

## UNIT 2

### OVERVIEW OF ENTERPRISE INFORMATION SYSTEMS

#### INTRODUCTION TO ENTERPRISE INFORMATION SYSTEMS

Information systems are formed with any combination of five key components/ resources: People (including processes), Software, hardware, telecommunication networks and data. In business context, it is a work system with an objective of information processing. It involves capturing, transmitting, storing, retrieving, manipulating and displaying information. Information systems perform three vital roles in business:

**Support business operations:** May it is recording transactions, processing orders or tracking inventory, information systems provide support through business process automation. This enables operational executives to provide quick response to both internal and external customers. E.g. Point of sales systems provide support to billing clerks by enabling quick retrieval of stock keeping units information and generating invoice.

**Support managerial decision making:** The science of decision making when applied through information systems enables managers to leverage information systems processing speed and accuracy. Information systems provide appropriate information to managers for identifying trends, develop action plans and evaluate outcome of previous decisions. E.g. Marketing automation systems provide support to Marketing function by providing access to customer databases and procedures to run analysis to plan targeted promotions.

**Support strategic advantage:** The information systems can enable competitive advantage in the market through increasing speed and reducing cost through enterprise value chain and supply chain processes. E.g. Virtual store channel using electronic commerce technology provides greater accessibility to customers anywhere, anytime in a highly competitive retail market.

### 3.1 CLASSIFICATION OF ENTERPRISE INFORMATION SYSTEMS

#### Traditional classification (1950s to 1990s)

Enterprise information systems are classified into four major categories based on their utility in various levels of enterprise across functions. Figure 3.5 illustrates four types of information systems for three organizational levels across four major functions:

Level	Functions				Information system type
	Sales and marketing	Manufacturing and production	Finance and accounting	Human resources	
Strategic level	3 –years sales trend forecasting	3 – year operating plan	Profit planning	Personnel planning	<i>Executive information systems(1980s)</i>

Management level	Sales region analysis	Production scheduling	Profitability analysis	Contract cost analysis	<i>Decision support systems (1970s)</i>
	Sales management	Inventory control	Annual budgeting	Relocation cost control	<i>Management information systems (1960s)</i>
Operational level	Order processing	Material movement control	Payroll, Accounts payable	Employee record keeping	<i>Transaction processing systems (1950s)</i>

Figure 3.5: Classification of information systems

**Transportation processing systems (TPS):** These systems process routine transactions triggered by business events and assist executives in performing operational tasks. E.g. Order processing, material movement control, payroll, accounts payable and employee record keeping are some operational tasks that are supported by transactions processing systems.

**Management information systems (MIS):** These systems process high volume transactional level data and delivers summary reports required by middle managers. It uses simple models to process data and generates summary reports. E.g. Sales reports, stock reports, budget variance.

**Decision support systems (DSS):** These systems process low volume data from TPS, MIS and external systems by using sophisticated modeling and analysis tools to generate results that aid in taking informed decisions by middle level managers. The key characteristic of DSS is interactivity. E.g. regional sales analysis, production schedules, profitability analysis and contract cost analysis are few analyses that can be performed by decision support systems.

**Executive information systems (EIS):** These systems process aggregated data from multiple systems (internal and external sources) to generate projections for supporting senior managers on strategy formulation and execution. Like DSS these systems are also highly interactive and are developed for individual needs. E.g. 3 year sales trend forecasting for product groups, 3 year operations planning, profit planning and personnel planning are few planning task that are supported by executive information systems.

**Knowledge work and office automation systems (KWS & OAS):** These systems are similar to transaction processing systems that support knowledge workers and data workers tasks. These systems are used to create, store and communicate knowledge artifacts like product designs, revenue models, supply chain network models; data artifacts like email texts, customer data, application form data, and primary survey data.

