1. Classification and evolution of IS [IT vs IS]
2. IS in functional area
3. Information system architecture
4. Qualities of information systems
5. Managing Information System resources
6. Balanced scorecard – case studies

Data : Raw facts such as an employee's name and number of hours worked in a week, inventory part numbers or sales orders.
Information : A collection of facts organized in such a way that they have additional value beyond the value of the facts themselves.

Data Vs Information

Information System

- Information System is the study of complementary networks of hardware and software that people and organizations use to collect, filter, process, create, and distribute data.
- **The IS's designer** is concerned with how to use computer systems effectively in producing data for the right person at the right time.
- An information system is typically considered to be a set of interrelated elements or components that collect(input), manipulate(processes), and disseminate (output) data and information and provide a feedback mechanism to meet an objective.
    - Open System
    - Close System

Input – Captures raw data from organization or external environment e.g. Manual or automatic data capturing via scanner, camera, keyboard
Processing – Converts raw data into meaningful form, the output e.g. Sorting, searching, comparisons of data
Output – Transfers processed information to people of activities that use it e.g. Sales report, documentation Feedback – Output or data that is used to make changes to the input or processing activities A simple scenario to simulate this model is in a banking environment for *ATM transactions where a batch processing system capturing daily ATM transactions, sorting the data and produces a report such as number of withdrawal transactions report.*

1. Classification and Evaluation of IS

The growth of the IS field has made significant progress over the past 50 years. As the field has grown, new specialties and research communities have emerged, and the level of research has increased dramatically. It is all taken up with "punch card", electronic calculator and today, it has evolved to e-business, e-commercialism and the latest innovation, mobile computing as well as cloud computing. There is no fixed category or "type" of Information Systems. In Figure 1.2, the types of IS are simply a concept, an abstraction, which has been created as a way to simplify a complex problem through identifying areas of commonality between different things.

* Evaluation of IS

A. 1950s – EDP (Electronic Data Processing - Transaction Processing System)

During this period, the role of most IS was quite simple as they were mainly used for electronic data processing (EDP). It performs activities like transaction processing, recordkeeping and accounting. EDP is often defined as the use of computers in recording, classifying, manipulating, and summarizing data. It is also called transaction processing systems (TPS), automatic data processing, or information processing. (Computer Business Research. "TPS").

B. The first period (1960 to 1970) – EDP to MIS

During this period, another role was added to the use of computers, which is the processing of data into useful informative reports. Management information systems or MIS thus evolved from TPS.

The focus of this new role is to develop business application that provides managerial end users with pre-defined management reports that would give managers the information they needed for decision-making purposes. This era also marks the development period when the focus of organizations shifted slowly from merely simply automating basic business processes in the 1950s to consolidating the control within the data processing function.

Exception reports thus help managers focus on situations that require immediate decisions or actions.

C. The Second period (1970 to 1980) – PC and DSS (Decision Support System)

In this second era, technological advancement continued to climb. The major advancement was the introduction of the Personal Computers (PC). With the introduction of PCs, organizations began to distribute their computing/processing power across the organization. As the range of users broadened, organizations took a stronger management orientation to their traditionally technical-oriented approach to IS operations. The movement started focusing on "interactive computer-based system" to aid decision-makers in resolving problems. (Chris Boylan. "DSS" n.d). As a result of that, the pre-defined management reports were not sufficient to meet many of the decision-making needs of management anymore. In order to satisfy such needs, the concept of decision support systems (DSS) was born..

D. The Third period (1980 to 1990) – *Executive information systems (EIS)* and the Internet

During this era, many business units resorted to purchasing their own hardware and software to suit their departmental needs. This was the era of personal computing, giving rise to departmental computing. This trend led to new challenges of data incompatibility, connectivity and integrity across functional departments.

End users could now use their own computing resources to support their job requirements instead of waiting for the indirect support of a centralized corporate information services department. It became evident that most top executives did not use either MIS reports or the analytical modelling capabilities of DSS, so the concept of executive information systems (EIS) was developed. It is also known as an executive support system (ESS).

E. The Fourth period (1990 to 2000) – Artificial Intelligence (AI), Expert Systems (ES) and Knowledge Management Systems (KMS).

This era marks a significant shift of IS technology and the business environment. The commercialization of the Internet enabled new methods of communication and ways of conducting business that were not possible in the previous eras. The internet allows the dissemination of knowledge to different parts of the world, regardless of time and space. Moreover, breakthroughs occurred in the development and application of *Artificial Intelligence (AI)* techniques to business information systems. With less need for human intervention, knowledge workers could be freed up to handle more complex tasks. Expert systems (ES) and knowledge management systems (KMS) interrelated to each other. ES uses data from KM to generate desirable information system's output, for instance loan application approval system.

F. The fifth period (2000 – present) – e-Business, e-Commerce, Mobile and Cloud Computing

The rapid growth of the internet, intranets, extranets and other interconnected global networks in the 1990s dramatically changed the capabilities of IS in business. Internet-based and web-based enterprise and global electronic business and commerce systems are becoming commonplace in the operations and management of today's business enterprises. Today's information systems are still doing the same basic things just like 50 years ago from transactions processing, records keeping, reporting management and support management to the accounting system as well as processes of the organization. What has changed today is greater connectivity across similar and dissimilar system components, much higher level of integration of system functions across applications, great network infrastructure and powerful machines with higher storage capacity. The Internet and related technologies and applications have changed the way businesses operate and people work, and how information systems support business process, decision making and competitive advantage. **E-business** is the use of Internet technologies to work and empower business processes, e-commerce and enterprise collaboration within a company and with its customers, suppliers and other business stakeholders. And finally, **big data, mobile and cloud computing** in the latest era of smart phones, tablets and social media, and the rapid growth of wireless network technology. **Big data** is a collection of data from traditional and digital sources inside and outside of an organization that represents a source for ongoing discovery and analysis. **Cloud computing** enables convenient, on-demand network access to a shared pool of configurable computing devices such as networks, servers, storage, applications and services that can be rapidly provisioned and released with minimal management effort or service provider interactions. (Preston A. Cox. 2011).

