UCSC

IT1105 – Information Systems and Technology

BIT – 1ST YEAR – SEMESTER 1
University of Colombo School of Computing

Student Manual

Lesson 5:

Business Information Systems

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Duration: 16 hrs

5: Business Information Systems

Instructional Objectives

Students will be able to:
- Identify basic activities and business objectives common to all transaction processing systems (TPSs)
- Describe some key control and management issues associated with a TPS
- Identify the inputs and outputs for the transaction processing systems associated with order processing, purchasing and accounting business process
- Define the term MIS (Management Information System)
- Distinguish the difference between a TPS and a MIS
- Describe the inputs and outputs associated with different types of MIS
- List and discuss the important characteristics of DSSs (Decision Support Systems)
- Identify and describe the basic components of a DSS
- Describe the characteristics of Group Support Systems (GSS) and Executive Support Systems (ESS)
- Identify uses of GSS and ESS
- Define the term Artificial Intelligence and identify its major application areas

5.1   Transaction Processing System (TPS)

5.1.1   Overview of TPS

Transactions are events that occur as part of doing business, such as sales, purchases, deposits, payments etc. Transaction Processing Systems (TPS) are cross functional systems that process data resulting from the daily routine transactions necessary for business functions. Automated TPSs consist of all the components of a computer based information system (CBIS), including databases, telecommunications, people, procedures, software and hardware devices used to process transactions.

TPSs are considered as operational level systems as they keep track of the elementary activities and transactions of the organization. The principal purpose of systems at this level is to answer routine questions and track the flow of transactions through the organization. These systems are used mainly by operational level employees of an organization.

Input to a TPS: Basic business transactions such as customer orders, purchase orders, receipts and invoices are inputs to a TPS.

Processing: In order to produce the required output processing is carried out on input data. The processing activities include data collection, data editing, data correction, data manipulation and data storage and document production.

Output of a TPS: Updated records after the last transaction.
For example withdrawing money from a savings account will cause a change in the balance of the savings account. The relevant record of the customer in the database will be updated to reflect this change.
An output of a TPS can also take the form of reports and documents. For example, the customer's savings book will be updated with the latest transaction.
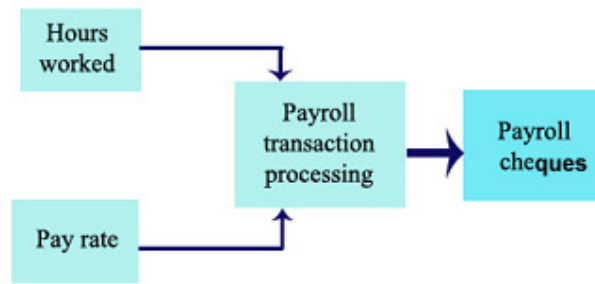
Figure 5.1: A Payroll Transaction Processing System

Figure 5.1 illustrates a basic payroll TPS. The **inputs** (numbers of employee hours worked and pay rates) go through a transformation **process** to produce **outputs** (pay cheques).

Table 5.1 provides a list of TPSs that can be found across five functional areas of a business.

Table 5.1 – TPSs for five functional areas of a business

	Type of TPS			
Functional Area	**Sales/Marketing**	**Manufacturing /Production**	**Finance/ Accounting**	**Human Resources**
Major Application Systems	Sales Order IS Market Research System Pricing System	Material Resource Planning System Purchase Order Control Systems Engineering Systems Quality Control Systems	Budgeting Accounts receivable/payable General Ledger Funds Management Systems	Payroll Employee Records Benefit Systems Career Path Systems

As TPSs often perform activities related to customer contacts - such as order processing and invoicing- these information systems play a critical role in providing value to the customer. Apart from external customers, internal stakeholders also heavily rely on TPSs to carry out routine operations of the organization (as shown on table 5.1). Therefore, if TPSs fail to operate correctly, the impact on the organization can be high.

5.1.2   Types of Transaction Processing methods

5.1.2.1 Batch Processing
With batch processing systems, business transactions are collected over a period of time and prepared for processing as a single unit or batch. Batch jobs can be stored up during working hours and then executed during the evening or whenever the computer is idle. The time period during which transaction are accumulated is whatever length of time is needed to meet the needs of the users of that system.

For example, it may be important to process invoices and customer payments for the accounts receivable system daily, whereas, the payroll system may receive time cards and process them biweekly or monthly to create checks and update employee earning records. Another example of batch processing is the way that credit card companies

process billing. The customer does not receive a bill for each separate credit card purchase but one monthly bill for all of that month's purchases. The bill is created through batch processing, where all of the data are collected and held until the bill is processed as a batch at the end of the billing cycle. This is depicted in figure 5.2.
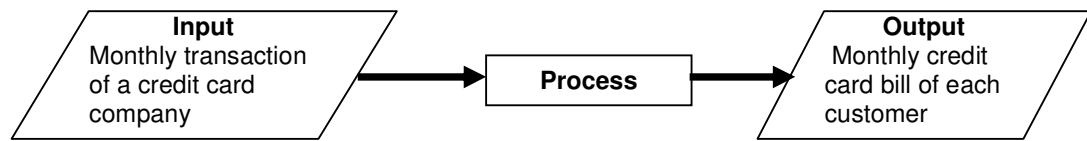

Figure 5.2: Batch processing example: Customer billing

The essential characteristics of a batch processing system is that there is some delay between the occurrence of the event and the final processing of the related transaction to update the organization's records.

Typical batch processing applications include payroll transactions and billing. Furthermore, specific organizational goals also define the method of transaction processing best suited for the various applications of the company.

5.1.2.2 Online Processing

Today's computer technology allows another processing method called online transaction processing (OLTP). In OLTP, each transaction is processed immediately, without the delay of collecting transactions into a batch. As soon as the input is available, a computer program performs the necessary processing and updates the records affected by that single transaction. Consequently, at any time the data in an online system always reflects the current status.

When you make an airline reservation, for instance, the transaction is processed, and all databases, such as seat occupancy and accounts receivable, are updated immediately.

This type of processing is absolutely essential for businesses that require quick access to up-to-date information such as airlines, travel agencies, and stock investment firms.

Many firms are using the Internet, extranets and other networks that tie them electronically to their customers or suppliers for online transaction processing. Such real-time systems, which capture and process transactions immediately, can help firms provide a superior service to customers and other trading partners. This capability adds value to their products and services, and thus gives them an important way to differentiate themselves from their competitors.

Example of OLTP - When travel agent A confirms a reservation, the central database needs to be updated quickly before travel agent B makes a reservation. If the database is not updated online, a situation may arise where a travel agent may confirm a seat for a passenger without knowing the aircraft is fully booked.
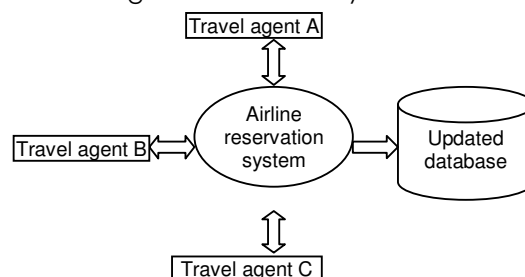

Figure 5.3: Online transaction processing

Online entry with delayed processing
A third type of transaction processing, called online entry with delayed processing is a compromise between batch processing and online processing. With this type of system, transactions are entered into the computer system when they occur, but they are not processed immediately.
Example: Ordering over the telephone

Although the technology exists to carry out OLTP, it is not used for all transactions. For many applications, batch processing is considered to be more appropriate and cost-effective.

5.1.3   Organizational Objectives of a TPS

Because of the importance of transaction processing, organizations expect their TPSs to achieve a number of specific objectives, including the following.

Capture, Process, Store Transactions and Produce Outputs
The primary objective of any TPS is to capture large volumes of data, process data, store transactions and to produce a variety of documents related to routine business activities. These business activities can be directly or indirectly related to selling products and services to customers.

Processing orders, purchasing materials, controlling inventory, billing customers, and paying suppliers and employees are all business activities that result from customer orders.
These activities result in transactions that are processed by the TPS.

Many businesses including telecommunications companies, financial-services organizations are under enormous pressure to process larger volumes of transactions in near-real time.

Ensure Accuracy and Integrity of Data and Information
Another objective of any TPS is error-free data input and processing.
Example An editing program should have the ability to determine that an entry that should read "60 hours" is not entered as "600 hours" or "6000 hours" due to a data entry error.

An important component of data integrity is to avoid fraudulent transactions.
Example E-commerce companies face this problem when accepting credit or debit card information over the Internet. It is important to make sure that the customer is using a valid credit or debit card. One approach is to use a digital certificate. A digital certificate is a small computer file that serves as both an ID card and a signature. Some believe that digital certificates, which use complex mathematical codes, are almost fraud proof.

As the volume of data being processed and stored increases, it becomes more difficult for individuals and machines to review all input data.

A company must ensure both data integrity and data accuracy because data and information generated by the TPS are often used by other information systems in an organization.

Produce Timely Reports and Documents
The ability to conduct business transactions quickly can be very important for an organization's bottom line.

Although manual transaction processing systems can take days to produce routine documents, the use of computerized TPSs significantly reduces this response time.

Improvements in information technology, especially hardware and telecommunications links, allow transactions to be processed in a matter of seconds.