### Role of enterprise information systems in supply chain management function

Supply chain management function requires business process view and involvement of cross

functional teams. Supply chain information systems provide cross functional information across multiple organizational levels. It includes production and storage facilities, inventory management, transportation management, material sourcing and distribution functions. An enterprise with its operations spread across multiple geographies depends on communication networks to coordinate internal supply chain activities through internally focused enterprise information systems. On the contrary, externally focused enterprise information systems tend to extend their functionality to supply chain partners. The intranets, extranets and virtual private networks are used to access enterprise information systems that are designed with appropriate information technology architectures (as discussed in the above section). Figure 3.6 illustrates the application of information systems in four key supply chain management functions.

Level	Supply chain management functions				Information system type
	Sourcing	Inventory	Transportation	Distribution	
Strategic level	Design collaboration and NPD status	Inventory tradeoffs and projections	Transportation tradeoffs and cost projections	Channel profit projections	<i>Executive information systems</i>
Management level	Supplier analysis	ABC analysis	Asset utilization analysis	Variance analysis	<i>Decision support systems</i>
	Supplier performance reports	Inventory policy control	Delivery performance reports	Primary sales performance reports	<i>Management information systems</i>
Operational level	Purchasing	Material movement control	Dispatching	Re-order processing	<i>Transaction processing systems</i>

Figure 3.6: Supply chain information systems

### Contemporary classification (Since 1990s)

The enterprise information systems are also called as *enterprise applications or enterprise systems*. With the developing economies embracing globalization and liberalization, many enterprises expanded operations across continents that lead to reorganization of enterprise information systems. Many enterprises witnessed high costs of expanding, integrating and managing functionally organized enterprise applications. Many found that it was also not technologically feasible. This problem of economic viability and technological feasibility of enterprise information systems integration and maintenance was solved with development of functionally integrated enterprise applications sharing a common database. These integrated enterprise systems allowed flow through of transaction through multiple functional modules of the application suite and that catered to all levels (operational, managerial and strategic levels) in the enterprise. These enterprise systems packages are known as enterprise resource planning (ERP) systems. They include some that have developed out of the administrative (financial and human resources) side of the business (e.g., SAP and PeopleSoft {now Oracle}), and some from materials resource planning in manufacturing (e.g., Baan {now Infor Global}).

As illustrated in figure 3.7, the enterprise applications landscape can be best viewed in three levels:



Functional level, Integrated enterprise level and extended enterprise level.

	Integrated enterprise level	Extended enterprise level
Functional level		
Functional silos (No integration)	Internally integrated business processes and functions	Selective integration of supply chain partners business processes
Standalone functional applications	ERP applications	SCM applications CRM applications

Figure 3.7: Enterprise applications landscape

**Functional level applications:** These are traditional information systems (as discussed in previous section) that were developed to support businesses at operational, managerial and executive levels. They are modeled on the business processes required to manage select business function. As discussed above, there are functional level applications supporting finance and accounts, human resources management, manufacturing and production, sales and marketing, Logistics and distribution functional silos. Since business processes are unique for every enterprise, the functional level applications were developed by in house IT teams or with support from strategic IT partners.

The biggest drawback of these systems was replication of multiple data bases for each functional application and complexity in integrating multiple applications for seamless data flow.

**Integrated enterprise level applications:** These are true enterprise applications and also are called as enterprise resource planning applications. There are three important circumstances during 1990s that led to wide adoption of these applications across the world.

1. Proliferation of the Internet as an economical communication network
2. Development of Client / Server architecture
3. Emergence of major enterprise application vendors

The common characteristics of these applications are *centralized database, integrated business processes with functional view, and modular approach for implementation.*

**Extended enterprise level applications:** These applications extended the integrated enterprise systems functionality to supply chain partners. The emergence of B2B e-commerce and e-business models made it possible to leverage Internet for integrating inter-organizational business processes. The two major categories of extended enterprise applications are supply chain and customer relationship management systems. They share the characteristics of integrated enterprise applications.

