## UNIT III

| SUBJECT NAME | SUBJECT CODE | SEMESTER | PREPARED BY |
|---|---|---|---|
| Management Information System | I8BBA62C | VI | Dr.K.Karthikai, Assistant professor in BBA |

## INFORMATION SYSTEM FOR DECISION MAKING

Information systems can support the diverse information and decision making needs of managers. Information technologies have significantly strengthened the role information systems play in supporting the decision making activities of managerial end users.

## DECISION SUPPORT SYSTEMS

A decision support system can be defined simply as a system that provides information for making semi-structured and unstructured decisions. However, this simple definition of DSS is not fully illustrative because when information systems were first developed for semi-structured and unstructured decisions, emphasis was placed on finding the structure and programming of the decision as much as possible. The results were often inefficient and inflexible systems that were ignored or impaired by decision makers because of their ineffectiveness. Thus, in order to make decision support systems effective a different approach to information systems should be taken. This approach is not to structure and automate decision making process; it is to provide support for decision making particularly semi-structured and unstructured decisions. Based on this approach, DSS is defined as follows:

"Decision support systems (DSS) represent a different approach to information system support for semi-structured and unstructured decisions. They support a variety of unstructured decision processes."

"A decision support system is a computer system at the management level of an organisation that combines data, sophisticated analytical tools, and user-friendly software to support semi-structured and unstructured decision making."

**Features of Decision Support Systems** There are several features of decision support systems that distinguish them from other information systems of an organisation. These features are as follows:

1. The philosophy of decision support systems is to give users the tools necessary to analyse important blocks of data, using easily controlled sophisticated models in a flexible manner. DSS are designed to deliver capabilities, not simply to respond to information needs.

2. DSS are tightly focused on a specific decision or set of decisions, such as routing, queuing, evaluating, and so on. Thus, they are no used for general purpose.
3. DSS are aimed at higher-middle and top management with emphasis on change, flexibility, and quick response, and there is less emphasis on to link users to structured information flows and correspondingly a greater emphasis is placed on models, graphics and assumptions.
4. The design of DSS applies a different set of skills than the design of structured, operational systems. DSS designers must not only & technically competent but also be able to observe, understand, and identify with the decision-makers' world.

**TYPES OF DECISION MAKING**

Most information in an organization supports some type of decision-making process. Some decisions seem quite simple; while others are complicated. The extent to which a decision is simple or complicated is referred to as the structure of decision-making process. The structure of the decision-making process is affected, by such factors as the amount of available information, the extent to which information is objective and subjective, and how often the decision must be made. The decision-making process can be structured, unstructured, or in between (Semi-Structured).

**Structured decisions** - When a decision can be programmed, an organisation can prepare a decision rule or decision procedure. This can be expressed as a set of steps to follow a flow-chart, a decision table, or a formula. The decision procedure will also specify the information to be acquired before the decision rules are applied. Since structured programmable decisions can be pre specified, many of these decisions can be handled by lower-level personnel with little specialized knowledge. In fact, many highly structured decisions may be completely automated although human review is generally considered desirable. Examples of highly structured decisions are inventory reorder formulas and rules for granting credit.

**Structured decision: Decisions that are repetitive, routine, and have a definite procedure for handling them.**

The-information system requirements for structured decisions are clear and unambiguous procedures for entering the required input data, validation procedures to ensure, correct and complete input, processing of the input using the decision log, and output of the programmed decision in a form that is useful for action. A useful output should be clear as to how it is to be used and should contain enough data to assist the recipient to assess the reasonableness of the decision.

**Unstructured, Non programmable decisions**- The unstructured decision has no pre-established decision procedure, either because the decision is too infrequent to justify the organizational cost of preparing a decision procedure (even though it may be partly programmable) or because the decision process is not understood well enough or is too changeable to allow a stable pre-established decision procedure. The support requirements for unstructured decision making are access to data and a variety of analysis and decision procedures that can be applied to the solution of the problem. The data requirements are not completely known in advance, so data retrieval must allow for adhoc retrieval requests. Interactive decision support systems with generalised inquiry and analysis capabilities are appropriate information system support for unstructured decision making.

**Unstructured decisions : Nonroutine decision in which the decision maker must provide judgement, evaluation, and insights into the problem definition; there is no agreed upon procedure for making such decisions.**

**Semi structured decisions:** Decision where only part of the problem has a clear-cut answer provided by an accepted procedure.