Increase Labor Efficiency
Manual business processes require significant number of employees and equipments to process the necessary business transactions. By automating these manual processes, organizations are able to substantially reduce the number of employees and equipment required to carry out a specific transaction. For example, a small minicomputer linked to a company's cash registers has replaced a room full of clerks, typewriters, and filling cabinets.

Provide Increased and Enhanced Customer Service
One objective of TPSs is to assist an organization to provide a fast, efficient service. Electronic Data Interchange (EDI) systems of some companies allow customers to place orders electronically, thus bypassing slower and more error-prone methods of written or oral communication. Another example would be utilizing technologies such as the Internet to improve customer service. Through the Internet customers are able to browse a catalogue of products and order an item, purchase the air tickets etc. by accessing the relevant databases of the organization. Among other benefits, this reduces the need for the customer to physically be present at the supplier's premises, thus improving customer service.

Increase Customer Loyalty
Transaction processing systems of a firm are often the means of communicating with the customer. Therefore, it is important that the customer interaction with these systems keep customers satisfied and returning.
For example the use of store cards. Store cards can be used to collect points whenever a transaction takes place. A TPS will capture information about the purchasing details of a customer. These points are usually equivalent to money (100 points equals Rs. 10 etc.). The collected points may be redeemed against gift vouchers or money.

Achieve Competitive Advantage
Another objective of a TPS can be achieving competitive advantage. The following table 5.2 provides a list factors that may contribute to achieving competitive advantage by using a TPS.

Table 5.2 - Example of Transaction Processing Systems for Competitive Advantages

Competitive Advantage	Example
Increase customer loyalty	Use of customer interaction system to monitor and track each customer interaction with the company. Example: by introducing store cards
Provide an improved service to customers	Use of tracking systems that are accessible by customers to determine the status of a shipment or an application. Example: The tracking system used by FedEX, Royal Mail (for registered post)
Facilitate a better relationship with suppliers	Use of an Internet marketplace to allow the company or an individual to purchase products from suppliers at discounted prices.
Superior information gathering	Use of sales order configuration system to ensure that products ordered will meet customer's objectives

Cost reduction	Use of warehouse management system employing RFID technology to reduce labour hours and improve inventory accuracy
Better management of inventory levels	Use of collaborative planning, forecasting, and replenishment to ensure the right amount of inventory is in stores

Depending on the specific nature and goals of the organization, any of the objectives discussed may be more important than others.

By meeting these objectives, TPSs can support corporate goals such as cost reduction, increased production, improved quality and customer satisfaction and more efficient and effective operations.

5.1.4   Activities in a TPS

All TPSs perform a common set of basic data processing activities. TPSs capture and process data that describes fundamental business transactions. This data is used to update databases and to produce a variety of reports which are used by people both within and outside the enterprise. These can be considered as the activities of a typical TPS. Apart from these activities some TPSs can include inquiry processing capabilities.
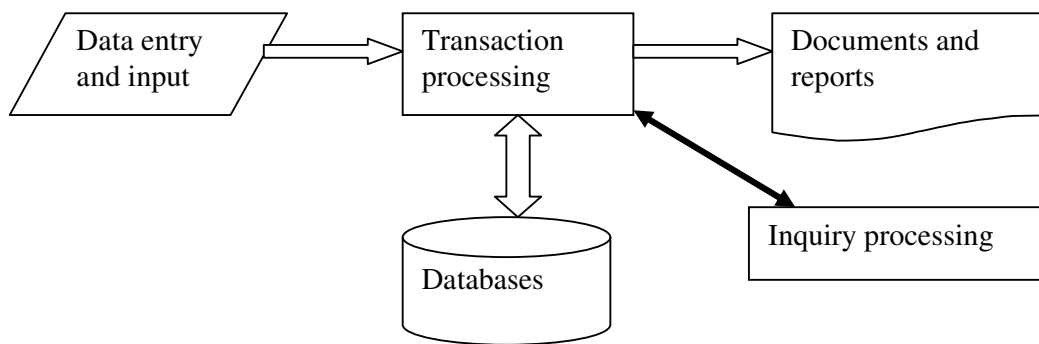

Figure 5.4: Activities of a TPS

The business data goes through a **transaction processing cycle** that includes data collection, data editing, data correction, data manipulation, data storage and document production.

Data Collection
Data collection is the process of capturing and gathering all data necessary to complete a transaction. In some cases it can be done manually by collecting hand written sales orders or changes to inventory.

It can also be automated via special input devices such as scanners, point-of-sale devices.
Example: data entry by point-of-sale terminals using optical scanning of bar codes and credit card readers at a retail store or any other business is an example of automating data entry.

Once the item is scanned at a retail store, the product ID for each item is determined automatically, and its price is found in the item database. It is much quicker and more accurate than having a clerk enter codes manually at the cash register. This eventually leads to better customer satisfaction due to reduced queuing times.

Data Editing

An important step in processing transaction data is to perform data editing for validity and completeness to detect any problems.

For example, quantity and cost data must be numeric and name should be characters. Often the codes associated with an individual transaction are edited against a database containing valid codes. If any code entered (or scanned) is not present in the database, the transaction is rejected.

Data Correction

It is not enough simply to reject invalid data. The system should also provide error messages that alert those responsible for the data editing function. Error messages must specify the problem and corrective action required.

Data correction involves reentering mis-keyed or mis-scanned data that was found during data editing.

Data Manipulation

Data manipulation is the process of performing calculations and other data transformations related to business transactions.

Data manipulation can include classifying data, sorting data, moving data in the organization's database for further processing.
Example: In a Sales TPS, data manipulation includes adding total monthly sales for a particular year, to calculate total sales for that year.

Database Maintenance

An organization's database must be maintained by its TPSs so that they are always correct and up-to-date. Therefore, transaction processing systems update the corporate databases of an organization to reflect changes resulting from daily business transactions. For example, when a customer withdraws money from a savings account, customer account will be updated with the new account balance.

Production of Document / Reports

Document production involves generating output records and reports. These documents may be hard-copy paper reports or displays on computer screens (sometimes referred to as soft copy).

Examples:
> Hard-copy documents – monthly bank statement, invoices, paycheck, sales receipts
> Soft-copy report - outstanding balance report for invoices displayed by an accounts receivable TPS.

TPSs provide other useful management information and decision support, such as printed or on-screen reports that help managers and employees perform various activities.
Example: A report showing current inventory levels allows management to decide whether new stock is required.

Inquiry processing

Many transaction processing systems allow the use of the Internet, intranets, extranets and Web browsers or database management query languages to make inquiries and receive responses concerning the results of transaction processing activity. Example: Most Banks provide a facility to check transactions of a bank account through the Internet.

5.1.5   Control and Management of a TPS

Transaction processing systems are the backbone of any organization's information systems. They capture facts about the fundamental business operations of the organization. Without these facts in a typical organization, customers cannot be invoiced, and employees and suppliers cannot be paid.

In fact, most organizations would not be able to function smoothly if their TPSs failed.

Business Continuity Planning
Any business organization must be aware of disasters and be prepared to deal with such situations.   Disasters can be natural emergencies such as a flood, a fire, or an earthquake, hacker attack or erasure of an important file.

Business continuity planning identifies the processes that must be restored first in the event of a disaster to carry out with minimum disruption.

It also specifies the actions that must be taken and by whom to restore operations.

Some of the key actions include safe evacuation of all employees, assessment of the impact of the disaster, relocation to alternate work places, backup and recovery of important electronic and manual business records, and use of alternate equipment.

Disaster Recovery
Disaster recovery focuses on the actions that must be taken to restore computer operations and services in the event of a disaster.

It includes providing for alternate computing and network facilities; the transfer of key personnel, data, and software to a backup site; and the rapid resumption of data processing and communications.

5.1.6   TPS Applications

In this section we provide an overview of several common transaction processing systems that support the order processing, purchasing and accounting business processes. Although each organization may have unique business processes, only a generalized view is presented.

Table 5.3 - Overview of several common transaction processing systems

(1) Order Processing	(2) Purchasing	(3) Accounting
Order entry	Inventory control(raw materials, packing materials, spare parts and supplies)	Budget
Sales configuration	Purchase order processing Receiving	Accounts receivable
Shipment planning	Accounts payable	Payroll
Inventory control (finished product)		Asset management
Invoicing and billing		General ledger

(1) Order Processing Systems
Order processing system includes order entry, sales configuration, shipment planning, shipment execution, inventory control and invoicing. Based on the requirements of the organization, the systems and the information flow of an Order Processing System may change from one organization to another.

Here we discuss input, process and output activities related to the order processing system.

The business processes supported by these systems are so critical to the operation of an enterprise that the order processing systems are sometimes referred to as the lifeblood of the organization.

