Data Warehouse Concepts (Introduction)

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Course Structure

- Introduction to Decision Support Systems
- Data Warehouse Concepts/ Terminologies
- Data Warehouse Architecture
- Logical Model Design
- Physical Model Design
- DW Project Lifecycle overview

Course Evaluation

- Assessment :

  - Exams   50%
  - Project   30%
  - Lab   20%

References

- The Data Warehouse Toolkit- The Definitive Guide to Dimensional Modeling, 3rd ed. , Ralph Kimball , Margy Ross

- Business Intelligence a managerial Approach , 2$_{nd}$ ed. Efraim Turban

- Decision Support Systems and Intelligent Systems ,efraim Turban 6th edition, Prentice Hall, Upper Saddle River, NJ

- IS Today (Valacich& Schneider) Copyright © 2010 Pearson Education, Inc. Published as Prentice Hall

Gartner: CIOs Top 10 Technology Priorities 2015

Top 10 CIO Technology Priorities in 2015

Top 10 Technology Priorities	Ranking
Business intelligence and analytics	1
Infrastructure and data center	2
Cloud	3
ERP	4
Mobile	5
Digitalization/Digital Marketing	6
Security	7
Networking, voice and data communications	8
Customer Relationship Management	9
Industry-specific applications	10

Ranking based on how many CIOs cited each as a top 3 new spending priority for 2015.

Gartner: CIOs Top 10 Technology Priorities 2016

Technology Priorities for CIOs in 2016

1 BI/Analytics
2 Cloud
3 Mobile
4 Digitization/Digital Marketing
5 Infrastructure & Data Centre
6 ERP
7 Security
8 Industry Specific Applications
9 CRM
10 Networking/Voice/Data Communications

TOP 10

Management

Management is a process by which organizational goals (*outputs*) are achieved through the use of corporate resources (*inputs*). These organizational decisions (*processes*) are typically made by managers.

- A manager's role can be categorized into:

    - **Interpersonal -** figurehead, leader, liaison

    - **Informational -** monitor, disseminator, spokesperson

    - **Decisional -** entrepreneur, problem solver, resource coordinator, and negotiator

Information systems support all three roles especially decision .

Decision-Making Levels of an Organization

Managers and Decision Making

A **decision** refers to a choice made between alternatives. Decision making in organizations can be classified into two broad categories: **problem solving** and **opportunity exploitation.**

- Why Managers Need the Support of Information Technology. It is very difficult to make good decisions without valid, timely and relevant information.

    - Number of **alternatives** to be considered is increasing

    - Many decisions are made under **time** pressure.

    - Due to **uncertainty** in the decision environment, it is frequently necessary to conduct a sophisticated analysis.

    - It is often necessary to rapidly access **remote** information.

Can we make better decisions?

Managers and IT

1. Why do managers need the support of information technology in making decisions?

2. Can the manager's job be fully automated?

3. What IT aids are available to support managers?

4. How are the information needs of managers determined?

Management Support Systems

Discovery, communication and collaboration tools provide indirect support to decision making, however there are several other information technologies used to directly support decision making.

- Decision Support Systems (DSS) provide support primarily to analytical, quantitative types of decisions.

- Executive (Enterprise) Support Systems (ESS) support the informational roles of executives.

- Group Decision Support Systems supports managers and staff working in groups.

- Intelligent Systems

Decision Process (Simon)

