitting in and being consistent with the company's business processes
- Degree of integration between the various components of the ERP system
- Technology such as the use of Web for user access, object-orientation for re-use, and XML for information exchange
- Security support for privacy and integrity of information
- Ability to support multi-site planning and control
- Availability of regular upgrades
- Amount of customization required
- Flexibility and scalability
- User friendliness to hide the internal complexity
- Quick implementation; shortened Return on Investment (ROI) period
- Local support infrastructure
- Availability of reference sites

- Total costs, including cost of license, training, implementation, maintenance, customization, and hardware requirements

After selection of the right ERP system, the ERP system needs to be installed, maintained, and managed. The success of an ERP solution depends on how quickly the benefits can be reaped from it. This necessitates rapid implementations which lead to shortened ROI periods.

6.3.5 Trends in ERP Systems

ERP systems have gone through several "face lifts" and have enhanced their products to become "Internet Enabled" so that customers worldwide can have direct access to the supplier's ERP system. ERP systems are also embedding the workflow management functionally to provide a mechanism to manage and control the flow of work by monitoring logistic aspects like workload, capacity, throughput times, work queue lengths, and processing times.

A major trend in ERPs is the use of *mobile apps* and *AI (Artificial Intelligence)* to leverage the common ERP databases. The common database, typically located on a large server in the cloud, supports multiple mobile and desktop apps to serve the enterprise needs. For example, in healthcare, a common EHR database supports multiple mobile apps used by doctors as well as patients. In addition, ERP systems are adopting the component-based technology, especially based on Web Services. Thus, various applications in an ERP system are reusable components that can be replaced by other components. In addition, many ERP systems are becoming "*smart*", i.e., they contain extensive knowledge about the customer, the suppliers and the employees. Smart ERPs utilize this knowledge to detect any problems and/or opportunities, adjust accordingly, and learn to do it better in the next round. AI techniques are used heavily in smart ERPs.

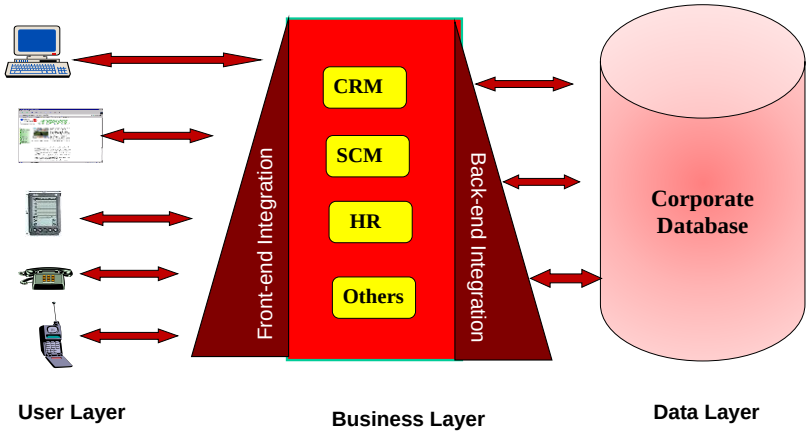


Figure 6-2: Architectural View of ERP Systems – The Trend

A conceptual architectural view of the evolving ERPs in terms of the typical layers (user presentation, business logic, and data) is presented in Figure 6-2. According to this architecture, the front-end of ERP systems must be able to handle a multitude of users and mobile devices while the back-end must be able to communicate with the corporate database that may consist of multiple physical databases, including Big Data. The middle layer provides the content aggregation multiple ERP systems such as CRM, SCM and the likes. This layer should be component-based (i.e., modular) so that new functionalities can be added/removed easily. The front-end integration layer is responsible for handling many different user devices including speech recognition and Internet of Things systems

and also routing users to most appropriate ERP system. The back-end integration layer is responsible for accessing many different user devices, including Big Data and Micro Data sosurces from IOTs, and also routing the ERP apps to apropriate data sources. Both integration are presented as "cones" to capture the idea that some integrations and routings are simple (thin) while others are more complex (thick).

ERP References

- Bradford, Marianne, "Modern ERP: Select, Implement, and Use Today's Advanced Business Systems", 2015.
- Davenport, Thomas H. "Putting the Enterprise into the Enterprise System", Harvard Business Review, July-August 1998.
- Magal, Simha and Jeffrey Word, " Integrated Business Processes with ERP Systems", 2011.
- Pienaar, Abré and Johan du Toit, "Thinking about ERP: The Executive`s guide to setting strategy for selecting, implementing and operating ERP", 2015.
- ERP Outsourcing Forum (http://www.outsourcing-erp.com).
- www.sap.com - SAP Web site with many white papers and tutorials on SAP and ERP.
- www.microsoft.com – Microsoft Web site with information on Microsoft Dynamics – Microsoft ERP Suite
- www.baan.com - BAAN Web site with links to many sources of information.

6.4 Portals: From Web Sites to View Integration

6.4.1 Overview

Simply stated, a portal is a Web site that serves as a doorway to a specific topic - ranging from space programs to gardening. Specifically, portals are intermediaries that offer an aggregated set of services for a well-defined (we hope!) set of users. Portals are reasonably popular in modern enterprises (they were more popular circa 1999). The oldest and perhaps still the best known portals are the Web search engines such as Yahoo and Lycos that allow users to search the Web sites for information. Over the years, the portals have evolved into Web sites that offer, in addition to Web searches, a broad array of resources such as Emails, forums, online shopping malls, and personalization tools. Advanced portals combine Web documents, databases, applications, visualization tools, search engines, integration technologies, speech recognitions, and natural language processing to give users an integrated view.

A portal includes a set of integrated programs designed to make it easier for a user to find information and, if needed, to conduct business or personal interest activities (e.g., shopping, setting up meetings, chatting). Typically, these programs offer at least the following core features (see Figure 6-3):

- Web searching and Web advertising (e.g., home pages, banner ads, etc.)
- News about the topic of your interest
- Reference tools and specialized assistants (wizards) to help with your chores (e.g., scheduling meetings, calendaring, video conferencing)
- Access to online shopping venues and, if needed, to back-end systems and services

- Some communication capabilities such as email and chat rooms, etc.

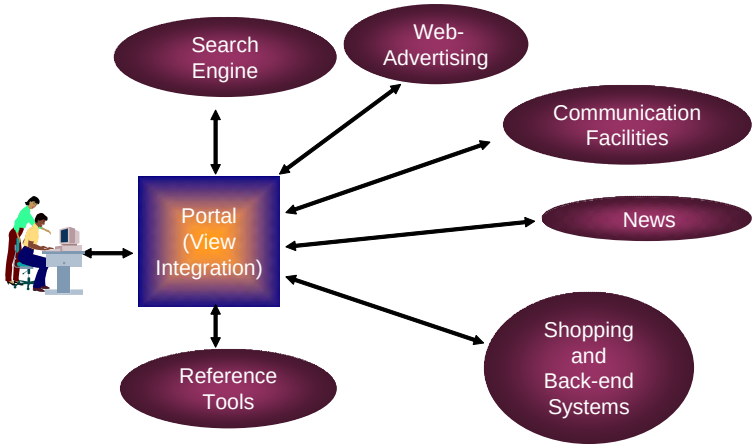


Figure 6-3: Conceptual View of Portals

The purpose of all these integrated programs is to provide convenience and a sense of community to the user, and to help make the user feel more comfortable about using the portal for the purpose of beginning his/her journey. So in this sense the portal is offering a valuable time-saving service. Of course, the purpose of the portal builder is to make sure that you conduct *all* of your activities by using the portal, thus capturing your "behavior" that could later be used for marketing. By offering visitors a portal to a specific topic, the portal vendor can control the results the user gets when he/she searches for a keyword.

6.4.2 Classes of Portals

Portals can be, as shown in Table 6-1, Internet-based or enterprise-based. Internet portals provide uniform access to the information on the Internet, while enterprise portals provide a similar uniform access to the information systems and processes of an enterprise. In addition, portals can be directed to horizontal or vertical markets. Due to our emphasis on digital enterprise, the enterprise portals are of particular interest to us. These portals are usually aimed at employee productivity and can be designed for employees and contractors, customers, or trading partners. An example of enterprise portals for trading partners is the GM and Commerce One Alliance that ties together more than 1000 partners. Let us review these portals in a little more detail.

Table 6-1: Taxonomy of Portals (Source: Gartner)

	Horizontal	Vertical
Internet-based	Eyeball aggregators such as Yahoo (first such portal) and many others	"Vortals" such as eBay, AliBaba, E-LOAN, E*TRADE, etc.
Enterprise-based	Horizontal Enterprise Portals such as UNPAN.org (a United Nations Portal for governments)	Enterprise Portals such as Space.com, WebMD, and VerticalNet

Eyeball Aggregators (HorizontalPortals). These portals are Internet Portals that provide horizontal aggregated services. Known as eyeball aggregators or "Mega/Super Portals", these portals originated as the Internet search and navigation tools. Examples of these portals are Google, Yahoo, and Infoseek. Initially, the Internet Portals provided a "window" from which users could find and view desired content. However, they have evolved into powerful sites that offer a wide array of online resources and services such as personalization services, communities of interest, free emails and chat rooms, and direct access to specialized functions, such as shopping networks, auctions, and online trading sites. The Internet portals are becoming MegaPortals due to consolidation.

Vertical Portals. Vertical Portals, also known as "Vortals", focus on a specific industry or community. and are the dominant segment of Internet Portals. Vortals provide the same core functionality as Internet Portals, but are targeted to a specific industry or niche:

- aggregation of relevant content
- links to related industry, supplier and even competitor sites
- community and collaboration capabilities
- e-commerce services for products and services relevant to the industry

Examples of vertical portals include webmd.com in healthcare, telezoo.com in the area of telecommunications, cnet.com for computer-related technologies, and many others. In addition, vortals such as eBay and E*TRADE are popular for auctions and trades.

Enterprise Portals. Enterprise Portals, also known as corporate or transaction portals, provide a door into an enterprise's information, applications, and processes. Enterprise Portals personalize and aggregate the corporate computing resources primarily for its employees. In some cases, enterprise portals are built for the customers and partners. The focus of enterprise portals is on improving the productivity of its employees, thus they provide work related aids that may include conducting business transactions. Typical enterprise portals provide a personalized view, based on the role of the employee, of the following services:

- access to applications and transactions needed by the employee to conduct work
- information retrieval tools
- PC desktop services
- communication services such as email, instant messaging, voice over IP

For example, an enterprise portal for financial analysts may provide facilities for stock analysis, trading, and settlements, in addition to the email, fax, news, calendaring, and video conferencing services. Enterprise Portals can provide integrated applications access, information management and knowledge management within enterprises as well as between enterprises and their partners, suppliers, and customers. At the time of this writing, enterprise portals commonly integrate enterprise resource planning (ERP) systems, such as SAP and PeopleSoft, through mobile devices. These portals are also providing support for mission-critical operations. This includes support for application integration, process and workflow management, and aggregation of resources (information, applications, services, communities) relevant to the context or task being performed.

6.4.3 Example: A Knowledge Portal for Small to Medium Businesses (SMBs)

GEZA (Global Enterprenuership Zone for All) is a United Nations sanctioned knowledge portal for training and consultation of SMBs in developing and developed countries. This is important because helping SMBs to succeed is crucial to the economic growth of developing countries. However, just making IT available to SMBs is not enough --- they need to know how to use it effectively. In

addition, most SMBs (in developed as well as developing countries) do not know how to use IT effectively (e.g., how to start a business on the Internet, how to do ecommerce, how to develop IT plans, etc.), and high quality consulting services are not readily available to SMBs.

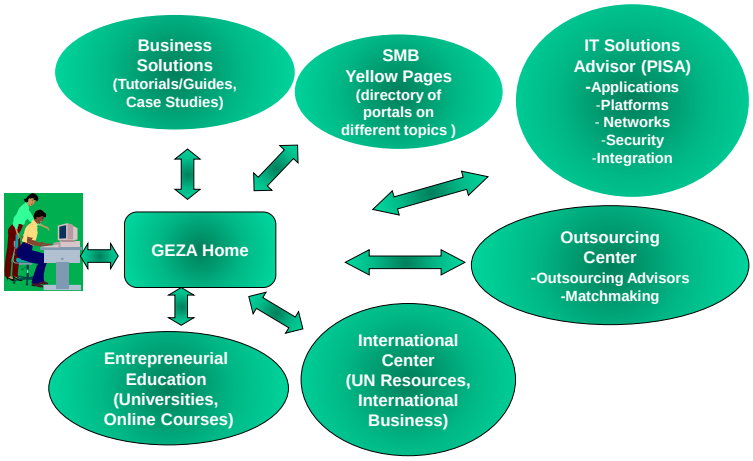


Figure 6-4: GEZA Conceptual Model

GEZA, conceptually shown in figure 6-4, concentrates on entrepreneurship issues for developing countries with main attention to SMBs and provides the following set of services:

- Knowledge Services: business news, case studies, and guidelines on how to do business over the Internet, how to get funding, etc.
- SMB Yellow Pages: a comprehensive directory of SMB Portals that contain extensive information on different aspects of starting, running, and managing a business.
- IT Solutions: an innovative computer aided consulting tool for IT Planning, Integration, Security, and Administration - PISA (see [2]).
- Outsourcing Center: allows SMBs to advertise their services, provides matchmaking for buyers and sellers, and advise for outsourcing.

The GEZA portal is designed and developed by NGE Solutions and is available at www.ngegeza.com.

Case Study: Can an Enterprise Portal Change Culture of an Enterprise

Enterprise Portals, as stated previously, personalize and aggregate the corporate computing resources primarily for its employees, customers, and partners. The portal provides different views for different roles of different users. For example, MyHU is an enterprise portal that supports the students, faculty, and administration of Harrisburg University. Basically, enterprise portals provide an integrated view of all enterprise systems. This is known as view integration, i.e., present a single view even if the back-end systems are very diverse, reside on different platforms, and use different technologies. In most cases, the Web browser serves as a view integrator that seamlessly invokes back-end applications and databases.

Besides integrating different types of knowledge, enterprise portals can somewhat change the culture of some organizations. Consider, for example, XXXCorp (an imaginary organization based on a real organization) that acquired many companies around the globe. However, the acquired companies were ignoring the corporate culture of the parent organization, ignoring all corporate announcements, and

continuing their work as usual. The corporate portal was not being used at all. A small task force emabraked on a Portal Project to change everything by taking the following steps:

- First task was to make all weekly time sheets available through the Portal. Thus, all employees of all companies *had to* use the Portal once a week.
- The employee benefits information was then moved to the Portal so that all employees had to use the Portal for that purpose.
- The job openings were then moved to the Portal, thus increasing the traffic further.

Consequently, the traffic to the Portal was increased gradually and systematically. A major advantage was that when an employee of XXXCorp travelled overseas and visited multiple "owned" companies, the same view of corporate services could be seen by all through the Portal. This tremendously improved collaborations between the companies and gradually changed the culture of XXXCorp to a highly collaborative company.

Note: XXXCorp example is based on firsthand experience of the author.

6.5 Customer Relationship Management (CRM) Systems: Keeping Customer in the Forefront

6.5.1 What is Customer Relationship Management?

Simply stated, *Customer Relationship Management (CRM*) is "a management approach that enables organizations to identify, attract and increase retention of profitable customers, by managing relationships with them" (Source: "CRM Strategies", Ovum Report, 1999). CRM systems are an outgrowth of the traditional customer care systems that concentrate on customer loyalty through improved service and communication. The average firm loses 10% of its customers each year due to poor service, and sales personnel can spend up to 40% of their time coordinating and managing major account interactions -- stealing time from revenue-generating activities. As products and services become harder and harder to differentiate, CRMs have become a source of revenue, profitability, and value. A study conducted by Andersen Consulting in the Telecom industry found a direct link between CRM improvement and financial improvement of surveyed companies – CRM performance accounts for 50% of the companies' return on sales. The sidebar "How Important is Customer Retention? " lists some of the regularly quoted numbers about the importance of customer retention. Even if you do not believe all these numbers, the overall message is quite clear.

Figure 6-5 shows a conceptual view of the main features of a CRM system:

- Customer information – the focus of the CRM system
- Marketing activities that represent the contacts, marketing campaign data, market analysis, etc.
- Sales activities and results such as web sales, telephone sales, store sales, etc.
- Service activities such as trouble tickets and complaints, items returned, call center data, self data.

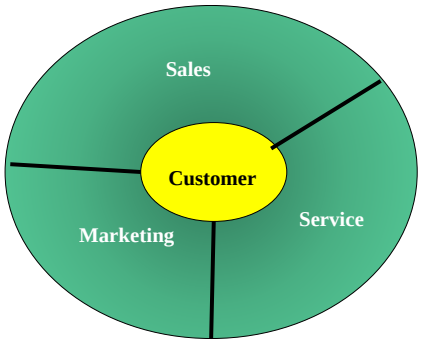


Figure 6-5: High Level Conceptual View of CRM

Over the years, CRM has evolved into a collection of methodologies, software, and Internet capabilities that help an enterprise manage customer relationships in an organized way. CRM applications, often used in combination with call centers, data warehousing, and E-commerce applications, allow companies to gather and access information about customers' buying histories, preferences, complaints, and other data so they can better anticipate what customers want and need. Due to these reasons, ***data mining and Big Data*** have become a cornerstone of CRMs. The main idea is to analyze the customer data to discover desirable as well as undesirable behaviors, symptoms, and trends. A great deal of work on business analytics and data mining for CRM is being done at present (see, for example, "Building Data Mining Applications for CRM" by Alex Berson, and the Knowledge and Data Discovery Conference proceedings). We will review data mining later.

CRMs typically consist of a database of customers with sufficient details that can be used by management, marketing, and work force (technicians, service representatives) to:

- Assess customer satisfaction/dissatisfaction and match customer needs with product plans and offerings.
- Determine what products a customer had purchased to identify best customers, develop effective marketing campaigns, and generate quality leads for the sales team.
- Improve telesales and streamline existing processes (for example, taking orders using mobile devices).
- Form individualized relationships with customers and identify the most profitable customers for highest level of service.
- Provide employees with the information and processes necessary to know their customers and understand their needs.

CRMs must meet the needs of modern customers who access the company through emails, call centers, faxes and Web sites. These customers demand immediate response and a personalized touch. Meeting their needs places new demands on the enterprise. Since traditional enterprise resource planning applications did not include a customer management aspect, CRM was the next logical step.