[Following figure is a system-level flowchart that shows the various systems and the information that flows between them. a rectangle represent a system, a line represents the flow of information from one system to another, and a circle represents any entity outside the system-in this case, the customer]
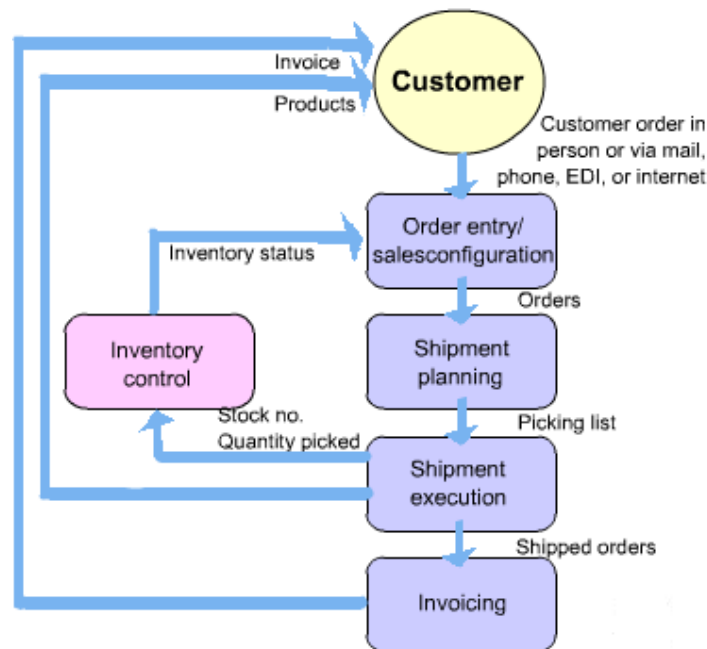

Figure 5.5: Order processing system

Order Entry and Sales Configuration
The order entry system captures the basic data needed to process a customer order. Orders may come through the mail, telephone ordering system and be gathered by a staff of sales representatives. Alternatively it may arrive via Electronic Data Interchange (EDI) transactions directly from a customer's computer over a wide area network, or be entered directly over the Internet by the customer using a data entry form on the firm's web site.

Inputs to such a system will include customer details, product, and the quantity required. This will lead to an entry in the daily sales journal.

The sales configuration system ensures that the products and services ordered are sufficient to accomplish the customer's objectives and will work well together.
For example, using a sales configuration program, a sales representative knows that a computer printer needs a certain cable and a Local Area Network (LAN) so that it can be connected to the LAN.

Sales configuration software can also solve customer problems and answer their questions.
Example: A sales configuration program can determine whether a factory robot made by one manufacturer can be controlled by a customer system developed by another manufacturer.

Sales configuration programs can eliminate mistakes, reduce costs, and increase revenues.

Shipment Planning
New orders received and any other orders not yet shipped (open orders) are passed from the order entry system to the shipment planning system.

The shipment planning system determines which open orders will be filled and from which location they will be shipped.

While this may be a simple task for a small organization with local customers, it can be an extremely complicated task for a global operation.

However, a key objective of this process should be to minimize shipping and warehousing costs while still meeting customer delivery dates.

The output of the shipping planning system is a plan that shows where each order is to be filled and precise schedule for shipping with a specific carrier on a specific date and time.

Another output generated by this system is a picking list that warehouse operators use to select the ordered goods from the warehouse. These outputs may be in paper form, or they may be computer records that are transmitted electronically.

Shipment Execution
The shipment execution system provides coordination for the outflow of all products from an organization. The objective of this system is to deliver quality products on time to customers.

The shipping department is usually responsible for physically packaging and delivering quality products to customers and suppliers.
The system receives the picking list from the shipment planning system.

As items are picked and loaded for shipment, warehouse operators must enter data about the exact items and quantity of each that are loaded for each order (input). When the shipment execution is completed, "shipped orders" transaction is sent downstream to the invoicing system.

This transaction specify exact name of company, name of person involved, item names and quantities. This data is used to generate a customer invoice.

Another output of this system would be packing documents. This is usually enclosed with the item and sent to the customer and gives information about items that are being shipped etc.

Inventory Control
For each item picked during the shipment execution process, a transaction providing the stock number and quantity picked is passed to the inventory-control system. In this way, the computerized inventory records are updated to reflect the exact quantity on hand of each stock-keeping unit.

Once product has been picked out of inventory, other documents and reports are initiated by the inventory-control application (output). One important report is the inventory status report which lists inventory items shipped over a specific time period. The information on this report may include stock numbers, description, number of units on hand, number of units ordered and costs etc.

Invoicing
Customer invoices are generated based on records receiving from the shipment execution TPS. This application encourages follow-up on existing sales activities, increases profitability, and improves customer service.

Most invoicing programs automatically compute discounts, applicable taxes, and other miscellaneous charges.

(2) Purchasing transaction processing systems

These are the systems that include inventory control, purchase order processing, receiving, and accounts payable.
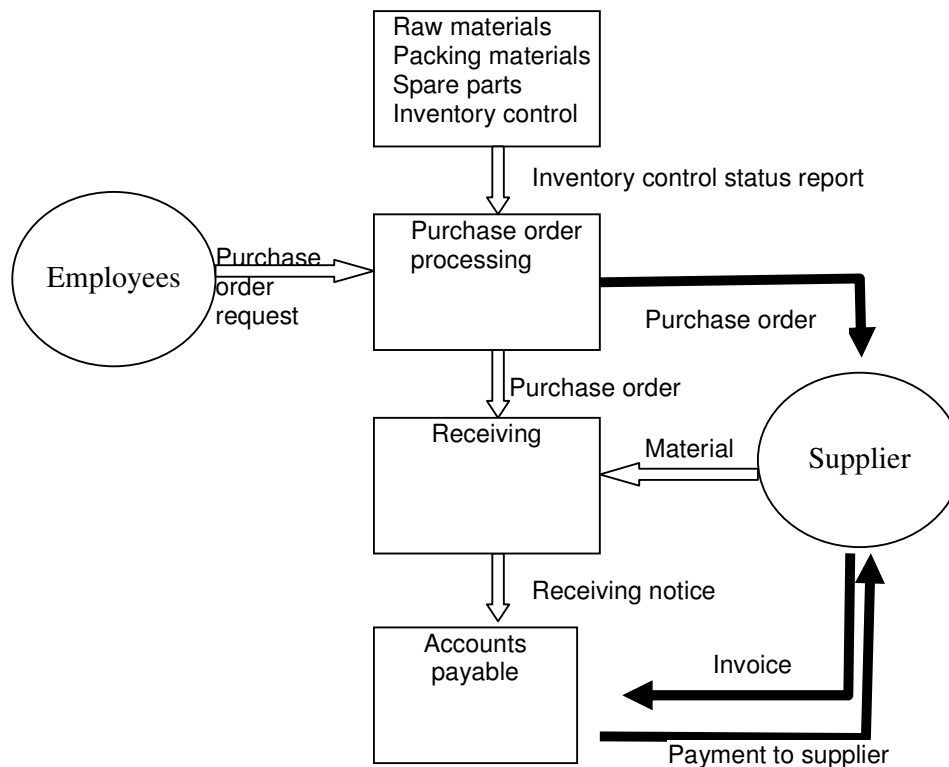

Figure 5.6: Purchasing transaction processing system

Inventory Control
Types of inventory owned by an organization depend on the type of organization. Typically a manufacturing firm would have an inventory of raw material, finished goods, packing materials etc. On the other hand, the inventory of an airline which is a service industry firm includes number of seats in a specific aircraft.

Effective Inventory controlling allows an organization to deliver finished goods to customers on time (applies to manufacturing firms) and to reduce cash tied up with idle inventory. A mistake in tracking current raw material inventory can cost an organization a lot, causing the manufacturer to miss targets.

In order to make effective purchasing decisions the inventory control system must identify the correct stock levels and inform the management when stocks are low.

An output of this system would be a report which provides the status of the raw material and other related inventories to the purchase order processing system. For this purpose the quantity available (stock items) should be updated whenever a stock item is used in manufacturing.

Purchase Order Processing
An organization's purchasing department is responsible for all its purchasing activities.
The purchase order processing system helps purchasing departments complete their transactions quickly and efficiently. The purchasing function begins when the purchasing department receives a purchase order request or when the inventory control status report suggests the need to re-order.

Every organization has its own policies, practices, and procedures for purchasing supplies and equipment.

The purchasing department facilitates the purchasing process by keeping data on suppliers goods and services.

Based on the requirements of the order, a purchase order is developed and sent to the supplier.

Receiving
Many organizations have a department responsible for inspecting incoming items and sending (routing) them to the relevant department which made the initial purchase order request.

In addition, the receiving department notifies the purchasing department when items have been received. This notification may be done using a paper form called a receiving report or electronically through a business transaction created by entering data into the receiving TPS (output).

An important function of many receiving departments is quality control by inspection. Any items that fail inspection are sent back to the supplier.

Accounts Payable
The major output of this system is payments to suppliers for materials and services.

Input from the purchase order processing system provides an electronic record to the accounts payable application that updates the accounts payable database to create a liability record showing the firm has made a commitment to purchase a specific good or service. Once the accounts payable department receives an invoice from a supplier, the invoice is verified and checked for accuracy.

Upon receiving notice that the goods and services have been delivered in a satisfactory manner from the receiving department, the data is entered in to the accounts payable application. Accounts payable application records purchases from, amounts owed to, and payments to suppliers. It produces cash management reports.

