## UNIT –V

### Management Information System

A management information system (MIS) is a system that provides information needed to manage organizations effectively.
Management information systems involve three primary resources: technology, information, and people. It's important to recognize that while all three resources are key components when studying management information systems ... the most important resource is people.

Management information systems are regarded to be a subset of the overall internal controls procedures in a business, which cover the application of people, documents, technologies, and procedures used by management accountants to solve business problems such as costing a product, service or a business-wide strategy.

Academically, the term is commonly used to refer to the group of information management methods tied to the automation or support of human decision making, e.g. Decision Support Systems, Expert systems, and Executive information systems.

MISs are interactive human/machine systems that support decision making for users both in and out of traditional organizational boundaries. These systems are used to support an organization's daily operational activities; current and future tactical decisions; and overall strategic direction. MISs are made up of several major applications including, but not limited to, the financial and human resources systems.

*Financial applications* make up the heart of an AIS in practice. Modules commonly implemented include: general ledger, payables, procurement/purchasing, receivables, billing, inventory, assets, projects, and budgeting.

*Human resource applications* make up another major part of modern information systems. Modules commonly integrated with the AIS include: human resources, benefits administration, pension administration, payroll, and time and labor reporting.

### Evolution of MIS

#### The Internet
As the internet has evolved so has the management information system. From the early start of Yahoo and the Netscape browser to the dominance of Go ogle and the emergence of Mozilla, the information management system has benefited from the advances within the internet.

#### Email
The ability to send emails back and forth allowed information to be passed on and managed through the email and POP medium. This led to several advances within the structure and inbound systems.

SocialMedia

This is the next medium that will have significant influence. We are already seeing many breakthroughs in using APIs with both Face book and Twitter that will change the landscape of management information systems.

## Characteristics of MIS

Management information systems (MIS) is an organized approach to gathering information from company operations and making a strategic management decision. Developing quality characteristics for gathering information is essential to making solid management decisions.

1. Provides reports with fixed and standard formats
2. Hard-copy and soft-copy reports
3. Uses internal data stored in the computer system
4. End users can develop custom reports
5. Requires formal requests from users
6. Provides support to managers as they work to achieve corporate goals
7. Enables managers to compare results to established company goals and identify problem areas and opportunities for improvement
8. Data may be made available from management information systems on a company's intranet
9. Employees can use browsers and their PC to gain access to the data.

### Relevance

Information should be relevant to the strategic decision that company management is currently reviewing. Because companies may review several business opportunities at one time, avoiding information not relating to the decision is essential.

### Accurate

MIS information should be accurate and avoid any inclusions of estimates or probable costs. Making decisions based on estimates can lead to cost overruns or lower profits from future operations.

### Timely

Many management decisions are based on information from a certain time period, such as quarterly or annual periods. Information outside of the requested time frame may skew information and lead to an improperly informed decision.

### Exhaustive

MIS information gathering should resemble an upside-down triangle. The early stages of information gathering should be exhaustive, including all types of company information. As management narrows its decision-making process, the information is refined to include only the most relevant pieces.

Cost-Effective

The MIS needs to be a cost-effective and efficient system for gathering information. Most of these systems are developed internally, creating costs that cannot be passed to clients.

## Components of MIS

Hardware
Input and output devices constitute the hardware components of MIS

Software
The programs and applications that convert data into machine-readable language are known as software

Procedures
Procedures are sets of rules or guidelines, which an organization establishes for the use of a computer-based information system

Personnel
The computer experts, managers, users, analysts, programmers, database managers, and many other computer professionals who utilize the computer-based information systems are the personnel in a management information system

## Decision models

Transaction processing system

A transaction processing system is a type of information system. TPSs collect, store, modify, and retrieve the transactions of an organization. A transaction is an event that generates or modifies data that is eventually stored in an information system.

The essence of a transaction program is that it manages data that must be left in a consistent state. E.g. if an electronic payment is made, the amount must be both withdrawn from one account and added to the other; it cannot complete only one of those steps. In case of a failure preventing transaction completion, the partially executed transaction must be 'rolled back' by the TPS.

While this type of integrity must be provided also for batch transaction processing, it is particularly important for online processing: if e.g. an airline seat reservation system is accessed by multiple operators, after an empty seat inquiry, the seat reservation data must be locked until the reservation is made, otherwise another user may get the impression a seat is still free while it is actually being booked at the time. Without proper transaction monitoring, double bookings may occur. Other transaction monitor functions include deadlock detection and resolution (deadlocks may be inevitable in certain cases of cross-dependence on data), and transaction logging (in 'journals') for 'forward recovery' in case of massive failures.

Decision support system

A decision support system (DSS) is a computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance.

DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, personal knowledge, or business models to identify and solve problems and make decisions.

Typical information that a decision support application might gather and present are:

- inventories of information assets (including legacy and relational data sources, cubes, data warehouses, and data marts),
- comparative sales figures between one period and the next,
- projected revenue figures based on product sales assumptions

A Decision Support System is a way to model data and make quality decisions based on it. Making the right decision in business is usually based on data quality and one's ability to sift through and analyze the data to find trends that solutions and strategies can be created from/for. Decision Support Systems are usually computer applications with a human component. They can shift through large amounts of data and pick between the many choices.

What are Decision Support Systems?

While many people think of Decision Support Systems as a specialized part of a business, most companies have actually integrated them into their day to day operating activities. For instance, many companies constantly download and analyze sales data, budget sheets, and forecasts.

They update their strategy once they analyze and evaluate the current results. Decision Support Systems have a definite structure in businesses. In reality, however, the data and decisions that are based on them are fluid and constantly changing.

Decision Support Systems are used to collect data, analyze and shape the data that is collected, and make sound decisions or construct strategies from analysis. Whether computers, databases, or people are involved usually does not matter.

It is important to note that although computers and artificial intelligence are at work, it is ultimately up to humans to execute these strategies or formulate the data into a usable hypothesis.

Business functions

The functions of a business are the key specialisms that it is divided up into such as marketing, accounts, production, etc. In the past many businesses were divided up on functional lines and this is still the case today in many organisations where it makes sense to create distinct departments in this. Many manufacturing organizations are divided up on functional lines. Clearly the most important department in a manufacturing company is often the production department. In individual factories there may be a works or factory manager with overall responsibility for organising and managing the production function.