*** Classification of IS**

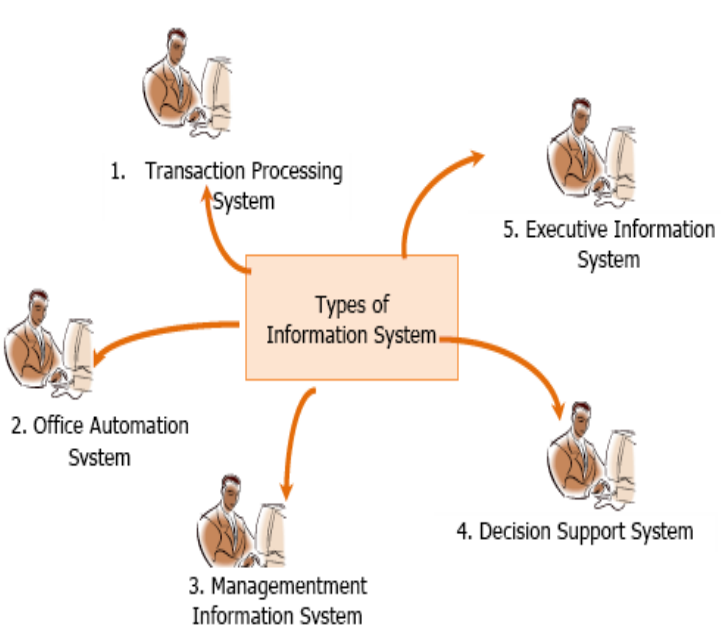
As most organizations are hierarchical, the way in which the different classes or type of IS is categorized tends to follow hierarchy. This is often described as "the pyramid model" because the way in which the systems are arranged mirrors the nature of the tasks found at various different levels in the organization. The most usual types of Information Systems among other used in an organization is the four-stage model based on the people who use the systems as pictured in Figure

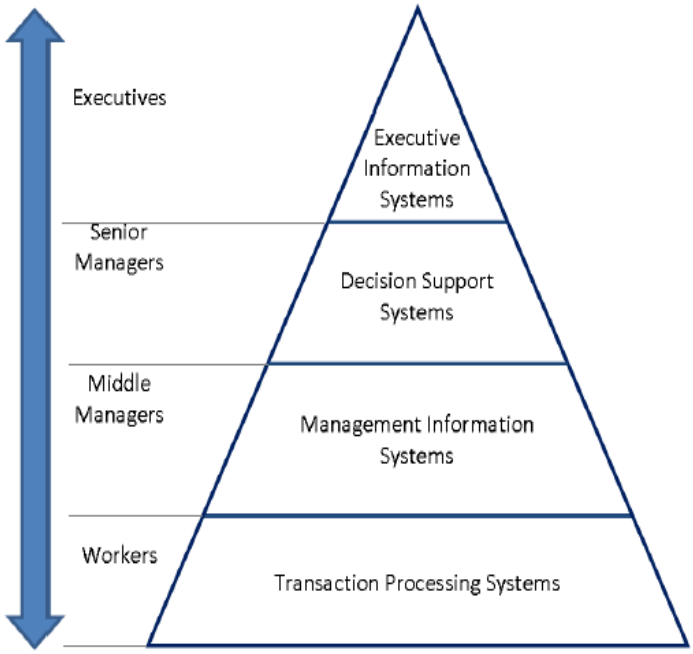
Transaction processing systems – is a type of information that collects, stores, modifies and retrieve the data transactions of an organization's **day-to-day transactions**. Examples of outputs from TPS are cash deposits, payment, order, accounting systems and automatic teller machine (ATM).

For example, recording a business activity such as client's payment, customer's order and so on. TPS is the first computerized systems developed to process business data – a function originally called data processing.

TPS were among the first computerized systems developed to process business data which function is originally called data processing. Usually TPS computerizes or automates an existing manual process to allow for faster processing, reduced clerical costs and improved customer service.

The early TPS used batch processing data which is accumulated over a period of time and all transactions are processed afterwards. Today, as computer became more powerful, systems developers have built an online transaction processing system (OLTP). However, some routine processing tasks such as calculating paychecks or printing invoices are performed more effectively on a batch basis. Many organizations still use batch-processing techniques. (BPC. "TPS").

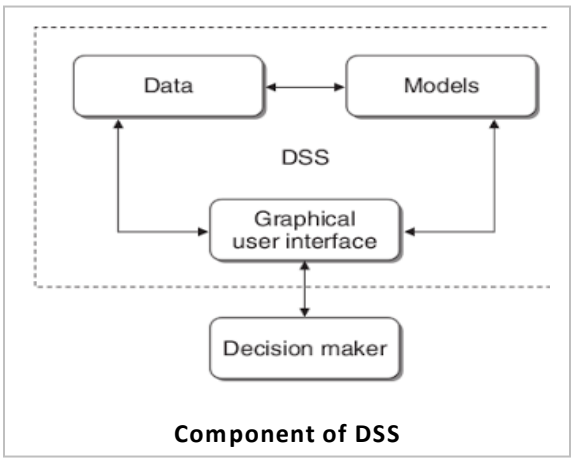




Fig– Four level pyramid model of the different levels of hierarchy

Management Information Systems (MIS) – provide information in the form of pre-specified reports and displays to support business decision-making. Examples of output from MIS are sales analysis, production performance and cost trend reporting systems.
Typically, MIS generates three basic types of information i.e. Detailed, summary and exception. ***Detailed information*** *reports typically confirm transaction-processing activities. A detailed Order Report is an example of a detailed report.* ***Summary information*** *consolidates data into a format that an individual can review quickly and easily, while* ***exception information*** *filters data to report information that is outside of a normal condition.* An example of exception report is an inventory report. The report may notify the purchasing department of items it needs to reorder. Exception reports help managers save time because they do not have to search through a detailed report for exceptions.
Main function of MIS are : Data collection, storing, processing, distribution, analysis, prediction, forecasting, planning, control.