The current focus on keeping customers coming back is much more intense than the customer satisfaction efforts of the past. The customer satisfaction initiatives often ended with a common means of *measuring* customer satisfaction -- not necessarily means of *improving* customer satisfaction. CRM is also broader than the age-old principle that “the customer is always right”. Instead, CRM assumes that not all customers are always right -- it helps you to identify the classes of customers that need different levels of attention. In other words, CRM concentrates on providing optimal value to “optimal” customers. It is obvious that the customers make buying decisions based on more than just price – their buying decisions are based on their experience that includes product

and price, but also includes sales, service, recognition, and support. For ongoing customer loyalty and value, companies must consider all these factors (i.e., price, product quality, service, and support).

How Important is Customer Retention?

It is obviously important to build systems that keep the customers happy. Here are some pieces of information to highlight the stakes:

- By some estimates, it costs five times more to obtain a new customer than to keep an old one.
- 25% of customers generate 85% of profits.
- It is not enough to just take orders from customers (anyone can do that). It is important to work intimately with the customers to explore new needs.
- It costs 6 times more to sell to a new customer than to an existing one.
- A typical dissatisfied customer will tell 8 to 10 people.
- A company can boost its profits by 85% by increasing customer retention 5%.
- The odds of selling a product to a new customer are 15% versus 50 % to an existing one.
- 70% of complaining customers will do business again with the same company if it quickly takes care of the problem.

Example: X wireless was adding 1.5 million customers/year but losing 900,000 customers/year. Because of the very high cost of getting new customers, the company was reportedly losing $600,000,000 per year (Source: Knowledge Stream Partners).

General Sources: [Kalakota 2000, Gartner and Forrestor Reports 2015-2018].

6.5.2 Few Short Examples of CRM

Amazon has consistently proven it is capable of running a world-class CRM strategy. Amazon has millions of loyal customers who prefer Amazon for online shopping amid extreme competition. Instead of buying a CRM system, Amazon chose to develop its own highly customized CRM system that has been extremely successful. Overall a well-managed and efficient CRM strategy has been a crucial aspect of their success. At the core of Amazon CRM strategy is an easy purchasing process – it has a simple, easy-to-use interface, one-click ordering, and stored personal and card details that makes online purchase smooth and quick. In addition, recommendations of products based on previous purchases is a clever use of customer data that ensures customers feel valued. Amazon's CRM also deals with most of their customer queries before reaching the stage where human intervention is required. See, for example, Demir, A. (2017), "Management Information System: Case Study of Amazon.Com", Quest Journal, weblink: questjournals.org/jrbm/papers/vol4-issue11/B4111117.pdf, Jan 13, 2017.

Dell Computer has deployed its Premier Page Program to thousands of corporate customers. The program allows Dell to enhance its successful direct-sales practices by leveraging the Web to offer a hybrid solution. This solution combines enhanced order management capabilities (product configuration, personalized pricing, order status, and shipment tracking) with customer relationship functionality (contact information, document repositories, real-time access to customer/technical assistance). The returns are quite good: Dell reports that more than $10 million worth of Dell PCs are ordered daily via Premier Pages. . Further, customers report higher satisfaction levels and intentions

to make Dell their sole source for PCs. In 2017, Premiere has become a sominant player in Dell's growth (for details, see http://en.community.dell.com/dell-groups/dell_premier/).

Boeing PART Web is a catalog of repair parts, price, inventory level, order, and delivery for authorized customers only. The main driver for this effort is competitive edge -- repair parts are also available from OEMs, not only from Boeing. The pricing for customers is based on their contracts with Boeing.

Telenor Mobil, via its online dealer extranet system, allows 1,300 dealers and 10,000 users to begin a two-way electronic dialogue, including order entry with Telenor. The Telenor system allows dealers to sign up customers instantly, reducing phone activation times from 10 days to a few minutes.

Many companies offer price incentives for customers to use their Web-based services (this also allows the company to capture important customer data). For example, AT&T offers a 9-centper minute rate for domestic long distance -- instead of its usual 10-cent rate -- for customers who use their internet billing service.

For ongoing developments, examples, and case studies in CRM, see the following:

- (https://www.salesforce.com/crm/examples) – Salesforce.com is a very successful CRM company. This site has many examples of CRM use.
- (www.crm-forum.com) – This site contains news, product announcements, and a library of products and literature.
- (www.crmcommunity.com) - This site has a very large number of papers and reports on CRM.
- zdnet.com/techupdate/ - Good for trends and technical updates on CRM.
- CRM Guru (www.crmguru.com) -- A good site for tutorials on CRM.
- www.knowledgestorm.com -- This site has a great deal of information on CRMs.

Government Relationship Management (GRM) –Government Loves You

Citizens, for some strange reason, are expecting more from their government agencies. It is very nice to know, for example, where your car was towed to, how many parking tickets have not been paid yet, how some of the new regulations can impact your business, etc. To respond to this market need, the governments are also becoming more "customer oriented." As part of the e–government initiatives,Government Relationship Management (GRM) systems are being developed to help government agencies view themselves through the eyes of their constituents. IBM, for example, has an active practice in "Citizen Relationship Management" that provides a variety of services to assist government agencies in their jobs (http://www-1.ibm.com/industries/government/doc/content/solution/262302109.html). Additional information can be found at http://www.e-government.com/.

6.5.3 Why CRMs?

Several trends have brought CRM to the forefront. First, as global competition has increased and products have become harder to differentiate, companies have begun moving from a product-centric view of the world to a customer-centric one. Second, technology has matured to the point where enterprises can store the complex and diverse customer information into a single system instead of 20 different systems. Finally, the Internet technologies allow diverse users and employees to access the customer information through a variety of devices.

The real impetus for CRM in today's environment is competitive differentiation. It is increasingly difficult, if not impossible, to compete on the basis of product, because technology advancements have enabled the near-immediate replication of product features and functions. For many products, the time lag between a new product launch and saturation of the market is weeks, not months, with very few unique products. Other market differentiators such as price, promotions, and distribution sites are still important, however, none of them can alone support the success of most businesses. Here are the reasons:

- Price, which has traditionally been a basis of competitive differentiation, is no longer a means for many to compete. Trading hubs and electronic marketplaces have considerably complicated the pricing issue.
- Promotional strategies have also lessened as a means of differentiation due to abundance of clubs, special offers and sales.
- Distribution sites are also less influential in the success or failure of a business because customers can buy from a "virtual" enterprise that only exists on the Web. In addition, even the smallest businesses can compete in the Internet economy.

Due to these reasons, CRMs are vital means of differentiating by attracting customers to frequent your business rather than that of your competitors. Simply stated, the goal of CRMs is to instill greater customer loyalty. Other reasons for CRM include:

- Having a deeper knowledge of customers
- The ability to provide faster response to customer inquiries
- Identifying the most profitable customers
- Increased efficiency through automation
- Getting more marketing or cross-selling opportunities
- Receiving customer feedback that leads to new and improved products or services
- Doing more one-to-one marketing
- Obtaining information that can be shared with the company's business partners

The basic idea is that in the current highly competitive and volatile environment, the successful providers will specialize in customers rather than in the products that they may sell to customers. Several customer-focused business models are being formed by companies such as Amazon (beginning with books, but now also offering a wide range of other products and services to their customers), Dell, Starbucks, and others. The success of these efforts depends on their ability to continually monitor and understand customers' needs, and then match them to products and services that best meet those needs. In addition, membership associations, such as AAA, AMA or AARP have expanded their services to offer a wide range of products and services to meet their members' needs.

It is important for companies to remember that customer relationship management is not a cost center but a competitive differentiator.

Case Study: A Small CRM for a Small Company

Mitchells of Westport and Richards of Greenwich is a small clothing retailer based in an affluent Connecticut suburb. The company was founded in 1958, with the opening of a single store in Westport. Mitchells/Richards caters to an upscale clientele, providing them with high-end fashion and superior customer service. Its main competitors are other exclusive retailers such as Neiman Marcus, Saks and Barney's. Mitchells/Richards has grown from its modest beginnings to become a thriving business with sales exceeding $60 million annually.

One of the cornerstones that Mitchells/Richards was founded on was the ability to provide customer service that exceeded client expectations. Ed Mitchell, founder of Mitchells/Richards, prided himself on personally knowing each and every one of his customers and their individual fashion preferences. However, as the store's customer base began to expand rapidly, this personalized service, which separated Mitchells/Richards from its competitors, became increasingly difficult to maintain. The retailer needed to find a way to continue its personal relationship with customers, and service them as efficiently as in the past.

Mitchells/Richards developed an SKU database which profiles over 187,000 of its customers and their purchasing patterns. This system has helped the retailer maintain its loyal customer base and anticipate future needs. Mitchells/Richards has also recently installed comprehensive Customer Relationship Management (CRM) and Point of Sale (POS) software to further assist with monitoring client demands and preferences. Additionally, the retailer has begun installing interactive kiosks on the floor of its stores to help customers better locate products and services. Mitchells/Richards is exploring a Web strategy as the next step in the IT development.

The new database and software have helped Mitchells/Richards build upon the company's earlier success. The CRM software transfers pertinent sales and consumer information between each of the flagship stores and helps the retailer stay informed about the most profitable product lines, the most productive sale representatives, and the most active/profitable clients. This enables upper management to closely monitor individual salesperson performance and keep up-to-speed on the latest customer trends. With the help of IT, Mitchells/Richards has continued to provide personalized customer service and have seen sales grow to over $60 million annually as a result.
Source: http://www-1.ibm.com/businesscenter/us/smbusapub.nsf/detailcontacts/SBCenterE938

6.5.4 CRM Technologies and Architectures

Technically speaking, designing CRMs is similar to designing many web-based information systems. The specific issues to be considered for CRM design include the following:

- Information access and exchange issues such as what information needs to be shared, in what form, with whom and under what type of controls.
- Communication process management issues, given the complexity of inter-team communications, communications rules (i.e., who manages the communications flow between and among teams) and communications tracking.
- Transaction management issues such as what currently is on order, what the delivery status is, and what the open issues are.

Smart Customer Relationship Management (CRM) Systems are very popular at present. Smart CRMs concentrate on the knowledge about the customers and use this knowledge to detect significant problems with customer services (mostly through extensive use of social media technologies), quickly adjust as needed (i.e., address the customer complaints) and learn to do it better in the next round by using machine learning technologies.

CRM software is currently provided by vendors such as Siebel, Vantive, and Clarify. A conceptual view is presented in Figure 6-6 in terms of the typical layers (presentation, business logic, and integration). Most vendors include at least the following elements:

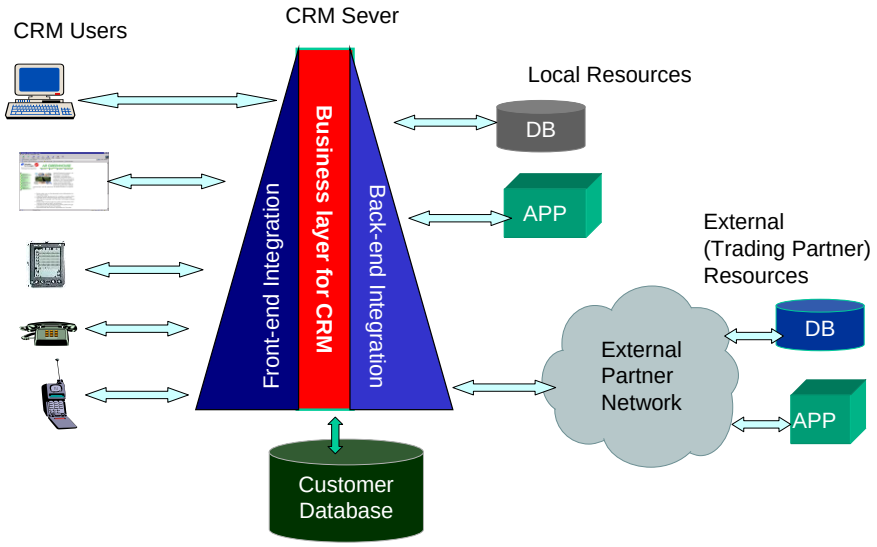


Figure 6-6: High Level Architecture of CRM

- **Web**: The most important use of the Web from the CRM perspective is self-service, so customers can make inquiries about their accounts anytime from anywhere. The Web should also be used for Electronic Bill Presentment and Payment (EBPP), so customers can see what they owe and pay online if needed. For revenue-enhancement, companies can also provide instant messages to be used for cross-selling and up-selling services based on customer profiles.
- **Interactive Voice Response (IVR)**: An IVR system is required for customers to do self-service inquiries via the phone instead of the web.
- **Call Center Technology**: Some type of call center technology with PBX or VoIP (Voice over Internet Protocol) integrated with intelligent call-routing is crucial for interfaces with the live Customer Service Representatives.
- **Business Rules**: Business rules are needed to ensure that any transaction with the customer is processed in an efficient manner. For example, if a company wants the most profitable and high volume customers to be serviced by experts, then the business rules should clearly define the criteria for assigning experts to customer problems. Based on the complexity of transactions, an organization may need hundreds of business rules.
- **Customer Database:** This contains the complete customer information that includes customer profile, products bought, complaints filed and issues raised by the customer, and any other pertinent customer data.
- **Integration framework**: A technology framework that allows all applications and databases that have customer information to be integrated can make a big difference in implementation.
- **Additional Databases, Data warehouses, and Data Mining:** Managing relationships with customers depends on customer information, which is usually in various disparate databases. You can access these sources through the integration technologies or develop a data warehouse. Consolidating the relevant information in one place and making sure that the information interrelates is not an easy task. Once done however, data warehousing augments a company's revenue potential and customer service. For example, a company can segment the types of customers it has in the data warehouse and launch a marketing campaign geared toward specific types of customers. Similarly, good data warehousing can help in presenting the information

based on certain business rules to help in cross-selling and up-selling to customers calling for other reasons. Mining of customer data (e.g., what they have bought, when) and Web clickstreams (e.g., Web pages the customer visited) is common in CRM (see section 6.9).

Companies can implement their CRM strategy through off-the-shelf CRM packages mentioned previously (e.g., Siebel, Vantive, and Clarify) that provide functionality at various levels. At present, most of these products are robust and comprehensive. However, companies still need to implement the right processes and integrate all legacy applications for a successful CRM program. Alternatively, companies can create their own applications and buy some technologies for certain key components like data warehousing. This solution usually takes much longer and is rarely more successful than buying off-the-shelf solutions. The companies can also outsource the CRM function to companies that can provide turnkey solutions. This helps companies eliminate the costs relating to their capital infrastructure for CRM and allows them to focus on their core competencies. Credible outsourcing companies guarantee results, which eliminates any risk for companies in outsourcing.

Companies must allow customers to interact with them from any touch point that they are comfortable with i.e. Web, natural , mobile apps, social media, and/or in-person meetings. Over-use of technology for the sake of technology can backfire and is potentially devastating. An appropriate combination of technology and people is the key to success.

Self-Serve Customers and Caring for Smaller Customers

Self serve customer systems allow customers to receive services without interacting with the human representatives. Examples range from automated teller machines to e-tickets that the customers can use to get airline boarding passes without interacting with the representatives.

Self serve customer systems do not eliminate the need for customer care. In fact, self services can free up resources to maintain contact with smaller, less profitable customers. For example, periodic contacts could be maintained with customers who have not purchased anything for a while. An example of useful friendly reminders is: ”We have not heard from you for too long and we are wondering how you are doing”. Keeping contacts with inactive customers is also part of CRM. .

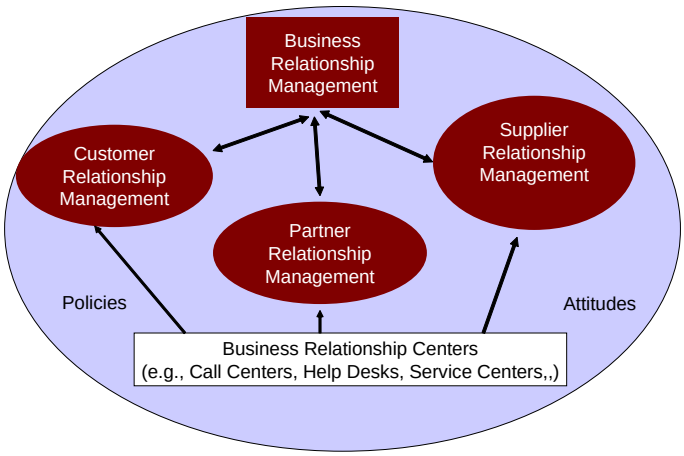


Figure 6-7: Customer Relationship Management as Part of Business Relationship Management

6.5.5 Extending CRM to Business Relationship Management

Customer relationship management (CRM) can be viewed as part of Business Relationship Management that includes all aspects of relationship management (see

Figure 6-7). In particular, the partner relationship management and supplier relationship management are worth reviewing.

Managers of partner and supplier relationships face numerous challenges. These challenges have increased because EC/EB has significantly augmented the interaction and volume of activity between organizations and their partners and suppliers. Suppliers and partner relationship managers require information that can help them to reduce the partner churn rates, increase brand equity, better leads, access to market intelligence, and better training and certification systems. Partner relationship management (PRM) and Supplier Relationship management (SRM) must keep track of all on-going negotiations and also keep a record of completed agreements. In typical interactions between the partners and suppliers of an organization, several teams are involved at various stages of negotiations. PRM and SRM must keep track of all these exchanges. Commercial products, such as the OnDemand B-2-B Portal, address this market. In addition, many consulting firms that specialize in CRM are also beginning to provide PRM and SRM services.

Another aspect of CRM is sales initiative management. In a typical sales initiative, more than 10 staff members with different skills interact with potential customers. This information must also be captured to better manage the sales initiatives and to improve the future initiatives. One could conceive an Initiative Relationship Management (IRM) for this purpose.

In short, CRM concentrates on customer relationship to gain a market differentiator – instead of the typical product focus. CRM can be extended to business relationship management that may include relationship management of partners, suppliers, and sales initiatives.