Then there may be production managers for each of the product lines e.g. biscuits, chocolates etc. However, in addition to the production function there will be other functional specialisms such as the advertising and sales department, the finance and accounts departments, the administration department, the personnel (or human resources) department etc.

Organisations are organised on functional lines when it is felt that this is the best way of communicating and organising the organisation. Specialists are able to focus on their specialism under the supervision of specialist managers.
However, this may not be the only way of organising the organisation. For a number of projects cross-functional teams may be set up. For example, in developing a new product line it may make sense to set up a team containing specialists from marketing, advertising and sales, production, finance and accounts etc.

Once the project is completed these specialists can then go back to concentrating on their own specialist area or they may be pulled into another cross-functional project. When specialists have more than one line manager they may be organised in a matrix structure. For example, when projects are set up a production line worker may both be accountable to the production manager and to the project leader for new product development.

Accounting

Accounting function is vital for any size business. Accounting is how you keep track of your monetary resources, money you owe to vendors and money that customers owe you; and they determine profitability and what you owe on taxes. Therefore, the accounting functions in your business should be managed well and the results monitored often.

Make a list of all the accounting functions your business has or is likely to have in the near future. These will normally include accounts payable, accounts receivable, banking, investing, taxes, inventory management and fixed asset management. All companies have the need to track profitability.

If you have investors or have a partnership agreement, there may be the need to track conditions separately for specific investors or partners as well. Draw a process map showing how these functions relate to one another.

When you pay vendors, the outstanding payable balance decreases and your cash balance decreases. The exact reverse relationship is true of accounts receivable; when you receive money from customers, the outstanding receivable balance decreases while your cash balance increases. In both cases, accounting entries must be made reflecting these activities. Creating a process map will help you visualize the flow of information.

Determine where the major risks of theft or embezzlement lie. This will be different for each company and industry. Common problem areas include fake vendors set up by employees and customer charges that are written off and pocketed by employees. You may want to enlist the help of an outside accounting firm in this step.

Set up effective internal controls to safeguard against loss, paying special attention to the problem areas you noted in the previous step. The controls can be set by policy and procedures, by software functionality or both. A common internal procedure is not allowing an employee who deals with accounts receivable to ever balance the checking account. Another would be to place tight restrictions on the creation of new vendor records, and have a procedure of independently verifying the existence of these newly created vendors.

Tactical management

The difference between strategy and tactics is that strategy defines "what" is to be done but tactics defines the "how". Tactical management is the use of tactics to implement strategy. This is different from traditional management in that in traditional management there is usually one procedure (standard operating procedure) for getting any action done whereas tactical management allows the manager to select appropriate tactics for best achieving the objective.

Control systems

A control system is a device or set of devices to manage, command, direct or regulate the behavior of other devices or systems.

There are two common classes of control systems, with many variations and combinations: logic or sequential controls, and feedback or linear controls. There is also fuzzy logic, which attempts to combine some of the design simplicity of logic with the utility of linear control. Some devices or systems are inherently not controllable.

The term "control system" may be applied to the essentially manual controls that allow an operator, for example, to close and open a hydraulic press, perhaps including logic so that it cannot be moved unless safety guards are in place.

An automatic sequential control system may trigger a series of mechanical actuators in the correct sequence to perform a task.

## Financial Management Information System (FMIS)

The FMIS is the primary automated financial system for the Offices, Boards and Divisions, the U.S. Attorneys, and the Bureau of Prisons.

The FMIS supports the full range of financial management requirements, including the general ledger function, budget execution, travel, third party and Treasury payment, credit card purchases, etc. FMIS is continually evolving to make use of new techniques and technologies to respond to new requirements and provide easily obtainable and understandable information to all levels of staff involved in financial operations or management as well as budget formulation and execution.

The FMIS currently collects data via forms based PC front ends, mainframe front ends and file transfers, processes the data in a mainframe VM/CMS environment and stores data on a massively parallel processing back end database machine (Teradata).

It uses 4th generation languages and relational tables to develop applications for transaction processing and reporting, enabling rapid development to provide a flexible system responsive to changing needs and capable of describing complex interrelationships among data as useful information.

The information is used for operational processing of the funds flowing to, from, and within the Department, management controls and external reporting requirements, and planning and forecasting activities. In accordance with the CFO Act of 1990, OMB Circular A-127 and other JFMIP requirements FMIS is continuing progress towards an integrated financial management system.

Objectives:
The primary objectives of FMIS are:

- To automate transaction processing related to the receipt or payment of funds
- To automate record storage and retrieval related to the process.
- To support management controls over the process, including internal / external report requirements.
- To provide reliable information for use in planning for the Department's future needs and assessing its present and past activities.

## Investment analysis and services

Investment has different meanings in finance and economics. In Finance investment is putting money into something with the expectation of gain, that upon thorough analysis, has a high degree of security of principle, as well as security of return, within an expected period of time. In contrast putting money into something with an expectation of gain without thorough analysis, without security of principal, and without security of return is speculation or gambling.

Investment is related to saving or deferring consumption. Investment is involved in many areas of the economy, such as business management and finance whether for households, firms, or governments.

To avoid speculation an investment must be either directly backed by the pledge of sufficient collateral or insured by sufficient assets pledged by a third party. A thoroughly analyzed loan of money backed by collateral with greater immediate value than the loan amount may be considered an investment.

A financial instrument that is insured by the pledge of assets from a third party, such as a deposit in a financial institution insured by a government agency may be considered an investment. Examples of these agencies include, in the United States, the Securities Investor Protection Corporation, Federal Deposit Insurance Corporation , or National Credit Union Administration, or in Canada, the Canada Deposit Insurance Corporation.

The investment decision (also known as capital budgeting) is one of the fundamental decisions of business management: Managers determine the investment value of the assets that a business enterprise has within its control or possession. These assets may be physical (such as buildings or machinery), intangible (such as patents, software, goodwill), or financial (see below). Assets are used to produce streams of revenue that often are associated with particular costs or outflows.

All together, the manager must determine whether the net present value of the investment to the enterprise is positive using the marginal cost of capital that is associated with the particular area of business.

In terms of financial assets, these are often marketable securities such as a company stock (an equity investment) or bonds (a debt investment). At times, the goal of the investment is to produce future cash flows, while at others it may be for the purpose of gaining access to more assets by establishing control or influence over the operation of a second company (the investee).