**SIMON'S MODEL OF DECISION MAKING**

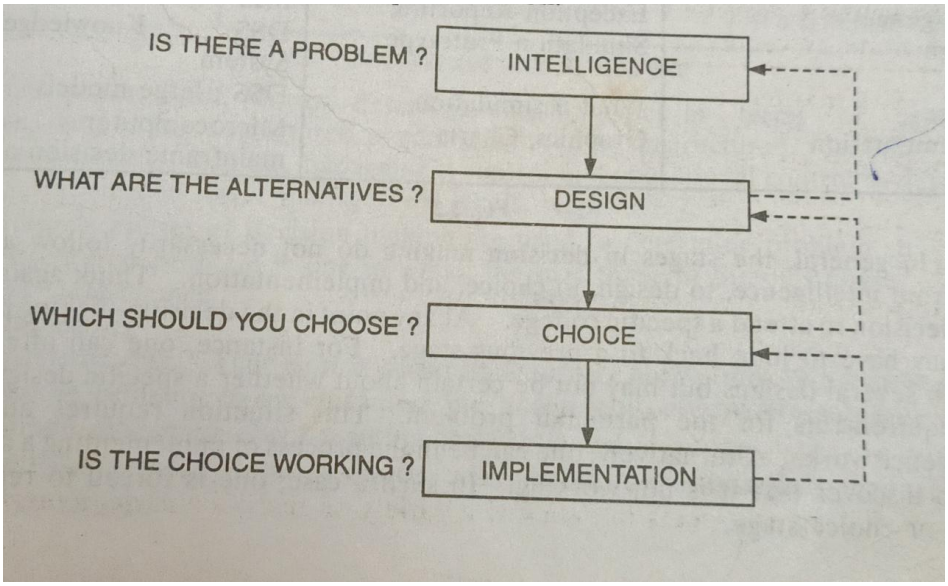
Making decisions is not a single activity that takes place all at once. The process consists of several different activities that take place at different times.

Take any important decision that you as a student make-for example, whether or not to attend college-and ask yourself precisely when you decided to go to college. Chances are that you made the decision over a long period of time; you were influenced by friends, counselors, and parents ; and you used different information sources to find out about each alternative. Let us try to break down decision making into its **component Stages**.

The decision maker has to perceive and understand problems. Once perceived, solutions must be designed; once solutions are designed, choices have to be made about a particular solution; finally, the solution has to be carried out and implemented.

Herbert A. Simon (1960) described four different stages in decision making : **Intelligence, Design, Choice and Implementation.**

Simon's Model of Decision Making




**1. Intelligence**: Consist of identifying the problems occurring in, organization. Intelligence indicates why, where, and with what effects a situation, occurs. This broad set of information-gathering activities is required to inform managers how well the organization is performing and to let them know where problem exist. Traditional MIS systems that deliver a wide variety of detailed information, can help identify problems, especially if the systems report exceptions (with added ability to call up text and additional detailed information).

5.**Design:** During design stage, the individual designs possible solutions to the problems. This activity may require more intelligence so that the manager may decide if a particular solution is appropriate. The design stage may also entail more carefully specified and directed information activities. Smaller DSS systems are idea in this stage of decision making because they operate on simple models, can be developed quickly, and can be operated with limited data.

***6.*** **Choice:** Choice stage consists of choosing among alternatives. Here manager can use information tools that can calculate and keep track of the consequences, costs, and opportunities provided by each alternative designed in the second stage. The decision maker might require a larger DSS system to develop more extensive data on a variety of alternatives and to use complex analytic models needed to account for all the consequences.

**4. Implementation**: The last stage in decision making is implementation , Here managers can use a reporting system that delivers routine reports on the progress of a specific solution. The system will also report some of the difficulties that arise, will indicate

resource constraints, and will suggest possible solutions. Support systems can range from full-blown MIS systems to much smaller systems as well as project-planning software operating on microcomputers.

**Decision Support System -** Decision support systems are a major category of management support systems. They are computer based information systems that provide interactive information support to managers during the decision-making process. Decision support Systems use - 1. Analytical models 2. Specialized databases 3. A decision maker's own insights and Judgements. 4. An interactive, computer-based modelling process to support the making of semi structured and unstructured decisions by individual managers. Therefore, they are designed to be adhoc, quick-response systems that are initiated and controlled by managerial end users. Decision support systems are thus able to directly support the specific types of decisions and the personal decision-making styles and needs of individual managers.