Decision Support Systems (DSS) - The new role of information systems was to provide managerial end users with ad-hoc and interactive support of their decision-making process. DSS uses data from internal and/or external sources. **Internal sources** of data might include sales, manufacturing, inventory or financial data from an organization's database. **External source**s could include interest rates, population trends or material pricing. Managers that use DSS can manipulate the data used for DSS to help with decisions. **A database** is a repository or data store that is organized for efficient access, search, retrieval and update. Physically, a database is usually stored on hard disks, magnetic tape, optical disks as well as cloud (storage hosting). Decision Support Systems (DSS) – provide interactive ad-hoc support for the decision-making process of managers and other business professionals. DSS serves the management, operations, and planning levels of an organization usually mid and higher management to make a decision.



Component of DSS

Model Base : Is a model that represents the problem into a format quantitative (mathematical model as an example) as the basis of simulations or decision-making, including the purpose of objective, related components, limitations exist (constraints), and related matters Other. Base Model enables decision makers to analyze as a whole by developing and comparing alternative solutions.

Benefits : Fast response in an unexpected situations, cost saving

Examples

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

Expert systems (ES) – is a computer system that facilate the decision-making ability of human experts. Some ES are designed to take the place of human experts, while others are designed to support them. For example, there are expert systems that can diagnose human illnesses, make financial forecasts and schedule routes for delivery vehicles. A wide variety of methods can be used to simulate the performance of the expert however common to most or all are **1)** the creation of a knowledge base which uses some knowledge representation formalism to capture the subject matter expert's knowledge and **2)** a process of gathering that knowledge from the subject matter expert's and collecting it according to the formalism, which is called knowledge engineering.

Knowledge Management System (KMS) – is a knowledge-based system that supports the creation, organization and dissemination of business knowledge within the enterprise. Knowledge Management Systems are the integration of technologies and mechanisms that are developed to support the four KM processes (discovery, capture, sharing, application). KMS can be classified into four:

I. **Knowledge Discovery Systems** support the process of developing new tacit or explicit knowledge from data and information or from the synthesis of prior knowledge. These systems support two KM sub processes associated with knowledge discovery: **combination-** enabling the discovery of new explicit knowledge; and **socialization-** enabling the discovery of new tacit knowledge.
II. **Knowledge Capture Systems** support the process of retrieving either explicit or tacit knowledge that resides within people, artifacts, or organizational entities. These systems can help capture knowledge that resides within or outside organizational boundaries including within consultants, competitors, customers, suppliers, and prior employers of the organization's new employees.
III. **Knowledge Sharing Systems** support the process through which explicit or tacit knowledge is communicated to other individuals.
IV. **Knowledge Application Systems** support the process through which some individuals utilize knowledge possessed by other individuals without actually acquiring, or learning, that knowledge. E.g. Expert System, DSS, fault diagnosis(troubleshooting), help desk

KM Processes	KM Systems	KM Subprocesses	Illustrative KM Mechanisms	Illustrative KM Technologies
Knowledge Discovery	Knowledge Discovery Systems	Combination Socialization	- Meetings, telephone conversations, collaborative creation of documents - Employee rotation across departments, conferences. brainstorming retreats, cooperative projects	- Databases, Web-based access to data, data mining, repositories of information, Web portals, best practices and lessons learned - Videoconferencing, electronic discussion groups, e-mail
Knowledge Capture	Knowledge Capture Systems	Externalization Internalization	- Models, prototypes, best practices, lessons learned - Learning by doing, on-the-job training, learning by observation, and face-to-face meetings	- Expert systems, chat groups, best practices, lessons learned databases - Computer-based communication, AI-based knowledge acquisition, computer-based simulations
Knowledge Sharing	Knowledge Sharing Systems	Socialization Exchange	- Employee rotation across departments, conferences. brainstorming retreats, cooperative projects - Memos, manuals, letters, presentations	- Videoconferencing, electronic discussion groups, e-mail - Team collaboration tools, Web-based access to data, databases, and repositories of information, best practices databases, lessons learned systems, expertise locator systems
Knowledge Application	Knowledge Application Systems	Direction Routines	- Traditional hierarchical relationships in organizations, help desks, support centers - Organizational policies, work practices, standards	- Capture and transfer of experts' knowledge, troubleshooting systems, case-based reasoning systems, decision support systems - Expert systems, enterprise resource planning systems, management information systems

Executive information systems (EIS) – is a type of management information system intended to facilitate and support the information and decision-making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the organization making strategic decisions to improve the long-term performance of the organization.. It is commonly considered as a specialized form of DSS. (Mir Mohammad et al. 2012). Examples of the EIS are systems for easy access to analysis of business performance, actions of all competitors, and economic developments to support strategic planning. During this period is also where PC hardware, software and telecommunications evolved rapidly as well as widespread adoption of the TCP/IP network or the Internet. It becomes a new phenomenon in IT industry.