Sources of Information for Customer Relationship Management

- Payne, A., "Handbook of CRM: Achieving Excellence through Customer Management", Butterworth-Heinemann; 2005
- Finnegan, D. and Willcocks, L., "Implementing CRM: From Technology to Knowledge", John Wiley, 2007
- Greenberg, P. "CRM at the Speed of Light: Capturing and Keeping Customers in Internet Real Time", McGraw Hill, 2001.
- Berson, A., "Building Data Mining Applications for CRM" McGraw-Hill, 2000.
- Seybold, P., "Customer.com", Wiley, 2001.
- (www.crm-forum.com) CRM Forum site containing news, product announcements, and a library of products and literature.
- (www.crmcommunity.com) - CRMCommunity site has a very large number of papers and reports on CRM.
- zdnet.com/techupdate/ - Good for trends and technical updates on CRM.
- CRM Guru (www.crmguru.com) has good tutorials on CRM.
- (www.crmassist.com) Portal for CRM containing pointers to many CRM products (ITToolbox) and reports
- Fryer, Bronwyn, "SO HAPPY TOGETHER." CFO Magazine. June 1999 http://www.techweb.com/se/directlink.cgi?IWK19990927S0057.

Time To Take a Break

- ERPs, Portals and CRM
- Supply Chain Management
- ePurchasing and eMarkets
- Corporate & Backoffice Systems

Suggested Review Questions Before Proceeding

- Does it still make sense to characterize applications as C2B, B2B, and B2E? Why are applications spanning multiple business activities?
- What role do applications play in real-time enterprises?
- What are different forms of portals? What is the role of enterprise portals in e-business? Can portals play a role in integration?
- Why is CRM considered important in today's business? Is it only important for marketing?
- What are the variants of CRM systems and where can they be used?
- How is data mining related to CRM?
- What are the issues in managing and deploying portals and CRM systems?
- What clashes might result when initial esystems are introduced into a more legacy oriented environment ? What steps might be taken to make sure that the esystems succeed ?

6.6 Supply Chain Management Systems: tote Backbone of B2B e-Business

6.6.1 Overview

A *supply chain* is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Suppliers, distributors, manufacturers, and resellers play different roles in supply chains (see Figure 6-8). Supply chains exist in manufacturing, retail, and many other organizations. Naturally, the complexity of the chain may vary greatly from industry to industry and firm to firm. For example, the supply chain for a small vegetable store may be very simple (buy the vegetables from farmers directly and sell them) but may be long and complex for a national food store. In large scale manufacturing industries, the supply chain may involve dozens and even hundreds of partners.

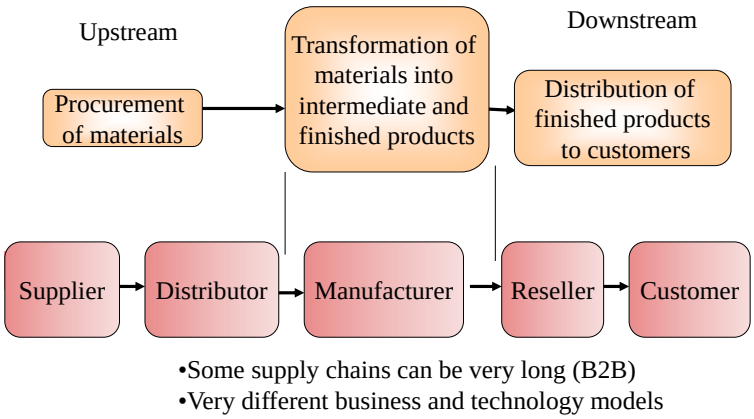


Figure 6-8: Conceptual View of Supply Chains

A key problem in supply chains is that marketing, distribution, planning, manufacturing, and purchasing from different organizations have to work together. Many organizations in a supply chain have their own objectives and these are often conflicting. Supply chain management is a strategy through which different functions along the supply chain can be integrated. The purpose of supply chain management (SCM) is to coordinate the activities of various players in the chain. According to Cooper and Ellram [1993], a supply chain management is a well-balanced and well-practiced relay team. Such a team is more competitive when each player knows how to be positioned for the hand-off. The relationships are the strongest between players who directly pass the baton, but the entire team needs to make a coordinated effort to win the race.

Supply chains and supply chain management approaches have been around for centuries. Over the years a large body of research and know-how in supply chains has been accumulated and can be found in several text books and magazines (see the sidebar on "Supply Chain Management References " for a small subset). Detailed discussion of SCMs is far beyond the scope of this book. We quickly give some background information about supply chain decisions and models and then concentrate on how the Internet and e-business are fundamentally changing supply chains.

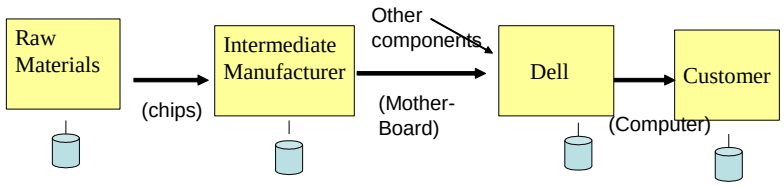
6.6.2 Types of Supply Chain Management (SCM) Systems

Supply chain systems are of different types, but broadly, they fall into the following categories (see Figure 6-9):

- Manufacturing SCM. In these types of supply chain management systems, raw materials are assembled into finished goods by multiple players in the chain. These SCMs are used in the manufacturing industry. For example, different parts of Dell computers are assembled in different parts of the world and finally assembled at Dell headquarters.
- Finished Goods SCM. In these systems, the finished goods are sent from suppliers to the business. This model is heavily used by retail industries. For example, Sears gets its items from different suppliers.
- Mixture and Specilizations. Of course, some companies may get finished goods plus raw materials to assemble products themselves. In addition, several specializations of supply chains such as the following exist: supply chains for food distrubution in developing countries, supply chains for fisheries in small islands, supply chains of agricultural products to remotely located

consumers, and supply chains to convert plastic waste into new consumer goods by using 3D printers.

a) Manufacturing Supply Chain (example: Dell)



b) Finished Goods Supply Chain (example: Sears, Amazon)

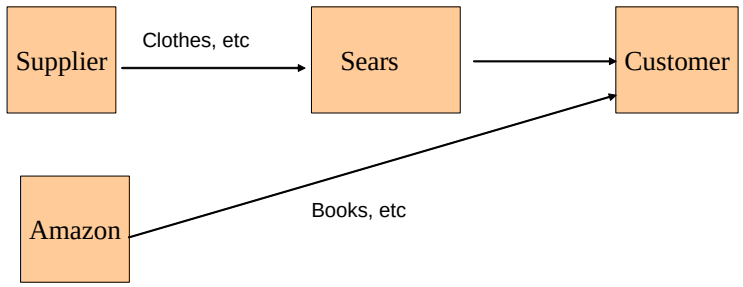


Figure 6-9: Two Types of Supply Chain Systems

6.6.3 Example of a Supply Chain – The Walmart Model

The purpose of supply chains in the retail industry is to find out which items are at high demand and keep the inventory levels high for the items in demand. Many retail stores fail beacuse they do not manage their supply chains properly. For example, Kmart eventually had to file for bankruptcy because it had no idea which items were in high demand. Thus, high demand items were not stocked properly and the shelves were empty when the customers wanted to buy the items – they chose to go elsewhere to buy the needed items.

Walmart has one of the largest and most efficient supply chain management system in the retail industry. The main ingredients of WalMart supply chain management system are (see figure 6-10):

- The core is an "Item Database" that contains extensive information about each item sold by Walmart. The database shows item-id (barcode), price, items on hand, sales activity, etc.
- Handheld device is the main tool. It reads the barcode of an item on the shelf and looks up the item database for price, items on hand, items sold today, this week, this month.
- Item database is monitored by programs that automatically generate a request to suppliers (over 3000 suppliers, many overseas).
- Suppliers are notified over an extensive network. They have to be able to receive and respond to purchases electronically.
- Items arrive in warehouse are scanned and added to the item database.
- When an item is purchased, the checkout counter automatically updates the item database.
- The database is mined/analyzed for trends (local, regional, national, international).
- The system uses a "pull model" with suppliers (i.e., pull whatever is needed whenever) instead of push (suppliers push the product).

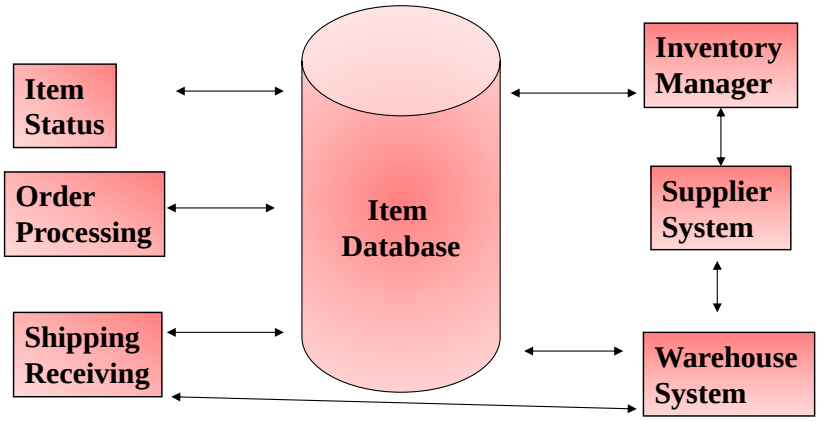


Figure 6-10: Conceptual View of Walmart Supply Chain System

6.6.4 Supply Chain Decisions and Models

In a supply chain, a large number of decisions are made at strategic (i.e., for longer time horizon) and operational (i.e., day-to-day shorter time horizon) levels. The following major decision areas in supply chain management occur both at strategic and operational levels [Ganeshan 1995]:

- **Location Decisions** that determine the location of purchasing, manufacturing, and distribution facilities. Although location decisions are primarily strategic, they also have implications on an operational level.
- **Production Decisions** include what products to produce, and which plants in which to produce them. These decisions also include allocation of suppliers to plants, plants to distribution centers (DCs), and DCs to customer markets.
- **Purchase Decisions** that include what to buy, where to buy it from, and how to transport the purchased items to DCs and final centers.
- **Inventory Decisions** refer to means by which inventories are managed to buffer against any uncertainty that might exist in the supply chain (i.e., keep inventory of items in case some materials do not arrive in time).
- **Transportation Decisions** that determine how the items are transported around the supply chain. These decisions are closely linked to the inventory decisions, since there is a tradeoff between inventory cost and transportation cost (a company can keep large inventories in a warehouse to minimize transportation costs).

These decisions, as stated previously, can be at strategic and operational levels and require different types of information models. The information models show the players in the supply chain and what information they consume/produce throughout the supply chain. The models for strategic decisions are typically large and require a considerable amount of information because strategic decisions try to integrate various aspects of the supply chain. Often, due to the enormity of information requirements, strategic information models provide approximate solutions to the decisions they describe. The operational decisions, meanwhile, address the day-to-day operation of the supply chain. Due to their narrow perspective, these models often contain a considerable amount of detail and provide very good, if not optimal, solutions to the operational decisions.

In addition to strategic and operational level decisions, some intermediate level decisions may also need to be made in practice.

These decisions and information models, as we will see, are being greatly influenced by the Internet Economy and E-business. For a more detailed discussion of design aspects of supply chains, the reader should review available text books in this area (e.g., Hugos, M., "Essentials of Supply Chain Management", 2nd Edition, John Wiley, 2006; "Introduction to Supply Chain Management", by Handfield and Nichols, Prentice Hall; 1998; and "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies", by Simchi-Levi, and Kaminsky, Irwin/McGraw-Hill, 1999).

6.6.5 "Electronification" of Supply Chain Management ("sum")

It is important to establish a technology strategy for SCM that supports multiple levels of decision making and gives a clear view of the flow of products, services, and information. An information technology system is needed that integrates capabilities at three levels:

- For operational decisions, the system must be able to handle day-to-day transactions and e-commerce across the supply chain, and provide instant information on orders and daily scheduling.
- For mid-term decisions, the system must facilitate planning and decision making, supporting the shipment planning and production scheduling needed to allocate resources efficiently.
- For strategic value, the system must provide tools, such as an integrated supply chain network model, that synthesize data for use in high-level "what-if" scenario planning to help managers evaluate plants, distribution centers, suppliers, and third-party service alternatives.

Unfortunately, the information that most companies require urgently to enhance supply chain management resides outside of their own systems. This is precisely where the Internet is playing a major role. Internet connectivity creates opportunities to change the supply chain fundamentally. But the Internet is not the only player in "eSCM". Collectively, these technologies are changing the existing/old model of SCM to the new model where the suppliers communicate with the consumers in fewer steps (see Figure 6-11).

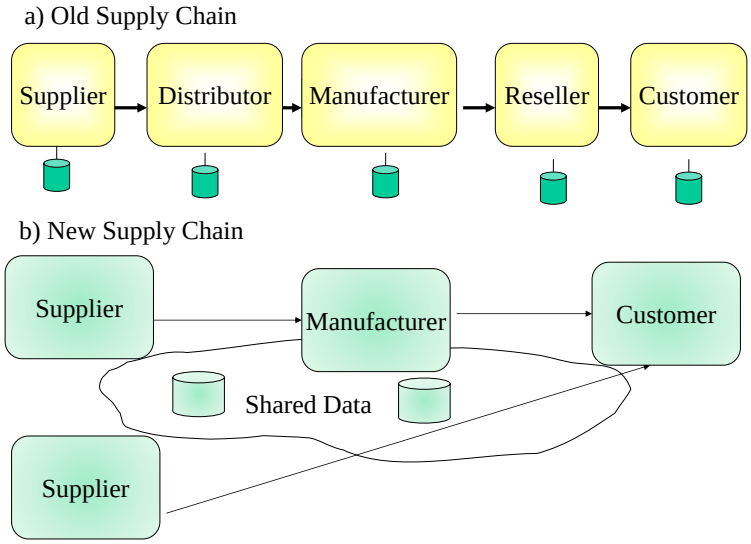


Figure 6-11: Old Versus New Models of Supply Chain

The following technologies are changing the SCM landscape (we will cover these technologies in later chapters of this book):

- Internet by providing direct links between supply chain players around the globe
- Web and XML by providing access and interchange between supply chain players

- EDI (Electronic Data Interchange) for handling orders between large companies (EDI is an older technology but still used heavily in SCM)
- ERPs (Enterprise Resource Planning) systems that provide access to resources throughout an organization
- Enterprise application integration (EAI) platforms that make it easy for companies to integrate with a diverse array of suppliers, resellers, manufacturers, and customers

6.6.6 Illustrative Examples of Modern Supply Chains

There are several successful examples of multi-national corporations that reap benefits and maintain their competitive edge due to efficient SCMs. Some representatives of industry practitioners include Procter & Gamble, Wal-Mart, Coca-Cola, Hewlett Packard, Cisco, IBM, Sun Micro Systems, Compaq Computers, DELL, and 3COM. There are at least 40 supply chain products and solution providers. Some of the key product vendors include i2 Technologies, BEA Software, Manugistics, Persistence Software, Oracle, SAP, Sybase, Agile Software Inc., Calico Commerce, Veritas Software, Descartes Systems Group, QAD Inc., Summit Technologies, RBA Associates, SNS Supply Chain Management, HK Systems Inc., and Sun Micro Systems. There are several consulting organizations that are engaged in SCM solutions: JD Edwards, Anderson Consulting, Radient Systems, ABC Technologies, SYNTRA Corporation, Yantra Corporation, TransView Corporation, Candle Corporation, and IDS Scheer. There are more than 200 Fortune 500 companies that have SCM. The market for SCM keeps growing due to mergers among corporations, new e-commerce virtual enterprises, change/expansion in company focus, new customer demands, and global competition.

An example of supply chain management is Procter & Gamble (P&G) that introduced the Streamlined Logistics program to improve customer service and supply chain efficiency. The first phase consolidated ordering, receipt, and invoicing of multiple brands, harmonized payment terms, and reduced pricing categories. For the customers, this implied that they could mix a load of soap, paper, or food products on a full truck to get the best possible pricing. They could also take advantage of common-quantity pricing across all product lines. To ensure customer satisfaction, P&G instituted a scorecard to enable both distributors and vendors to evaluate P&G's efficiency in such key areas as category management, assortment, efficient product introduction, promotion, and replenishment. P&G also has undertaken Streamlined Logistics II to reduce unloading time in food-retailer warehouses. By combining such tools as activity-based costing and Electronic Data Interchange (EDI) with drop-and-hook programs and elimination of pallet exchanges, P&G expects to remove non-value-added costs and improve consumer value -- in the process saving $50 million (Source: Aberdeen Group Report on Supply Chains, Feb. 2000).

6.6.7 Selling Chain Management

Selling chain management concentrates on a different type of chain - the sales chain. Due to the advent of e-business, many new sales channels are now available to enterprises. Increasingly, selling chain management software is needed to automate direct and indirect sales. "Selling chains" can be formed around multiple sales channels for different products. For example, Dell sells its computers through Web interfaces, telephones, or Dell authorized stores. Selling chain management software can present a uniform view that allows an organization to understand, diagnose, and correct problems in multiple sales channels. For example, Dell would need to understand which sales channels are most profitable and why. The main idea of selling chain management software is to help companies sell better across all sales channels (see Figure 6-12). Many selling chain management systems manage customer orders and are thus customer facing as compared to supply chain management systems that are supplier facing. These two chain management systems work on the front-end and

back-end systems respectively, and complement each other. For a detailed discussion of selling chain management, see [Kalakota 2001, Chapter 7].

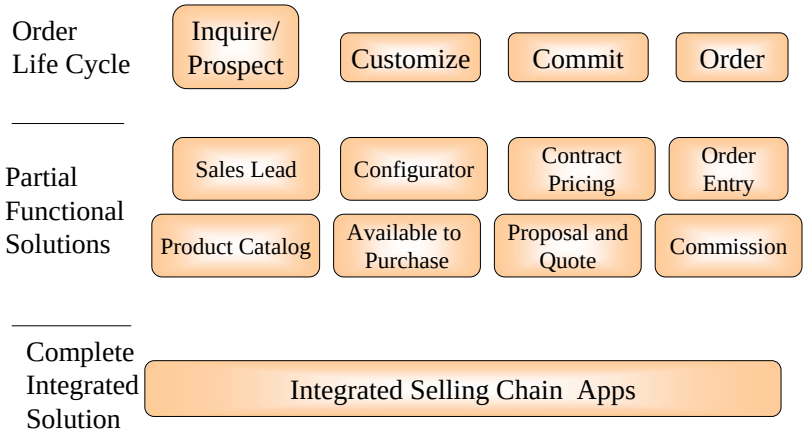


Figure 6-12: Selling Chain Management

6.6.8 Trends in SCM

Supply Chain Management (SCM) is an enterprise wide infrastructure for managing networks of facilities and distribution options such as procurement of materials, transformation of these materials into intermediate and finished products, and distribution of finished products to customers. Supply chains exist in both manufacturing and service organizations. Complexity of a supply chain may vary from industry to industry and from firm to firm. In a typical manufacturing industry, the supply chain will integrate suppliers of raw or semi-finished goods, inventory of intermediate storage, distribution of material, and all other related activities in its suppliers to end-product pipeline. Similarly, in a service-oriented organization, the supply chain management provides a smooth interface among various vendors, warehouses, inventory management, customer order processing and delivery, and end users. Thus, SCM can be viewed as a system of information, communications and computing infrastructure that provides a reliable interface among participating subsystems to realize efficient workflow among all participating entities.