Business firms or organisations raise funds from investors in the form of equites and debts (collectively known as the capital structure) and further reinvest it into various investment schemes by carefully analysing the returns in order to meet out their obligations relating to purchase of assets which provides them long term benefits.

1. Money committed or property acquired for future income.

2. Two main classes of investment are (1) Fixed income investment such as bonds, fixed deposits, preference shares, and (2) Variable income investment such as business ownership (equities), or property ownership. In economics, investment means creation of capital or goods capable of producing other goods or services.

<u>Investment analysis:</u>

- Investment analysis provided by Paul Comstock Partners is an ongoing process of evaluating current and potential allocations of financial assets and choosing those allocations that best fit the investor's needs and goals.

- Successful investing must control risk and deliver adequate returns for forward planning, consumption needs, tax liabilities, and inflation protection.

- We will provide active investment analysis to construct and implement an investment program that incorporates the business acumen of the client and the existing portfolio of assets.

- Paul Comstock Partners create an asset allocation model using a variety of tools including a unique Monte Carlo analysis that maximizes the probability of achieving the plan's objectives while identifying realistic downside risks.

- T he Monte Carlo Analysis is able to estimate the probability of achieving the success of your financial plan by accounting for the yearly variability in the two main factors contributing to it's outcome, the return rate on your investments and the inflation rate.

- An investment analysis form is the perfect place to record key figures and pieces of information about your company as you find them in your research.

- I investment analysis form allows you to better interpret your data systematically, as all of the information is collected into a standardized format.

- Creating your own investment analysis form can enable you to interpret the information you deem important in selecting an investment without losing your head in a sea of numbers.

## **MIS and Market Research**

Market research is any organized effort to gather information about markets or customers. It is a very important component of business strategy. The term is commonly interchanged with marketing research; however, expert practitioners may wish to draw a distinction, in that *marketing* research is concerned specifically about marketing processes, while *market* research is concerned specifically with markets.

Market Research is a key factor to get advantage over competitors. Market research provides important information to identify and analyze the market need, market size and competition.

Market research is for discovering what people want, need, or believe. It can also involve discovering how they act. Once that research is completed, it can be used to determine how to market your product. Questionnaires and focus group discussion surveys are some of the instruments for market research. For starting up a business, there are some important things:

Market information

Through Market information one can know the prices of the different commodities in the market, as well as the supply and demand situation. Information about the markets can be obtained from different sources, varieties and formats, as well as the sources and varieties that have to be obtained to make the business work.

Market segmentation

Market segmentation is the division of the market or population into subgroups with similar motivations. It is widely used for segmenting on geographic differences, personality differences, demographic differences, technographic differences, use of product differences, psychographic differences and gender differences.

Market trends

Market trends are the upward or downward movement of a market, during a period of time. The market size is more difficult to estimate if one is starting with something completely new. In this case, you will have to derive the figures from the number of potential customers, or customer segments.

Besides information about the target market, one also needs information about one's competitors, customers, products, etc. Lastly, you need to measure marketing effectiveness. A few techniques are:

- Customer analysis
- Choice modelling
- Competitor analysis
- Risk analysis
- Product research
- Advertising the research
- Marketing mix modeling

Marketing research can be defined as,

"A systematic manner of objective collection and analysis of data about a particular target market, competition, and/or environment".

Marketing or business research always incorporates some form of data collection whether it is secondary research (often referred to as desk research) or primary research which is collected directly from a respondent.

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The purpose of marketing research is to gain a proper understanding on the subject matter to derive effective business insights. As the markets are becoming competitive on a global level, market research is on the agenda of all organizations to collect targeted and specific data.

## What is a Marketing or Business Research Proposal?

A marketing research proposal can be defined as,

*"A plan that offers ideas for conducting research".*

*OR*

*"A marketing research proposal details the who, the what, the where, the when and the how of research and the information and costs associated with it".*

Before carrying out marketing research on college/university level, the researcher is supposed to write a marketing research proposal. The main aim of this proposal is to provide the research committee an overview of your idea and obtain their approval.

## Objective/Purpose of a Marketing Research Strategy Plan

- Why is the purpose of this research?
- What benefits does the marketing department expects to gain through the research data?
- What methods will be used for conducting the research?
- How long will the research work take?
- How much will the research study cost in monetary as well as resource?
- Who will be involved?

### *Abstract*

An abstract is the first part of the marketing research proposal. It explains why the research is taking place, the goals of this research and brief information on the methodology and theories used.

### *Introduction*

The introduction part is aimed at giving the readers an overall idea of the marketing research. The introduction must include the information needed to carry out the research in a smooth and effective manner.

For instance, if the purpose of research is to study the impact of television viewing habits on young generation, then the first information required is the kind of television programs and channels, which are influencing the youngsters in a positive or negative way.

### Research Problem

A research problem is the situation that causes the researcher to feel apprehensive, confused and ill at ease. It is the demarcation of a problem area within a certain context involving the WHO or WHAT, the WHERE, the WHEN and the WHY of the problem situation. Research problem leads to a hypothesis for the project.

### Research Methods/Tools

This is the most critical part of the marketing research proposal. The researcher must provide detailed information on the kind of research methods or techniques he will be incorporating into his research. This section also includes the key research objectives and goals.

### Research Design

The researcher must give a complete description of the research design he will be following in his work. The research design can be exploratory, casual, descriptive or adopted.

## Target Marketing:

A target market is a group of customers that the business has decided to aim its marketing efforts and ultimately its merchandise. A well-defined target market is the first element to a marketing strategy. The target market and the marketing mix variables of product, place(distribution), promotion and price are the four elements of a marketing mix strategy that determine the success of a product in the marketplace.

Once these distinct customers have been defined, a marketing mix strategy of product, distribution, promotion and price can be built by the business to satisfy the target market.

Market segmentations

Target markets are groups of people separated by distinguishable and noticeable aspects. Target markets can be separated into:

- Geographic segmentations, addresses (their location)
- Demographic/socio-economic segmentation (gender,age, income occupation, education, sex, household size, age, and stage in the family life cycle)
- Psychographic segmentation (similar attitudes, values, and lifestyles)
- Behavioral segmentation (occasions, degree of loyalty)
- Product-related segmentation (relationship to a product)

A principal concept in target marketing is that those who are targeted show a strong affinity or brand loyalty to that particular brand. Target Marketing allows the marketer / sales team to customize their message to the targeted group of consumers in a more focused manner.