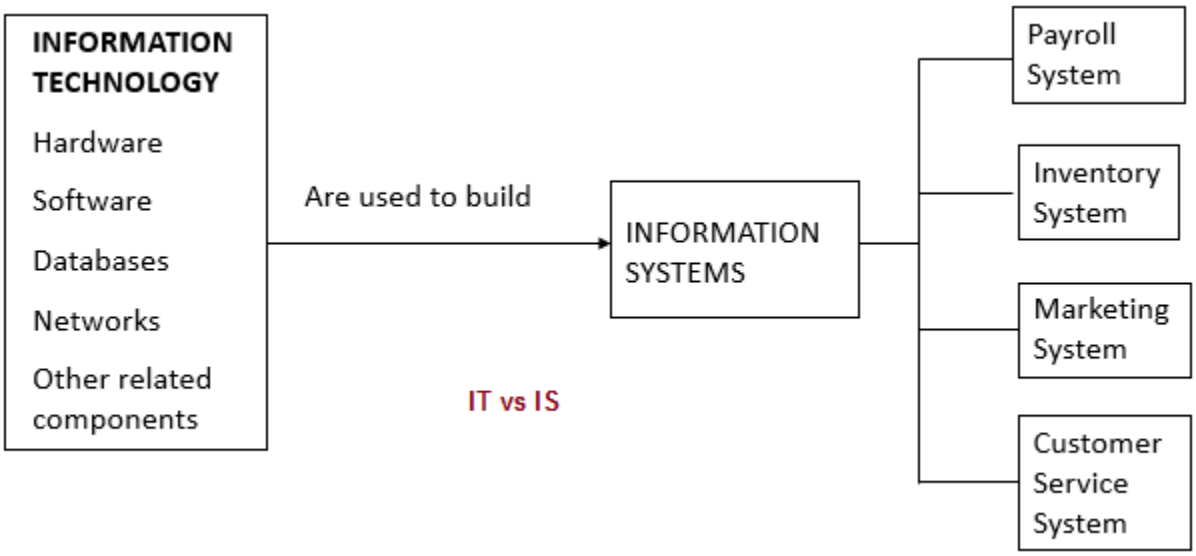
Difference between DSS and EIS

- DSS is for middle managements **whereas** EIS is for top managements.
- DSS consumes operational data. EIS uses only high level performance indicators form the organization as well as data from outside the organization
- EIS is for long-term decision-making **whereas** DSS is for middle term or short term decision making
- EIS is more user-friendly and interactive, as executives generally have limited time and computing background.

*** IT vs IS**

IT(Hardware, Software, Networks) are used to build IS(Inventory, Payroll). IT focuses on computing technology, technical skills, IS is business oriented requires business skills, technical skills. IS deals with business side but IT deals with technical side

- **Origin:** Information systems have been in existence since pre-mechanical era in form of books, drawings, etc. However, the origin of information technology is mostly associated with invention of computers.
- **Development:** Information systems have undergone great deal of evolution, i.e. from manual record keeping to the current cloud storage system. Similarly, information technology is seeing constant changes with evermore faster processor and constantly shrinking size of storage devices.
- **Business Application:** Businesses have been using information systems e.g. in form of manual books of accounts to modern TALLY. The mode of communication has also gone under big change, for example, from a letter to email. Information technology has helped drive efficiency across organization with improved productivity and precision manufacturing.



IT vs IS

2. IS in functional area

* **Financial MIS :** A financial MIS provides financial information for managers to make daily decisions on operations within the organization. Most systems provide these functions:

- Integrate financial information from multiple sources
- Provide easy access to financial information in summarized form
- Enable financial analysis using easy-to-use tools
- Compare historic and current financial activity

A financial MIS often has a number of subsystems, depending on the type of organization. These include systems to analyze revenues, costs and profits, auditing systems for both internal and external purposes and systems to manage funds. A financial MIS can also be used to prepare reports for third parties, such as external auditors or shareholders.

* **Marketing MIS :** A marketing MIS supports activities throughout the many activities of marketing departments. Some of the typical subsystems of a marketing MIS are marketing research, product development and delivery, promotion and advertising, product pricing and sales analysis.

One of the most common uses of a marketing MIS is to produce sales reports. These are typically produced on a regular schedule, such as by week, month and quarter. Reports can be organized by sales representative, product, customer or geographic area. Such reports allow managers to see which aspects of sales are doing well and which ones need attention.

* **Manufacturing MIS :** Manufacturing is one of the areas where information systems have made a major impact. A typical manufacturing MIS is used to monitor the flow of materials and products throughout the organization.

* **Human Resource MIS :** Concerned with all of the activities related to employees and potential employees of the organization.

3. Information system architecture

The architecture of an information system defines that system in terms of components and interactions among those components, from the viewpoint of specific aspects of that system, and based on specific structuring principles. Information systems architecture provides a foundation for organizing the various components of any information system you care to develop.