**COMPONENTS OF A DECISION SUPPORT SYSTEM**

The components of a DSS present in any decision support system. The hardware, software, network, data, model, and people resources needed to provide interactive decision support for managers. The functions of these components.

1. **Hardware and Network Resources :** Personal computer workstations provide the prima hardware resource for a DSS. They can be used on a stand-alone basis, but are typically connected by wide area or local area networks to servers and other computer systems for access to other DSS software, model and data resources.
2. **Software Resources**: DSS software packages (DSS generators) contain software modules to manage DSS databases, decision models and end user/system dialogue.
3. **Data Resources**: A DSS database contains data and information extracted from the databases of the organization, external databases and a manager's personal databases. It includes summarized data and information most needed by managers for specific type of decisions.
7. **Model Resources**: The model base includes a library of mathematical models and analytical techniques stored as programs, subroutines, spread sheets and command files.

8. **People Resources:** Managers or their staff specialists can use DSS to explore decision alternatives. Such end users can also develop their own simple decision support systems. However, they leave the development of large or complex decision support systems

and DSS software packages to information systems specialists.

**USING DECISION SUPPORT SYSTEMS**

Using a decision support system involves four basic types of analytical Modelling activities: (1) What-if analysis (2) Sensitivity analysis

(3) Goal-seeking analysis, and (4) Optimization analysis.

**1. What-if analysis:** In what-if analysis, an end user make changes to variables or relationships among variables, and observes the resulting changes in the values other variables.

**Example:** What if we cut advertising by 10 percent? What would happen to sales ?

2. **Sensitivity Analysis**: Sensitivity analysis is a special case of what-if analysis. Typically, the value of only one variable is changed repeatedly, and the resulting change, on other variables are observed. So sensitivity analysis is really a case of what-if analysis involving repeated changes to only one variable at a time. Sensitivity analysis is used when decision makers are uncertain about the assumptions made in estimating the value of certain key variables.

**Example:** Let's cut advertising by $ 100 repeatedly so we can see its relationship to sales.

3. **Goal-seeking analysis :** Goal-seeking analysis reverses the direction of the analysis done in what-if and sensitivity analysis. Instead of observing how changes in a variable affect other variables, goal-seeking analysis (also called how can analyses) Sets a target value (a goal) for a variable and then repeatedly changes other variables until the target value is achieved.

**Example:** Let's try increases in advertising until sales reach $ 1 million.

4. **Optimisation analysis:** Optimization analysis is a more complex extension of goal-seeking analysis. Instead of setting a specific target variables, given certain constraints.Then one or more other variables are changed repeatedly, subject to the specified constraints, until the best values for the target variables are discovered. **Example :** What's the best amount of advertising to have, given our budget and choice of media?

**KNOWLEDGE SYSTEM**

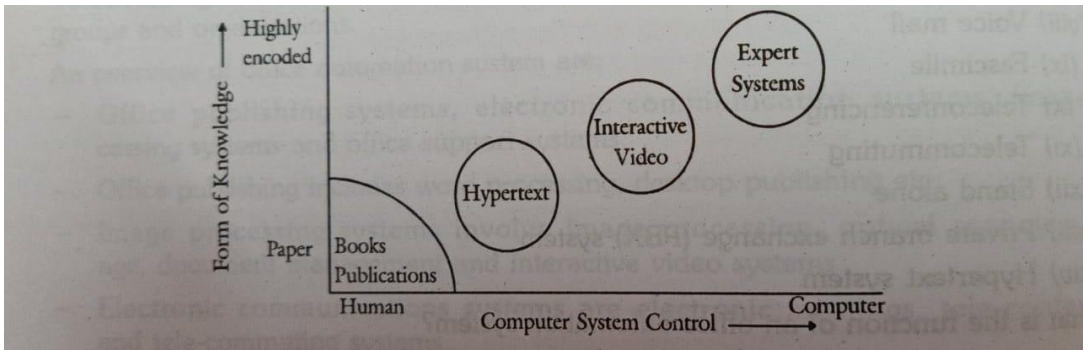
A knowledge system is a computer based system that represents knowledge and makes it available to users in a form tailored to the solution of specific problems. Some such system, reduce knowledge acquisition time or knowledge acquisition cost. Others replicate valuable

expertise and still others reduce operational response time. Another type of knowledge System, stores and saves valuable expertise. Knowledge system technology is evolving many more knowledge application problems have been envisioned than have been solved. There is even disagreement over what Constitutes a knowledge system.