### 3.2 DISCUSSION ON POPULAR ENTERPRISE APPLICATION PACKAGES

There are various enterprise applications that were developed for meeting specific requirements of businesses. These enterprise applications are also called as e-business applications as they not only

integrate the internal functions but also the enterprise supply chain partners business processes or enterprise systems. Below is the list of enterprise application packages:

1. Enterprise resource planning (ERP)
2. Supply chain management (SCM): Advanced planning and scheduling, Distribution requirements planning, Warehouse management, Transportation management
3. Customer relationship management (CRM): SFA, Marketing, Account management
4. Product life cycle management (PLM)
5. Business intelligence

**Enterprise resource planning packages:** These applications integrate business process flows across four major functions: *Finance and accounts, Sales and marketing, Manufacturing and production, Human resource management*. According to Davenport, “ERP system comprises of a commercial software package that promises the seamless integration of all the information flowing through the company—financial, accounting, human resources, supply chain and customer information”. Apart from integrated processes and centralized database, these systems provide best practices in the industry. The best practices are captured as the vendor implements ERP applications. These best practices are then translated into process flow in the ERP packages subsequent versions. ERPs are also referred as *enterprise applications backbones* as all the other applications are extensions of ERP using internet

Table 3.1 and Table 3.2 summarize advantages and disadvantages of ERP systems<sup>5</sup>.

#### Advantages of ERP applications

Advantage	Description
Reliable information access	Common DBMS, consistent and accurate data, improved reports.
Avoid data and operations redundancy	Modules access same data from the central database, avoids multiple data input and update operations.
Delivery and cycle time reduction	Minimizes retrieving and reporting delays.
Cost reduction	Time savings, improved control by enterprise-wide analysis of organizational decisions.
Easy adaptability	Changes in business processes easy to adapt and restructure.
Improved scalability	Structured and modular design with “add-ons.”

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<sup>5</sup>Source: The evolution of ERP Systems: A Historical Perspective; Mohammad A. Rashid, Massey University–Albany, New Zealand; Liaquat Hossain, Syracuse University, USA; Jon David Patrick, University of Sydney, Australia

Improved maintenance	Vendor-supported long-term contract as part of the system procurement.
Global outreach	Extended modules such as CRM and SCM.
E-Commerce, e-business	Internet commerce, collaborative culture.

Table 3.1: ERP applications advantages

### Disadvantages of ERP applications

Disadvantage	How to overcome
Time-consuming	Minimize sensitive issues, internal politics and raise general consensus.
Expensive	Cost may vary from thousands of dollars to millions. Business process reengineering cost may be extremely high.
Conformity of the modules	The architecture and components of the selected system should conform to the business processes, culture and strategic goals of the organization.
Vendor dependence	Single vendor vs. multi-vendor consideration, options for “best of breeds,” long-term committed support.
Features and complexity	ERP system may have too many features and modules so the user needs to consider carefully and implement the needful only.
Scalability and global outreach	Look for vendor investment in R&D, long-term commitment to product and services, consider Internet-enabled systems.
Extended ERP capability	Consider middle-ware “add-on” facilities and extended modules such as CRM and SCM.

Table 3.2: ERP applications disadvantages

Figure 3.8 illustrates ERP logical structure with core functional modules in a manufacturing setup.