The following trends in SCM are worth noting (see Figure 6-13b):

- Smart and Mobile SCM: SCMs have knowledge about the suppliers and use this knowledge to detect any problem, quickly adjust accordingly and learns to do it better in the next round. An example is the IBM Smarter Supply Chain Mangement system. Smart SCMs heavily utilize machine learning and mobile computing to detect, adjust and learn.
- Time lag among constituent subsystems is being eliminated as much as possible. With the advent of consumer centric e-commerce enterprises and a competitive global business environment, leading companies now recognize that their SCM should function very efficiently to meet customer demands. Hence, the notion of "zero latency", also known as real-time, supply chain management has become one of the very basic requirements of modern SCM systems.
- In addition to zero latency, supply chains are also being designed as “active” systems where a disruption in the supply chain is not only noticed but also adjusted to by using alternate paths. For example, if a particular supplier is causing the delay, then the system can consider alternates such as electronic marketplaces to supply the needed items.

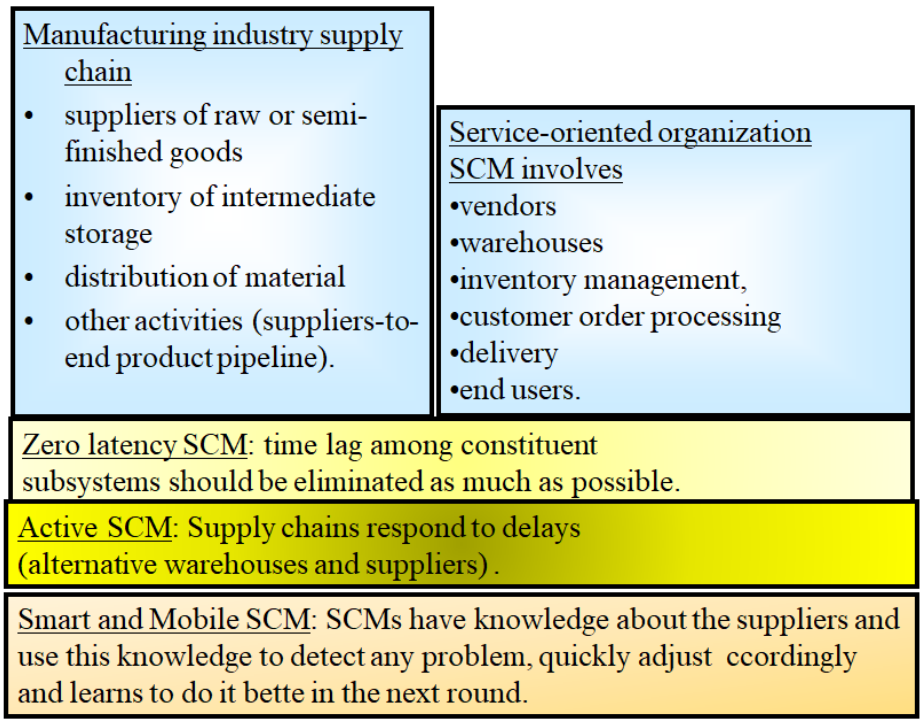


Figure 6-13b: Supply Chains Evolving to Zero Latency ("Real-Time") and Active SCM

Supply Chain References

- "Essentials of Supply Chain Management", Hugos, M, 2nd Edition, John Wiley, 2006
- "Web-based Supply Chain Management", Tan, G, et al, Information Systems Frontiers, Jan 2000, pp. 41-56.
- "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies", by Simchi-Levi, and Kaminsky, McGraw-Hill, 1999.
- Information Systems Frontiers Journal, Special Issue on Supply Chain Management, Kluwer, 2001.
- "Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Service)", Martin, C., Financial Times Management; 2nd edition (April 1999) , ISBN: 0273630490.
- "Advanced Supply Chain Management: How to Build a Sustained Competition", Poirier, C. C., Publishers' Group West; February 1999, ISBN: 1576750523.
- "Business Logistics Management", Ballou, R. H., Prentice Hall, Englewood Cliffs, NJ, Third Edition, 1992.
- For research papers in this area, "Supply Chain Management Review" from Cahners Publishing Co. is a good source.
- An introduction to SCM – http://silmaril.smeal.psu.edu/misc/supply_chain_intro.html.
- For a basic definition and overview -- http://www.ascet.com/ascet/wp/wpHakanson.html.
- Collection of white papers on SCM by industry participants and solution providers by Anderson Consulting - http://www.ac.com/services/scm/scm_thought_ASCET_Editorial_Board.html, http://www.ascet.com/ascet/docs/wpTOC.html.
- An overview of SCM and various activities at Supply-Chain Council – http://www.supply-chain.org.
- A collection of case studies -- http://www.ascet.com/ascet/cs/index.html.
- A collection of solution providers (60) -- http://www.ascet.com/ascet/docs/spTOC.html.

- Sprint's ION as an infrasctructure solution for SCM http://www.ascet.com/ascet/sp/spSprint.html.
- Global Supply Chain Management – http://www.globalsupplychain.com.
- Supply Chain Management: Journal Overview – http://www.mcb.co.uk/scm.htm.

Time To Take a Break

- ✓ ERPs, Portals and CRM
- ✓ Supply Chain Management
- ePurchasing and eMarkets
- Corporate & Backoffice Systems

Suggested Review Questions Before Proceeding

- Why are ERPs important for organizations? What specific problems do they address?
- What are the future trends in ERPs and why should these trends be of interest to organizations?
- Why are SCMs important for organizations? What specific problems do they address?
- What are the variants of supply chain management systems and where can they be used?
- List some examples of ERP and SCM systems that you know.

6.7 Online Purchasing Systems: The Cornerstone of e-Commerce

6.7.1 Overview

Online purchasing is at the core of E-commerce, because it represents online buying/selling through a an online catalog. It includes consumers, buyers, and suppliers engaging in on-line trade and includes links to back-end systems for inventory updates and credit checking. As shown in

Figure 6-14, the purchasing process consists of several steps that can be viewed in terms of pre-purchase, purchase consummation, and post-purchase activities. In the pre-purchase activities, the users browse through various sites, compare prices, and select the online-merchants from which they want to buy the goods. Naturally, Web and Internet have had profound impacts on these activities. In the purchase consummation activities, the user may use a shopping cart and place an order by using a payment system. Naturally, the e-commerce payment systems play an important role in this area. The post purchase activities involve the classical "back-end" systems that handle item delivery, payment disputes, quality issues and returning policies, etc. Many of these applications are legacy applications that have been around since the 1970s and 1980s. See [Turban 2012] for examples.

The main idea is that online purchasing systems span new Web technologies as well as old systems. Specifically, online purchasing involves a large number of Web based systems that allow users to search company catalogs for certain price ranges and then place orders for chosen product(s). These systems also need to support mobile users. In addition, the order processing, inventory control, payment, and shipping/delivery systems are employed. All these systems need to work together to satisfy the demands of online buyers and sellers. Due to this demand, several specialized middleware services are becoming available to support mobile computing and online purchasing and are also being packaged with other infrastructure services to form ***"Middleware Platforms".*** Examples of these platforms are ***e-commerce Platforms*** such as IBM's Websphere and Microsoft's Internet Commerce platform. Let us briefly review some common examples of online purchasing such as Web storefronts and virtual shops.

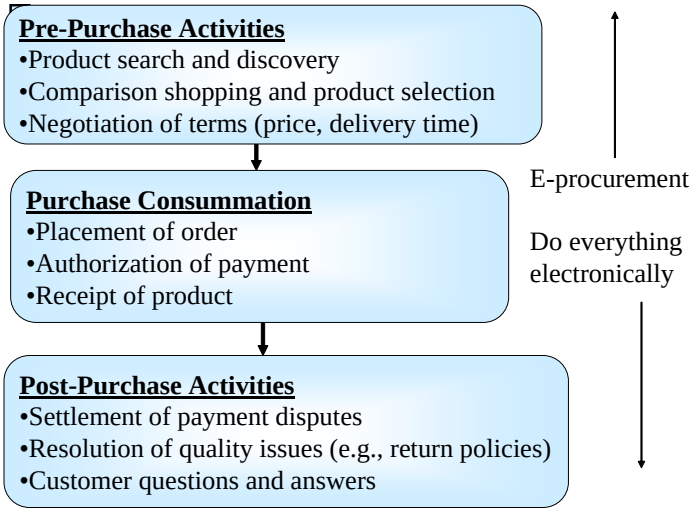


Figure 6-14: Purchasing Steps

6.7.2 Example of Setting Up a Simple Online Purchasing System – Bob's Bicycle Shop

Let us assume that Bob owns a bicycle shop and wants to sell his bicycles over the Internet. Let us assume that Bob does not want to develop any software himself. Here are the key steps.

Step 1: Set up a Web site. Bob can contact an ISP for Web hosting. Most ISPs also provide services for website design and coding. An extensive list of ISPs and Web hosters can be found at the website (www.webhostdir.com).

Step 2: Get a domain name. Bob has to get a domain name to be in business. A Web hoster can get Bob a domain name or Bob can do it himself by using the Web sites (www.allwhois.com) and (www.networksolutions.com).

Step 3: Get shopping cart software. Most e-commerce purchasing systems use shopping cart software. Bob can build or outsource his shopping cart processing by using Paypal, Yahoo or Amazon services.

Step 4: Set up a payment system. Payment systems in many e-commerce sites take credit cards. Once again, Bob can connect to a service provider that specializes in credit card processing. Cybercash (www.cybercash.com) and Miva (www.miva.com) are examples of companies that

provide a variety of credit card processing software as well as hosting services for credit card processing. But how does Bob get paid? Most credit card processors need a merchant account to transfer money into. Merchant accounts can be set up by banks, or Bob can use companies such as cybercash or authorize.net for setting up merchant accounts.

Step 5: Set up a Shipping System. Bob will also have to make arrangements to have the bicycles shipped to the customers. He can also outsource this to carriers such as Federal Express or UPS.

Bob can choose to outsource the entire e-commerce process by using complete online purchasing, payment and shipping systems by partnering with Amazon, Paypal, Yahoo, and others. The Web site (www.webhostdir.com) has a very large collection of possible service providers for e-commerce.

6.7.3 Web Storefronts and Virtual Shops for Purchasing

Web Storefronts. Web storefronts use the Internet to market and sell products and services to a global audience of customers. For simplicity, a Web storefront can be limited to one seller, i.e., enable a seller to use the Internet to differentiate its product offerings; enhance customer service; and lower marketing, sales, and order processing costs. For example, a shoe store can develop a Web Storefront that allows customers to purchase shoes over the Internet. As shown in Figure 6-15, storefronts support Web based purchasing systems that allow users to search company catalogs for certain price ranges and then place orders for chosen product(s). This represents online buying/selling through a catalog using a shopping cart, electronic wallet, or similar tool. It includes both consumers purchasing goods and online buyers purchasing goods from a supplier. It can also include links to back-end systems for inventory updates and credit checking.

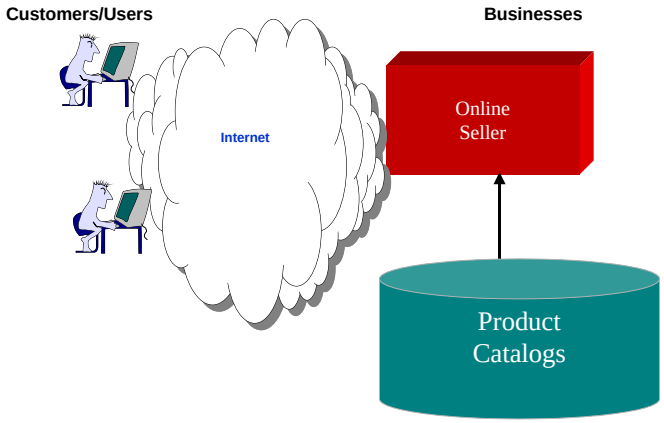


Figure 6-15: Online Purchasing Through a Storefront

A very large number of Web storefronts currently exist. Examples are:

- Amazon.com -- for online purchasing of over 200 million items
- Staples.com -- for buying office supplies online
- Shop.com -- for buying groceries
- Flowers.com – for buying flowers

Storefronts basically show a company's presence on the Web and are usually based on a product catalog that shows product features, price, expected delivery time, etc. These web-based sales solutions deliver process and cost improvements to sellers but they are very "supplier centric". These

supplier-centric solutions can complicate efforts of customers to control expenditures and maintain preferred supplier relationships. For example, you may have to visit several storefronts for a bargain.

Virtual Shops. Virtual shops go one step beyond the Web storefronts by providing a storefront that represents several back-end sellers. In other words, the restriction of a single seller is removed. For example, Amazon.com supports purchase of books by tying several bookstores together. Enterprises that support virtual operations are known as "virtual enterprises" or extended enterprises. Basically, a

Virtual Enterprise (VE) is a temporary alliance of a variety of value adding services in a supply chain, that unite for a specific period of time for a specific business objective, and disband when the goal is achieved. VEs are common in the area of research and development, where far-flung research organizations form temporary alliances to work on common areas of research. For example, several European Union projects formed virtual enterprises and the United States Army Research Laboratory's Federated Laboratories is a virtual enterprise with changing partners and topics.

Virtual enterprises can be, if needed, customized to reflect a buying organization's unique trading agreements, workflow, and business rules. These virtual procurement channels, also known as *e-procurement*, enable a self-service purchasing environment that pushes product selection and order initiation to the desktops of frontline employees through a common Web browser. Many unique issues in virtual shops and virtual enterprise arise. An example is customer care. See the sidebar "Customer Care in Virtual Environments".

Customer Care in Virtual Environments

In the realm of Virtual Enterprises (VE), the concepts of Virtual Customer Care and Billing (CC & B) need special attention. In the VE, there is a temporary union of separate sites joined to fill the order of a retail/wholesale customer. The VE beings truly virtual, maintains no warehouse, and probably has multiple semi-interactive billing systems; one to interface with the customers and others to interface with its suppliers. Each of these suppliers would have its own customer care and billing systems, servicing its own products or services. The customer, interacting only with the VE, is unaware of these individual entities including their behind-the-scenes support, i.e., CC & B. He places the order, pays the bill, and expects care and support only from the VE.

Should a customer's problem arise, e.g., late or missing order, damaged goods, unwanted goods, or bill adjustment, he should address a central CC & B facility belonging to the VE, or a VCC & B sector. These facilities are not necessarily located or associated with any of the suppliers. It is important to deal with most of the customer queries first by using technologies before reaching the stage where human intervention is required. Amazon uses this approach very successfully.

- COS Software (*k-Commerce Support*™ by *Inference*) is a knowledge-based toolkit for CC&B using case-based reasoning (CBR). This package contains five solution modes for assisted and self-service access.
- Desktop - conversation-based, helps CSRs answer questions.
- Web - interactive, self-service, XML based and scalable.
- Email - analyzes and answers customer questions
- Chat - interactive customer service; multiple customers simultaneously.
- IVR - answers questions before reaching a CSR.

6.7.4 Online Purchasing – A Closer Look

Figure 6-16 shows a simplified view of online purchasing that shows C2B as well as B2B operations. The seller can provide the main catalog, the order processing, payment, and inventory control systems. If needed, the items not available at the seller can be provided by the other suppliers through their own catalogs and purchasing systems.

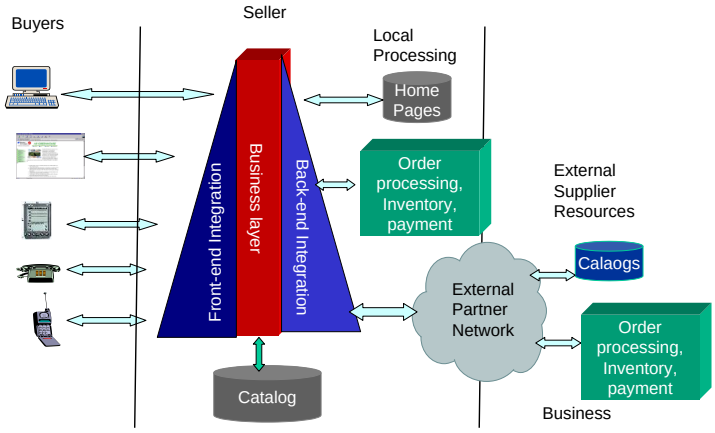


Figure 6-16: A Simple Internet-based Purchasing System

Taking the example of Bob's Bicycle Shop, the following configurations are possible:

- Bob (the seller) provides most of the products and only the backorders are placed to the external suppliers. For example, if Bob does not have enough bicycles in stock, only then external suppliers are contacted.
- The seller provides some of the products and others are provided by external suppliers based on a pre-negotiated business agreement. For example, Bob can provide bicycles while Sam can provide shoes and other sport items but customers do not know that they are different providers.
- Bob is a virtual shop where he does not have any items in inventory.

Online purchasing systems, as stated previously, involve a large number of components such as Web pages, search engines, product catalogs, order processing, payment, inventory control, and shipping/receiving systems. Figure 6-17 shows the various components of an online purchasing system. These components may reside on different computers and may be built by using different technologies. In addition, all these components may need to be configured differently and will need to work together to satisfy the demands of online traders. We will discuss the technical, architectural, and integration issues related to online purchasing and EC/EB in the Platform, Architecture, and Integration Modules of this book.