Research has shown that racial similarity, role congruence, labeling intensity of ethnic identification, shared knowledge and ethnic salience all promote positive effects on the target market.

Research has generally shown that target marketing strategies are constructed from consumer inferences of similarities between some aspects of the advertisement (e.g., source pictured, language used, lifestyle represented) and characteristics of the consumer (e.g. reality or desire of having the represented style). Consumers are persuaded by the characteristics in the advertisement and those of the consumer.

MIS and Customer Relationship Management

It is a widely-implemented strategy for managing a company's interactions with customers, clients and sales prospects. It involves using technology to organize, automate, and synchronize business processes—principally sales activities, but also those for marketing, customer service, and technical support. The overall goals are to find, attract, and win new clients, nurture and retain those the company already has, entice former clients back into the fold, and reduce the costs of marketing and client service.

Challenges

Successful development, implementation, use and support of customer relationship management systems can provide a significant advantage to the user, but often, there are obstacles that obstruct the user from using the system to its full potential. Instances of a CRM attempting to contain a large, complex group of data can become cumbersome and difficult to understand for an ill-trained user.

Additionally, an interface that is difficult to navigate or understand can hinder the CRM's effectiveness, causing users to pick and choose which areas of the system to be used, while others may be pushed aside.

This fragmented implementation can cause inherent challenges, as only certain parts are used and the system is not fully functional. The increased use of customer relationship management software has also led to an industry-wide shift in evaluating the role of the developer in designing and maintaining its software.

Complexity

Tools and workflows can be complex, especially for large businesses. Previously these tools were generally limited to contact management: monitoring and recording interactions and communications. Software solutions then expanded to embrace deal tracking, territories, opportunities, and the sales pipeline itself. Next came the advent of tools for other client-interface business functions, as described below. These tools

have been, and still are, offered as on-premises software that companies purchase and run on their own IT infrastructure.

Poor usability

One of the largest challenges that customer relationship management systems face is poor usability. With a difficult interface for a user to navigate, implementation can be fragmented or not entirely complete.The importance of usability in a system has developed over time.Customers are likely not as patient to work through malfunctions or gaps in user safety, and there is an expectation that the usability of systems should be somewhat intuitive: "it helps make the machine an extension of the way I think — not how it wants to me think."

An intuitive design can prove most effective in developing the content and layout of a customer relationship management system. Two 2008 case studies show that the layout of a system provides a strong correlation to the ease of use for a system and that it proved more beneficial for the design to focus on presenting information in a way that reflected the most important goals and tasks of the user, rather than the structure of the organization. This "ease of service" is paramount for developing a system that is usable.

In many cases, the growth of capabilities and complexities of systems has hampered the usability of a customer relationship management system. An overly complex computer system can result in an equally complex and non-friendly user interface, thus not allowing the system to work as fully intended. This bloated software can appear sluggish and/or overwhelming to the user, keeping the system from full use and potential. A series of 1998 research indicates that each item added to an information display can significantly affect the overall experience the user.

Fragmentation

Often, poor usability can lead to implementations that are fragmented — isolated initiatives by individual departments to address their own needs. Systems that start disunited usually stay that way: siloed thinking and decision processes frequently lead to separate and incompatible systems, and dysfunctional processes.

A fragmented implementation can negate any financial benefit associated with a customer relationship management system, as companies choose not to use all the associated features factored when justifying the investment. Instead, it is important that support for the CRM system is companywide. The challenge of fragmented implementations may be mitigated with improvements in late-generation CRM systems.

Business reputation

Business reputation has become a growing challenge. The outcome of internal fragmentation that is observed and commented upon by customers is now visible to the rest of the world in the era of the social customer; in the past, only employees or partners were aware of it. Addressing the fragmentation requires a shift in philosophy

and mindset in an organization so that everyone considers the impact to the customer of policy, decisions and actions

Some developments and shifts have made companies more conscious of the life-cycle of a customer relationship management system. Companies now consider the possibility of brand loyalty and persistence of its users to purchase updates, upgrades and future editions of software.

Security concerns

A large challenge faced by developers and users is found in striking a balance between ease of use in the CRM interface and suitable and acceptable security measures and features. Corporations investing in CRM software do so expecting a relative ease of use while also requiring that customer and other sensitive data remain secure. This balance can be difficult, as many believe that improvements in security come at the expense of system usability.

Research and study show the importance of designing and developing technology that balances a positive user interface with security features that meet industry and corporate standards. A 2002 study shows, however, that security and usability can coexist harmoniously. In many ways, a secure CRM system can become more usable.

## MIS and Human Resource Management

An effective human resource management information system must provide answers to questions such as:

- What positions are available within the company?
- What are the responsibilities for the position?
- What skills and experience are required?
- Who does the position report to?
- What is the pay rate for the position?
- What positions are filled?

*What is position information?*

A position represents a job within a company or division e.g.

- Informatics developer;
- Payroll supervisor;
- Project manager; or
- Sales representative.

*Position information requirements include things like:*

- Position type;
- Responsibilities;
- Classification e.g. is it salary based, hourly paid, part time or full time;

- Account and budget information e.g. what general ledger account should be charged for employee's salaries for this position;
- Position reporting structures e.g. the report-to position;
- The pay rates and pay steps established for the position type and the changes to these pay rates over time; and
- Position effective date.

*What human resource management information system employee data is managed?*

Companies may want to track things such as:

- The various employees who filled a position over time e.g. an employee may fill a sales representative position in one sales division, be transferred to another sales division, and be replaced by a second employee;
- The staffing firm that proposed the employee;
- The union responsible for the position;
- Benefits e.g.
    - Benefits available for employee; and
    - Benefits paid to the employee;
- Payroll information e.g.
    - Requested deductions;
    - Gross amount paid;
    - Amount deducted; and
    - Payment details such as direct bank deductions;
- Address information; and
- Contact information e.g. phone numbers and emergency contact information.

*What are human resource management information system challenges?*

Human resource management systems are frequently the system of record for employee information. However, they are usually implemented as stand-alone systems that do not communicate well with other systems, which need employee data e.g.