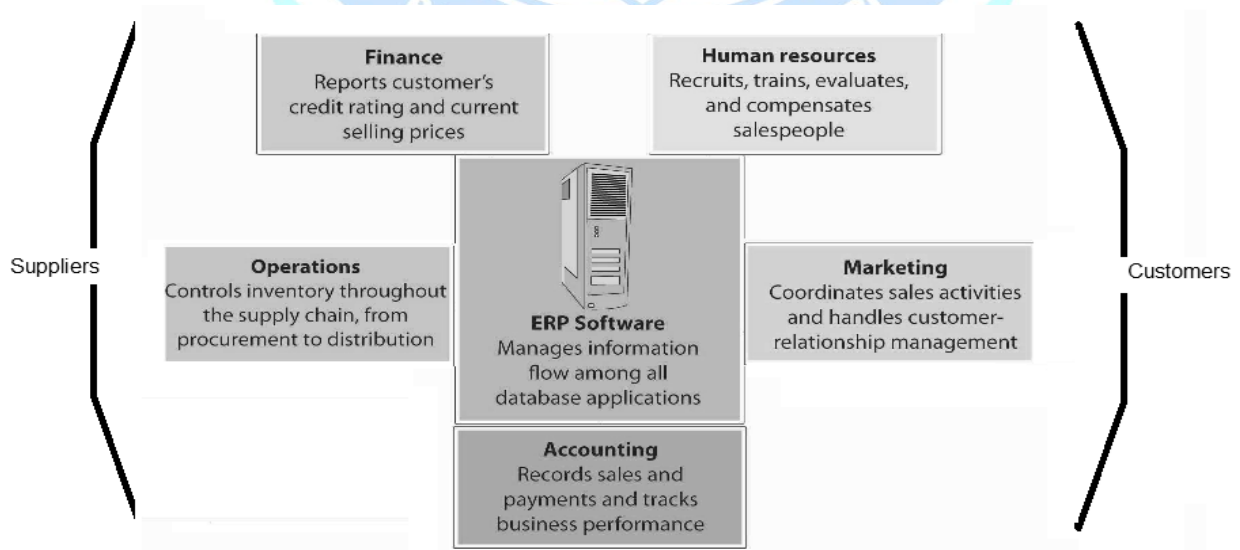


Figure 3.8: ERP logical structure (manufacturing company)



The ERP packages can provide support at operational, managerial and strategic levels across wide range of internal enterprise business activities and systems. Table 3.3 provides a list of such activities.

Sales & Marketing	Manufacturing	Production
Forecasting Order entry Full sales support Customer service Field service Marketing	Sales and operations planning Capacity requirement planning Advanced planning and scheduling Inventory management Manufacturing engineering <i>Manufacturing execution systems</i> Research and development	Master scheduling Quality management Maintenance management Product engineering Production activity control Full JIT support <i>Enterprise production systems</i>
Finance & Accounting	Human resource management	Supply chain management*
Accounting A/P, A/R, GL Financial planning Advanced costing Standard costing Executive decision support Assets management	Personnel management Org. management Payroll Time management Personal development	Order management Purchasing Logistics and distribution <i>Electronic Data Interchange</i>

Table 3.3: Business activities and systems supported by ERP applications (manufacturing industry)

\* Internal supply chain activities that are add-ons to ERP core functional modules.

**Supply chain management packages:** In addition to ERP functional modules related to internal supply chain management (order management, purchasing, logistics & distribution), supply chain management packages are of two types:

1. Add-on supply chain packages to ERP
2. Extended ERP packages

Figure 3.9 illustrates the conceptual arrangement of supply chain packages with reference to ERP