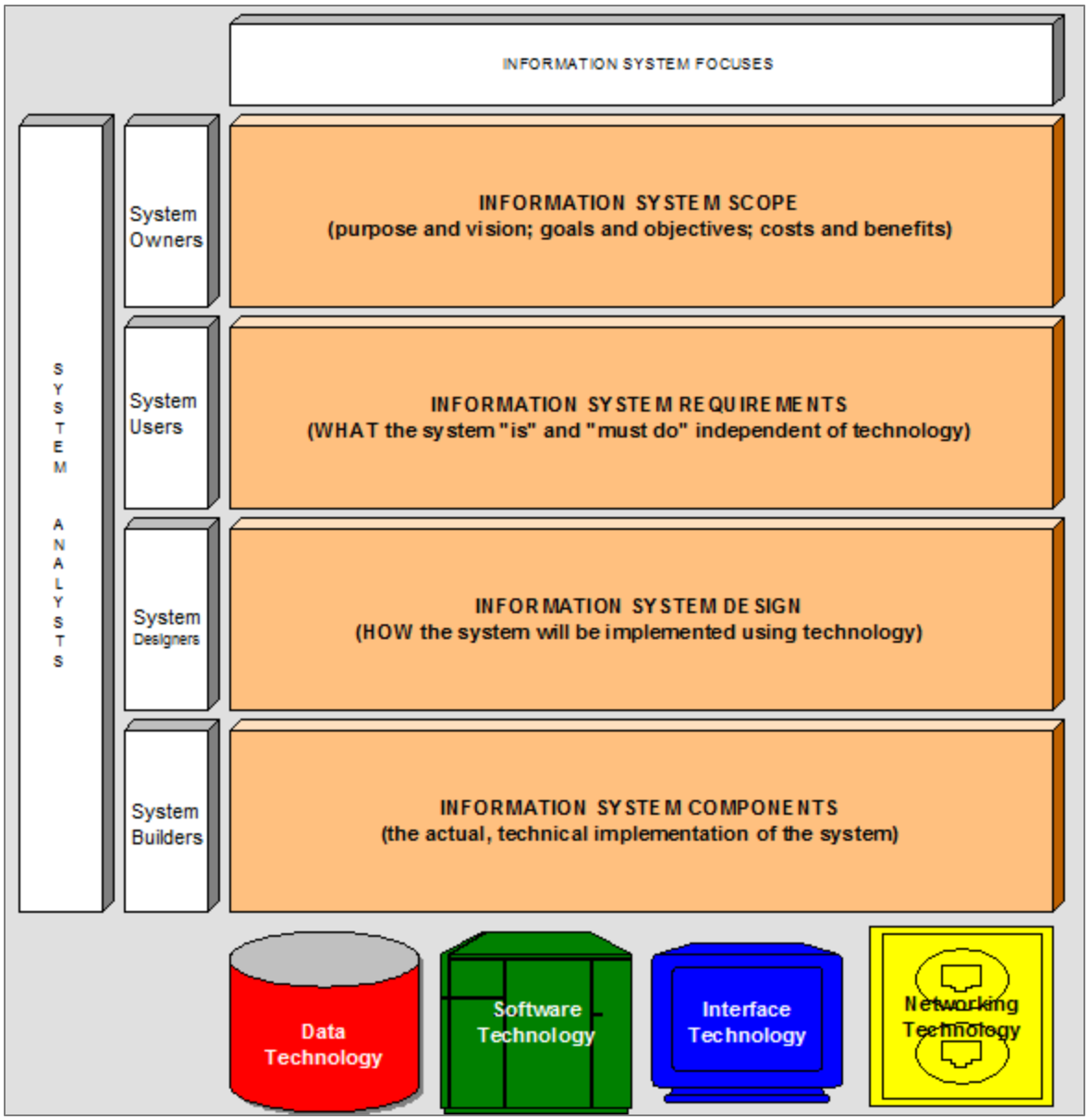


Fig. Information System Framework

Different people have different views of the system. **Managers, Users, and Technical Specialists** each view the system in different ways, and in different levels of detail. We call these people **stakeholders** in the system. They can be broadly classified into four groups:

- **System owners** pay for the system to be built and maintained. They own the system, set priorities for the system, and determine policies for its use. In some cases, system owners may also be system users.

- All participants in the information systems game share one thing in common, they are what the U.S. Department of Labor now calls information workers. Today, more than 60 percent of the U.S. labor force is involved in the production, distribution, and usage of information. For any system, large or small, there will be one or more system owners.
- System owners usually come from the ranks of management. For medium-to-large information systems, the owners are usually middle or executive managers. For smaller systems, the owners may be middle managers or supervisors. For personal information systems, the owner and user are the same person. System owners tend to think in very general terms, not in details and to be the least interested (or impressed) with the technology used in any information system. They are concerned with the 'value' returned by the system. Value is measured in different ways.
    - What is the *purpose* of the system?
    - What is the vision of the system – goals and objectives?
    - How much will the system cost to build?
    - How much will the system cost to operate?
    - Will those costs be offset by measurable benefits?
    - What about intangible benefits?

- System owners are an information system's sponsors and chief advocates. They are usually responsible for budgeting the money and time to develop, operate, and maintain the information system. They are also ultimately responsible for the system's justification and acceptance.
- **System users** are the people who actually use the system to perform or support the work to be completed. In today's team -oriented business world, system users frequently work side-by-side with system designers. System users are the people who use (and directly benefit from) the information system on a regular basis – capturing, validating, entering, responding to, storing, and exchanging data and information. System users make up the vast majority of the information workers in any information system. System users define (**1**) the problems to be solved, (**2**) the opportunities to be exploited, (**3**) the requirements to be fulfilled, and (**4**) the business constraints to be imposed by (or for) the information systems. They also tend to be concerned with how easy (or difficult) the system is to learn and use. Unlike system owners, system users tend to be less concerned with costs and benefits of the system. Instead, they are co ncerned with 'business requirements' of the system.
  - **Internal users** are employees of the business for which an information system is built. Internal users are the largest class of users and comprise the largest percentage of system users in most businesses.
    - **Clerical and service workers** perform most of the day-to-day data processing in the average business. Most of the fundamental data in any business is captured or created by these workers, many of whom perform manual labors in addition to processing of data . Information systems that target these workers tend to focus on transaction processing speed and accuracy.
    - **Technical and professional staff** consists largely of business and industrial specialists who perform highly skilled and specialized work. Their work is based on well-defined bodies of knowledge; hence, they are sometimes called knowledge workers. Information systems that target these knowledge works tend to focus on data analysis as well as generating timely information for problem solving.
    - **Supervisors**, middle managers, and executive managers are all decision makers. Supervisors tend to focus on day-to-day management issues. Middle managers are more concerned with tactical, or short-term management plans and problems. Executive managers are concerned with overall business performance, an strategic or long-term planning and problem solving. Information systems for management tend to focus entirely on information access. Managers need the right information at the right time to solve problems and make good decisions.
  - **Remote and mobile users :** like traditional internal users, they are employees of the business. Unlike traditional internal users , they are geographically separated from the business. An example is the sales and service representatives.
    Many business are looking to **telecommuting** to reduce costs and improve worker productivity. Telecommuting, stated simply, is working from home. There is considerable evidence to suggest that many employees can be just as productive working at home if they can be connected to the company's information systems through modern telecommunications technology.
  - **External Users :** Businesses are redesigning their information systems to directly connect to and interoperate with their business and trading partners, suppliers, customers, and even the end consumer. The explosive growth of the Internet for electronic commer ce is making the consumer as an **external user** of information systems. Currently, *World Wide Web* pages on the Internet are mostly used to market information to the end consumer of products.
- **System designers** are the technical specialists who design the system to meet the users requirements. In many cases, system designers may also be system builders. System designers translate users' business requirements and constraints into technical solutions. They design the computer files, databases, inputs, outputs, screens, networks, and programs that will meet the system users' requirements. They also integrate the technical solution back into the day-to-day business environment.
- **Systems builders** are the technical specialists who construct, test, and deliver the system into operation. System builders construct the information system components based upon the design specifications from the system designers. In many cases, the system desi gner and builder for a component are one and the same. E.g.The applications programmer

What are Information Workers? The term **information worker** (also called knowledge worker) was coined to describe those people whose jobs involve the creation, collection, processing, distribution, and use of information.