- Order management;
- Shipment management;
- Billing management; and
- Work order management.

If every application captures and stores employee data, then there is a lot of redundant processing. This increases the information management costs e.g.

- There is cost associated with synchronizing data between systems;
- There are additional data quality issues and costs as different systems may capture data using different rules; and
- There are additional data movement costs as it is necessary to load data warehouses from multi sources and to sort out which data is the correct version and the most accurate version.

*What is a better way to manage this information?*

Maintaining human resource data in a variety of individual databases is less efficient than storing it in one database and having all applications access the data as needed. Alternate options to individual systems include:

Enterprise resource planning (ERP), many companies have invested in ERP systems, which handle human resource management and other business functions.

ERP should be evaluated to ensure that they meet business information management requirements.

Redesign, some companies have made investments in an enterprise data model and new management information systems to access common data.

This option is not as costly as it might appear since much of the analysis work will be required even if an ERP option is selected. Companies should complete a cost benefit analysis to compare the cost of re-design with the cost of ERP.

Master data management (MDM) is becoming a common, but expensive, means of ensuring synchronization of key data among applications.

A Human Resource Management System (HRMS) or Human Resource Information System (HRIS), refers to the systems and processes at the intersection between human resource management (HRM) and information technology. It merges HRM as a discipline and in particular its basic HR activities and processes with the information technology field, whereas the programming of data processing systems evolved into standardized routines and packages of enterprise resource planning (ERP) software. On the whole, these ERP systems have their origin on software that integrates information from different applications into one universal database.

The linkage of its financial and human resource modules through one database is the most important distinction to the individually and proprietary developed predecessors, which makes this software application both rigid and flexible.

The HR management module is a component covering many other HR aspects from application to retirement. The system records basic demographic and address data, selection, training and development, capabilities and skills management, compensation planning records and other related activities. Leading edge systems provide the ability to "read" applications and enter relevant data to applicable database fields, notify employers and provide position management and position control. Human resource management function involves the recruitment, placement, evaluation, compensation and development of the employees of an organization. Initially, businesses used computer based information systems to:

- produce pay checks and payroll reports;
- maintain personnel records;
- Pursue Talent Management.

Online recruiting has become one of the primary methods employed by HR departments to garner potential candidates for available positions within an organization. Talent Management systems typically encompass:

- analyzing personnel usage within an organization;
- identifying potential applicants;
- recruiting through company-facing listings;
- Recruiting through online recruiting sites or publications that market to both recruiters and applicants.

The significant cost incurred in maintaining an organized recruitment effort, cross-posting within and across general or industry-specific job boards and maintaining a competitive exposure of availabilities has given rise to the development of a dedicated Applicant Tracking System, or 'ATS', module.

The training module provides a system for organizations to administer and track employee training and development efforts. The system, normally called a Learning Management System if a stand alone product, allows HR to track education, qualifications and skills of the employees, as well as outlining what training courses, books, CDs, web based learning or materials are available to develop which skills. Courses can then be offered in date specific sessions, with delegates and training resources being mapped and managed within the same system. Sophisticated LMS allow managers to approve training, budgets and calendars alongside performance management and appraisal metrics.

The Employee Self-Service module allows employees to query HR related data and perform some HR transactions over the system. Employees may query their attendance record from the system without asking the information from HR personnel. The module also lets supervisors approve O.T. requests from their subordinates through the system without overloading the task on HR department.

Many organizations have gone beyond the traditional functions and developed human resource management information systems, which support recruitment, selection; hiring, job placement, performance appraisals, employee benefit analysis, health, safety and security, while others integrate an outsourced Applicant Tracking System that encompasses a subset of the above.

Employee Record Management

The term "employee record management" describes an important aspect of human resource (HR) management. The HR office collects many types of information about an organization's personnel, including their personal information. An employer must protect personnel records against theft and other unauthorized uses through employee record management.

Consumer Protection

Federal laws protect an individual's right to privacy and protection from unauthorized disclosure of personal information. One of the important pieces of personally

identifiable information collected by employers is an employee's Social Security Number (SSN). Employers use the SSN to report an employee's earnings, including payroll taxes and FICA contributions. By controlling who has access to paper files and electronic files containing an employee's SSN and other personally identifiable information, an employer manages records and prevents fraud.

### Decision-Making

Employee records management includes standard operating procedures. For example, an employer develops a protocol for handling each type of employee record. Employees need a standard protocol for deciding what information to save, discard or preserve for each record.

### Role Assignment

Information technology personnel assist an employer with managing records by controlling the roles of employees in their organization's information system. For example, through role assignment, a computer programmer can authorize only people with a business need to view an employee's SSN when they log in to the information system.

### Storage

Records management also requires adequate physical storage. For example, employers must maintain employee records, such as payroll records, to comply with federal laws. To keep records, employers must choose how to store them and prevent long-term damage or destruction. Employers must provide spaces where paper files are free from fire and water damage.

### Performance Evaluation

The major aims of Performance Evaluation are to:

Collect and disseminate information relative to performance aspects, and in particular to the topics described below.
Promote interdisciplinary flow of technical information among researchers and professionals.
Serve as a publication medium for various special interest groups.

Performance studies of computers, computer communications, telecommunications and distributed systems

Resource allocation and control methods and algorithms (e.g. routing and flow control in networks, bandwidth allocation, processor scheduling, memory management)

Modeling and analysis methods (e.g. queuing and scheduling theory, simulation methods, data analysis)

Measurement techniques (e.g. software and hardware monitors) and workload characterization

System architecture, design and implementation discussed from a performance viewpoint

Performance evaluation applications (e.g. system tuning, procurement, capacity planning)

Case studies and model validations.

A performance appraisal, employee appraisal, performance review, or (career) development discussion is a method by which the job performance of an employee is evaluated (generally in terms of quality, quantity, cost, and time) typically by the corresponding manager or supervisor.

A performance appraisal is a part of guiding and managing career development. It is the process of obtaining, analyzing, and recording information about the relative worth of an employee to the organization.

Performance appraisal is an analysis of an employee's recent successes and failures, personal strengths and weaknesses, and suitability for promotion or further training. It is also the judgement of an employee's performance in a job based on considerations other than productivity alone.