(3) Accounting Systems
Accounting information systems are the oldest and most widely used IS in business. They record and report business transactions and other economic events. A typical accounting system may include the budget, accounts receivable, payroll, asset management, and general ledger applications.
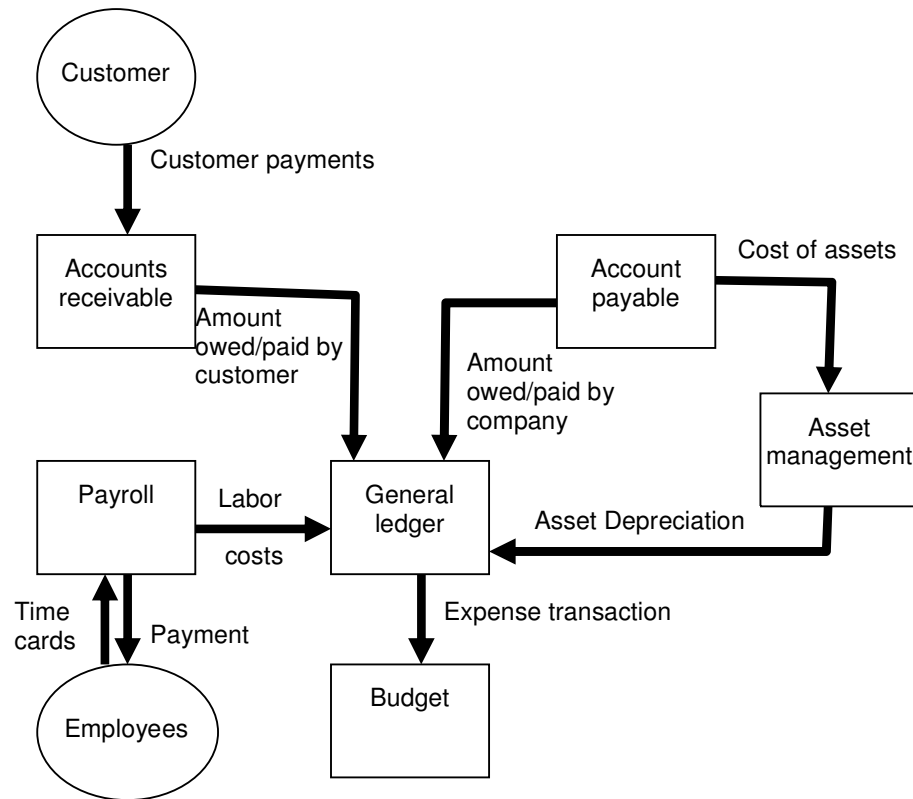
Figure 5.7: An example of an accounting system

Budget

In an organization, a budget is a financial plan that identifies items and rupee amounts that the organization estimates it will spend. In some organizations, budgeting can be an expensive and time-consuming process of manually distributing and consolidating information. The **budget transaction processing system** automates many of the tasks required to collect budget data, distribute it to users, and consolidate the prepared budgets.

Accounts receivable

The accounts receivable system keeps track of the money owed to the company on charges for goods sold and services performed.

When goods are shipped to a customer, the customer's accounts payable system receives a business transaction from the invoicing system, and the customer's account is updated in the accounts receivable system of the supplier.

A statement reflecting the balance due is sent to active customers. Upon receipt of payment, the amount due from that customer is reduced by the amount of payment.

A major output of accounts receivable application is the monthly bills and statements sent to customers.

Reports are generated to identify customers whose accounts are overdue by more than a particular number of days (depending on the policies of the company this may change).

Another important function of the accounts receivable application is to identify bad credit risks.

Payroll

The two primary outputs of the payroll system are the payroll cheques and pay slip, which are distributed to the employees, and the payroll register, which is a summary report of all payroll transactions.

The number of hours worked by each employee is collected using a variety of data entry devices, including time clocks, time cards, and industrial data-collection devices in a subsystem called time and attendance.

Once collected, payroll data is used to prepare weekly, biweekly, or monthly employee pay cheques (time period depends on the organization).

The payroll application interfaces with other applications. For example, all payroll entries are entered into the general ledger systems.

Packaged software applications are commonly used to automate the payroll process. Many of these applications could be customized to suite the needs of the organization.

Asset Management

Capital assets such as buildings, vehicles represent major investments for the organization. The asset management transaction processing system records the depreciation of assets in an organization. This is used for tax reporting purposes etc..

General ledger

Every monetary transaction that occurs within an organization must be properly recorded. Examples of monetary transactions are payment of a supplier's invoice, receipt of payment from a customer, and payment to an employee. A computerized general ledger system is designed to allow automated financial reporting and data entry.

The general ledger application produces a detailed list of all business transactions and activities. The outputs include reports such as profit and loss (P&L) statements, balance sheets, and general ledger statements.

There are off-the-shelf applications to support transactions mentioned above. E.g. Net Ledger

5.2   Management Information Systems (MIS)

5.2.1   Overview of MIS

The main objective of MIS is to provide lower and middle management with printed or electronic reports with inquiry capabilities so that they can control, organize and plan more effectively and efficiently. Organizations can achieve competitive advantage by effectively using the information generated by MIS.

The concept of MIS emerged partly as a response to the shortcomings of the first computerized TPSs, which often improved transaction processing but provided little information for management. Computerized MISs typically extract and summarize data from TPSs to allow managers to monitor and direct the organization.

Input to MIS:

> Internal data sources – from organization's TPS and ERP systems and related databases.
> External data sources – customers, suppliers, competitors and stock holders (not already captured by TPS), Internet and extranets

Process: MIS uses the input data and processes it into information for the use of managers primarily in the form of pre-determined reports.

Outputs of MIS: Collection of reports that are distributed to managers including scheduled reports, key-indicator reports, demand reports, exception reports and drill-down reports.
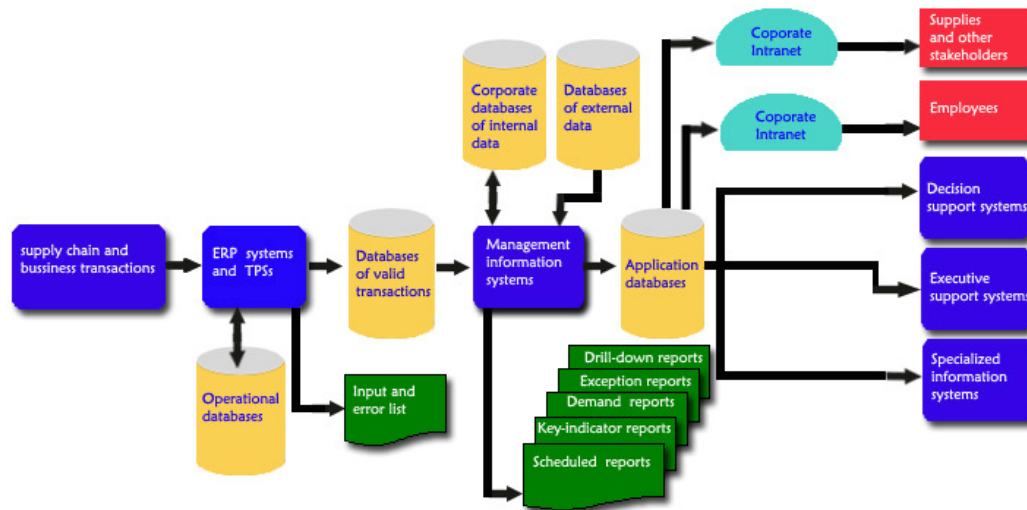

Figure 5.8: Sources of Managerial Information

There are several types of reports produced by MIS. As mentioned before, these reports provide summarized information rather than detail.

Scheduled (Periodic) reports: reports produced periodically or on a schedule such as daily, weekly or monthly, depending on the decision making need. The format and the informational content of scheduled reports is fixed in advance.
Examples: daily or weekly sales analysis reports, monthly financial reports.

Another scheduled report is the key-indicator report. These reports provide a summary of the previous day's critical activities and typically available at the beginning of each work day. These reports summarize inventory levels, production activity, sales volume etc. They are used by managers and executives to take quick, corrective action on important aspects of the business.

Demand reports: Reports or screen outputs developed to give relevant information at someone's request (adhoc). Suppliers as well as customers can use demand reports.
Example- inventory level of certain product

Exception reports: Reports which are automatically produced when a situation is unusual or requires management action. Exception reports are most often used to monitor aspects important to an organization's success. For example, purchasing managers may need an exception report when suppliers are late in deliveries. Such a report may be triggered automatically by the delay of an individual supplier or produced on a scheduled basis, but only if there are late suppliers. Parameters or trigger points should be set carefully, if not you may end up with too many exception reports.

When the quantity of certain raw material drops, a report will be produced to alert the management mentioning the steps that should be taken to re-order these items.

In general, when an exception report is produced, a manger or executive takes action based on the information provided by the report. In the above example, the manager will take action to order raw material.

Drill-down reports: Reports which provide detail data about a situation. Through the use of drill-down reports analysts are able to see data at a higher level first (sales for entire company), then at a more detailed level (sales for one dept) and then a very detailed level (sales per one sales representative.)

Important things to consider when developing reports
As mentioned before, it is important to set the parameters carefully in Exception reports. Each report should be tailored to user requirements and produced in a timely fashion as outdated reports are of no value. It is also important to periodically review reports in order to identify reports which are of no use, improve the content of reports and introduce new reports.

