

## Chapter 5 – Decision Support and Artificial Intelligence

IT can help in decision-making processes – IT can provide brainpower. IT power is actually replacing human brainpower.

The extended brainpower that IT offers you as a decision maker comes in the form of decision support systems and artificial intelligence.

### Types of decisions you face

1. **Structured decision** – involves processing a certain kind of information in a specific way so that you will always get the right answer (decisions you can program)
2. **Non-structured decision** – Is one for which there may be several “right” answers and there is no precise way to get a right answer. No rules or criteria exist.
3. **Recurring decision** – Is one that happens repeatedly, and often periodically
4. **Non-recurring or Ad hoc decision** – Is one that you make infrequently and you may even have different criteria for determining the best solution each time.

### How you make a decision (4 distinct phases)

1. **Intelligent (find what to fix)** – find or recognize a problem, need, or opportunity (also called the diagnostic phase of decision making).
2. **Design (find fixes)** – possible ways of solving a problem. Develop all the possible solutions you can.
3. **Choice (pick a fix)** – examine and weigh the merits of each solution, estimate the consequences of each, and choose the best one.
4. **Implementation (apply the fix)** – carry out the chosen solution, monitor the results, and make adjustments as necessary

**Decision Support Systems** – Allow you to locate and use information effectively. It is a highly flexible and interactive IT system that is designed to support decision-making when a problem is not structured.

### Components of a DSS system

1. **Data Management** – Performs the function of storing and maintaining the information that you want your DSS to use. It consists of both the DSS information and the DSS database management system. The information you use comes from one or more of three sources:
  - a. Virtually any information available in the organization.

- b. External sources (Federal gov't, stats can, etc.)
  - c. Personal information
2. **Model Management** – Consists of both the DSS models and the DSS model management system. A model is a representation of some event, fact, or situation. DSS models may include (what-if Models, Optimization models, Goal-seeking Models, Statistical Models)
  3. **User Interface Management** – The UIM components allows you to communicate with the DSS. It consists of the user interface & the user interface management system.

**Developing a DSS involves 4 steps:**

1. Intelligence – examine the problem and consider whether you need a DSS or whether you could more effectively solve the problem with some other IT system.
2. Design – What's available to you commercially? Or what can you build? A DSS generator is software that enables you to develop a DSS for a specific task.
3. Choice – What will you buy or build? Commercially available packages should be flexible and if you're combining models, consider compatibility.
4. Implementation – Build or install the DSS and learn, test, and evaluate your DSS thoroughly.

Ethical questions in DSS – Ethical behavior means considering the results of your actions – this is called accountability. The higher the risk of potential damage, the more important accountability becomes.

**Group Decision Support system (GDSS)** – Is a type of decision support system that facilitates the formulation and the solution to problems by a team. A GDSS facilitates team decision-making by integrating 1) groupware, 2) DSS capabilities, and 3) telecommunications.

The team decision – Three distinct steps

- ⇒ Brainstorming – Generation of ideas. Identifying strengths, weaknesses, opportunities, or threats faced by your organization. Avoid discussing the merits or drawbacks of the ideas of the other team members... simply note them.
- ⇒ Issue Categorization and Analysis – Arrange ideas into measurable classifications. Then you further discuss those ideas, clarify any unresolved issues, and evaluate the worth of each idea.
- ⇒ Ranking and Voting – Assigning weights to each idea once you've evaluated them. After prioritizing them, the team votes on the final ranking.

Key Components in a GDSS (People and IT tools)

People in GDSS – People have one of two roles in a GDSS. The first role is a member of the **team** working on a problem. A GDSS is simply ineffective when team members don't want to work together. The second role is that of the **facilitator** who

helps the team reach its goals. A facilitator has two roles, one non-technical (planning and running the meeting) and one technical (handling administrative and technical details)

### IT tools in GDSS

- ⇒ Groupware – any kind of software that allows you and your team to communicate and share documents. It has capabilities that support the three phases of team decision making (Brainstorming, Issue Categorization, Ranking and Voting)
- ⇒ DSS Capabilities – depend on the type of decision you're making. So you must consider which method of analysis must be applied to your information to render the most informed decision.
- ⇒ Telecommunications – The hardware and software that connects computers

**Meeting** – Cooperation is the keystone to innovation & creativity in business. Cooperation, however, involves meeting, and meetings consume a large portion of work time.

GDSS will help your organization get the most from its meetings by directly addressing the two biggest problems associated with meetings – too much time spent and too little productivity achieved. GDSS exist to maximize the positive effects of team decision-making – the synergy of collective effort – and minimize the negative effects of wasted time and energy.

Groupthink arises when members are discouraged from thinking independently. A GDSS enhanced meeting induces a greater level of independent thought and a greater degree of anonymity.

Meetings can be classified into two categories, Same-time meetings and different time meetings.