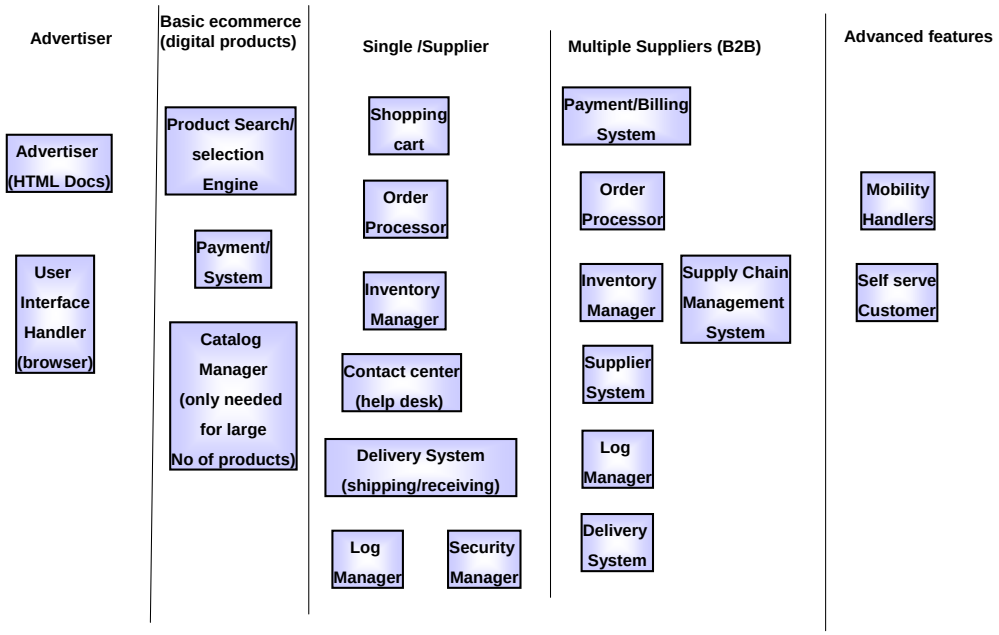


Figure 6-17: Logical Components of Online Purchasing

6.8 eProcurement and Electronic Marketplaces: The Purchasing Networks

6.8.1 Overview

eProcurement has evolved from simple purchasing systems to complex marketplaces that involve bargaining over trading networks. Any of the procurement interactions (C2B, B2B, C2C) can be conducted directly or through intermediaries. Modern enterprises are increasingly relying on different types of intermediaries. The role of intermediaries in commerce is changing as a consequence of the increasing momentum of e-commerce. In fact, it has been argued [Bakos 1997, Bailey 1997] that the role of traditional intermediaries is reduced and will eventually be eliminated with the gradual introduction of "friction-free electronic marketplaces", in which lower costs of market transactions will make it easier to match buyers and sellers directly. However, analyses on the evolution of e-commerce strategies [Bakos 1998, Taylor 2001] suggest that, while certain types of intermediaries are indeed bound for extinction, a new role is emerging for electronic intermediaries in the new marketplace. The functions performed by these intermediaries include matching buyers and sellers, providing product information to buyers and marketing information to sellers, aggregating information, integrating the components of consumer processes, managing physical deliveries and payments, and providing trust relationships and ensuring the integrity of the markets [Wuman 2001, Bakos 1998].

Intermediaries basically match buyers and sellers to reduce transaction costs and to ease trading-relationship management. In the late 1990s, the value of Internet-based B2B transactions grew at more than 150% annually before the Internet bubble burst. These transactions are currently being executed through three primary channels:

- Web storefronts;

- Virtual shops; and
- Electronic marketplaces (eMarkets)

We have already looked at Web storefronts and virtual shops. Let us now review different aspects of eMarkets.

6.8.2 Electronic Marketplaces (eMarkets)

B2B e-commerce has been vastly accelerated by the introduction of electronic marketplaces and exchanges. Electronic marketplaces, also known as Emarkets or e-markets, bring together multiple vendors "under one roof" and provide a single point of access for brokering financial transactions and information exchange across a large community of buyers and sellers. Emarkets offer a powerful means for purchasing based on vendors, price, terms, orders, payment plans, etc. The participation of multiple and diverse suppliers differentiates emarkets from Web-storefronts and virtual shops. Emarkets use catalogs, auctions, and reverse auctions (i.e., a customer quotes a price he/she is willing to pay). See Figure 6-18.

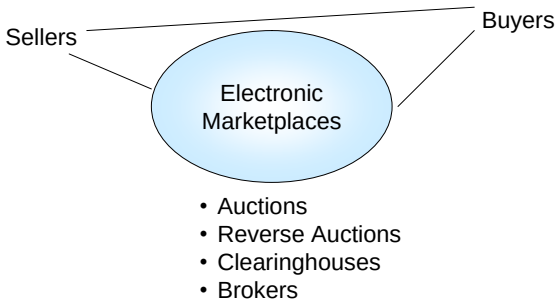


Figure 6-18: Conceptual View of Electronic Marketplaces

Currently, a very large number of emarkets (EMs) are being developed. According to the Aberdeen Group, 600 B2B EMs existed in April 2000, with new entrants coming online at a rate of 50 per month (since then, many have disappeared). Despite some setbacks, it is expected that many online transactions will be channeled through emarkets in this decade. Thus, organizations will need to decide which emarkets to buy from, which to sell into, and which to build.

An interesting example of emarkets is Verticalnet.com which provides several marketplaces in a diverse array of segments. Huge marketplaces have been set up by Fortune 500 players such as GM, FORD, and Boeing. In the telecommunications industry, emarketplayers include: British Telecom, Deutsche Telecom, BellSouth, SBC, and others. Examples of Telco EMs are telezoo.com, demandline.com, simplexity.com, thegtx.com, and band-x.com.

The Web sites www.bobcat.com and www.ontology.com have a list of many electronic marketplaces. Current EMs are beginning to consolidate a wide range of intermediaries such as the following (we will review the functions of an EM in the next section):
Clearing houses that provide a common point for traders (e.g., catalog clearing houses)
Trading hubs that allow customers to trade goods and services (e.g., BandX for bandwidth trading)
Brokerages that provide brokers that act on your behalf (e.g., shopbots that shop on your behalf for certain items based on your needs)

In essence, the initial focus of EMs on automating financial transactions has been extended to include a transparent view of demand, production plans, and supply and capacity status to all supply-chain

participants. Unlike the buyer- or seller-centric e-commerce models such as storefronts and virtual shops, EMs can be equally beneficial to all participants. For example, according to Aberdeen, EMs provide the following benefits:

- Benefits to buyers: Buyers can select suitable products/services and gain access to new market opportunities. Business buyers can automate and streamline procurement processes.
- Benefits to suppliers: Suppliers can automate order and fulfillment processes, and reduce order processing errors and costs. Businesses can also identify new sales opportunities and capture increased value for excess inventories or assets.
- Benefits to market managers: Market managers can insert themselves into buyer-supplier trading relationships to assess brokering and conduct transactions across the marketplace.

6.8.3 Electronic Marketplaces – A Closer Look

EMs, as the intermediaries, improve information sharing between buyers and sellers, help lowering the cost of logistics, promoting quick, just-in-time deliveries, and reducing inventories. By doing so, they occupy a strategic position in the marketplace. The main functions of a market can be summarized as (see figure 6-18):

- matching buyers and sellers;
- aggregation and reverse aggregation;
- facilitating the exchange of goods and services along with associated information (e.g., payments); and
- providing an institutional infrastructure in the form of a regulatory framework, for the enforcement of common trading rules

In the electronic marketplace, intermediaries leverage technology -- primarily, networking and database technology to perform functions a through c (function d is traditionally the government's responsibility, and it is of less interest here).

Let us analyze the functions of new intermediaries and mention the role of technologies in the current marketplace.

The **matching** function consists of three main steps: determining product offerings, searching, and price determination. The parameters used by buyers during the first phase include personal budget, offered price, and product characteristics. In the case of services (non-tangible goods), two main dimensions are usually considered for searching: the *function* performed by the service (e.g., carry passengers on a flight from A to B, or delivering food to your home), and *how* it is performed. The latter includes objective *Quality of Service* (QoS) parameters such as reliability (how likely it is that you end up at your intended destination at the scheduled time, or that your food is actually delivered), as well as more subjective parameters, such as the friendliness of the service operators. During the first phase, customers typically navigate in the two-dimensional space of functions and quality until they "converge"to a region of interest. Thus, one of the basic requirements of an electronic intermediary is to support the search function efficiently.

- matching buyers and sellers
  - determining product offerings
  - searching
  - price determination
- facilitating the exchange of goods and services along with associated information (e.g. payments, transactions)
  - logistics and settlement (i.e., how the goods/services are delivered and how payments are made)
  - trust management (how buyers and sellers are mutually protected from malicious or opportunistic behaviors)
  - physical infrastructure, such as a robust network infrastructure and a software architecture suitable for trading
- providing an institutional infrastructure
  - regulatory framework for the enforcement of common trading rules

Figure 6-19: Functions of an Electronic Marketplace

The next phase consists of negotiating a price, which can be a function of many variables (market trends, demand and supply balance). In this phase, intermediaries differentiate themselves primarily by the type of price determination model they support, from personal bargaining between seller and buyer, to fixed price with predictable fluctuations, to various forms of auctioning. The main non-functional dimension for pricing support is that of *timeliness*: prices are determined at a given time and are valid only during a given time interval. It is important to guarantee that a price is determined and advertised in time, in such a way as to ensure fairness among buyers (and competing sellers), and that it is no longer used after it expires. Real-time auctioning in a distributed setting is still an area of interesting experimentation. It may involve the use of networking technology for the interaction of a large number of participants with hard reliability and timing constraints (research in this area, however, is not new). See for instance [Wuman 2001, Taylor 2001, Bakos 1998].

Aggregation brings together a large number of buyers and sellers under the same virtual roof. Aggregation mainly provides consumers with an easy access to many large suppliers. For example, PlasticsNet.com allows plastics processors to issue a single purchase order for hundreds of plastics products from a diverse set of suppliers. **Reverse aggregation** permits multiple buyers to group together for better consumer prices. Examples of emarkets that adopt this strategy are FOB.com, BizBuyer.com, and PurchasingCenter.com.

The next function of intermediaries is to **facilitate transactions**. Three main areas are of concern in this phase are: *logistics* and *settlement* (i.e., how the goods/services are delivered and how payments are made), *trust management* (how buyers and sellers are mutually protected from malicious or opportunistic behaviors), and the provisioning of a *physical infrastructure*, such as a robust network infrastructure and a software architecture suitable for trading[1]. Some of these aspects are discussed in the e-commerce technical literature.

[1] The design and implementation of suitable architectures are discussed elsewhere in this text.

According to [Bakos 1998] there are two main distinctions between an electronic marketplace and its traditional counterpart: the increased *customization* and *personalization* of product offering, and the *aggregation* and *de-aggregation* of information-based product components. Two main factors enable customization: the ability to collect detailed and accurate information on individual customers (demographics as well as observed searching and purchasing behavior), and the ability to deliver personalized goods (think of electronic newspapers). The relevant technology for exploiting individual information is *data mining*: techniques are being researched to perform statistical inference on large amounts of data, by aggregating it in various ways in the hope of extracting reliable knowledge that can be used to make accurate predictions on future user's behavior (a detailed discussion on these techniques is beyond the scope of this survey).

The production of personalized goods is also an active area of investigation. One of the main concerns is the cost of packaging a customized solution vs. the expected benefit (user's perception of the service, monetary added value, customer loyalty, etc.).

6.8.4 What is the Right eMarket Strategy?

eMarkets emerged as the de facto standard for B2B e-commerce in the late 1990s. At the time of this writing, there are more than 1000 eMarkets, representing a diverse range of industries, products, services, and trading relationships. Companies need to make the following decisions:

- Which eMarkets to buy from
- Which to sell into (i.e., which to participate in)
- Which to build and manage on their own

Thus, the e-business strategy of most organizations has to include the eMarkets strategy. The success of a given EM may depend on several factors such as potential profitability, market fragmentation (EMs will be most successful in highly fragmented industries), efficiency, etc. Most consulting groups such as Gartner and Aberdeen provide technical reports in this area.

6.8.5 eMarket High Level Architectures

Many EMs at present use large consolidated catalogs that contain information from a variety of partners. The customers access these catalogs through the EM front-end and browse, select, purchase items based on some purchasing rules. In practice, however, the EMs may also directly connect with remote applications and catalogs of partners through an integration layer. Figure 6-20 shows such an architecture. According to this architecture, the front-end of an EM must be able to handle a multitude of users and devices while the back-end must be able to communicate with multiple trading partners. Note that XML can be (should be) used in the front-end and back-end integration. EDI is an important player in the back-end integration, with a shift from EDI to XML is believed to be a future trend. The middle tier provides the content aggregation and should be component-based so that new functionalities can be added/removed easily. Platforms to support EMs are commercially available from CommerceOne, Ariba, and others.

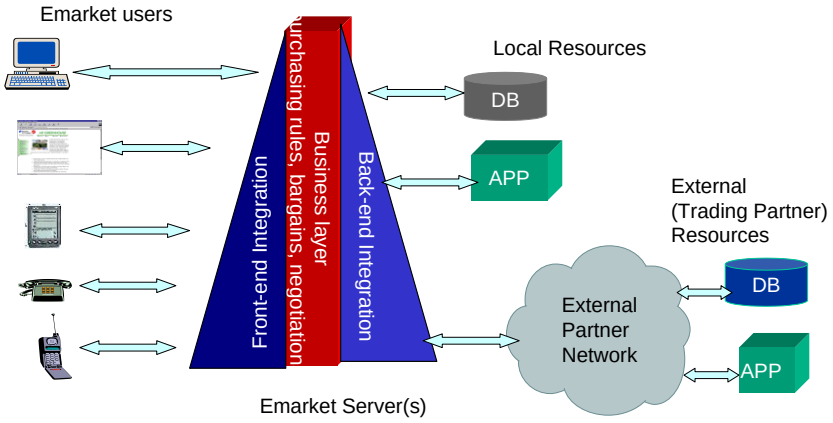


Figure 6-20: High Level Architectural View of an eMarket

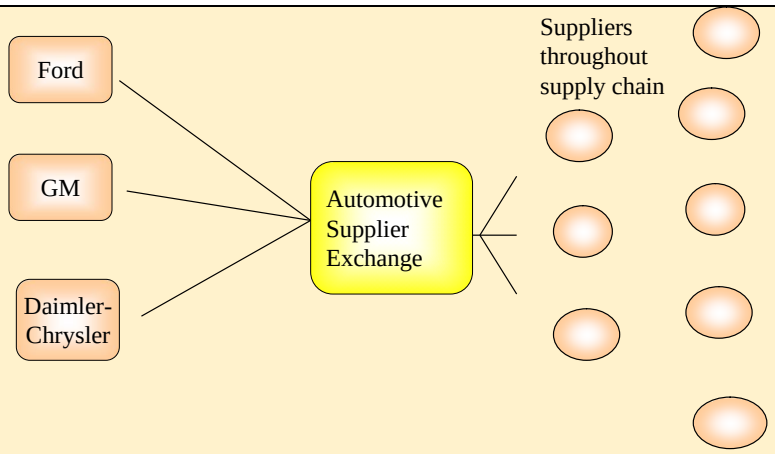
6.8.6 eMarket Concluding Comments

Several eMarkets have emerged in almost all industry segments. These EMs restructure traditional buyer-supplier relationships, providing a Web-based hub for efficiently matching supply and demand, reducing transaction costs, and enhancing trading relationships. EMs do, and will increasingly, provide a single, integrated Web-based platform for e-commerce activities, and also synthesize business processes across the supply chain. EMs can also deliver web-based planning, scheduling, and collaboration services to a wide range of organizations.

Many technical issues are raised by EMs. Several standards bodies, mostly based on XML, are attempting to address these issues. In addition, several EM platforms are becoming commercially available. Examples of the EM platforms are Commerce One platform, AribaNet platform, e-Speak from Hewlett Packard, and Oracle Exchange from Oracle.

eMarket Example: Automotive Supplier Exchange

Generall Motors, Ford Motor, and DaimlerChrysler formed a global B2B emarket in February 2000 as a supplier exchange for automotives. This exchange, eventually named Covisint, was supposed to change the world by significantly cutting costs and time. For example, Ford estimated that the exchange could save Ford between 4 Billion to 14 Billion annually in transaction costs. The following figure shows a conceptual view of the exchange that interconnects hundreds of suppliers to the automotive companies over the Internet for collaboration and online auctions. The exchange has been open to automakers and suppliers around the globe and has grown to include 11 automakers and more than 5,000 suppliers. Although Covisint has grown, many automakers and suppliers have taken a wait-and-see approach and some have developed their own emarkets and exchanges.



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Time To Take a Break

- ERPs, Portals and CRM
- Supply Chain Management
- ePurchasing and eMarkets
- Corporate & Backoffice Systems

Suggested Review Questions Before Proceeding

- What role does online purchasing play in e-commerce?
- What are the key differences between C2B and B2B purchasing?
- What role do emarkets play in enterprises? What are different types of emarkets? Which ones have succeeded and which ones have not? Why?
- List some examples of emarkets and online purchasing systems that you have used.

6.9 Corporate Management, Enterprise Planning and Business Intelligence

6.9.1 Corporate Management Overview

Corporate management is concerned with managing the overall corporate activities. In general, this business functional area involves the following business processes (dark border area in Figure 6-21):

- Corporate Planning that includes strategic as well as tactical planning of financial, IT, and physical resources.
- Enterprise Purchasing involves purchasing of supplies, furniture, and other assets for day to day use.
- Business Monitoring and Control of the financial, physical, and human resources. This also involves understanding the trends/patterns throughout the organization.
- Business Intelligence to analyze, understand, and use the trends/patterns throughout the organization. This is usually accomplished through a corporate data warehouse that is analyzed through data mining to discover patterns
- Knowledge Management for storing and managing all knowledge about the corporation by capturing, processing, and querying the corporate knowledgebase.