The Role of the System Analyst

- For the system owners and users, the analyst typically constructs and validates their views.
- For the system designers and builders, the analyst (at the very least) ensures that the technical views are consistent and co mpatible with the business views.

Interpreting IS architectures

- Syntax: structure of the architecture
- Semantics: meaning of components and interactions
- Pragmatics: reasons behind structure & meaning

Aspects of IS Architectures

Data aspect architecture : Architecture of data managed by systems, e.g. using (E)ER diagrams.

System aspect architecture: Architecture of application software, e.g. using data flow diagrams or module diagrams.

Configuration aspect architecture: Architecture of hardware and low-level software (e.g. OS, DBMS), e.g. using configuration diagrams.

Communication aspect architecture: Architecture of communication infrastructure (networks, communication software), using e.g. topology diagrams

Organization aspect architecture: Architecture of organization structure and processes related to administration and maintenance of systems, using e.g. organigrams and procedure handbooks

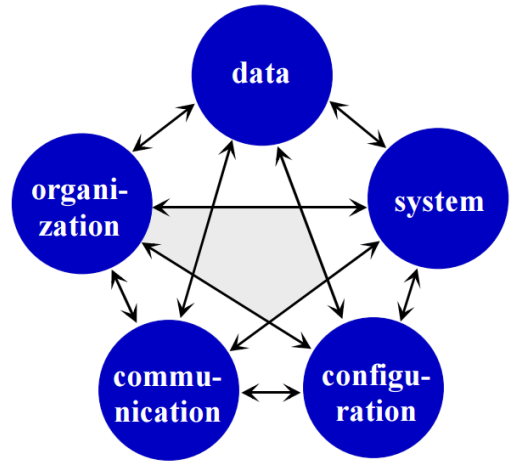


Fig. Aspects of IS Architectures

Type of IS architectures

Based on structuring principles:

- Monolithic / Layered / Columned / OO
- Single-Level versus Multi-Level

Based on purpose:

- Conceptual versus Technical
- Application versus General System
- Reference versus Concrete

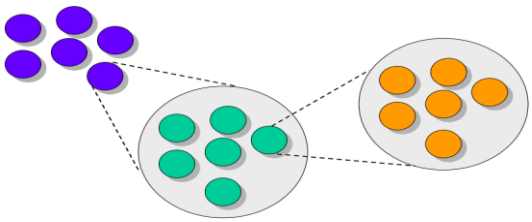
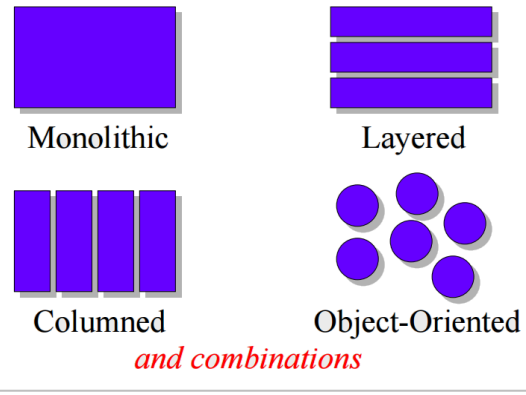


Fig. Multilevel architecture



Multi-level architectures: allow for multiple aggregation levels of functionality

- ***Syntax***: several system modules in the same layer.
- ***Semantics***: multiple subsystems at the same abstraction level using each others functionality.
- ***Pragmatics***: separation of concerns (system arch.) Pipe or distribution (conf. arch.).
- ***Conceptual architecture***: describes structure of conceptual design of system
- ***Technical architecture***: describes structure of implementation of system
- ***Application***: describes architecture for specific application and context
- ***General system***: describes architecture for general application and context
- ***Concrete***: describes architecture of a specific system to be directly applied
- ***Reference***: describes blue-print of abstract system to be "concretized" before application

4. Qualities of information systems

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.

i. ***Understandable***: Since information is already in a summarized form, it must be understood by the receiver so that he will interpret it correctly. He must be able to decode any abbreviations, shorthand notations or any other acronyms contained in the information.

ii. ***Relevant***: Information is good only if it is relevant. This means that it should be pertinent and meaningful to the decision maker and should be in his area of responsibility.

iii. ***Complete***: It should contain all the facts that are necessary for the decision maker to satisfactorily solve the problem at hand using such information. Nothing important should be left out. Although information cannot always be complete, every reasonable effort should be made to obtain it.

iv. ***Available***: Information may be useless if it is not readily accessible ' in the desired form, when it is needed. Advances in technology have made information more accessible today than ever before.

v. ***Reliable***: The information should be counted on to be trustworthy. It should be accurate, consistent with facts and verifiable. Inadequate or incorrect information generally leads to decisions of poor quality. For example, sales figures that have not been adjusted for returns and refunds are not reliable.
vi. ***Concise***: Too much information is a big burden on management and cannot be processed in time and accurately due to "bounded rationality". Bounded rationality determines the limits of the thinking process which cannot sort out and process large amounts of information. Accordingly, information should be to the point and just enough – no more, no less.
vii. ***Timely***: Information must be delivered at the right time and the right place to the right person. Premature information can become obsolete or be forgotten by the time it is actually needed. Similarly, some crucial decisions can be delayed because proper and necessary information is not available in time, resulting in missed opportunities. Accordingly the time gap between collection of data and the presentation of the proper information to the decision maker must be reduced as much as possible.
viii. ***Cost-effective***: The information is not desirable if the solution is more costly than the problem. The cost of gathering data and processing it into information must be weighed against the benefits derived from using such information.