**Same time (Synchronous) Meetings** – interact directly with one another simultaneously.

- ⇒ Same room
- ⇒ Same City – not in the same room
- ⇒ Same Planet – dispersed geographically and meet electronically

**Different Time (Asynchronous) Meetings** – Located in the same city but may not find it convenient or efficient to meet at the same time. It takes longer to complete the meeting.

**Geographic Information System** – A decision support system designed specifically to work with spacial information. (Locations, Demographics, etc.) Information can be retrieved from commercially available spatial information databases, Gov't agencies, stats Canada, etc.

### Artificial Intelligence

DSS, GDSS, and GIS augment business brainpower.

**Artificial Intelligence** – The techniques and software that enables computers to mimic human behavior in various ways. It is the science of making machines imitate human thinking and behavior.

**Robot** – A mechanical device equipped with simulated human senses and the capability of taking action on its own.

### AI Systems that businesses use

- ⇒ Expert systems, which reason through problems and offer advice in the form of a conclusion or recommendation
- ⇒ Neural networks, which can be “trained” to recognize patterns
- ⇒ Genetic Algorithms, which can generate increasingly better solutions to problems by generating many, many solutions, choosing the best one, and using those to generate even better solutions
- ⇒ Intelligent Agents, which are adaptive systems that work independently, carrying out specific, repetitive or predictable tasks.

**Expert System** – also called knowledge-based system, is an AI system that applies reasoning capabilities to reach a conclusion. Excellent for diagnostic (what’s wrong?) or prescriptive (What to do?) problems

### Components of an expert system

#### 1. Information Types

- a. Domain Expertise – the set of problem-solving steps – the reasoning process that will solve the problem.
- b. “Why” information – how it reached its conclusion or why it asked you a question.
- c. Problem Facts – symptoms of and assertions about your problem

#### 2. People

- a. Domain Experts – provides the domain expertise in the form of problem-solving strategies
- b. **Knowledge Engineer** – An IT specialist, who formulates the domain expertise into an expert system. **Rule-Based expert systems** also exist
- c. Knowledge Worker – The user.

#### 3. IT Components

- a. Knowledge Base – stores the rules
- b. Knowledge Acquisition – The knowledge engineer uses the knowledge acquisition component of the expert system to enter the rules
- c. Inference Engine – part of the expert system that takes your problem facts and searches the knowledge base for rules that fit.
- d. User Interface – the part of the expert system that you use to run a consultation
- e. Explanation Module – where the “why” information is stored.

You can acquire expert systems in three ways:

1. You can buy a complete off the shelf expert system
2. You can develop an expert system using an expert system shell (software package designed to facilitate the development of the expert system)
3. You can build an expert system by scratch

Advantages of An expert System

- ⇒ Handle massive amounts of information
- ⇒ Reduce error
- ⇒ Aggregate information from various sources
- ⇒ Provide consistency in decision making
- ⇒ Provide new information
- ⇒ Decrease personnel time spent on tasks
- ⇒ Reduce cost

Ethical questions in expert systems

1. Will the expert system act ethically?
2. What kind of decision should you let an expert system make for you?
3. Should you accept the decision of an expert system without question?

**Neural Networks** – Is an AI system that is capable of learning because it’s patterned after the human brain. Neural networks work best on pattern-recognition problem for which a vast amount of historical information is available.

There are two major categories of neural network products – stand-alone and those that work in conjunction with a spreadsheet.

How does it work?

After lots of practice, a neural network can recognize patterns without human intervention. You develop and train a neural network for a specific problem area. Once it has been trained, you provide it with a new pattern and it will give you information about that pattern.

**Genetic Algorithms** – Is an AI system that mimics the evolutionary, survival of the fittest process to generate increasingly better solutions to a problem. Genetic Algorithms use three concepts of evolution:

- ⇒ Selection – or survival of the fittest. The key to selection is to give preference to better outcomes
- ⇒ Crossover – or combining portions of good outcomes in the hope of creating an even better outcome
- ⇒ Mutation – or randomly trying combinations and evaluating the success (or failure) of the outcomes.

GA are best suited to decision making environments in which thousands of solutions are possible and each of those solutions must be carefully evaluated.

**Intelligent Agents** – Is an AI system that can move around your computer or network performing repetitive tasks independently, adapting itself to your preference. An intelligent agent is a combination of the most modern software technologies.

IA's can act as personal assistants, find and retrieve information from your company database, or find and retrieve information across networks.

#### Combining IT Brainpower systems

DSS, GDSS, and GIS's all require that you know which steps to take to solve the problem and that you execute them

In AI systems, the know-how is in the system. You provide the problem and the system takes care of solving it

A DSS that incorporates expert systems is called an intelligent DSS, a DSS/ES, or a knowledge-based DSS.

When you combine GIS with a neural network, you get a huge amount of information, displayed in pattern, which your neural network can analyze.

**Hybrid Intelligent Systems** – A new type of AI system that incorporates two or more AI techniques.

Neural Networks & Expert Systems – A trainable expert system. (Example p.210)  
Neural Networks & Genetic Algorithms - (example p.211)