(a) Scheduled Report

Daily Sales Detail Report

Prepared 08/10/06

Order #	Customer ID	Salesperson ID	Planned Ship Date	Quantity	Amount
P56324	C25845	ASD	8/12/2006	144	$250
P56325	C25436	ASD	8/13/2006	289	$566
P56326	C57821	GES	8/12/2006	54	$566
P56327	C25836	GHJ	8/14/2006	87	$24
P56328	C78541	JUY	8/12/2006	546	$1,255
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(b) Key-Indicater Report

Daily Sales Key-Indicator Report

	This Month	Last Year
Total Orders Month to Date	$1,808	$1,914
Forecasted Sales for the Month	$2,406	$2,608

(c) Demand Report

Daily Sales by Salesperson Summary Report

Prepared 08/10/06

Salesperson	Amount
ASD	$42,345
GES	$38,950
GHJ	$22,154
JUY	$12,358
…… .	…… …… ..

(d) Exception Report

Daily Sales Exception Report-Orders Over $10,000

Prepared 08/10/06

Order #	Customer ID	Salesperson ID	Planned Ship Date	Quantity	Amount
P56324	C25845	ASD	8/12/2006	576	$12,578
P12554	C25436	GES	8/13/2006	289	$10,356
P65326	C57821	GHY	8/12/2006	144	$18,654
…… ..	…… …… ……		…… …… ..	……	…… …
…… …	…… …… ……		…… …… ..	……	…… …

(e) First-Level Drill-Down Report

Earnings by Quarter (Millions)

		Actual	Forecast	Varience
2nd Qtr.	2007	$12.60	$11.80	6.8%
1st Qtr.	2007	$10.80	$10.70	0.9%
4th Qtr.	2006	$14.30	$14.50	-1.4%
3rd Qtr.	2006	$12.80	$13.30	-3.8%

(f) Second-Level Drill-Down Report

Sales and Expenses (Millions)

Qtr: 2nd Qtr. 2007	Actual	Forecast	Varience
Gross Sales	$110.9	$108.3	2.4%
Expenses	$ 98.3	$ 96.5	1.9%
Profit	$ 12.6	$ 11.8	6.8%

(g) Third-Level Drill-Down Report

Sales by Division (Millions)

Qtr: 2nd Qtr. 2007	Actual	Forecast	Varience
Beauty Care	$ 34.5	$ 33.9	1.8%
Health Care	$ 30.0	$ 28.0	7.1%
Soap	$ 22.8	$ 23.3	-0.9%
Snacks	$ 12.1	$ 12.5	-3.2%
Electronics	$ 11.5	$ 10.9	5.5%
Total	$110.9	$108.3	2.4%

(h) Forth-Level Drill-Down Report

Sales by Product Category (Millions)

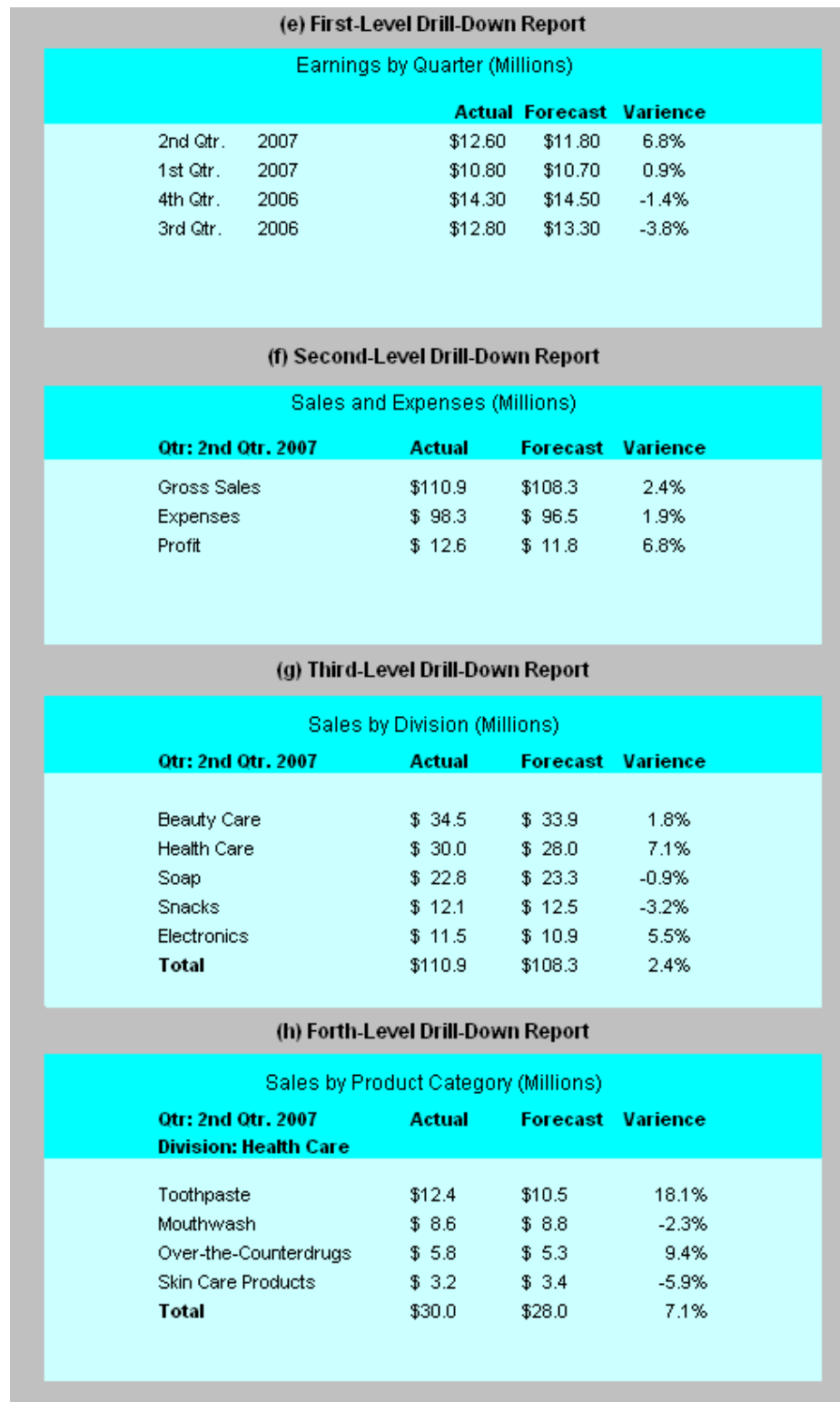| Qtr: 2nd Qtr. 2007 **Division: Health Care**	Actual	Forecast	Varience
Toothpaste	$12.4	$10.5	18.1%
Mouthwash	$ 8.6	$ 8.8	-2.3%
Over-the-Counterdrugs	$ 5.8	$ 5.3	9.4%
Skin Care Products	$ 3.2	$ 3.4	-5.9%
Total	$30.0	$28.0	7.1%

Figure 5.9: Drill-down report

5.2.2   Characteristics of a MIS

In general MIS perform the following functions.

- **Provide reports with fixed and standard formats**: for example, scheduled reports for inventory control may contain the same type of information placed in the same locations on the reports. Different managers may use the same report for different purposes.

- **Produce hard-copy and soft-copy reports:** Some MIS reports are printed on paper. They are known as hard-copy reports (tangible). Other reports can be soft-copy reports where typically the output is displayed on a computer screen. The soft copy reports are typically formatted in a report like fashion and use visual displays on computer screens.

- **Use internal data stored in the computer system:** Primarily MIS reports use internal sources of data that are contained in computerized databases. These sources of data can be outputs generated by TPSs or ERP systems. Some MISs use external sources of data about competitors, the industry, economy and so on. The Internet is often used as a source for external data.

- **Allow end users to develop their own custom reports**: Typically, analysts and programmers are involved in developing and implementing complex MIS reports.

   At the same time end users are also increasingly developing their own simple programs to query a database and produce basic reports.

5.2.3   MIS in Functional Areas of Business

Most organizations are structured along functional lines or areas. Some of the traditional functional areas include finance, manufacturing, marketing and human resources.
The MIS can be divided along those functional lines, in order to produce reports tailored to individual functions.
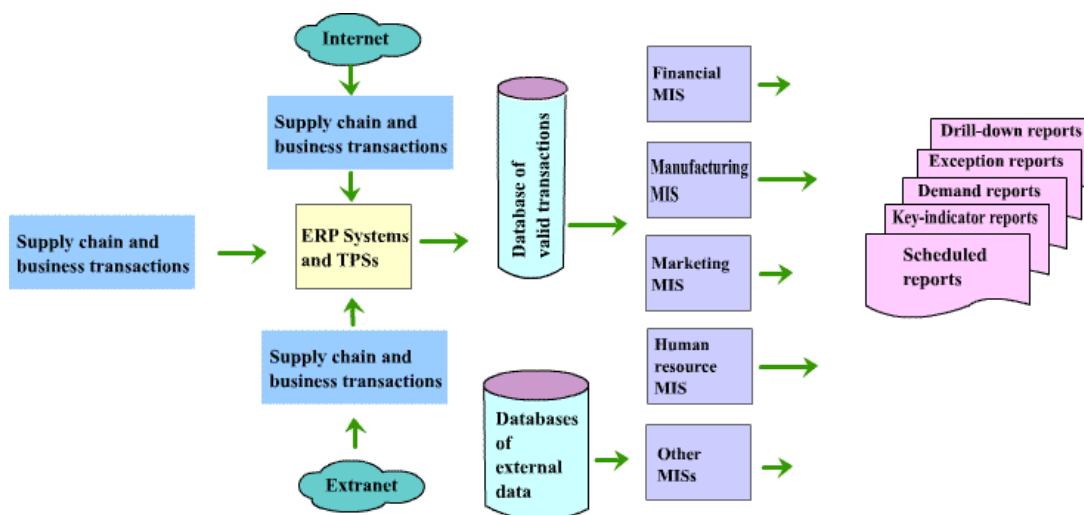

Figure 5.10: The MIS is an integrated collection of functional information systems, each supporting particular functional areas.