**TYPES OF KNOWLEDGE SYSTEMS**

Three types of knowledge systems are - (i) Hypertext (ii) Interactive video (iii) Expert systems.

Control and structure of knowledge processing alternatives




**Hypertext** – It is an important methodology for the construction and interactive use of text databases. A hypertext is a body of text of any size in electronic form that is indexed so that it can quickly searched by a reader. It we highlight a term on a hypertext document displayed on the computer video screen and press a key, the computer could instantly bring up a display of a passage of text related to that term. Once we finished reading that pop-up display, We could return to the original reading, or jump to another part of the document instantly. Thus the use of hypertext provides an environment for interactive reading of a document.

Several software packages are available for the development of hypertext documents.

Hypercard package is the most popularly used for the Apple Macintosh microcomputer .The basic unit of text is called a card. A hypertext document consists of stacks or collections of interrelated and indexed cards. Hypertext document packages are known as stackware. It can be programmed to let a reader navigate through the document by following one or more of the scripts. The hypertext contains only text and a limited amount of graphics.

Hypermedia are documents that contain multiple forms of media, including text, graphics, video and so on. Proponents of hypertext and hypermedia expect such electronic documents to become as popular as more traditional paper documents such as books, magazines and newspapers.

**Interactive Video (1.V.) -** It links video segments via menu processing applications. This allows knowledge stored in video media to be accessed non sequentially. Such applications involve a greater degree of computer control than hypertext applications. Interactive video is used primarily in tracking and advisory capacities.

Interactive video applications overcome one of the biggest disadvantages of video media. It is not necessary to view the material sequentially. Sections can be controlled through menus. From time to time, the user is presented with other menus. Usually, he is given the opportunity to repeat the last segment, to continue with the next segment, or to jump to some other segment. With the I.V. applications, the applicant takes more responsibility (and control) for the presentation of the material.

Airlines, for example, use interactive video to train personnel on procedures for the use a new equipment. It is also used to guide the procedures for the repair of expensive equipment. I.V. provides a multitude of media-music, video, sketches, text, pictures etc.—all under the control of the user. The repair of an expensive equipment, say aircraft may justify the price of an expensive interactive video system. Considering the amount of data required to store video images, they need optical disk storage.

**Expert System** An expert system is a computer based information system in which knowledge is represent, in data, in which the processing of the knowledge is directed, primarily by computer Programs This system has the greatest degree of computer control of the three systems studied, The development of systems that process the knowledge of a true human expert has proven to be difficult and expensive. The technology however, is useful in the solution of many smaller problems.

ES employs human knowledge captured in a computer to solve problems that ordinarily require human expertise. These can be used by non-experts to improve their problem solving abilities. ES becomes a knowledgeable assistant to human experts. Such systems could function better than any single expert, in making judgements in a specific, usually narrow area of expertise, termed as "'Domain''.

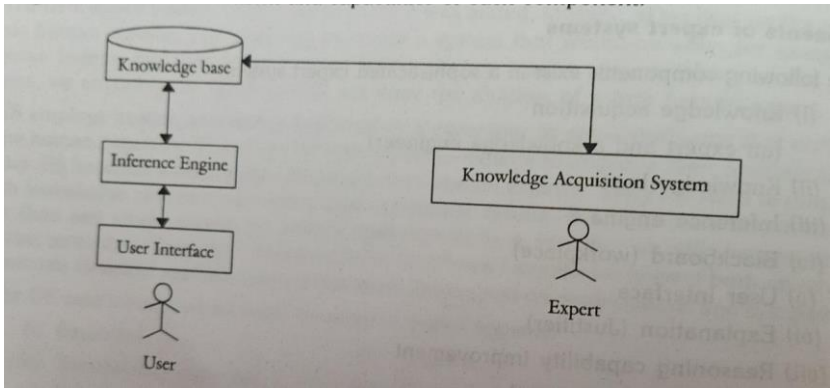
**EXPERT SYSTEMS**

A knowledge-based information system (KBIS) adds a knowledge base to the major components found in other types of computer based information system. An Expert system (ES) is a knowledge-based information system that uses its knowledge about a specific ,complex applications area to act as expert consultant to end users.