5. Managing Information System resources

The individual **data** being processed through the use of **hardware** and **software** and shared through **network** connection has allowed us to utilize more **information** in less time.

- Networks …connected in some manner that allows to sharing of resources
- Hardware and Peripheral Devices …tangible and can be touched
- Software …intangible and can't be touched physically
- Data …one piece of a record
- People …work together to create usable information

(i) PEOPLE RESOURCES

People are required for the operation of all information systems. These people resources include end users and IS specialists.
· End users (also called users or clients) are people who use an information system or the information it produces. They can be accountants, salespersons, engineers, clerks, customers, or managers. Most of us are information system end users.
· IS Specialists are people who develop and operate information systems. They include systems analysts, programmers, computer operators, and other managerial technical, and clerical IS personnel. Briefly, systems analysts design information systems based on the information requirements of end uses, programmers prepare computer programs based on the specifications of systems analysts, and computer operators operate large computer systems.

(ii) HARDWARE RESOURCES

The concept of Hardware resources includes all physical devices and materials used in information processing. Specially, it includes not only machines, such as computers and other equipment, but also all data media, that is, all tangible objects on which data is recorded, from sheets of paper to magnetic disks. Example of hardware in computer-based information systems are:
· Computer systems, which consist of central processing units containing microprocessors, and variety of interconnected peripheral devices. Examples are microcomputer systems, midrange computer systems, and large mainframe computer systems.
· Computer peripherals, which are devices such as a keyboard or electronic mouse for input of data and commands, a video screen or printer for output of information, and magnetic or optical disks for storage of data resources.

(iii) SOFTWARE RESOURCES

The concept of Software Resources includes all sets of information processing instructions. This generic concept of software includes not only the sets of operating instructions called programs, which direct and control computer hardware, but also the sets of information processing instructions needed by people, called procedures. It is important to understand that even information systems that don't use computers have a software resource component. This is true even for the information systems of ancient times, or the manual and machine-supported information systems still used in the world today. They all require software resources in the form of information processing instructions and procedures in order to properly capture, process, and disseminate information to their users. *The following are the examples of software resources:*
· System Software, such as an operating system program, which con controls and supports the operations of a computer system.
· Application Software, which are programs that direct processing for a particular use of computers by end users. Examples are a sales analysis program, a payroll program, and a work processing program.
· Procedures, which are operating instructions for the people who will use an information system.

(iv) DATA RESOURCES

Data is more than the raw material of information systems. The concept of data resources has been broadened by managers and information systems professionals. They realize that data constitutes a valuable organization resource. Thus, you should view data as data resources that must be managed effectively to benefit all end users in an organization. Data can take many forms, including traditional alphanumeric data, composed of numbers and alphabetical and other characters that describe business transactions and other events and entities. Text data, consisting of sentences and paragraphs used in written communications; image data, such as graphic shapes and figures; and audio data, the human voice and other sounds, are also important forms of data. *The data resources of information systems are typically organized into:*
· Database that hold processed and organized data.

· Knowledge bases that hold knowledge in variety of forms such as facts, rules, and case examples about successful business practices. For example, data about sales transactions may be accumulated and stored in a sales database for subsequent processing that yields daily, weekly, and monthly sales analysis reports for management. Knowledge bases are used by knowledge management systems and expert systems to share knowledge and give expert advice on specific subjects.

6. The Balanced Scorecard (BSC)

A balanced scorecard is a systematic approach to tracking the effectiveness of organization's implementation of its strategic vision . The BSC framework is based on the balance between leading and lagging indicators, which can respectively be thought of as the *drivers* and *outcomes* of your company goals. When used in the Balanced Scorecard framework, these key indicators tell you whether or not you're accomplishing your goals and whether you're on the right track to accomplish future goals.

To embark on the Balanced Scorecard path an organization first must know (and understand) the following:

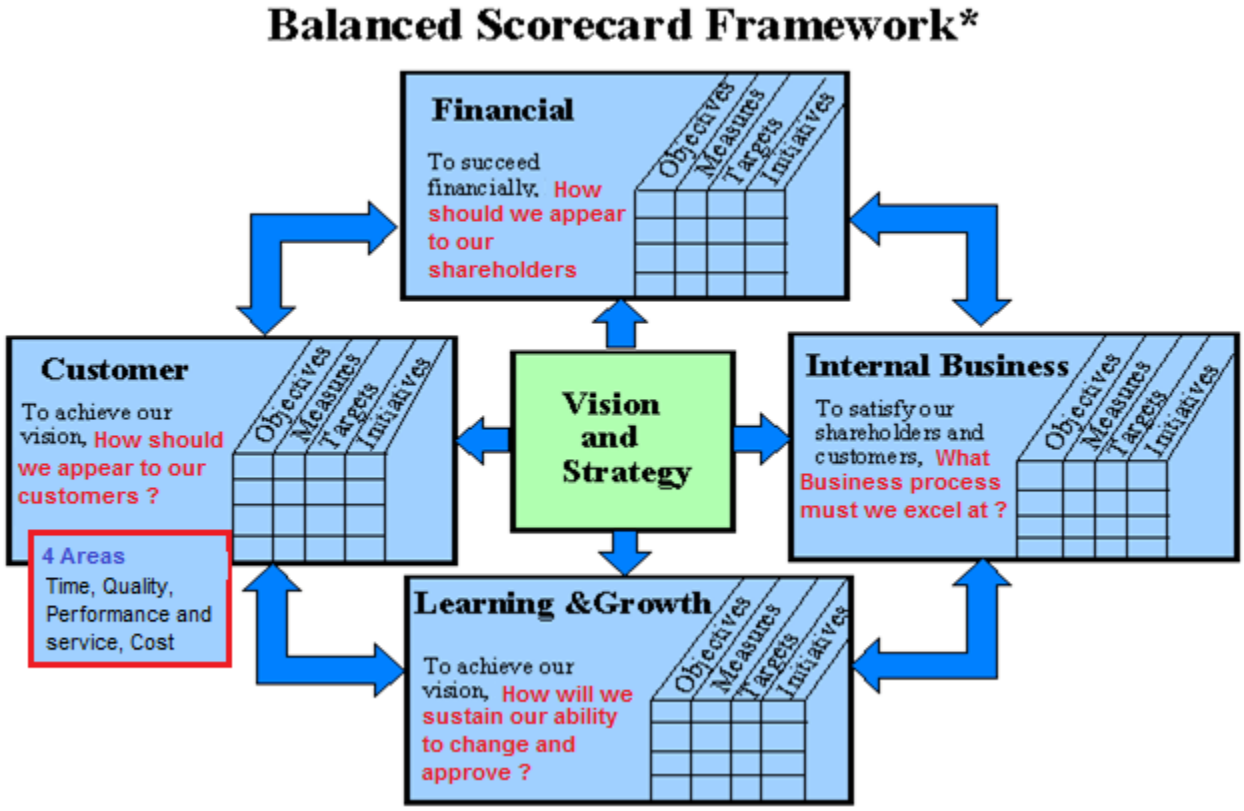
- The company's mission statement
- The company's strategic plan/vision