MIS and Inventories

Inventory control systems maintain information about activities within firms that ensure the delivery of products to customers. The subsystems that perform these functions include sales, manufacturing, warehousing, ordering, and receiving.

In different firms the activities associated with each of these areas may not be strictly contained within separate subsystems, but these functions must be performed in sequence in order to have a well-run inventory control system.

In today's business environment, even small and mid-sized businesses have come to rely on computerized inventory management systems. Certainly, there are plenty of small retail outlets, manufacturers, and other businesses that continue to rely on manual means of inventory tracking.

Indeed, for some small businesses, like convenience stores, shoe stores, or nurseries, purchase of an electronic inventory tracking system might constitute a wasteful use of financial resources.

But for other firms operating in industries that feature high volume turnover of raw materials and/or finished products, computerized tracking systems have emerged as a key component of business strategies aimed at increasing productivity and maintaining competitiveness.

Computers and Inventory

Automation can dramatically impact all phases of inventory management, including counting and monitoring of inventory items; recording and retrieval of item storage location; recording changes to inventory; and anticipating inventory needs, including inventory handling requirements.

This is true even of stand-alone systems that are not integrated with other areas of the business, but many analysts indicate that productivity—and hence profitability—gains that are garnered through use of automated systems can be increased even more when a business integrates its inventory control systems with other systems such as accounting and sales to better control inventory levels.

The goal: to control inventory quarter to quarter, so it doesn't come back to bite the bottom line. Key components of an integrated system ... are general ledger, electronic data interchange, database connectivity, and connections to a range of vertical business applications."

Warehouse Layout and Operation

The move toward automation in inventory management naturally has moved into the warehouse as well. Citing various warehousing experts, Sarah Bergin contended in _Transportation and Distribution_ magazine that "the key to getting productivity gains from inventory management ... is placing real-time intelligent information processing in the warehouse.

This empowers employees to take actions that achieve immediate results. Real-time processing in the warehouse uses combinations of hardware including material handling and data collection technologies. But according to these executives, the intelligent part of the system is sophisticated software which automates and controls all aspects of warehouse operations."

Another important component of good inventory management is creation and maintenance of a sensible, effective warehousing design. A well-organized, user-friendly warehouse layout can be of enormous benefit to small business owners, especially if they are involved in processing large volumes of goods and materials. Conversely, an inefficient warehouse system can cost businesses dearly in terms of efficiency, customer service, and, ultimately, profitability.

_Transportation and Distribution_ magazine cited several steps that businesses utilizing warehouse storage systems can take to help ensure that they get the most out of their facilities. It recommended that companies utilize the following tools:

Stock locator database—"The stock locator database required for proactive decision making will be an adjunct of the inventory file in a state-of-the-art space management system. A running record will be maintained of the stock number, lot number, and number of pallet loads in each storage location. Grid coordinates of the reserve area, including individual rack tier positions, must therefore be established,

and the pallet load capacity of all storage locations must be incorporated into the database."

Grid coordinate numbering system—Warehouse numbering system should be developed in conjunction with the storage layout, and should be user-friendly so that workers can quickly locate currently stocked items and open storage spaces alike.

Communication systems—again, this can be a valuable investment if the business's warehouse requirements are significant. Such facilities often utilize fork lift machinery that can be used more effectively if their operators are not required to periodically return to a central assignment area.

Current technology makes it possible for the warehouse computer system to interact with terminal displays or other communications devices on the fork lifts themselves. "Task assignment can then be made by visual display or printout, and task completion can be confirmed by scanning, keyboard entry, or voice recognition," observed *Transportation and Distribution.*

Maximization of storage capacity—Warehouses that adhere to rigid "storage by incoming lot size" storage arrangements do not always make the best use of their space. Instead, businesses should settle on a strategy that eases traffic congestion and best eases problems associated with ongoing turnover in inventory.

Some companies choose to outsource their warehouse functions. "This allows a company that isn't as confident in running their own warehousing operations to concentrate on their core business and let the experts worry about keeping track of their inventory," wrote Bergin. Third-party inventory control operations can provides companies with an array of valuable information, including analysis of products and spare parts, evaluations of their time sensitivity, and information on vendors. Of course, businesses weighing whether to outsource such a key component of their operation need to consider the expense of such a course of action, as well as their feelings about relinquishing that level of control.

## Production and Design

In film and television, a production designer is the person responsible for the overall look of a filmed event such as films, TV programs, music videos or adverts. Production designers have one of the key creative roles in the creation of motion pictures and television. Working directly with the director and producer, they must select the settings and style to visually tell the story. The term "production designer" was coined by William Cameron Menzies while he was working on the film *Gone with the Wind.* Previously (and often subsequently) the people with the same responsibilities were called "art directors."

Responsibilities

From early in pre-production, the production designer collaborates with the director and director of photography to establish the visual feel and specific aesthetic needs of the project.

The production designer guides key staff in other departments such as the costume designer, the key hair and make-up stylists, the special effects director and the locations manager (among others) to establish a unified visual appearance to the film.

The "art department" is a group of people who work with the production designer to implement the scenic elements of that vision. The art director supervises set construction and painting, as well as modifications to existing locations, such as changing signs or installing new carpet.

An art director has myriad specialists reporting to them including the construction department, which includes carpenters, painters, plasterers, riggers and other trades, propmakers, greensmen (landscapers), sign painters, and scenic artists.

A production illustrator, such as Mentor Huebner, provides pre-production concept art and storyboards. The set decorator, often someone with experience in interior decoration, finds decorative items for the sets such as furniture, wallpaper, knick-knacks and lighting fixtures.

Working under the decorator are buyers, as well as a crew of set dressers who bring the items to the set, arrange furniture, hang curtains and "dress" the set. A property master coordinates with the production designer, but also works closely with the director and actors to provide the items handled directly by the actors such as newspapers, weapons, musical instruments and food.

For the most part, the prop crews, along with an on-set dresser, maintain the integrity of the production designer's vision during the shoot and manipulate the items for the camera.

Since 1929 the Academy of Motion Picture Arts and Sciences grants an Art Direction Award to an outstanding Production Designer. An Art Director may only be considered eligible for an Oscar when there is no Production Designer credited.

Some of the crew who work in the art department under the production designer include: art director, set designer (draughtsman), set decorator, costume designer, property master, concept illustrator, graphic designer, and model maker.