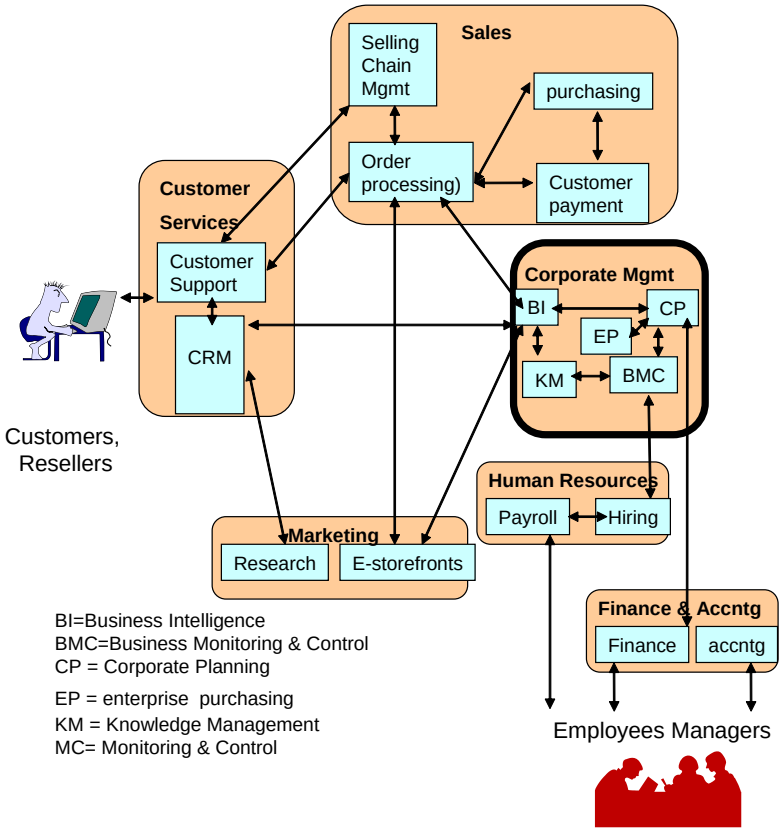

Figure 6-21: Corporate Management – A Conceptual View

Different views of corporate management exist. The view shown below (figure 6-21) is commonly used to capture the interdependencies between the main activities of corporate management. The main idea is that planning, asset procurement, business monitoring and control (BMC), business

intelligence and knowledge management rely on shared corporate data (a data warehouse) as a central resource. This resource is not commonly one large physical database but is typically spread over several physical data sources that are interlinked. This resource supports all corporate activities and contains summaries and snapshots of data from various parts of an enterprise.

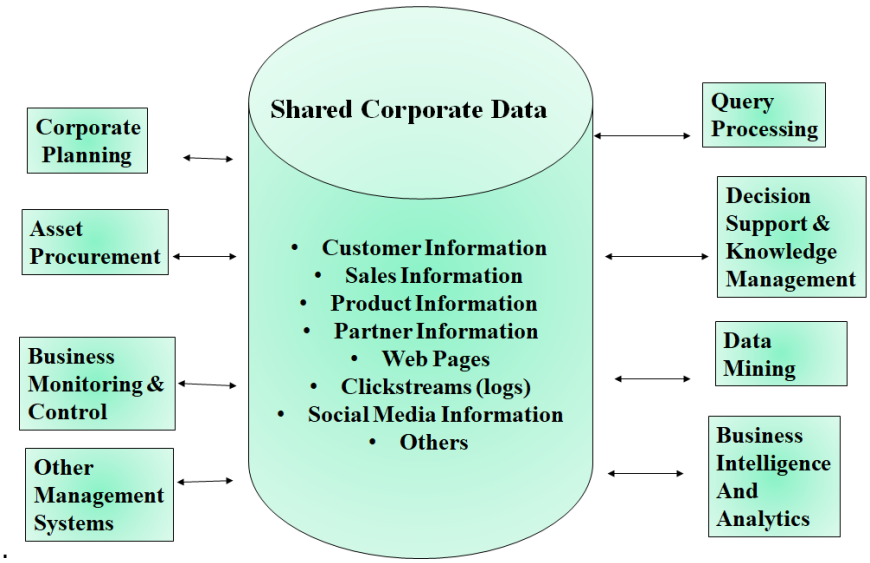

Figure 6-22: Shared Corporated Data (Data Warehouse)

Most of the systems that support different aspects of corporate management are decision-support systems (DSS) and/or executive support systems (ESS) that work from the corporate data resource. Although many corporate management activities are performed manually, DSS and ESS have been developed and are being developed on an ongoing basis.

DSS help managers make decisions that are unique and not easily specified in advance. Although DSS use internal information such as sales, they often bring in information from external sources, such as product prices of competitors. DSS provide a variety of models to aggregate, condense, and analyze data. DSS are interactive and are designed so that users can work with them directly. Examples of DSS are financial planning, airline routing, and production planning systems.

Executive Support Systems (ESS) are used by senior managers to make decisions. ESS are DSS that serve the strategic level of the organization and address decisions requiring judgment and executive insight. ESS concentrate more on external information such as new tax laws or competitors. Instead of focussing on individual problems, ESS provide a generalized computing and telecommunications capacity with advanced graphic capabilities that can be applied to management problems. An example of ESS is a system that assists in answering questions such as the following: What are the competitors doing? What are the new regulations that may impact us? What new acquisitions should be undertaken? Which units should we sell?

6.9.2 Corporate Planning

Corporate Planning includes strategic as well as tactical planning of financial, IT, and physical resources. As shown in the figure 6-22, business strategies decide what type of products and/or

services are needed (arrow 1). The financial, marketing, and other services are outlined to support the business strategy (arrow 2). Information systems (ISs) are developed to support products and services and the support systems (arrows 3, 4 and 5). The IT infrastructure in the past was only developed to support the information systems (arrow 6). But now, the same IT infrastructure is also used to deliver the products and services as well as the support services (arrows 7 and 8). This is the main shift due to e-business.

Corporate planning determines what needs to be done (the objective), outlines the steps and the sequence of steps to accomplish the objective, and lists the time and effort needed to meet the objective. The result of a planning process is a document, a ***plan***, which is a repository of information about the approach, the steps, the resources needed, and the time frame for an effort. Within this general framework, several levels and types of planning exist in real life and enterprises. Our focus is on planning for transition from strategies to working solutions.

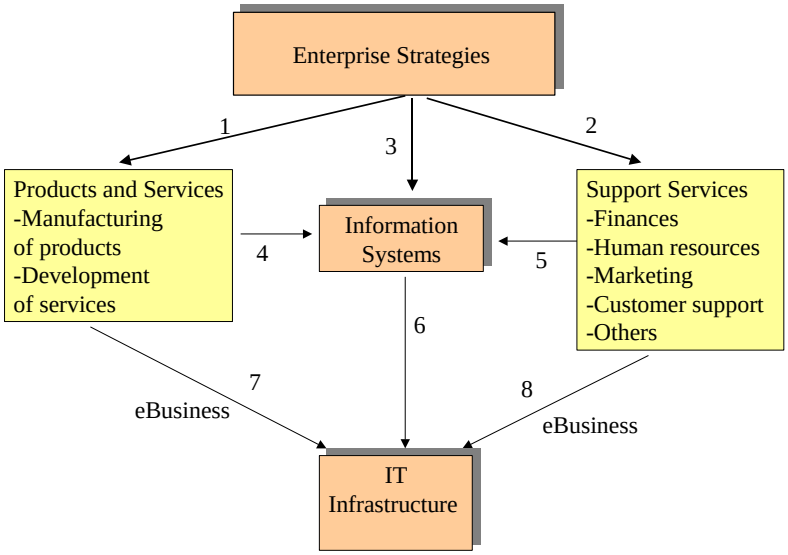

Figure 6-23: IS Planning

In enterprises, there can be several types of planning efforts (business, IS, IT infrastructure) at several levels (strategic, tactical, operational). These planning efforts cover different horizons (strategic plans are longer range than tactical or operational ones), and have different areas of focus (business plans concentrate on business issues while IS and IT infrastructure plans focus on information systems and technologies). These plans also support and feed into each other (IS plans support business plans and strategic plans feed tactical and operational plans). The following figure (6-23) shows the various levels and types of plans with interrelationships between them. The reality is quite different: In many real life cases, one big plan exists (if at all) that includes all levels and types.

	Business	Information System	IT Infrastructure
Strategic Plan(3-5 years)	Strategic business planning Goal: What new markets to get into in the long run	Strategic IS planning Goal: What ISs will be needed to support the strategic business plan	Strategic IT infrastructure planning Goal: What type of IT infrastructure will be needed to support strategic IS plan
Tactical Planning (1-2 years)	Tactical business planning Goal: What to do with the existing products and services	Tactical IS planning Goal: How to support the tactical business plan through IS. and also the strategic IS plan	Tactical IT infrastructure planning Goal: How to support the tactical IS plan through IT . and also the strategic IT plan
Operational Planning(6months-1 year)	Operational business planning Goal: How to deliver the products and services to existing customers	Operational IS planning Goal: How to support the operational business plan through ISs. and also the tactical IS plan	Tactical IT infrastructure planning Goal: How to support the operational IS plan through IT . and also the tactical IT plan

Figure 6-24: Different Types of Planning

6.9.3 Enterprise Purchasing (Asset Procurement)

Enterprise Purchasing, also known as corporate asset procurement, involves purchasing of supplies, furniture, and other resources for day to day use. This activity is similar to C2B purchasing but the purpose is different. In this type of purchasing the enterprise is the customer (buyer). However, since sellers are also enterprises, this type of purchasing involves B2B trade.

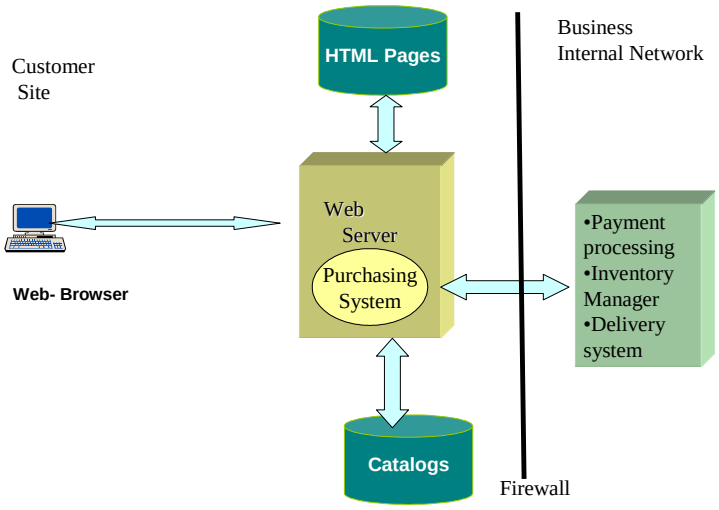

Figure 6-25: An Online Purchasing System

The purchasing (procurement) process involves many components such as new web-based applications and legacy applications that have been around since the 1970s and 1980s (see figure 4-24). The main idea is that online purchasing systems span very new Web technologies as well as very old systems. Specifically, online purchasing involves a large number of Web based systems that

allow users to search company catalogs for certain price ranges and then place orders for chosen product(s). These systems also need to support mobile users. In addition, the order processing, inventory control, payment, and shipping/receiving systems are employed. All these systems need to work together to satisfy the demands of online buyers and sellers.

In general, enterprise purchasing systems are very similar to the general purpose purchasing systems (corporate asset procurement systems) -- sellers sell to companies as well as individuals. Thus, information about procurement (purchasing) systems can be reused here.

6.9.4 Business Monitoring and Control

Business Monitoring and Control (BMC) is concerned with efficient and effective use of financial, physical, and human resources. This also involves understanding the trends/patterns throughout the organization. The specific functions performed by BMC systems are:

- Monitor and control financial resources to make sure that the company is financially strong and stable. This is typically accomplished through financial audits and controls and involves regulations such as Sarbenese Oxley (SOX) Act.
- Monitor and control IT assets to make sure that no privacy and integrity violations occur. This involves the broad area of IT security audits and controls.
- Physical asset monitoring and control to assure that buildings, materials, office supplies, and other physical assets owned by the organization are not vulnerable. This involves building security and physical asset controls.
- Monitor and control human resources to make sure that people are doing jobs that need to be done. This is typically accomplished through lower level management in coordination with the Human Resource department.

To be effective, a BMC system must have access to information about several areas, detect events that need attention, understand past events, and be able to develop trends and patterns.

BMC has been a manual effort for several years, especially in small to medium businesses. However, many automated BMC systems have been developed and will continue to be developed in the future. Examples of the automated BMC systems are the Cognos Controller, management cockpits, financial control systems, etc.

6.9.5 Real-Time Business Activity Monitoring and Real-Time Enterprises

Many corporations such as GE and Intel have adopted the real-time enterprise model in which the real-time status of business activities critical to the company's day-to-day operations is displayed and acted upon. In the case of GE, a large screen displays an array of green, yellow, and red icons that represent the status of GE's business activities. This allows the managers to monitor and control business activities in real-time.

This model allows the managers to monitor and control business activities in real-time. For example, GE's goal is to monitor GE's mission-critical operations such as sales, daily order rates, inventory levels, and other important activities every 15 minutes across the company's 13 different businesses around the globe. The icons of up-to-the-minute business performance across the company are checked regularly by agents that send test transactions to exercise various business operations such as an online purchase. The digitization strategy of real-time enterprises may consist of three activities based on GE: "e-buy, e-make and e-sell." (see figure 6-25):

E-make is concerned with interacting faster within an enterprise. Also known as B2E (Business to Employees), this activity is concerned with tightly coupling all internal systems to a corporate information nerve center that allows constant monitoring and reaction to problems. ERPs, computer integrated manufacturing (CIM), and other integration efforts within organizations can be of help in this area.

- E-sell aims to hasten interaction with customers. Also known as C2B (Consumer to Business), this involves online purchasing systems such as GE's Polymerland Web site, which helps customers research GE's products and prices. This site has reduced phone calls to service representatives by 300,000 calls per year. By digitizing sales, GE has also speeded up service -- and has cut 60 percent from the costs of selling GE's vast array of products, from dishwashers to polymers. Dell Computers and Amazon.com are also good examples of e-selling.
- E-buy is also about interacting better and faster -- but with suppliers. This B2B (Business to Business) activity saved GE more than $680 million through Web-based auctions. Similar results have been reported from the auto emarket established by GE, Ford, and Chrysler. Speed gains also show up in billing. For example, simply by collecting more data on customers who were late in paying their bills, GE was able to be more effective in getting them to pay on time, for a savings of $6 million in interest.

Real-time companies are building digital nervous systems that connect everything involved in the company's business -- IT systems, factories, employees, suppliers, customers, and products. To support the monitoring and split-second reaction times across widely distributed business units, the companies have to rely on sophisticated IT infrastructure (e.g., wired and wireless networks, global positioning satellites, sensors, handheld devices, interconnectivity middleware, and large databases). In essence, the real-time enterprises take the concept of device monitoring as used in network management platforms and extend it to the enterprise level.

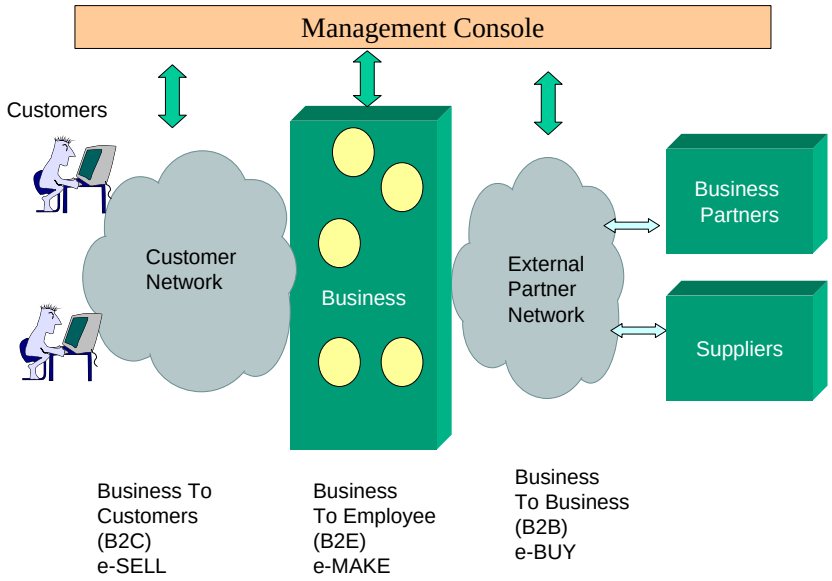

Figure 6-26: Real-Time Enterprises

6.9.6 Knowledge Management and Business Intelligence

Knowledge Management, in an enterprise context, is concerned with managing all knowledge about the enterprise by capturing, processing, and querying the corporate knowledgebase. Knowledge

management is a large and active area of work at present with many books, articles, and journals devoted to this topic (see below for a partial list of the references). The following brief discussion defines and explains knowledge and then discusses knowledge management in a corporate setting.

Knowledge, as shown in the figure 6-26 below, is on the continuum from data to wisdom. In its simplest form, data is an observation or an event without context. Information is data plus context that leads to an understanding of the relationship between data; knowledge is information plus the rules that explain the interrelationships, and wisdom arises from knowing the "true" knowledge that separates it from superficial knowledge. In other words, information represents *what*, knowledge *how* and wisdom *why*. The following table (table 6-2) attempts to explain the main ideas through an example.

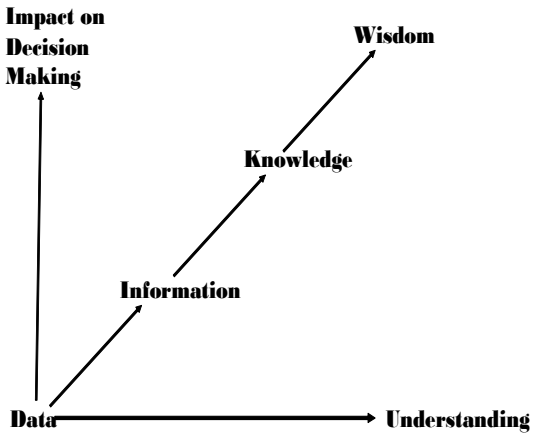

Figure 6-27: Knowledge Management

Table 6-2: Data Versus Information

	What is it?	Example
Data	Observations without context	30, 55
Information	Data with context and links	Minimum speed limit is 30, maximum speed limit is 55
Knowledge	Information plus rules	If you violate speed laws, you will get a ticket
Wisdom	Knowledge plus when and how to use it	Under bad weather conditions, the minimum speed laws do not necessarily apply (e.g., if snowing then you can travel at speeds lower than the minimum speed limit)

Knowledge Management in Enterprise Settings:

Knowledge Management (KM) in enterprises is concerned with capturing and distribution of organizational insights, experiences, and best practices to improve efficiency and avoid mistakes. The main idea is to extract organizational knowledge from individuals, or organizational processes, or practices, capture it in a machine readable format, and then make it available to others. Many large companies have initiated formal KM efforts. In particular, knowkledge intensive companies such as consulting firms have invested a great deal of resources in knowledge management. For example, Ernst and Young as well as Eccenture have active KM efforts that capture the consulting knowledge

of senior consultants and make it available to junior consultants. Several consulting firms also provide KM strategy as a consulting service. Good KM efforts help organizations to reduce redundant work by avoiding reinvention of the wheel, share insights and best practices, and reduce training time for new employees.