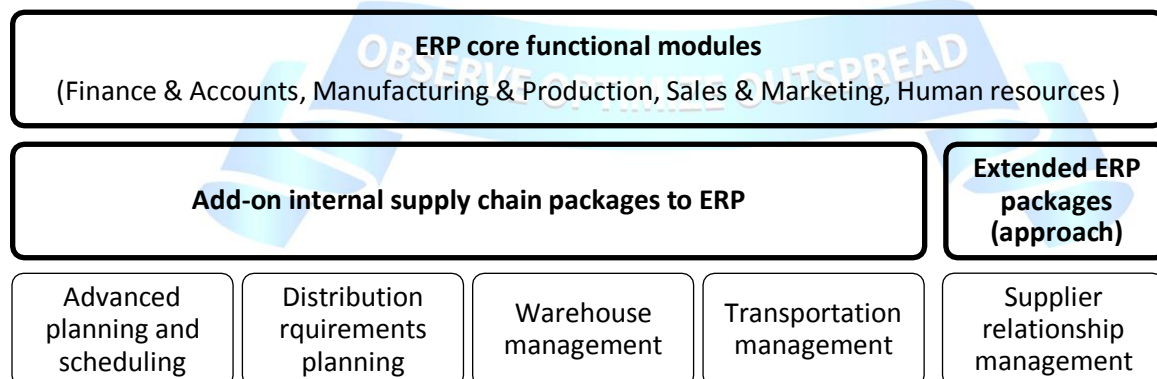


Figure 3.9: Internal supply chain and extended supply chain packages

### Add-on internal supply chain packages to ERP

The *internal supply chain management* involves operations management, logistics and distribution management that are limited to enterprise boundary (enabled by ERP manufacturing, production and supply chain modules). Advanced planning and scheduling, distribution requirements planning, warehouse management, transportation management, are additional supply chain management packages that optimize internal supply chain functions. All these systems take inputs from ERP system, process and at times provide input back to ERP systems for planning and execution.

**Advanced planning and scheduling systems (APS):** These applications use mathematical and heuristic modeling and optimization techniques and simulations. *At the strategic level, they perform logistics network design and at tactical level they do detailed scheduling.* Though every ERP has APS functionality, a comprehensive APS system connecting multiple manufacturing locations in an enterprise provides optimal solution taking into consideration total capacity, resources and demand. More importantly, APS outputs help in three types of decisions:

1. Available to promise (ATP: quote reliable delivery date to customer with known work in progress and finished goods inventory)
2. Capable to promise (CTP: quote reliable delivery date to customer with known ATP data and material inventory)
3. Profitable to promise (PTP: estimate profitable order through profitability analysis)

**Distribution Requirements Planning Systems (DRP):** ERP systems manage inventory and execute inventory policies. It manages raw materials and finished goods inventory at manufacturing locations. In case of multiple finished goods warehouses and retail locations, the DRP or inventory management system will recommend the stocking policy for each inventory item. These systems help in managing trade-off between stock out cost and inventory holding costs. *Like APS these systems take total inventory requirement across locations and other related information like lead times, suppliers and demand to suggest optimal inventory and replenishment policies.* They also help in performing customer segmentation analysis by combining inventory and customer information.

**Warehouse management systems (WMS):** These systems are designed to manage and optimize workflows and storage of goods within a warehouse. Typical WMS functionality includes *receiving, inventory control, order entry, order selection and visibility, quality control, storage location management, automated replenishment and shipping.* The cost of WMS is very high as it requires highly detailed setup with exact measurements of locations, SKUs and other SKU related requirements.

**Transportation management:** These systems are designed to manage transportation operations including mode selection, optimizing routes and loads, and ongoing maintenance. Typical TMS



functionality includes *transportation network design, shipment planning, routing, private fleet management, load matching and optimization, freight rating, manifesting, load tendering and delivery scheduling, shipment tracking and settlement, visibility tools and post-shipment analysis.*

### Extended ERP packages

*Extending the internal supply chain through collaboration with suppliers beyond enterprise boundary is enabled by supplier relationship management package.*

**Supplier relationship management:** These systems are designed to enable collaboration between focal enterprise and multiple levels of suppliers for realizing cost savings. The ERP functions include supplier data management, procurement and supplier performance evaluation from internal supply chain perspective. SRM application packages functionality extends beyond these basic functions. Typical SRM application package functions include *procure to pay process, catalog management, centralized sourcing, centralized contract management, supplier collaboration and supplier evaluation.* Since the application is shared with supply chain partners beyond enterprise boundary, Internet and EDI technologies become integral part of SRM application package design.

**Customer relationship management (CRM):** These systems are designed for managing enterprise interactions with its customers, clients and sales prospects. It involves sales activities, marketing, customer service, and technical support. The overall goals are to acquire, retain and enhance customers through a comprehensive approach. Similar to SRM, it also extends ERP sales and marketing functions. Typical CRM application package functions include *account management, sales force management, customer analytics and marketing automation.* Since the application is shared with customers (distributors and end customers for better service) beyond enterprise boundary, Internet technologies become integral part of CRM application package design. Figure 3.10 illustrates the conceptual relationship between ERP and CRM application packages.