**COMPONENT OF EXPERT SYSTEMS** - The following components exist in a sophisticated (1) Knowledge acquisition (an expert and a knowledge engineer) (ii)

Knowledge base (iii) Inference engine (iv) Blackboard (workplace) (v) User Interface (vi) Explanation (Justifier) (vii) Reasoning capability improvement (knowledge refinement).

Structure of an Expert System




The basic components of an Expert Systems are:

1. **Knowledge Base:** The knowledge base of an expert system containing ; (a) facts about a specific subject area (e.g. John is an analyst) and (b) heuristics (rules of thumb) that express the reasoning procedures of an expert on the subject (e.g. IF John is an analyst, THEN he reeq a workstation). There are many ways that such knowledge is represented in expert systems. Examples are rule-based, frame-based, object based and case based methods of knowledge representation.
2. **Software Resources**: An expert system software package contains an inference engine and other programs for refining knowledge and communicating with user. The inference engine program processes the knowledge (such as rules & facts) related to a specific problem. It then makes associations and inferences resulting in recommended courses of action for a user. User interface programs for communicating with end users are also needed, including an explanation program to explain the reasoning process to a user if requested.
3. **Hardware and Network Resources** : These include stand-alone microcomputer systems as well as microcomputer workstations and terminals connected to servers and midsize computers or mainframes in local and wide area telecommunications networks.
4. **People Resources**: An expert system provides expert advice to end users. This expertise is captured in a knowledge base by a knowledge engineer from facts and rules provided by one or more experts. Or experts and end users can be their own knowledge engineers and use expert system shells as development tools to build their own knowledge bases and expert systems.

**EXPERT SYSTEM APPLICATIONS -** Expert systems are being used for many different types of applications and the variety of applications is expected to continue to increase. Expert systems typically accomplish one or more generic uses. Expert systems are being used in many different fields, including medicine, engineering, the physical sciences, and business. Expert systems now help diagnose illnesses, search for minerals, analyze compounds, recommend repairs, and do financial planning. So from a strategic business standpoint, expert systems can and are being used to improve every step of the product cycle of a business, from finding customers to shipping products to them.

**Applications Categories and Typical Uses**

1. **Decision Management** - Systems that appraise situations or consider alternatives and make recommendations based on criteria supplied during the discovery process – (a) Loan Portfolio analysis (b) Employee performance evaluation (c) Insurance underwriting (d) Demographic forecasts.
2. **Diagnostic / troubleshooting** - Systems that infer underlying causes from reported symptoms and history – (a) Equipment calibration (b) Help desk operations (c) Software debugging (d) Medical diagnosis.
3. **Maintenance/Scheduling** - Systems that prioritize and schedule limited or time critical resources - (a) Maintenance scheduling (b) Production scheduling (c) Education scheduling (d) Project management.
4. **Design/Configuration** – Systems that help configure equipment components, given existing constraint - (a) Computer option installation (b) Manufacturability studies (c) Communications networks (d) Optimum assembly plan.
5. **Selection/Classification** - Systems that help users choose products or processes, often from among large or complex sets of alternatives – (a) Material selection (b) Delinquent account identification (c) Information classification (d) Suspect identification

   (a) **Process monitoring/control -** Systems that monitor and control procedures and processes. (a) Machine control (including robotics) (b) Inventory control (c) Production monitoring (d) Chemical testing.

**Benefits of Expert System** ES provides major benefits to users. Potential benefits are

(i) Cost reduction (Human expertise is costly vis-a-vis frequently used ES).

(ii) Increased output (Can work faster than humans; fewer people and reduced costs).

(iii) Improved quality (By providing consistent advice and reducing the error rate).

(iv) Reduced down time (A system called ‘Drilling Advisor’ was developed to find troubles in oil rigs. More operational ES are used for diagnosing malfunctions and prescribing repairs).

(v) Capturing scarce expertise (where not enough experts are ‘there, where experts retire or leave, expertise is required in widespread geographical locations).

(vi) Equipment operation (ES makes complex equipment to work. Example STEAMER is an ES/ intended to train inexperienced people to operate complex ship engines).