Then

- The financial status of the organization
- How the organization is currently structured and operating
- The level of expertise of their employees
- Customer satisfaction level

How BSC Works ? First, BSC "translates" your company's strategy into the four perspectives. It compares internal and external metrics, objective and subjective metrics and performance results and contributors to them. Ultimately, your goal is to figure out how the company is carrying out its strategy in each of these areas.

BSC Components



A Balanced Scorecard is most often used in three ways:

- **To bring an organization's strategy to life**. Those in the company can then use this strategy to make decisions company-wide.
- **To communicate the strategy across the organization**. This is where the strategy map is critical. Organizations print it and include it in interoffice communications, put it on their intranet, communicate it with business partners, publish it on their website , and more.
- **To track strategic performance**. That's typically done through monthly, quarterly, and annual reports.

Perspective	Generic Measurements
Financial	- Return On Investment - Cash Flow - Return on Capital Employed

	- Financial Results (Quarterly/Yearly)
Customer	- Delivery performance to customer - Quality performance for customer - Customer satisfaction rate - Customer percentage of market - Customer retention rate
Internal business process	Includes measurements along the internal value chain for: Innovation - measures of how well the company identifies the customers' future needs. Operations - measures of quality, cycle time, and costs. Post sales service - measures for warranty, repair and treatment of defects and returns. - Number of activities per function - Duplicate activities across functions - Process alignment (is the right process in the right department?) - Process bottlenecks - Process automation
Learning and growth	Includes measurements for: People - employee retention, training, skills, morale. Systems - measure of availability of critical real time information needed for front line employees. - Is there the correct level of expertise for the job? - Employee turnover - Job satisfaction - Training/Learning opportunities

How to use the Balanced Scorecard

The Balanced Scorecard is a concept helping you translate strategy into action. the Balanced Scorecard **starts** from the company vision and strategies, from here critical success factors are defined. Measures are constructed that aid target setting and performance measurement in areas critical to the strategies.

Implementation of the scorecard generally begins at the corporate level, but is usefull at all levels of an organization. The scorecard is not only an executive information system for corporate management but should form the basis for promoting behavioural change in the organization to conform with the vision and strategy. Often this means pushing the scorecard methodology down through the organisation.

Identify vision Identify Perspectives Identify CSF's Identify Measures Evaluate Identify Strategies Create Action Plans Follow up & Manage	- Create a Balanced Scorecard: - You have to identify a vision. Where is the organization going? - By identifying strategies you tell how you will get there. - Define perspectives, which means you have to ask what do we have to do well in each perspective. - Identify the Critical Success Factors - when enough is enough, and when not. - Thereafter ask how do we measure that everything is going the expected way? - Now it is necessary think of the evaluation of your Scorecard. Consider how do secure that the right things are measured. - Based on this work you should create action plans and plan reporting and operation of the Scorecard. - How will the Balanced Scorecard be managed? Which persons should have reports and what should they look like?

1. The Customer Perspective

Recent management philosophy has shown an increasing realization of the importance of customer focus and customer satisfaction in any business. These are leading indicators: if customers are not satisfied, they will eventually find other suppliers that will meet their needs. Poor performance from this perspective is thus a leading indicator of future decline, even though the current financial picture may look good. In developing metrics for satisfaction, customers should be analyzed in terms of kinds of customers and the kinds of processes for which we are providing a product or service to those customer groups.

2. The Financial Perspective

As with the traditional methodologies, measuring need financial data. But the point is that the current emphasis on financials leads to the "unbalanced" situation with regard to other perspectives. Timely and accurate funding data will always be a priority, and managers will do

whatever necessary to provide it. In fact, often there is more than enough handling and processing of financial data. There is perhaps a need to include additional financial-related data, such as risk assessment and cost-benefit data, in this category.

3. Internal Business Processes Perspective

Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer requirements and fulfills the mission. These metrics have to be carefully designed by those who know these processes most intimately; with missions being unique this definition cannot entirely be developed by outside consultants.

4. The Learning and Growth Perspective

This perspective includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. In the current climate of rapid technological change, it is becoming necessary for knowledge workers to be in a continuous learning mode. The importance of learning and growth has to be considered. A knowledge-worker organization often find themselves unable to hire new technical workers and at the same time is showing a decline in training of existing employees. This is a leading indicator of 'brain drain' that must be reversed. People are the only repository of knowledge - they are the main resource. Metrics can be put into place to guide managers in focusing training funds where they can help the most.