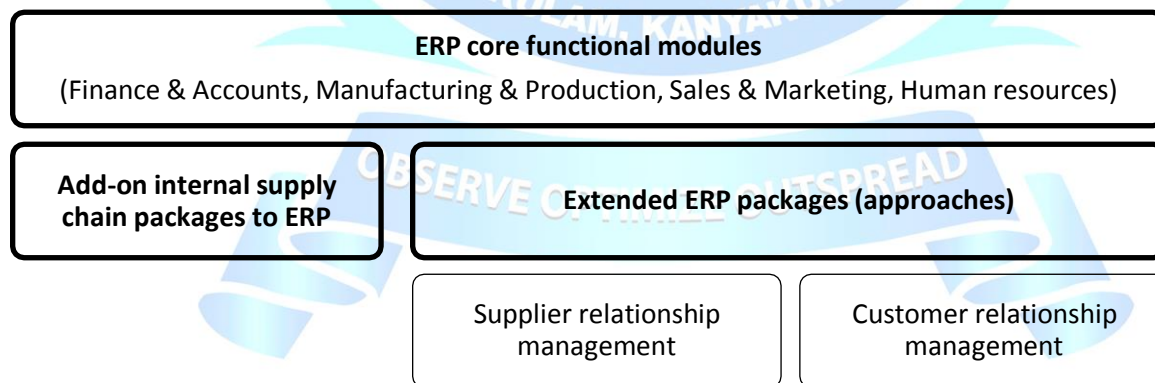
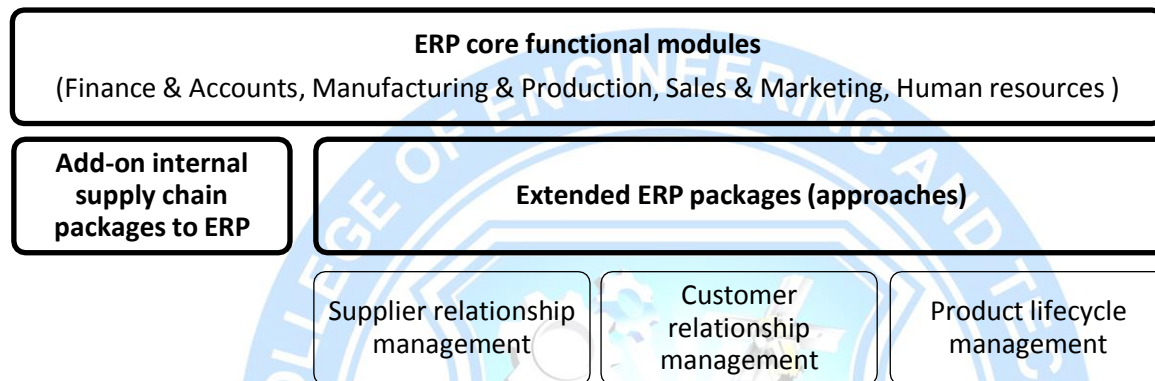


Figure 3.10: CRM as an extended ERP application package

### Product Lifecycle Management (PLM):

PLM application integrates people, data, processes and business systems and provides a product information backbone for companies and their extended enterprise. It combines methods, people and processes with tools such as computer aided design (CAD); computer aided manufacturing

(CAM) and Product data management (PDM). Typical PLM functions include *product management, product development and collaboration, product data management and product life cycle management (marketing)*. Since the application is shared with suppliers (for design collaboration), manufacturers (for manufacturing collaboration) and service partners (for service collaboration) beyond enterprise boundary, Internet technologies become integral part of PLM application package design. Figure 3.11 illustrates the conceptual relationship between ERP and PLM application packages.



While ERP is a strategic approach to integrate internal functions for efficient and effective utilization of resources, the SRM, CRM and PLM application packages complement ERP. These are extended ERP application packages and require use of internet and EDI technologies to enable collaboration through software interfaces.