(vii) Operation in hazardous environments (Make humans to stay outside).

(viii) Use of less expensive equipment (Many cases are there where ES can perform with instruments of lower cost than otherwise on expensive instruments for monitoring and control).

(ix) Reliability (ES are reliable, never tired, bored or sick, never go on strike or talk back; do not overlook relevant information and potential solutions).

(x) Response time (Faster than humans, where large volume of data is there).(xi) Working with incomplete and uncertain information: (ES works with incomplete information. The user may give answers like ’don’t know’, not sure to the systems questions; ES will still be able to produce an answer, though it may be an uncertain one).

(xi) Enhancing problems solving (Top expert’s judgement is allowed into the analysis in enhancing the problem solving; increases the user’s understanding through explanation. The systems are compatible with many manager's decision styles because of their use of judgement and symbolic, rather than numeric, information processing).

(xii) Educational benefits (ES gives training, provides experience and explanation facility can be used as a teaching device).

(xiii) Solving complex problems in narrow domain (used to solve problems whose complexity exceeds human ability i.e. scope of knowledge exceeds any one individual’s breadth of knowledge).

**Limitations of expert systems -** ES methodologies seem to be straightforward and effective only for relative simple application (say about a dozen generic categories) for applications of even modest complexity, Most ES are is generally hard to understand, debug, extend and maintain. Other factors and problems that slow down the commercial spread of ES are: (i) Knowledge is not always readily available. (ii) Expertise is hard to extract from humans. (iii) The approach of each expert to situational assessment may be different, yet Correct, (iv) It is

hard, even for a highly skilled expert, to abstract good situational assessment, when he is under time pressure. (v) ES works well, only in a narrow domain, in some cases very narrow, (iv) Most experts have no independent means of checking whether their conclusion, are reasonable. (v) The vocabulary that experts use for expressing facts and relations is frequently limited. (vi) Help is frequently required from knowledge engineers who are rare and expensive, a fact that makes ES construction costly.

(vii) The cost and/or the time of development may be a prohibitive factor. There is extensive research under way to overcome the above limitations, so the utilisation of ES is rapidly increasing.

Looking at these limitations of expert systems. some specialists in the management field opine that hiring and training human experts may be less expensive than developing an expert system. While this opinion may have its own merits, various limitations of expert systems, by no means, Suggest that these systems are not useful at all. Understanding of these limitations can provide benefits to the organisations in using expert systems in right perspective, as they have proved their worth for solving certain types of diagnostic problems. In limited areas, expert systems can help organisations to make higher-quality decisions using fewer people.

**ARTIFICIAL INTELLIGENCE**

Artificial intelligence is an ambiguous emotion laden term that most people find threatening, it is used in a practical sense for a group of related disciplines. The path of an Al was to build a device which reproduces the general purpose problem solving ability which humans were supposed to have. Their problem solving computer programs did not have a way to decide which process is good enough to solve a particular task. This gave way to build decision-making program and they were successful in deciding the particular process to solve a task. Thus, the computer programs could be compared to human experts.

Artificial Intelligence covers a wide field and includes five areas which are important in business.

(i) Expert systems .

(ii) Natural language (concerned with the development of human language, computer interfaces and with the translation of human languages).

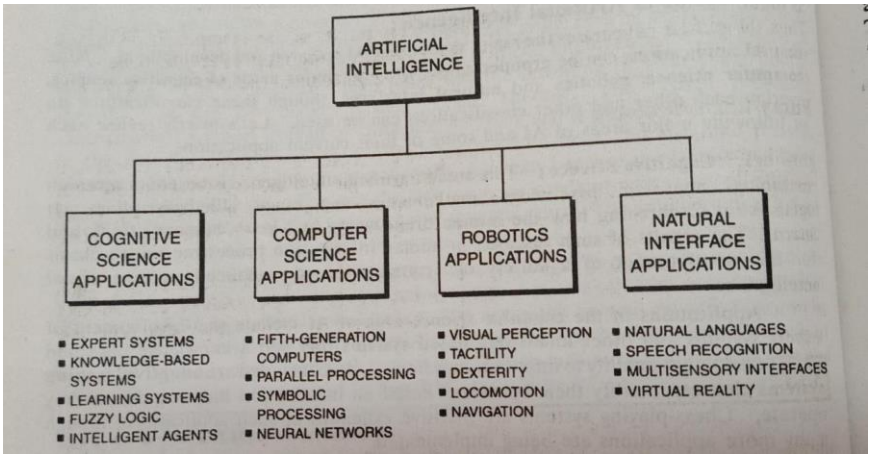
(iii) Pattern recognition systems (attempts to identify patterns in visual, auditory and other signals in data).