Decision makers goes through a fairly systematic process.
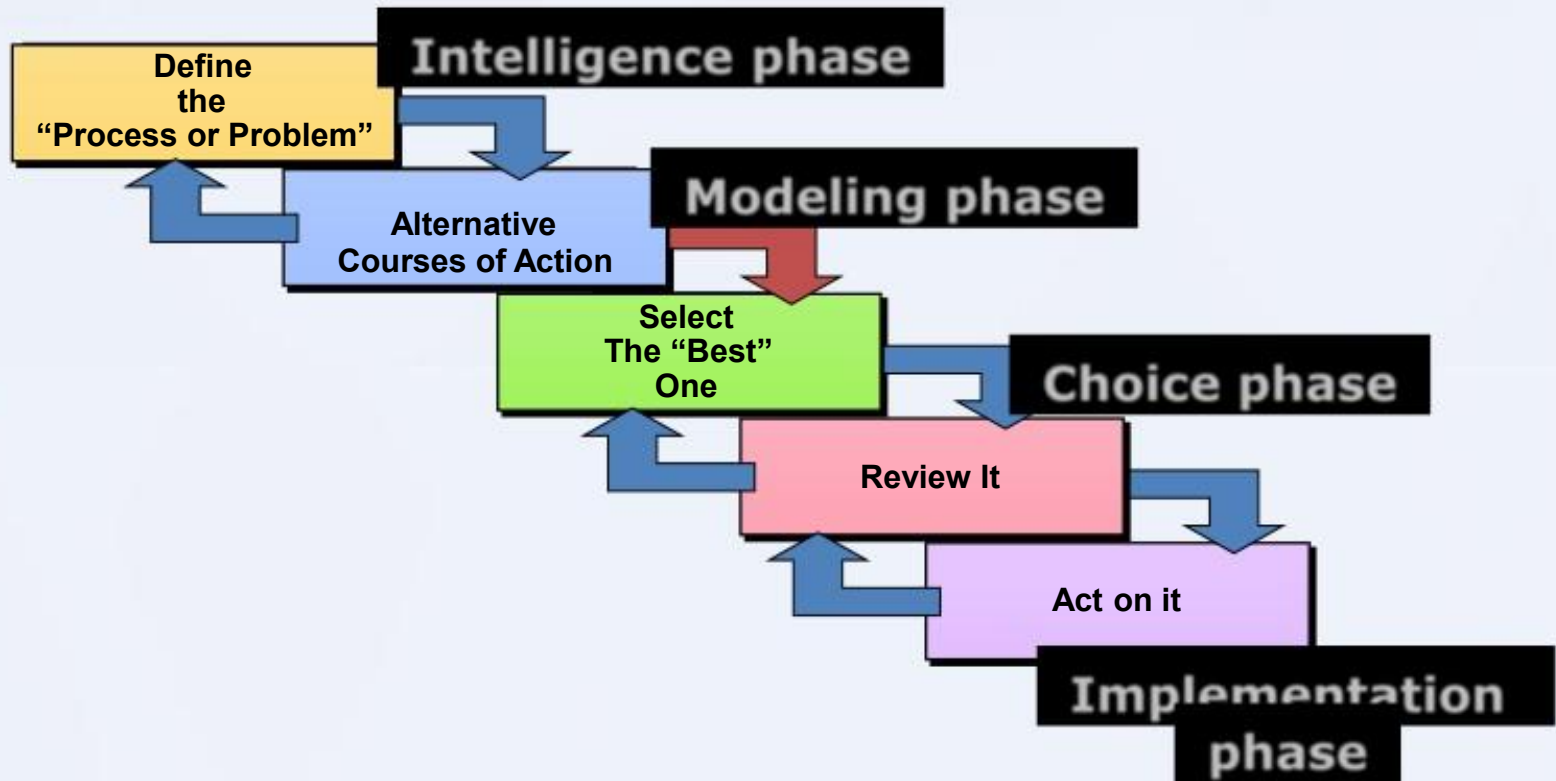
Decision Complexity

Decision making ranges from simple to very complex decisions that fall along a continuum that ranges from structured to unstructured. **Structured** processes refer to routine & repetitive problems with standard solutions. While **Unstructured** are "fuzzy," complex problems with no clear-cut solutions.

Structured : fulfillment / Operational objective/ Programmed
Semi-Structured : Reorder / Tactical objective
Unstructured : New Product / strategic objective / non-programmed

Decision-Making Levels of an Organization

Operational Level

- Day-to-day business processes

- Interactions with customers

- Decisions:
  - Structured
  - Recurring
  - Can often be automated using IS

- BI used to:
  - Optimize processes
  - Understand causes of performance problems

Operational Level (cont'd)

Who:	Foremen or Supervisor
What:	Automate Routine and Repetitive Activities and Events
Why:	Improve Organizational Efficiency

Executive Level

Managerial Level

Operational Level

Managerial Level

- Functional managers
  - Monitor and control operational-level activities
    - Focus: effectively utilizing and deploying resources
    - Goal: achieving strategic objectives
- Managers' decisions
  - Semi-structured
  - Moderately complex
  - Time horizon of few days to few months
- BI can help with:
  - Performance analytics
  - Forecasts
  - Providing key performance indicators on dashboards

Managerial Level (cont'd)

Executive Level

Managerial Level

Operational Level

Who: Midlevel Managers and Functional Managers

What: Automate the Monitoring and Controlling of Operational Activities

Why: Improve Organizational Effectiveness

Executive Level

- The president, CEO, vice presidents, board of directors

- Decisions
    - Unstructured
    - Long-term strategic issues
    - Complex and nonroutine problems with long-term ramifications

- BI is used to:
    - Obtain aggregate summaries of trends and projections
    - Provide KPIs across the organization

Executive Level (cont'd)

The Gorry and Scott Morton Grid

Degree of problem structure	Operational control	Management control	Strategic planning
Structured	Accounts receivable Order entry	Personnel report Make-or-buy	Tanker fleet Warehouse/ factory location
	Inventory control	Credit Evaluation	Mergers
Semistructured	Production scheduling	Variance analysis	Acquisitions
Unstructured	Approving Loans	Recruit executive	R&D planning

TPS

- **Transaction Processing System** is a type of Information systems , TPSs collect, store, modify, and retrieve the transactions of an organization.