Figure 3.11: PLM as an extended ERP application package

**Business Intelligence (BI):** The implementation of various application packages to integrate and optimize both internal and extended business processes result in huge volumes of accumulated data. The management information systems, decision support systems and executive information systems are used to process the data from functional applications and provide insight into various business activities. Similar to ERP, SCM, CRM and PLM application packages, vendors developed another set of packages that enable enterprises to extract data from multiple sources, cleanse the data and process it using various mathematical and statistical tools. Typical functionalities of BI tools include *reporting, dashboards and analytics*. Figure 3.12 illustrates conceptual relationship between ERP, extended ERP and BI packages.

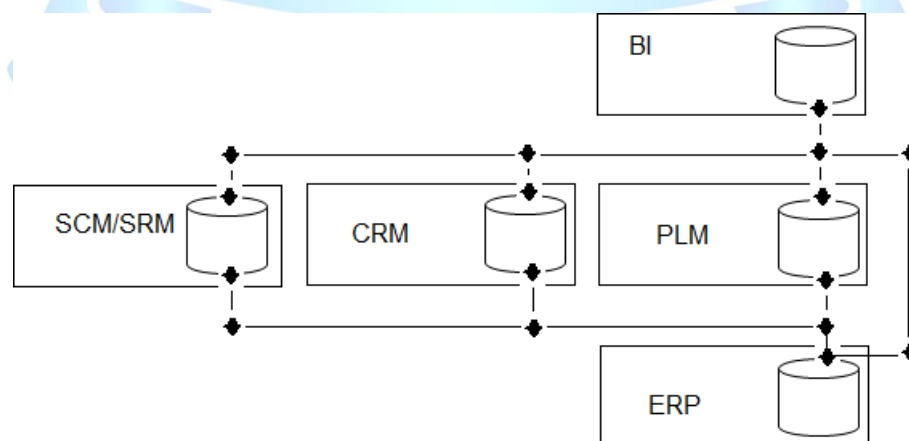


Figure 3.12: BI packages extracting, cleansing and processing data from ERP and extended ERP

### 3.3 BENEFITS OF ENTERPRISE APPLICATIONS

The implementation of enterprise systems involves a huge cost. Benefits of enterprise systems that are successfully implemented in alignment with business model tend to outweigh the cost incurred by an organization. Following are general benefits of enterprise systems:

1. **Integrated organizational system:** Enterprise applications result in development of integrated system within the organization. The systems implementation activity streamlines business processes, workflow leading to improved efficiency.
2. **Improved data entry:** Redundant database or re-entry of data across multiple enterprise systems is eliminated to maximum extent by integration of all systems in the enterprise.
3. **Incorporation of best practices:** Enterprise systems implementations generally require study and adoption of best industry practices for overall improvement of enterprise.
4. **Flow of information:** Since all the departments rely on integrated data base and structured workflow based on rules, interdepartmental and intra-enterprise communication improves to a great extent.
5. **Improved customer satisfaction:** The structured flow of information across multiple departments inside the enterprise leads to improved communication with supply chain partners. This overall coordination through improved communication results in on-time delivery of goods and services to customers leading to high customer satisfaction.
6. **Reduced inventory costs:** The implementation of enterprise system concepts like ERP, SCM, CRM, PLM results in better planning, collaboration and development of better forecasts and policies. This results in a reduced inventory cost.
7. **Improved collections:** The close integration of all functions with finance and accounts processes results in accurate billing and delivery. This results in faster and improved collections.
8. **Improved costing:** Tracing of costs of all activities will become easy with enterprise systems. This enables implementation of activity based costing for business improvement.
9. **Improved planning:** The integrated systems provide a consolidated view of forecasts, inventory, sales and collections. This supports management to make better plans and take informed decisions.

### 3.4 SELF-ASSESSMENT QUESTIONS

1. What are differences between mainframe and Client / Server architectures?



2. Distributed computing model improves customer service. Discuss.
3. How does cloud computing reduces capital and operational expenditures of an enterprise?
4. Define enterprise information system and discuss how they are helpful for enterprise?
5. Write a note on traditional classification of enterprise information systems?
6. What is contemporary classification of enterprise information system? Identify the key differences between traditional and contemporary classification?
7. What are the benefits of enterprise information systems?