Process and Control

Process control is a statistics and engineering discipline that deals with architectures, mechanisms and algorithms for maintaining the output of a specific process within a desired range.

For example, heating up the temperature in a room is a process that has the specific, desired outcome to reach and maintain a defined temperature (e.g. 20°C), kept constant over time. Here, the temperature is the controlled variable. At the same time, it is the input variable since it is measured by a thermometer and used to decide whether to heat or not to heat. The desired temperature (20°C) is the setpoint.

The state of the heater (e.g. the setting of the valve allowing hot water to flow through it) is called the manipulated variable since it is subject to control actions.

A commonly used control device called a programmable logic controller, or a PLC is used to read a set of digital and analog inputs, apply a set of logic statements, and generate a set of analog and digital outputs.

Using the example in the previous paragraph, the room temperature would be an input to the (programmable logic controller )PLC. The logical statements would compare the setpoint to the input temperature and determine whether more or less heating was necessary to keep the temperature constant.

A PLC output would then either open or close the hot water valve, an incremental amount, depending on whether more or less hot water was needed. Larger more complex systems can be controlled by a Distributed Control System (DCS).In practice, process control systems can be characterized as one or more of the following forms:

Discrete – Found in many manufacturing, motion and packaging applications. Robotic assembly, such as that found in automotive production, can be characterized as discrete process control. Most discrete manufacturing involves the production of discrete pieces of product, such as metal stamping.

Batch – Some applications require that specific quantities of raw materials be combined in specific ways for particular durations to produce an intermediate or end result. One example is the production of adhesives and glues, which normally require the mixing of raw materials in a heated vessel for a period of time to form a quantity of end product. Other important examples are the production of food, beverages and medicine. Batch processes are generally used to produce a relatively low to intermediate quantity of product per year (a few pounds to millions of pounds).

Continuous – Often, a physical system is represented through variables that are smooth and uninterrupted in time. The control of the water temperature in a heating jacket, for example, is an example of continuous process control. Some important continuous processes are the production of fuels, chemicals and plastics. Continuous processes in manufacturing are used to produce very large quantities of product per year (millions to billions of pounds).

Materials Requirements Planning (MRP)

MRP is a planning tool geared specifically to assembly operations. The aim is to allow each manufacturing unit to tell its supplier what parts it requires and when it requires them. The supplier may be the upstream process within the plant or an outside supplier.

Together with MRP it is probably the most widely used planning and scheduling tool in the world. MRP was created to tackle the problem of 'dependent demand'; determining how many of a particular component is required knowing the number of finished products. Advances in computer hardware made the calculation possible.

Master Production Schedule

The process starts at the top level with a Master Production Schedule (MPS). This is an amalgam of known demand, forecasts and product to be made for finished stock. The phasing of the demand may reflect the availability of the plant to respond. There are three distinct steps in preparing an MRP schedule:

1. exploding
2. netting
3. Offsetting.

Exploding

Explosion uses the Bill of Materials (BOM). This lists how many, of what components, are needed for each item (part, sub assembly, final assembly, finished product) of manufacture. Thus a car requires five wheels including the spare. BOM's are characterized by the number of levels involved, following the structure of assemblies and sub assemblies. The first level is represented by the MPS and is 'exploded' down to final assembly. Thus a given number of finished products is exploded to see how many items are required at the final assembly stage.

Netting

The next step is 'netting', in which any stock on hand is subtracted from the gross requirement determined through explosion, giving the quantity of each item needed to manufacture the required finished products.

Offsetting

The final step is 'offsetting'. This determines when manufacturing should start so that the finished items are available when required.

To do so a 'lead time' has to be assumed for the operation. This is the anticipated time for manufacturing. The whole process is repeated for the next level in the BOM and so on until the bottom is reached. These will give the requirements and timings to outside suppliers.

There are three major assumptions made when constructing an MRP schedule:

- The first, and possibly the most important, is that there is sufficient capacity available. For this reason MRP is sometimes called infinite capacity scheduling.
- The second is that the lead times are known, or can be estimated, in advance.
- The third is that the date the order is required can be used as the starting date from which to develop the schedule.

MRP calculates and maintains an optimum manufacturing plan based on master production schedules, sales forecasts, inventory status, open orders and bills of material. If properly implemented, it will reduce cash flow and increase profitability. MRP will provide you with the ability to be pro-active rather than re-

active in the management of your inventory levels and material flow. Implementing or improving Material Requirements Planning can provide the following benefits for your company:

- Reduced Inventory Levels
- Reduced Component Shortages
- Improved Shipping Performance
- Improved Customer Service
- Improved Productivity
- Simplified and Accurate Scheduling
- Reduced Purchasing Cost
- Improve Production Schedules
- Reduced Manufacturing Cost
- Reduced Lead Times
- Less Scrap and Rework
- Higher Production Quality
- Improved Communication
- Improved Plant Efficiency
- Reduced Freight Cost
- Reduction in Excess Inventory
- Reduced Overtime
- Improved Supply Schedules
- Improved Calculation of Material Requirements

MRP will plan production so that the right materials are at the right place at the right time. MRP determines the latest possible time to product goods, buy materials and add manufacturing value. Proper Material Requirements Planning can keep cash in the firm and still fulfill all production demands. It is the single most powerful tool in guiding inventory planning, purchase management and production control. MRP is easy to operate and adds dramatically to profits.

## Computer-integrated manufacturing (CIM)

It is the manufacturing approach of using computers to control the entire production process. This integration allows individual processes to exchange information with each other and initiate actions. Through the integration of computers, manufacturing can be faster and less error-prone, although the main advantage is the ability to create automated manufacturing processes. Typically CIM relies on closed-loop control processes, based on real-time input from sensors. It is also known as *flexible design and manufacturing*.

Key challenges

There are three major challenges to development of a smoothly operating computer-integrated manufacturing system:

- Integration of components from different suppliers: When different machines, such as CNC, conveyors and robots, are using different communications protocols.

- Data integrity: The higher the degree of automation, the more critical is the integrity of the data used to control the machines. While the CIM system saves on labor of operating the machines, it requires extra human labor in ensuring that there are proper safeguards for the data signals that are used to control the machines.

- Process control: Computers may be used to *assist* the human operators of the manufacturing facility, but there must always be a competent engineer on hand to handle circumstances which could not be foreseen by the designers of the control software.