5.2.3.1 Financial MIS

A financial MIS provides financial information not only to accountants, but to a broader set of people who need to make better decisions on a daily basis.

The following figure 5.11 describes a basic financial MIS. The typical inputs to a MIS include internal TPS databases, additional corporate databases of internal data and external data.

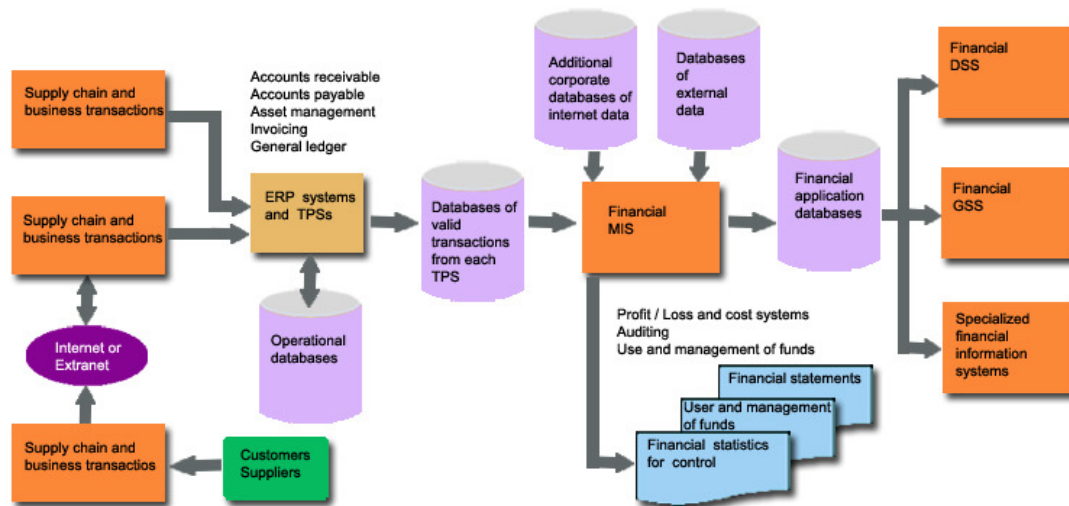Typical outputs (reports and updated databases) provide support for profit/loss and cost systems, auditing etc...

Figure 5.11: Overview of a Financial MIS

Profit/Loss and Cost systems

These systems organize revenue and cost data for the company. The revenue and expenses data of each department is captured by the TPS. The updated databases of these TPSs are the primary internal source of financial information for the MIS, ie the internal input to the MIS.

Auditing

Auditing involves analyzing the financial condition of an organization and determining whether financial statements and reports produced by financial MIS are accurate. Correct and proper auditing procedures are important as financial statements such as income statements and balance sheets are used by so many people and organizations.

5.2.3.2 Marketing MIS

A marketing MIS supports managerial activities related to product development, distribution, pricing decisions, promotions, and sales forecasting.

Customer Relationship Management (CRM) programs, available from some ERP vendors help a company manage all aspects of customer encounters.
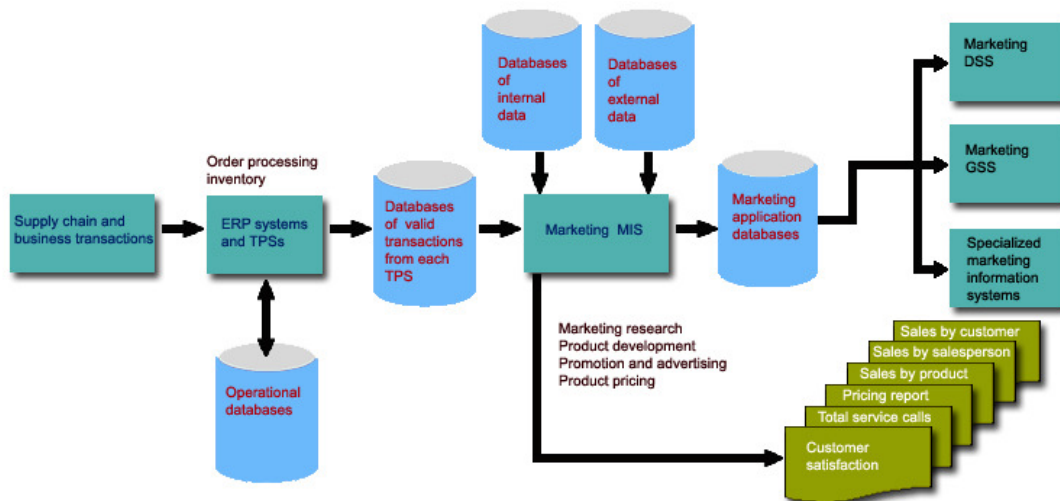
Figure 5.12: Overview of a marketing MIS
(shows the inputs, subsystems and outputs of a typical marketing MIS)

Sub systems for the marketing MIS include marketing research, product development, promotion and advertising and product pricing.

Market research:
Market research is a formal study of the market and customer preferences. Tools used for market research include surveys, questionnaires, pilot studies and interviews. Market research enables to identify potential future customers and the features that current customers really want in a good or service.

The ability to forecast demand is made possible by marketing research and sophisticated software.

Product development:
This involves the conversion of raw materials into finished goods and services. Product development focuses primarily on the physical attributes of the product. Important factors in product development decisions include plant capacity, labor skills, engineering factors and materials.

In many cases a computer program analyzes these various factors and selects the appropriate mix of labor, materials, plant and equipment and engineering designs. Computer programs can be used for make-or buy decisions.

Promotion and advertising:
One of the most important functions of any marketing effort is promotion and advertising. Product success is a direct function of the types of advertising and sales promotions carried out by the organization.

Product pricing:
Product or service pricing is another important and complex marketing function. With relation to a product, retail price, whole-sale price, and price discounts must be set.

Several reports can be used by marketing managers/sales managers to make effective decisions.
For example: reports such as sales by product item, sales made a sales person etc
Based on these reports the sales manager can identify which items have more or less demand.

5.2.3.3 Human Resource MIS (HR MIS)

A human resource MIS, also called the personnel MIS, is concerned with activities related to employees and potential employees of the organization.
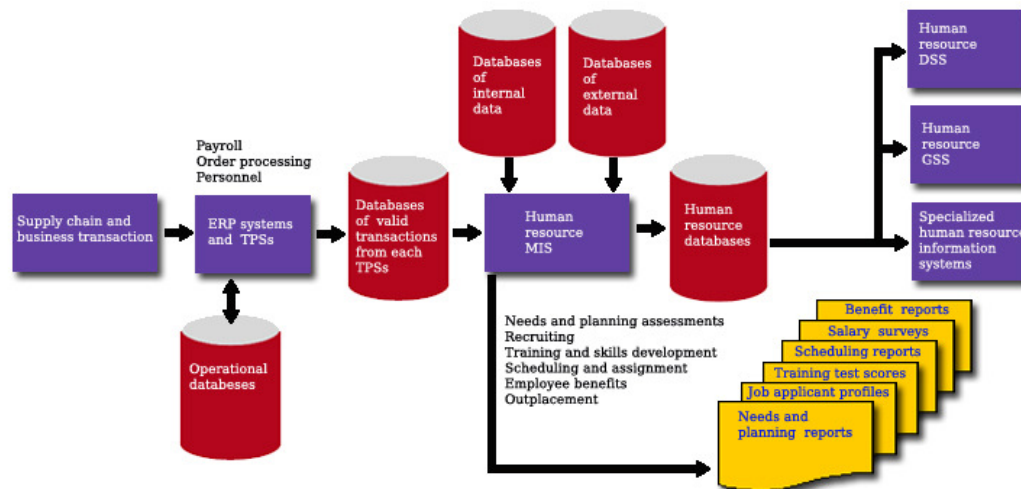

Figure 5.13: Overview of a human resource MIS

Outputs: Some organizations have computer systems to assist with human resource planning, hiring, training, skills inventorying, wage and salary administration.

Reports developed by these systems include human resource planning reports, job application review profiles, skills inventory reports, salary reports etc.

Human resource planning

One of the first aspects of any human resource MIS is determining personal and human needs.

Effective human resource planning requires defining the future number of employees needed and anticipating the future supply of people for these jobs.

The output of a human resource MIS would be a human resource needs and planning report.

Example: for a large construction project to be started next year project management and forecasting software can be used to determine types of employees needed and when. The output would be a human resource needs and planning report.

Personnel selection and Recruiting

If the human resource plan reveals that additional personnel are required, the next step is to recruit and select personnel.

Management information systems can also be used to help rank and select potential employees.

For every applicant, the system can analyze and print the results of interviews, tests and company visits. These reports are called a "job applicant review profile", and it assists corporate recruiting teams in final selection.