Due to the emphasis on KM, knowledge management systems (KMSs) are used in enterprises to capture communication between employees, convert data into knowledge, present it so that it can be used effectively in managing organizations, and support extensive query processing. KMSs in enterprises are generally supported through the following business processes and technologies:

- Business Intelligence, Data Mining, and Data Warehouses
- Social Networking
- Decision Support, and Expert Systems

We will explain these topics in later chapters.

6.9.7 Business Intelligence, Data Warehouses, and Data Mining – An Overview

Many e-business applications require the consumers to directly interact with the databases for business intelligence. An example is a corporate data warehouse that is used to support business intelligence through data mining and other processes. A data warehouse is a repository of information (data) for decision support. The notion of a data warehouse was first introduced by Barry Devlin and Paul Murphy [Devlin 1986] with statements such as the following:

"To ease access to the data …., it is vital that all the data reside in a single logical repository, the Business Data Warehouse".

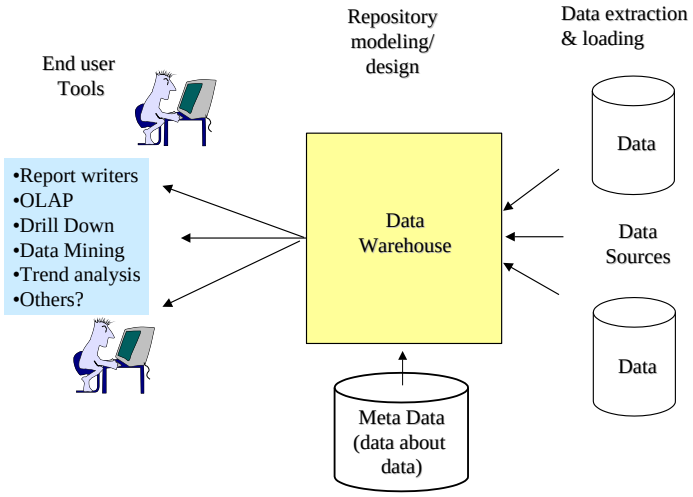

Figure 6-28: C2D Pattern - Data Warehousing

Figure 6-27 shows a conceptual view of a data warehouse. Such systems have been established in many organizations to provide access to operational data by creating a repository for decision support. Data mining tools play a key role in data warehousing because they exploit a combination of AI and statistical analysis techniques to discover information that is hidden or not apparent through typical

query and analysis tools. The availability of massive amounts of corporate data in data warehouses that is widely accessible by authorized Web users has provided a rich field for data mining and business intelligence. A brief review of data warehouses and data mining is given here.

6.9.8 Highlights of Data Warehouses

The basic components of a data warehouse are a comprehensive database that contains information to support corporate decisions, data sources that are used to populate the database, meta data (data about data) that defines the informational data contained in the warehouse in user and/or business terms, and decision support tools (e.g., report writers, spreadsheets, "drill down" applications, data mining tools) to access and analyze the data warehouse. Extract programs are used to load the data warehouse.

A large number of data warehouses (DWs) have been developed since the early 1990s. These include DWs for banking, healthcare, aerospace, retailing, manufacturing, telecom, and almost all other industry sectors. These DWs have been used to gain business intelligence such as the following:

- What was the best month for radio sales?
- Which doctors filed the largest number of claims during the last year?
- How many vacations do the employees in my company take per year?
- How many VISA card holders from our bank did not use their VISA card last year?
- Which doctors in New York charge more than the national average for plastic surgery?
- How many VCRs purchase orders were placed in the last three years?
- Which products stay the longest in the inventory?
- Which store is most profitable compared to the rest in the chain?

The centralized data warehouse approach, shown in Figure 6-29, is the most common approach to build a data warehouse. This approach, popularized by IBM's "Information Warehouse", advocates a large centralized warehouse database that adheres to a single, consistent enterprise data model. All operational and external data is copied and stored in the central data warehouse. The central warehouse may be used to populate individual data marts for improved performance and ease of access.

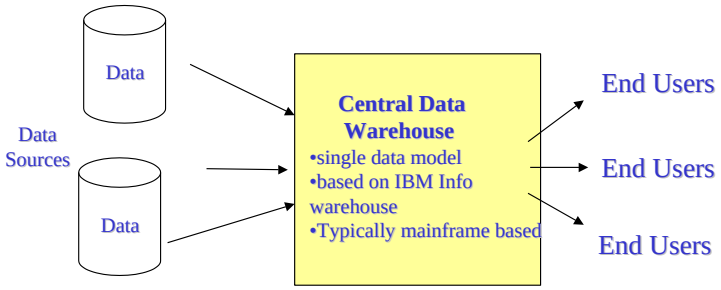

Figure 6-29: Centralized Data Warehouse

Another common approach is the localized data warehouses, also known as the "data marts", shown in Figure 6-30. Data marts are typically created by individual departments or divisions to support their own decision support activities. These data marts may be created to support specific products (e.g., automobile parts) or functions (e.g., loan management) of individual departments, divisions, or regions. In some cases, data marts may be created for user populations with the same technical environments. For example, separate data warehouses for PC users, for UNIX users, and for z/OS users could be created.

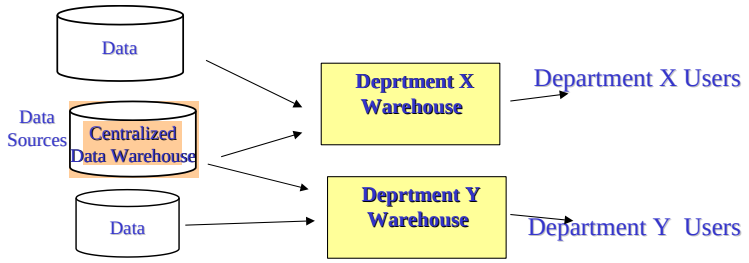

Figure 6-30: Localized Data Warehouses (The Data Marts)

6.9.9 Data Mining and Web Mining

Data mining tools exploit a combination of AI and statistical analysis to discover information that is hidden or not apparent through typical query and analysis tools. Specifically, the data mining tools use a variety of underlying technologies such as neural networks, decision trees, statistical analysis, and machine learning to detect:

- Associations (e.g., linking purchase of pizzas with beer);
- Sequences (e.g., tying events together such as marriage and purchase of furniture);
- Classifications (e.g., recognize patterns such as the attributes of customers who will discontinue doing business with you); and
- Forecasting (e.g., predicting future buying habits of customers based on past patterns).

Data mining has become a major growth area for data warehouses, especially for customer relationship management (CRM). Although the basic mining algorithms have been around for several years, the availability of massive amounts of corporate data in data warehouses has provided a rich field for these tools to mine. In particular, corporations can mine DWs to discover patterns of sales, customer buying habits, lifetime value (LTV) of customers, new customers likely to buy new products, demands on inventory, correlations between opening new stores and product sales, etc. For example, many data mining efforts have been devoted to understanding the customer behavior to retain customers, acquire customers, upsell (i.e., sell more expensive products), and cross sell (sell related products). Data mining has also been used in direct mail (i.e., determine who is most likely to buy from direct mail), crime prevention (i.e., where crimes are most likely to happen), fraud detection (i.e., which insurance claims and credit card transactions are likely to be fraudulent), trend analysis (i.e., predict changes in customer behavior), and financial forecasts (i.e., models of stock markets).

Web mining has gained popularity due to the widespread use of Web sites. The basic idea is to mine the Web sites, in particular, the behavior of the users who visit the Web sites. The customer requests, as captured in ***"clickstreams"*** (the log of users clicking for different Web pages) are being used regularly for content personalization of Web sites. For example, if you visit a Web site, view several pages, and then purchase an item, then your clickstreams will show a trace of all the pages you visited before you finally purchased something. These clickstreams can later be mined to understand how users purchase items.The main objectives of Web mining are:

- Look for e-commerce events associated with a single user during a single visit to determine what the user does during a visit.
- Look for and differentiate between product events (i.e., which particular products are being reviewed) and visit events (i.e., how long the user visited the Web site).
- Develop personalization that facilitates conversion of browsers to buyers, i.e., take full advantage of e-commerce Web site personalization.

A successful Web mining application will capture the behavior of site visitors and discover patterns that will help you design better and more profitable Web sites. The general objective is to identify and characterize data structures meaningful in e-commerce terms.

6.10 Back-Office Operations (Human Resources, Finance & Accounting)

6.10.1 Overview of Back-office Operations

Back-office operations, also known as internal operations, are concerned with running the internal operations of the corporations in a smooth and efficient manner. As shown in the following diagram (figure 6-30), this business functional area interfaces primarily with corporate management and involves the following:

- Human Resource Management includes hiring and retaining employees, employee training, performance management, and fringe benefits (e.g., health, vacation, pension).
- Finance and Accounting involves accounts payable, accounts receivables, loan management, and budgeting.

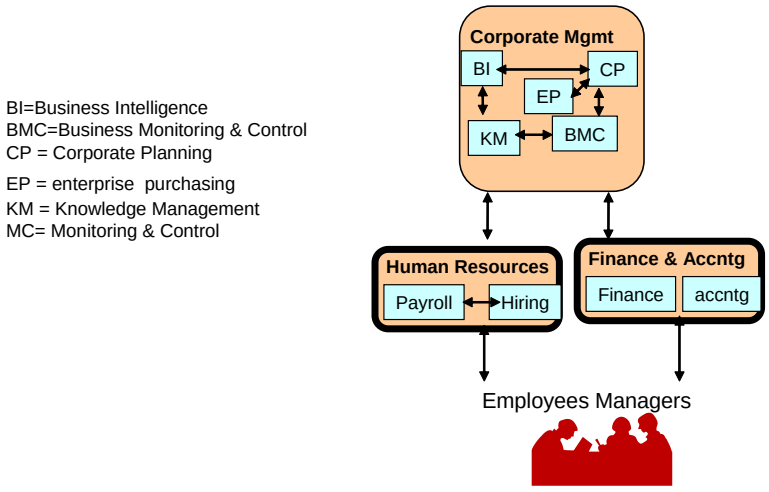

Figure 6-31: Back-Office Operations (Human Resources, Finance and Accounting)

Back-office operations is one of the oldest areas in IT. Payroll, accounts payable, accounts receivable, general ledger, finance and accounting, and other applications in HR have been around since the late 1960s. Hence, numerous software packages have been developed over the years and are operational around the globe. This includes legacy applications, new applications, and something in-between.

Many of these applications are "Legacy applications" that were developed in the 1960s and 1970s. Legacy applications present many challenges. First, legacy applications are becoming increasingly expensive to maintain and operate (it takes months to introduce a change). Second, these applications do not satisfy the flexibility and growth requirements of modern enterprises. Third, many off-the-shelf new packages with nice GUIs (Graphical User Interfaces) are becoming available, especially for small and medium sized organizations, that are highlighting weaknesses of legacy applications.

Finally, new employees do not want to work on systems that were created before the employees were created!

On the other hand, many new application packages are commercially available from companies such as PeopleSoft, JD Edwards, Cognos, and Microsoft Great Plains. These new packages have several nice features that older applications do not have. Typical approaches used by organizations are:

- Migration: Replace the legacy applications with new applications
- Adapters: Use some adapters that allow old systems to work with new technologies (e.g., access an old system from a web browser)
- Outsourcing/remote hosting: use an external agency to provide these services

The following materials should be used for additional readings on information systems for back-office operations:

- Marshall B. Romney and Paul J. Steinbart, "Accounting Information Systems, Prentice Hall; 10 edition, 2005.
- James D. Willson and Jack F. Duston (Editor), "Financial Information Systems Manual/1990 Update With Cumulative Index", Warren Gorham & Lamont, 1986
- International Journal of Intelligent Systems in Accounting, Finance and Management, special issues have been published on "AI and Accounting and Auditing", and other interesting topics.

6.10.2 Human Resource (HR) Management

HR systems concentrate on employees, the main asset of an organization. These systems manage employee career development, recruitment processes, personnel records, salary planning, compensation packages, and government regulations and their related reporting.

Figure 6-32: Levels of HR Systems

Human resource information systems support activities such as identifying potential employees, tracking them through the interviewing process, maintaining complete records on existing employees, and creating programs to develop employees' talents and skills. Payroll/time, keeping/vacation entitlement, etc. are often incorporated into a total HR solution.

HR systems exist at several levels in organizations (see figure 6-31). At the operational level, these systems process payrolls and track the recruitment and placement of the firm's employees. At the management level, HR systems help managers monitor and analyze the recruitment, training,

allocation, and compensation of employees. Strategic-level HR systems identify the manpower requirements (skills, educational levels, types of positions, number of positions, and cost) for meeting the company's long-term business plans.

Many HR application packages are commercially available from companies such as PeopleSoft, JD Edwards, and Microsoft Great Plains. In addition, several 'Workforce Analytics'' application packages are available from companies such as Cognos and 'Professional Services Automation' tools (see www.aberdeen.com for details).

However, many HR systems are available for rentals through ASPs (Application Service Providers). The clients of ASPs pay a monthly fee based on the number of employees. The fee typically includes templates and network connections.

The following table shows examples of HR systems.

Table 6-3 Examples of Human Resources Information Systems

System	Description	Organizational Level
Human resources planning	Plan the long-term labor force needs of the organization	Strategic
Compensation analysis	Monitor the range and distribution of employee wages, salaries, and benefits	Management
Training and development	Track employee training, skills, and performance appraisals	Operational

6.10.3 Finance and Accounting

Finance departments use finance and accounting (F&A) systems to meet internal as well as external financial needs and compliance deadlines. These systems allow companies to achieve productivity gains, reduce implementation time and costs, and lower risks associated with human error, employee changes, and other factors. Finance and accounting share the same goal—how to keep track of a firm's financial assets and fund flows. They provide answers to questions such as the following: What are the current financial assets? What is the cash flow situation? What records exist for payables, receivables, payrolls, and other fund flows?

The finance function concentrates on managing the firm's financial assets, such as cash, stocks, bonds, real estate, and other investments. The goal is to maximize the return on these financial assets. To determine if the firm is getting the best return on its investments, the finance function depends on a considerable amount of information from external sources.

The accounting function focuses on maintaining and managing the firm's financial records (e.g., receipts, disbursements, depreciations, payrolls) to track the flow of funds in a firm. After the financial scandals of early 2000 (e.g., Enron), many government regulations such as Sarbanes Oxley (SOX) Act drive the accounting practices.

F&A systems exist at several levels in organizations. Operational systems in F&A track the flow of funds in the firm through transactions such as paychecks, payments to vendors, securities reports, and receipts. At the management level, F&A information systems help managers oversee and control the

firm's financial resources. Strategic-level systems for F&A establish long-term investment goals for the firm and provide long-range forecasts of the firm's financial performance (see figure 6-32).

Figure 6-33: Finance and Accounting Systems

Many finance and accounting application packages are commercially available from companies such as Oracle, SAP, JD Edwards, and Microsoft Dynamics. However, many F&A systems are available for rentals through ASPs (Application Service Providers). The clients of ASPs pay a monthly fee based on the number of employees. The fee typically includes templates and network connections.

The following table shows some of the typical finance and accounting information systems found in large organizations.

Table 6-4. Examples of Finance and Accounting Information Systems

System	Description	Organizational Level
Profit planning	Plan long-term profits	Strategic
Accounts receivable	Track money owed the firm	Operational
Budgeting	Prepare short-term budgets	Management
Accounts receivable	Track money owed the firm	Operational

6.11 Hints about XYZCorp Case Study

Most of the questions raised in the case study introduced in the beginning of this chapter involve an analysis of the applications discussed in this chapter (i.e., CRMs, ERPs, SCMs, emarkets, ASPs, portals, mobile apps). Based on analysis of these applications and understanding of the company business and its strategic goals, you can prepare a table that lists the candidate applications and describes why each will be specifically needed by the company (each application is represented as a row). The following is a sample table. *It is extremely important to concentrate on applications that are critical to the business.*

Table 6-5: Enterprise Applications for XYZCorp

EB Applications	Why Applications will be Used in XYZCorp
Web advertising and Portals	Needed for the company products as an additional sales channel
Customer Relationship Management (CRM)	Important for customer retention
Online Purchasing and eProcurement	Important to provide 24X7 purchasing without having to increase staff
Electronic marketplaces and trading hubs	This may not be needed initially. Should be placed in the long range plan
Supply Chain Management	Important to cut down the production time and the time to serve customers
Enterprise resource planning (ERP) systems	Important for internal efficiencies
Data Warehouses and Data mining	Should be developed to support the CRM
Outsourced applications	It may be possible to outsource ERPs
Mobility and mobile applications	MEBAs (mobile e-business apps) are needed specifically to support customer facing (C2B) apps

6.12 Additional Case Studies

We have discussed several ERP successes, failures and struggles in this chapter. Here are some additional examples and sources.

6.12.1 Smart ERP Systems on the Move – Few Snippets

Many ERP systems at the time of this writing are claiming to be "Smart". In reality, a Smart ERP system must have a) the knowledge about the customers, suppliers, and employess, and b) the ability to use this knowledge to detect significant problems, quickly adjust accordingly and learn to do it better in the next round. Smart ERPs heavily utilize machine learning and mobile computing technologies to detect, adjust and learn. Here are some key examples.

Smart Supply Chain Management (SCM) Systems concentrate on the knowledge about the customers and use this knowledge to detect significant problems with the suppliers, quickly adjust accordingly (i.e., find alternate suppliers) and learn to do it better in the next round by using machine learning technologies. An example is the IBM Smarter Supply Chain Mangement of the Future (https://www-935.ibm.com/services/us/gbs/bus/html/gbs-csco-study.html) provides the following capabilities:

- Supply Chain Optimization, powered by IBM Watson AI, enables organizations to proactively predict, assess and mitigate disruptions and risks in the business partner network.
- Extensive B2B Collaboration improves the information flow across B2B business relationships and ensures that critical transactions and data exchange are frictionless and scalable.
- Order Management and Fulfillment uses intelligent fulfillment to optimize inventory utilization and fulfillment efficiencies in real time.