A computer-integrated manufacturing system is not the same as a *"lights-out" factory*, which would run completely independent of human intervention, although it is a big step in that direction. Part of the system involves flexible manufacturing, where the factory can be quickly modified to produce different products, or where the volume of products can be changed quickly with the aid of computers.

Just-in-time production (JIT)

Just-in-time production (JIT) is a management philosophy that embraces eliminating all waste and continually upgrading and improving production processes. The basic concept of just-in-time is that materials and supplies are replenished exactly when they are needed rather than too early or too late, thus ensuring an efficient flow of production.

Just-in-time (JIT) reduces the cost of having expensive materials sitting idle while waiting for production and eliminates the cost of having expensive equipment sitting idle while waiting for materials. It also reduces or eliminates related production costs such as scrap materials, defective products, unnecessary inventory, and wasted space, so that a company expends the least amount of resources—including materials, personnel, and facilities—to produce its final products.

While traditional companies focus more on planning than control, expending tremendous time and energy planning inventory level, materials and parts shipments, production schedules, etc., a just-in-time company emphasizes control more than planning by developing flexible, fast operations and processes that enable quick response to changing market conditions.

The Toyota Motor Company developed the just-in-time production strategy in Japan in the mid-1970s. The Japanese approach to just-in-time is to make products "flow like water" through a company. JIT readily exposes problems common in traditional companies, such as defective parts, lost orders, late shipments, and an over-reliance on overtime, by eliminating the excessive inventory levels and management practices used to compensate for these problems.

While JIT emphasizes the importance of reducing material inventories to support the concept of "the right parts, at the right place, at the right time," it is more than just an approach to dealing with materials. Just-in-time production affects all aspects of a company's operations, from product design and manufacturing operations to parts-suppliers and customer relations.

A just-in-time production environment requires a company to develop close relationships with selected vendors who participate in the design process and will ensure consistently high quality and on-time delivery of materials. Just-in-time product engineering and design emphasizes standardization and continuous process improvements.

The just-in-time production philosophy also changes the role of the labor force and of management. Just-in-time strives to develop flexible, broadly skilled workers who are capable of solving production problems and initiating process improvements. In a non-JIT environment, management typically makes all production-related decisions.

In a just-in-time production environment, teams comprised of workers and management make decisions jointly through consensus. Eliminating many of the status symbols traditionally reserved for management such as the executive dining room, reserved parking places, and executive bonuses creates a less adversarial relationship between workers and management, enhancing cooperation.

The just-in-time production concept, or management philosophy, is very much a part of the competitive strategy of most large companies today. Often referred to by other names such as "continuous flow manufacturing," "stockless production," "cellular manufacturing," or "lean production," just-in-time simplifies production and lowers costs, giving JIT companies a competitive edge.

Current management literature suggests that implementing just-in-time offers many advantages to companies, including

- maintaining minimum inventory levels

- establishing customer order-driven production planning and scheduling

- purchasing materials in small-lot sizes only when required

- performing simple, quick, and inexpensive machine setups

- developing a flexible, multiskilled, and empowered workforce

- creating a flexible manufacturing system that quickly adapts to changing market conditions

- improving and maintaining product quality

- developing time- and cost-effective preventive maintenance

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- promoting continuous process improvements

- improving worker morale

- reducing labor, material, and overhead costs

In spite of the obvious advantages of just-in-time production, many U.S. manufacturers have still not adopted a just-in-time philosophy. The dominant reason is that just-in-time requires an overall change in corporate culture at every level of an organization. JIT demands new types of relationships with suppliers, customers, and employees that render traditional methods and processes obsolete. Additionally, implementing just-in-time requires an ongoing commitment to continuous improvement, not only in a company's products but also in its processes.

## Geographic Information System (GIS)

GIS is a computer system for capturing, storing, checking, integrating, manipulating, analyzing and displaying data related to positions on the Earth's surface.

A GIS is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to location. Practitioners also define a GIS as including the procedures, operating personnel, and spatial data that go into the system.

Typically, a Geographical Information System is used for handling maps of one kind or another. These might be represented as several different layers where each layer holds data about a particular kind of feature.

Each feature is linked to a position on the graphical image on a map and a record in an attribute table. GIS can relate otherwise disparate on the basis of common geography, revealing hidden patterns, relationships, and trends that are not readily apparent in spreadsheets or statistical packages, often creating new information from existing data resources.

Hidden in most data is a geographical component: an address, postal code, census block, city, county, or latitude/longitude coordinate. With GIS, you can explore the spatial element of your data to display soil types, track crime patterns, analyze animal migration patterns, find the best location for an expanding business, model the path of atmospheric pollution, and make decisions for many types of complicated problems.

GIS can be used to manage, analyze and present Information about geographically located features, for example such information that can be presented on maps. Such information can be about polluting leakage, nurseries and roads, but also about individuals, vehicles and other things with a defined location.GIS can also be used to deal with other types of information that can be linked to a map.

Components of GIS

The key components of GIS are a computer system, geospatial data and users. A computer system for GIS consists of hardware, software and methods designed to support the data capture, processing, analysis, modeling and display of geospatial data.

A full GIS, or geographic information system, requires:
- Hardware
- Software
- Data
- People
- Methods

The power of a GIS comes from the ability to relate different information in a spatial context and to reach a conclusion about this relationship. Most of the information we have about our world contains a location reference, placing that information at some point on the globe. When rainfall information is collected, it is important to know where the rainfall is located.

This is done by using a location reference system, such as longitude and latitude, and perhaps elevation. Comparing the rainfall information with other information, such as the location of marshes across the landscape, may show that certain marshes receive little rainfall.

This fact may indicate that these marshes are likely to dry up, and this inference can help us make the most appropriate decisions about how humans should interact with the marsh. A GIS, therefore, can reveal important new information that leads to better decision-making.

Many computer databases that can be directly entered into a GIS are being produced by Federal, State, tribal, and local governments, private companies, academia, and nonprofit organizations. Different kinds of data in map form can be entered into a GIS.

A GIS can also convert existing digital information, which may not yet be in map form, into forms it can recognize and use. For example, digital satellite images can be analyzed to produce a map of digital information about land use and land cover. Likewise, census or hydrologic tabular data can be converted to a map like form and serve as layers of thematic information in a GIS.

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