Training and skills inventory

For some jobs very specific training should be given to new employees. Other jobs may require general training about the organizational culture, orientation, dress standards and the expectations of the organization.

Skills inventory reports help managers to evaluate current employees to determine their potential for a particular new position, and to determine raises or bonuses.

Wage and salary administration
This MIS subsystem involves determining wages, salaries and benefits (medical payments, saving plans, retirement accounts)

5.2.3.4 Manufacturing MIS

Compared to any other functional area, manufacturing has been improved by advances in technology. With emphasis on greater quality and productivity, having an efficient and effective manufacturing process is becoming critical to the success of manufacturing organizations.
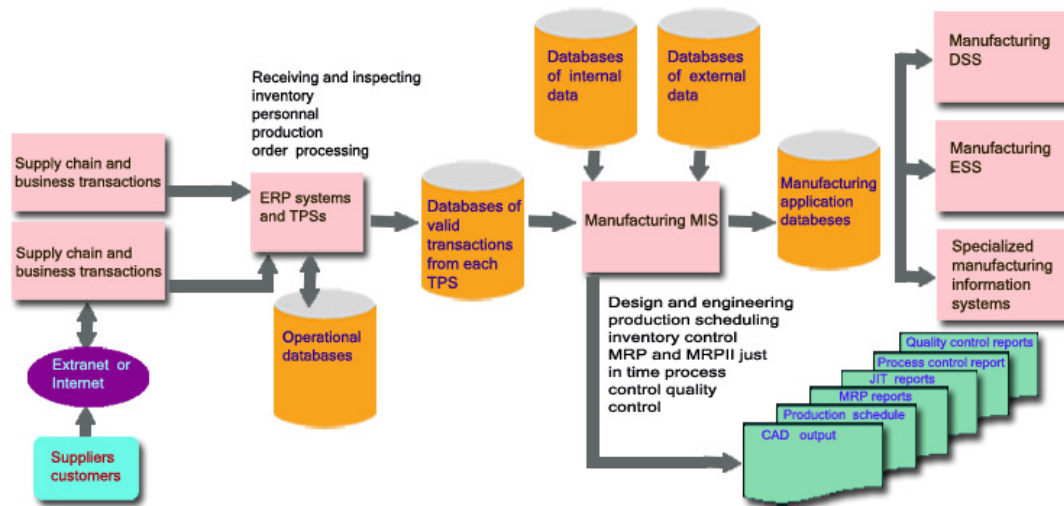

Figure 5.14: Overview of a manufacturing MIS

Design and engineering
At the start of the manufacturing process, many aspects of the design are finalized with the help of design and engineering departments. These activities include deciding the size and shape of parts, the way electrical components are attached to equipment etc...

Data from design and engineering can also be used to identify problems with existing products and help develop new products.

Master production schedule and inventory control
The overall objective of master production schedule sub system is to provide detailed plans for both short-term and long-term scheduling of manufacturing facilities. These systems use forecasting techniques to determine the best way to carry out productions.

Quality control and testing
This is a process that ensures that the finished products meet the needs of the customer.

In a product many aspects are checked relating to quality. For example, in a jam factory individual item packaging, taste etc. will be checked. MIS support in developing reports to inform the management about the quality control results. If there are many errors found the management has to look into the process of packaging etc. In order to identify the issue. Sometimes it may relate to lack of trained staff or defaults in equipment. Quality control reports can also be used to design better products.

5.3   **Decision Support Systems (DSS)**

5.3.1   Introduction to DSS

Decision support systems (DSS) are a type of a computer based information system that provide interactive information support to the human decision maker during the process of arriving at a decision. They are interactive systems that assist a decision maker when faced with unstructured or semi structured business problems.

In general DSS can perform the following functions.
- Handle large amounts of data from different sources – internal and external databases
- Provide report and presentation flexibility
- Offer both textual and graphical orientation
- Support drill-down analysis
- Perform complex, sophisticated analysis and comparisons using advanced software packages

5.3.2   Capabilities of a DSS

DSS can assist with problem solving phases, decision frequencies, and different degrees of problem structures. DSS approaches can also help at all levels of decision making process.

Support for problem solving phases:
Objective: assist decision makers with the phases of problem solving. The phases include intelligence, design, choice, implementation and monitoring.

Support for different decision frequencies:
Decisions can range from one of a kind to repetitive decisions. One of a kind decisions are typically handled by an ad hoc DSS. An ad hoc DSS is concerned with situations or decisions that come up only a few times during the life of the organization; in small businesses, they may happen only once.
Example: decision to invest on development of a new product.

Repetitive decisions are addressed by an institutional DSS. An institutional DSS handles situations or decisions that occur more than once, usually several times a year or more. An institutional DSS is used repeatedly and refined over the years.
Example: Production scheduling

Support for different problem structures:
Decisions can range from highly structured (programmed) to unstructured (non-programmed).

Highly structured problems are straightforward, requiring known facts and relationships. Semi structured or unstructured problems are more complex. The relationships among the pieces of data are not always clear; the data may be in a variety of formats and the data is often difficult to manipulate or obtain. DSSs are often used to support unstructured and semi-structured problems.

Support for various decision making levels:
DSSs can provide help for managers at different levels within the organization. Operational managers can get assistance for daily and routine decision making. Tactical decision makers can be supported with analysis tools to ensure proper planning and control. At the strategic level, DSSs can help managers by providing analysis for long term decisions requiring both internal and external information.

5.3.3   Basic Components of a DSS

Main components of a DSS include a database and a model base. In addition, a typical DSS contains a dialogue manager, which allows decision makers to easily access and manipulate the DSS and to use common business terms and phrases.

Apart from the dialogue manager additional components include access to the internet, networks and other computer-based systems. This allows the DSS to tie into other powerful systems, including the TPS or function-specific subsystems.
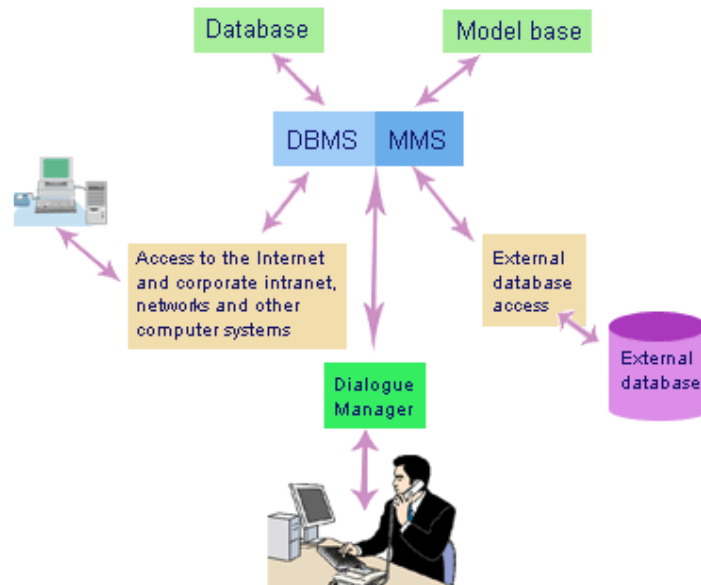

Figure 5.15: Conceptual model of a DSS

The database
The database management system allows managers and decision makers to perform qualitative analysis on the company's vast stores of data in databases, data warehouses, and data marts.

A data-driven DSS primarily performs qualitative analysis based on the company's databases and may retrieve information on sales, inventory etc.. Data mining and business intelligence are often used in a data-driven DSS.

A database management system can also be connected to external databases to give managers and decision makers even more information and decision support.

External databases can include the Internet, libraries, government databases to give key decision makers a better understanding of the company and its environment.

The Model base
The model base is a software component that consists of models. A model-driven DSS primarily performs mathematical or quantitative analysis. The model base allows managers and decision makers to perform quantitative analysis on both internal and external data.

For example, a spread sheet program might contain models to express relationships such as
sales value = product price x quantity

Model management software (MMS) is often used to coordinate the use of models in a DSS, including financial, statistical analysis, graphical, and project-management models.

The dialogue manager
The dialogue manger allows users to interact with the DSS to obtain information. It assists with all aspects of communications between the user and the hardware and software that constitute the DSS.

5.3.4   Comparison of MIS and DSS

A DSS differs from an MIS in numerous ways, including the type of problems solved, the support given to users, the decision emphasis and approach, and the type, speed, output and development of the system used. Following table provides an outline of these differences.

Table 5.2: Comparison of DSS and MIS

Factor	DSS	MIS
Type of problem	Good at handling unstructured problems that cannot be easily programmed. Provides support for semi-structured problems too.	Normally used only with more structured problems.
Users	Supports individuals, small groups, and the entire organization.	Supports primarily the organization.
Support	Supports all aspects and phases of decision-making. However, does not replace the decision maker – people still make the decisions.	This is not true of all MIS systems- some make automatic decisions and replace the decision maker.
Emphasis	A DSS emphasizes actual decisions and decision-making styles.	An MIS usually emphasizes information only.
Approach	A DSS provides interactive reports on computer screens.	An MIS uses regularly produced reports.

5.3.5   Group Support Systems (GSS)

Although DSS approach has resulted in better decision making for all levels of individual users, it is considered as not suitable for group decision making.