(iv) Vision systems (address the technology required for computer systems to see).

(v) Robotics — concerns the development of primarily industrial robots (like welding, painting robots).

**The Domains of Artificial Intelligence**

Areas of Artificial Intelligence




The major domains of Al research and development . Note that Al applications can be grouped under the four major areas of cognitive science, computer science, robotics and natural interfaces, though these classifications do overlap each other and other classifications can be used. The following major areas of AI and some of their current applications are:

**1.Cognitive Science:** This area of artificial intelligence is based on research in biology, neurology, psychology, mathematics and many allied disciplines. It focuses on researching how the human brain works and how humans think and learn. The results of such research in human information processing are the basis for the development of a variety of computer-based applications in artificial intelligence. Applications in the cognitive science area of AI include the development of expert systems and other knowledge based systems that add a knowledge base and some reasoning capability to information systems. Also included are adaptive learning systems that can modify their behaviour based on information they acquire as they operate. Chess-playing systems are primitive examples of such applications, though many more applications are being implemented.**Fuzzy logic system** can process data that are incomplete or ambiguous, that is fuzzy data. Thus they can solve unstructured problems with incomplete knowledge by developing approximate inferences and answers, as humans do.

**2.Computer Science**: ‘This area of AI applications focuses on the computer hardware and system software needed to produce the powerful supercomputers required for many AI applications. At the forefront of this area are effort to create a fifth generation of “intelligent”, computers, which use the parallel processing architecture. Such computers will be designed for optimum logical inference processing that depends on symbolic processing instead of the

numeric processing of traditional computing. Other attempts are being made to develop neural networks including massively parallel, neurocomputer systems whose architecture is based on the human brain's meshlike neuron structure. Neural network computers can process many different pieces of information simultaneously. Neural network software for traditional computers can learn by being shown sample problems and their solutions. As they start recognize patterns, they can begin to program themselves to solve such problems on their own.

3**. Robotics** : AI engineering and physiology are the basic disciplines of robotics. This technology produces robot machines with computer intelligence and computer-controlled, human like physical capabilities. This area thus includes applications designed to give robots the powers of sight or visual perception, touch or tactile capabilities, dexterity or skill in handling and manipulation, locomotion or the physical ability to move over any terrain, and navigation or the intelligence to properly find one's way to a destination.

**4.Natural Interfaces:** The development of natural interfaces is considered , a major area of Al applications and is essential to the natural use of compute human, The development of natural languages is a major thrust of this area of being able to talk to computers and robots in conversational human languages a have them "understand as easily as we understand each other is the goal of ay, Al researchers, Thus, this application area involves research and development of Lingustics, psychology, computer science, and other disciplines. Applications human language understanding, speech recognition and the development of multi-sensory devices that use a variety of body movements to operate computers. Thus this area of Al drives developments in the voice recognition and response, technology and natural programming languages.

**Neural Networks -**Neural networks are computing systems modelled after the brain's mesh like, network of interconnected processing elements called neurons. Of course neural networks are a lot simpler in architecture (the human brain is estimated to have over 100 billon neuron brain cells), However the brain the interconnected processor in a neural network operate in parallel and interact dynamically with each other. This enables the network to "learn" from data it process. That is, it learns to recognise patterns and relationships in the data it processes.

**Fuzzy Logic Systems-** Fuzzy logic system represents a small, but serious and g rowing, applications of AI in business. Fuzzy logic is a method of reasoning that resembles human reasoning since it allows for approximate values and inferences (fuzzy logic) and incomplete or ambiguous data (fuzzy data) instead of relying only on crisp data, such as binary (yes/no)

choices. Fuzzy logic uses terminology, that is deliberately imprecise, such as very high, increasing, somewhat decreased, reasonable and very low. This enables fuzzy systems to process incomplete data and quickly provide approximate, but acceptable solutions to problems that are difficult for other methods to solve.