Smart Customer Relationship Management (CRM) Systems concentrate on the knowledge about the customers and use this knowledge to detect significant problems with customer services (mostly through extensive use of social media technologies), quickly adjust as needed (i.e., address the

customer complaints) and learn to do it better in the next round by using machine learning technologies. Many CRM systems at present (e.g., Salesforce.com) have these features with emphasis on social media technologies. An interesting example is the Social Relationship Management (SRM) systems that capture, consolidate and analyze a company's social media efforts in different business activities for smarter ERPs. Oracle SRM is a very intriguing example (file:///C:/Users/aumar/AppData/Local/Microsoft/Windows/INetCache/IE/W8TBXEVA/social-relationship-mgmt-brief-1915605.pdf). It unifies a company's marketing, engagement and monitoring activities for better user experience. In most companies, "listening" to social is manual, error-prone and produces bad data due to semantic issues. In many products, listening is usually limited to monitoring with NLP (natural language processing) but this lacks advanced capabilities based on semantic analysis. Oracle SRM uses advanced semantic analysis to minimize errors and improve the ERP capabilities in the areas of learning about problems before they become serious.

Mobile ERPs have become a norm in the modern business settings. Mobile applications and wireless technologies have been playing an important role in ERPs since 2000. The common ERP database, typically located on a large server in the cloud, supports multiple mobile and desktop apps to serve the enterprise needs. For example, in healthcare, a common EHR database supports multiple mobile apps used by doctors as well as patients. Smart mobile apps utilize handset capabilities to detect any problems and/or opportunities, adjust accordingly, and learn to do it better in the next round. As an early example, mobile technology helped BT Industries, the world's largest manufacturer of warehouse trucks, simplify its truck maintenance and service system by using mobile technologies and saved over $3 million a year (www.computerweekly.com/feature/Case-study-mobile-ERP-Efficiency-in-connectivity). Companies such as UPS have heavily leveraged mobile technologies in every aspect of theiir shipping and delivery business. Some studies have focussed on the organizational aspects of using mobile ERPs *(* http://dx.doi.org/10.4301/S1807-17752015000200002*).*

6.12.2 Enterprise System Challenges – The Owens-Corning Case Study

ERP systems provide an itegrated solution that allows companies to integrate their applications around a common database. However, ERPs systems are very expensive and complex, and require carefull planning and staff training. The Owens-Corning case study is a good example of the key chanllenges and the approaches needed to address the challeneges.

Owens Corning (OC) is a global company that employees more than 15,000 employees and develops and produces insulation, roofing, and fiberglass composites. Formed in 1935, the company grew rapidly in the early 2000s by acquiring many companies. Due to its growth and acquisitions, the company ended up with more than 200 inflexible and isolated systems that did not communicate with each other. This was a major problem because Owens-Corning customers had to place separate telephone calls for each product ordered–one each for siding, roofing, and insulation. The company operated like a collection of autonomous units instead of one company.

Owens-Corning management selected the SAP ERP system to totally integrate all business systems on a global basis so everyone was operating on the same platform with the same information. However, the project to install SAP's enterprise system would ultimately cost Owens-Corning about $100 million and take several years. The major problems encountered were:

- The first major ERP conversion project was completed over a weekend. But on Monday morning when Owens-Corning went live with SAP, no one knew how to use the new system. So, the overall productivity and customer service dropped sharply during the first six months.

- There were several technical problems. For example, the application response time increased from seconds to minutes under the new system and the system did not work the way it was supposed to.
- The new system changed people's new roles and change management had to be redefined. Owens-Corning employees had not been properly trained, resulting in a lot of errors. Training was not easy because ERP systems are integrated, the users did not understand the impact their work was having on other departments. In addition, errors ripple throughout the system quickly in integrated systems. Fragmented systems do have an advantage – the errors are isolated.
- Customers also suffered because the quality of service declined significantly after the SAP system went live. Owens-Corning lost several important customers. The company had to spend extra funds on repairing this damage.
- To address these problems, the company instituted a new training approach that explained the complexities of the new system. Employees could not use the system until they had passed a test and were certified. Those who failed the test had to retake the training until they could pass it. About 20 percent of Owens-Corning employees never passed the test and had to change jobs. This job shifting caused employee morale problems and the new training costs went from 7% to 13% of the budget.

Despite all the problems that Owens-Corning had to face for almost 5 years, the company feels that the project is successful because all customers now have a single point of contact for all orders. The ERP has also allowed Owens-Corning to gradually and systematically expand its business and has led to an integrated and vibrant global corporation.

Sources:

- Owens Corning Website: https://www.owenscorning.com/, last visited: March 8, 2018
- CASE STUDY Owens-Corning's Enterprise System Struggle, https://fenix.tecnico.ulisboa.pt/downloadFile/3779571626716/AOSI-2007-CASOC.pdf
- Songini, M., "Owens Corning Pushes E-business Projects Despite Financial Struggles," *Computerworld,* January 25, 2001

6.12.3 An Integrated Manufacturing System

6.12.3.1 Overview

Manufacturing companies have a major integration task ahead of them. Simply stated, manufacturing companies need to extend and integrate the applications that support three types of processes:

- Business processes such as payrolls, accounts receivable/payable, order processings, marketing information systems, online-purchasing, and computerized checkout systems.
- Engineering processes such as computer-aided design, computer-aided engineering, and computer-aided process planning.
- Manufacturing processes such as material requirement planning, production scheduling, and flexible manufacturing systems.

Xbuild is a medium sized manufacturing company that is integrating and automating the order processing, inventory control, CAD/CAM (computer-aided design/computer-aided manufacturing), and the manufacturing processes of the company products that involve building IBM PC desktops, laptops, and network devices. This system, referred to as the ***Integrated Computer Integrated Manufacturing (ICIM)*** , will receive a customer order and assemble and pack the product for shipping within an hour of order reception.

Figure 6-34 shows a very high level view of ICIM. The first stage in this system is an order processing system which processes orders for a product. If the specified product is in stock and the customer's credit is acceptable, the product is shipped to the customer from the finished product inventory. The product inventory is adjusted to show products shipped. For an out of stock product, a CAD/CAE system retrieves or produces the design based on the customer specification. The design is then downloaded to a Computer Aided Process Planning (CAPP) system where the manufacturing program is automatically created showing how the product will be assembled. The CAPP system uses the information about available assembly equipment to generate the process plans. An MRP (Material Requirement Planning) system determines the materials needed for the product. MRP systems use sophisticated algorithms that take quantity discounts, vendor preferences, various capacity constraints, and factory status into account. The manufacturing program is downloaded to a flexible manufacturing system (FMS) which consists of an area controller, and several manufacturing devices. FMS also receives a production schedule (how many products to manufacture) and needed raw materials. Because FMS is a realtime system, it must conform to the constraints of realtime control on factory floors.

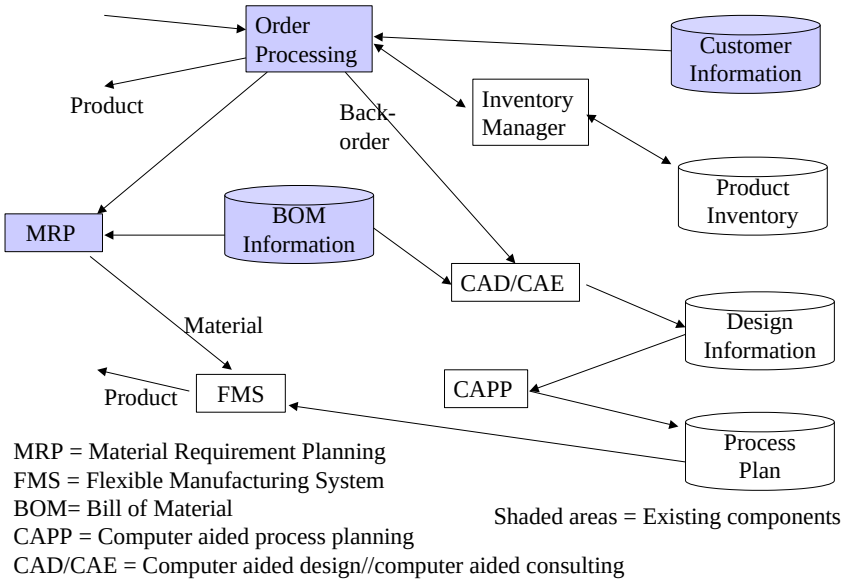

Figure 6-34: Advanced Integrated Control System (AICS)

As shown, this system has a combination of application types such as operational support (e.g., inventory manager, order processing), decision support (MRP), and realtime (FMS). At one point, some applications and associated databases are built by the company. Others are packaged applications that have been purchased, and the rest need to be either built, purchased, or outsourced. Interlinking of these applications is a major challenge many companies are facing.

6.12.3.2 Review and Discussion Questions

Extend ICIM to include an online purchasing system. In other words, integrate the ICIM system with an online purchasing system so that the customer can order a product online that is built by using ICIM and ship the product.

- Develop a business component model of ICIM. Does this help in integration?
- Develop a list of standards that are playing key roles in computer integrated manufacturing systems.

- Survey, evaluate, and pick COTS (commercial off the shelf) technologies and platforms that can support ICIM system. Keep the standards and interoperability issues in mind while making these decisions.
- Translate the logical architecture into a "solution architecture" that shows the middleware and network. You should also include security considerations and map existing COTS technologies in this architecture.
- Develop a detailed network design for this system. In particular, what network design issues will you need to consider supporting realtime operations such as FMS?

Hints: For integrating with online purchasing, you should review the purchasing systems represented by Figure 6-16. A good place to start for manufacturing standards is the Society of Manufacturing Engineers Web site (www.sme.com). For manufacturing related COTS products for MRP, BOM, and others, search for ERP (Enterprise Resource Planning) Systems from companies such as SAP (www.SAP.com), and BAAN (www.BAAN.com).

6.12.4 Kinion Furniture

Kinion Furniture Company is a small manufacturer of handmade furniture based in Oregon. The company ships around 1,000 orders per year, with each order taking 12 – 16 weeks to produce. Before implementing an integrated information technology system, Kinion was entering all sales orders by hand in its Portland showroom, and then bringing them manually to its manufacturing site in McManneville, 40 miles away. Their computer system was limited to DBA Software's accounting and manufacturing application. However, it wasn't networked among the showroom, manufacturing shop, and Vice President Kerry Kinion's home computer (on which the software was installed), making it impossible for anyone but Kinion to conveniently access the information. This led to a situation where the communication process was impeded and there was no real-time information between the sales and manufacturing departments. Ultimately, information was slowed down throughout the manufacturing process.

Due to these setbacks and the company's desire to use information systems for further growth, Kinion contacted the Washington State-based TechnoResources, Inc. In working with the firm Kinion focused on expediting the information-handling process. Based on TechnoResources' suggestions, Kinion implemented a number of software applications and technology services, including Microsoft Office, Microsoft Windows, Microsoft's SharePoint, and a Microsoft Windows Server. The additional help of high-speed digital subscriber lines (DSL) allowed Kinion to use these programs to access and exchange information electronically at a more rapid pace.

The enhanced information system yielded several important results for Kinion. The Windows-based network provided secure links from the showroom to the DBA system in Kerry Kinion's home as well as to one which was installed in the manufacturing shop. With Microsoft Access and Outlook, the company was able to establish an online order entry system also connected to the DBA system. This permitted order and customer contact information entered by sales representatives in the showroom to be immediately available to staff at the manufacturing shop. In addition, a Web-based intranet established using SharePoint Team Services provided an easy way to access information about company projects in real-time. Combined, the suite of technology solutions allowed Kinion Furniture to drastically reduce its order processing time, more easily access customer contact information, track orders, and share information among staff in different locations through a secure, integrated network.

Sources:

- Kinion Furniture Company: https://www.custommade.com/by/kinionfurniture/, visited March 15, 2018
- Kinion Furniture Company: Streamlines Operations for Handcrafted Furniture Manufacturer. (2002, March 21) [On-line] Available: www.microsoft.com/office/evaluation/indepth/casestudies/kinion.asp

6.13 Chapter Summary

Enterprise applicaation architectures (EAAs) show the enterprise applications and how they are interconnected with each other. This chapter has introduced an important player in modern EAAs -- enterprise resource planning (ERP) systems that provide a collection of applications that are integrated around a common database. To estaablish an EAA, companies can buy pre-integrated ERP systems that meet enterprise needs. We have discussed the following ERP systems in this chapter:

- Enterprise portals
- Customer relationship management (CRM)
- Online purchasing
- Electronic marketplaces and trading hubs
- Supply chain management
- Knowledge management systems
- Back-office systems

Although we introduced many of these topics in the previous chapter, this chapter goes through additional details. The key ideas are:

- Most ERP systems at present are becoming SOA (Service Oriented Architecture) enabled.
- Supply chain management and CRM are getting most attention in modern enterprises because they are partner facing (B2B) and customer facing (C2B).
- There is a great deal of activity in B2B trade because of changing business partnerships and mergers and acquisitions.

6.14 Additional Information

[1] Acharya, R (April 16, 2003)., “EAI: A Business Perspective”, eAI Journal
[2] Aberdeen Group (April 2000), “The e-Business Marketplace: The Future of Competition” Executive White Paper
[3] Bakos, Y. (Aug 1998), “The Emerging Role of Electronic Marketplaces on the Internet”. CACM, Vol. 41 No.8
[4] Bakos, Y., Bailey, J. (Spring 1997), “An exploratory study of the emerging role of electronic intermediaries”, International J. Electronic Commerce 1, 3
[5] Berson, A. (2000), "Building Data Mining Applications for CRM", McGraw-Hill
[6] Bradford, M., (2015), “Modern ERP: Select, Implement, and Use Today's Advanced Business Systems”, LuLu Publications, 2015
[7] Carter, S. (2007), “The New Language of Business: SOA & Web 2.0”, IBM Press
[8] Chabrow, E. (April 3, 2000),“Supply Chains Go Global”, Information Week
[9] Chopra, S. and Meindl, P. (2006), "Supply Chain Management", 3rd Edition, Prentice Hall

[10] Cooper, M. C., and Ellram, L. M. (1993), "Characteristics of Supply Chain Management and the Implications for Purchasing and Logistics Strategy", The International Journal of Logistics Management, 4, 2, 13-24
[11] Davenport, Thomas H. (July-August 1998), "Putting the Enterprise into the Enterprise System", Harvard Business Review
[12] Davydov, M. (2001), "Corporate Portals and e-business Integration", McGraw-Hill Professional Publishing
[13] Davis, M. et al, (January 2000), "Using an ASP: What are the Risks and Benefits?", Gartner Research Note, 10
[14] Dyche, J. (2001), "The CRM Handbook: A Business Guide to Customer Relationship Management", Addison-Wesley
[15] Erickson, G., and Rothberg, H. (Summer-Fall 2002), "B2B Internet Applications: Strategic Considerations", Competitiveness Review
[16] Gable, J. (March-April 2002), "Enterprise Application Integration", Information Management Journal
[17] Goldberg, B.J. (March-April 2002), "CRM In Real Time: Empowering Customer Relationships", CyberAge Books
[18] Gulledge, T. (Sept 2002), "B2B Emarketplace and Small- and Medium-sized Enterprises", Computers in Industry,
[19] Henderson, J. and Venkatraman, "Strategic Alignment: Leveraging Information Technology for Transforming Organizations", IBM Systems Journal, Vol. 32, No. 1, 1993, pp. 4-16.
[20] IDC, "Conducting e-Business: A User Survey ", 2001.
[21] Kalakota, R., and Whinston, A., "Frontiers of Electronic Commerce", Addison Wesley, 1996.
[22] Ketchpel, S., Garcia-Molina, H., "Making Trust Explicit in Distributed Commerce Transactions". 16th International Conference on Distributed Computing Systems (DCS96), 1996.
[23] Lee, J., Siau, K., and Hong,S. (Feb 2003), "Enterprise Integration with ERP and EAI", Communications of the ACM
[24] Luftmann, J. (1996), "Competing in the Information Age: Strategic Alignment in Practice", Oxford University Press
[25] Lynn, R. et al (2007), "Programming Portlets: From JSR 168 to IBM WebSphere Portal Extensions", Mc Press
[27] Magretta, J.(March-April 1998), "The Power of Virtual Integration: An Interview with Dell Computer's Michael Dell", Harvard Business Review
[26] Magal, R. and Word, J (2011)., "Integrated Business Processes with ERP Systems", Wiley
[28] Pienaar, Abré and Johan du Toit (2015), "Thinking about ERP: The Executive`s guide to setting strategy for selecting, implementing and operating ERP".
[27] Simchi-Levi, Kaminsky and Simchi-Levi (1999), "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies", Irwin/McGraw-Hill
[28] Shunter, M., and Waidner, M. (May 12-15 1997), "Architecture and Design of a Secure Electronic Marketplace", Procs. JENC8: 8th Joint European Networking Conference, Edinburgh
[29] Taylor, D., and Terhune, D. (2001), "Doing E-Business: Strategies for Thriving in an Electronic Marketplace". John Wiley
[30] Turban, E., et al (2010), "Decision Support and Business Intelligence", Prentice-Hall, 9th edition.
[31] Turban, E., et al (2012), "Electronic Commerce: A Managerial Perspective", Prentice-Hall, 7th edition.
[32] Tygar, J. (May 23-26, 1996), "Atomicity in Electronic Commerce", Proc. of ACM Symposium on Principles of Distributed Computing
[33] Umar, A. (2010), "Mobile Computing and Wireless Communications", NGE Solutions, Second Edition
[34] Umar, A. (Nov. 1997), "EC Bedrock", Database Programming and Design
[35] Umar, A., Elsinger, D., and Lai, M. (April 2000), "A Framework for Analyzing Next Generation Enterprises", Working Conference on Next Generation Enterprises, Buffalo, New York
[36] United Nations (2007), "eProcurement", UN Publications
[37] Wagner, B. and Monk,E. (2008), "Enterprise Resource Planning", Course Technology
[38] Wurman. P. (March-April 2001), "Dynamic Pricing in the Virtual Marketplace", IEEE Internet Computing, pp. 36-42.