A group support system (GSS), also called a group decision import system and a computerized collaborative work system consists of most of the elements in the DSS, plus software to provide effective support in group decision making settings.
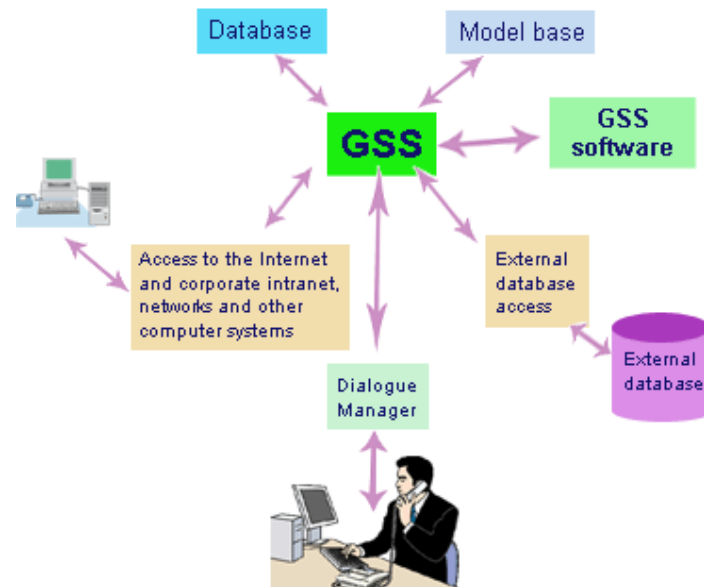
Figure 5.16: Configuration of a GSS

Group support systems are used in most industries.

Architects: to collaborate with other architects and builders to develop the best plan and to compete for contracts.

Manufacturing companies: to link raw material suppliers to their own company systems.

Engineers: use GSS called Mathcard Enterprise to create, share and reuse calculations.

Characteristics of a GSS

GSS developers utilize the advantages of individual support systems and add new approaches unique to group decision making. Following are some of the characteristics that improve and enhance decision making.

Special design: The software is developed in a way to promote creative thinking and good group making decisions.

Ease of use: GSS must be easy to learn and use

Supports different decision making: approaches

e.g. * Brainstorming- often consists of members offering ideas "off the top of their heads"

  * Group consensus approach- force the members in a group to reach a unanimous decision

  * Nominal group technique- encourage feedback from individual group members and the final decision is made by voting

Anonymous Input: Many GSSs support anonymous input. That is, the person giving an input is not known to the other members. This may enable better decision making.

Reduction of negative group behavior: ability to reduce or eliminate group behavior that is harmful to effective decision making. Procedures for effectively planning and managing group meetings can be incorporated into the GSS approach.

Parallel communication: Speed up meeting times and result in better decisions by providing facility to enter comments in the same time by entering into a PC.

 Automated record keeping: Keeps detailed records of a meeting automatically. Automatic voting and ranking features are available. After each group member votes, the GSS records each vote and makes appropriate rankings.

GSS software

Often called groupware.

Example: Lotus Notes

5.3.6   Executive Support Systems (ESS)

ESSs are specialized DSSs developed to assist senior-level executives to make strategic decisions. Sometimes it is also known as Executive Information Systems (EIS).

Some of the major decision making that can be supported through an ESS are, ability to provide an overall vision, strategic planning and organizing, strategic control and crisis management.

Although ESS is a special type of DSS. The modeling and analysis tools of a DSS allow users to answer questions. On the other hand ESSs present structured information about aspects of the organizations that is considered as important by the executives.

Characteristics of ESSs

Tailored to individual executives: An ESS is an interactive hands-on too, that allows an executive to focus, filter and organize data and information.

Easy to use: An ESS must be easy to learn and use and not very complex, in order to save the time of top-level executives.

Have drill-down abilities: An ESS allows executives to drill down into the company to determine how certain data was produced. Drilling down allows an executive to get more detailed information if needed.

Support the need for external data: Information from competitors, the government, trade associations and journals and consultants are required to make effective top level decisions. An effective ESS is able to extract data useful to the decision maker from variety of sources including the Internet and other electronic publishing sources.

Help with uncertain situations: There may be a high degree of uncertainty with most executive decisions. Handling these unknown situations using techniques such as modeling help top-level managers to measure the amount of risk in a decision.

Capabilities of ESSs

An effective ESSs should have the capability to support executive decisions with components such as strategic planning and organizing, crisis management etc. These decisions are related to an organization's overall profitability and direction.

Support for defining an overall vision: The vision includes the organization's major product lines and services, the types of businesses it supports today and in the future, and its overriding goals. Providing a broad vision for the entire organization is a key role of senior executives.

Support for strategic planning: Strategic planning involves determining long term objectives by analyzing the strengths and weaknesses of the organization, predicting future trends and projecting the developments of new product lines. It also involves planning the acquisition of new equipment, analyzing major possibilities, and making difficult decisions.

Support for strategic organizing and staffing: ESSs help top-levels executives to analyze the impact of; staffing decisions, changes in employee benefits, potential pay raises, and new work rules.

Support for strategic control: Strategic control involves monitoring and managing the overall operations of the organization. Effective ESS helps top-level managers make the most of their existing resources and control all aspects of the organization.

Support for crisis management: Strategic emergency plans can be put into place with the help of an ESS. These emergency plans help organizations recover quickly in the event of an emergency or a disaster.

5.4   Other Specialized Information Systems

5.4.1   An overview of Artificial Intelligence

Artificial Intelligence (AI) is a field of science and technology based on disciplines such as computer science, biology, psychology, linguistic, mathematics and engineering. The goal of AI is to develop computers that can think, see, hear, walk, talk and feel.

A major power of AI is the development of computer functions normally associated with human intelligence such as reasoning, learning and problem solving.

Artificial Intelligence systems include the people, procedures, hardware, software data and knowledge needed to develop computer systems and machines that demonstrate the characteristics of intelligence. Characteristics of intelligence include the following;

- Learn from experience and apply the knowledge acquired from experience.
- Handle complex situations
- Solve problems when important information is missing.
- Determine what is truly important
- React quickly and correctly to a new situation
- Understand visual images
- Be creative and imaginative
- Use heuristics (learn by discovering) or guesses

5.4.1.1 Introduction to other Application Areas of Artificial Intelligence
AI applications can be grouped under three major areas. They are Cognitive science, robotics and natural interfaces.
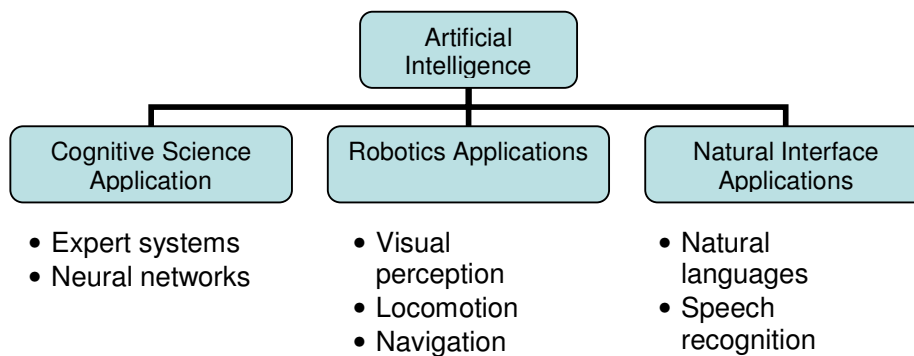

Figure 5.17: Some application areas of artificial intelligence

Cognitive science:
This area of AI is based on research on biology, neurology, psychology, mathematics etc. It focuses on researching how the human brain works and how humans think and learn. Applications in the cognitive science area of AI include expert systems, fuzzy logic and neural networks;

- **Expert systems:** An expert system captures the expertise of an expert or group of experts in a computer-based information system. It behaves similarly to a human expert in a particular field. For example an expert system can be in cases such as illness diagno**s**is.
- **Fuzzy logic systems:** These systems can process data that are incomplete or ambiguous, that is fuzzy data (example: data termed as low, very high,

reasonable). They work as humans by developing approximate inferences and answers to solve unstructured problems with incomplete knowledge.

- **Neural networks:** These are computing systems modeled based on brain's mesh-like network of neurons.

  Although neural networks are simpler than the human brain in architecture, similar to brain, the interconnected processors in a neural network operate in parallel and interact dynamically with each other. This enables neural networks to process many pieces of data at once to learn to recognize patterns.

  Some of the specific features of neural networks include the following:
  - The ability to discover relationships and trends in large databases
  - The ability to solve complex problems for which all the information is not present

  An Example of the use of neural networks:
      A neural network can be trained to learn which characteristics result in good or bad loans.

Robotics
Basic disciplines of robotics include AI, Engineering and physiology. This technology produces robot machines with computer intelligence and computer controlled, human like physical capabilities.

This area includes applications designed to give robots the powers of
    Visual perception: sight
    Locomotion: physical ability to move over any surface
    Navigation: the intelligence to properly find ways to a destination.

Natural interfaces
Development of natural interfaces is essential to the natural use of computers by humans. This area of applications are designed for,

Natural languages and Speech recognition: ability to communicate with computers and robots in conversational human languages and have them understand us as easily as we understand each other. This involves research and development in linguistics, psychology, computer science and other disciplines.