- Database transactions are processed reliably (rollback, deadlock, concurrency)

MIS Definition

- **Management Information System** : is a system that provides information needed to manage organizations effectively. Management information systems are regarded to be a subset of the overall internal controls procedures in a business, which cover the application of people, documents, technologies, and procedures used by Manager to solve business problems

Decision Support Systems

Decision support system (DSS) is a computer-based information system that combines models and data in an attempt to solve **semistructured** and **unstructured** problems with user involvement.

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Why Use DSS?

Perceived benefits

- **decision quality**

- **improved communication**

- **cost reduction**

- **increased productivity**

- **time savings**

- **improved customer and employee satisfaction**

Decision Support Systems and Intelligent Systems ,Efraim Turban , 6th edition, Prentice Hall, Upper Saddle River, NJ, 2001

Group Decision Support Systems

The DSS methodology was initially designed to support individual decision makers. However, decision making is frequently a shared process. Where a group may be involved in making the decision. When a decision-making group is supported electronically, the support is referred to as a **group decision support system (GDSS).**

- GDDS is an Interactive Computer based system support group of decision makers.

- Groups

   - **One-room group** whose members are in one place

   - **Virtual group**, whose members are in different locations

Executive Information (Support) Systems

An **executive information system (EIS),** also known as an **executive support system (ESS),** is a technology designed in response to the specific needs of top-level managers and executives.

- EIS are:
    - Very user friendly
    - Is supported by graphics
    - Provides the capabilities of *exception reporting* (reporting only the results that deviate from a set standard)
    - *Provide drill down* (investigating information in increasing detail).

- ESS goes beyond EIS to include:
    - Analyse support
    - Communications
    - Office automation
    - Intelligence support

Intelligent Support Systems (ISS)

Intelligent systems is a term that describes the various commercial applications of artificial intelligence (AI). AI is concerned with studying the thought processes of humans and representing those processes via machines (computers, robots, and so on). It's ultimate goal is to build machines that will mimic human intelligence.

- AI applications can be extremely valuable:

    - They can make computers easier to use.

    - They make knowledge more widely available.

    - They significantly increase the speed and consistency of some problem-solving procedures.

    - They handle problems that are difficult to solve by conventional computing and those that have incomplete or unclear data.

    - They increase the productivity of performing many tasks.

    - They helps in handling information overload by summarizing or interpreting information.

    - They assist in searching through large amounts of data.

ISS - Artificial Intelligence

The development of machines that exhibit intelligent characteristics draws upon several sciences and technologies, ranging from linguistics to mathematics.

TABLE 11.4 Commercial AI Techniques

Name	Short Description
Expert system (ES)	Computerized advisory systems usually based on rules. (See Section 11.6.)
Natural language processing (NLP)	Enables computers to recognize and even understand human languages. (See Section 11.7.)
Speech understanding	Enables computers to recognize words and understand short voice sentences. (See Section 11.7.)
Robotic and sensory systems	Programmable combination of mechanical and computer programs. Recognize their environments via sensors.
Computer vision and scene recognition	Enable computers to interpret the content of pictures captured by cameras.
Machine learning	Enables computers to interpret the content of data and information captured by sensors (see next three techniques).
Handwriting recognition	Enables computers to recognize characters (letters, digits) written by hand.
Neural computing (networks)	Using massive parallel processing, able to recognize patterns in large amount of data. (See Section 11.7.)
Fuzzy logic	Enables computers to reason with partial information. (See Section 11.7.)
Intelligent agents	Software programs that perform tasks for a human or machine master. (See Online Appendix W11.1.)
Semantic Web	An intelligent software program that "understands" content of Web pages. (See Section 11.7.)
Genetic programming	Automatic analysis and synthesis of computer programs (see Section 11.7).

Expert Systems (ES) - *One type of ISS*

Expert systems (ESs) are attempts to mimic human experts. It is decision-making software that can reach a level of performance comparable to a human expert in some specialized and usually narrow problem area. The idea is simple: **expertise** is transferred from an expert or other source of expertise to the computer.

- The transfer of expertise from an expert to a computer and then to the user involves four activities:

  - Knowledge **acquisition** (from experts or other sources)

  - Knowledge **representation** (organized as rules or frames in the computer)

  - Knowledge **inferencing** is performed in a component called the **inference engine** of the ES and results in the recommendation.

  - Knowledge **transfer** to the user (the expert's knowledge has been transferred to users).

Expert Systems (ES) *- One type of ISS*
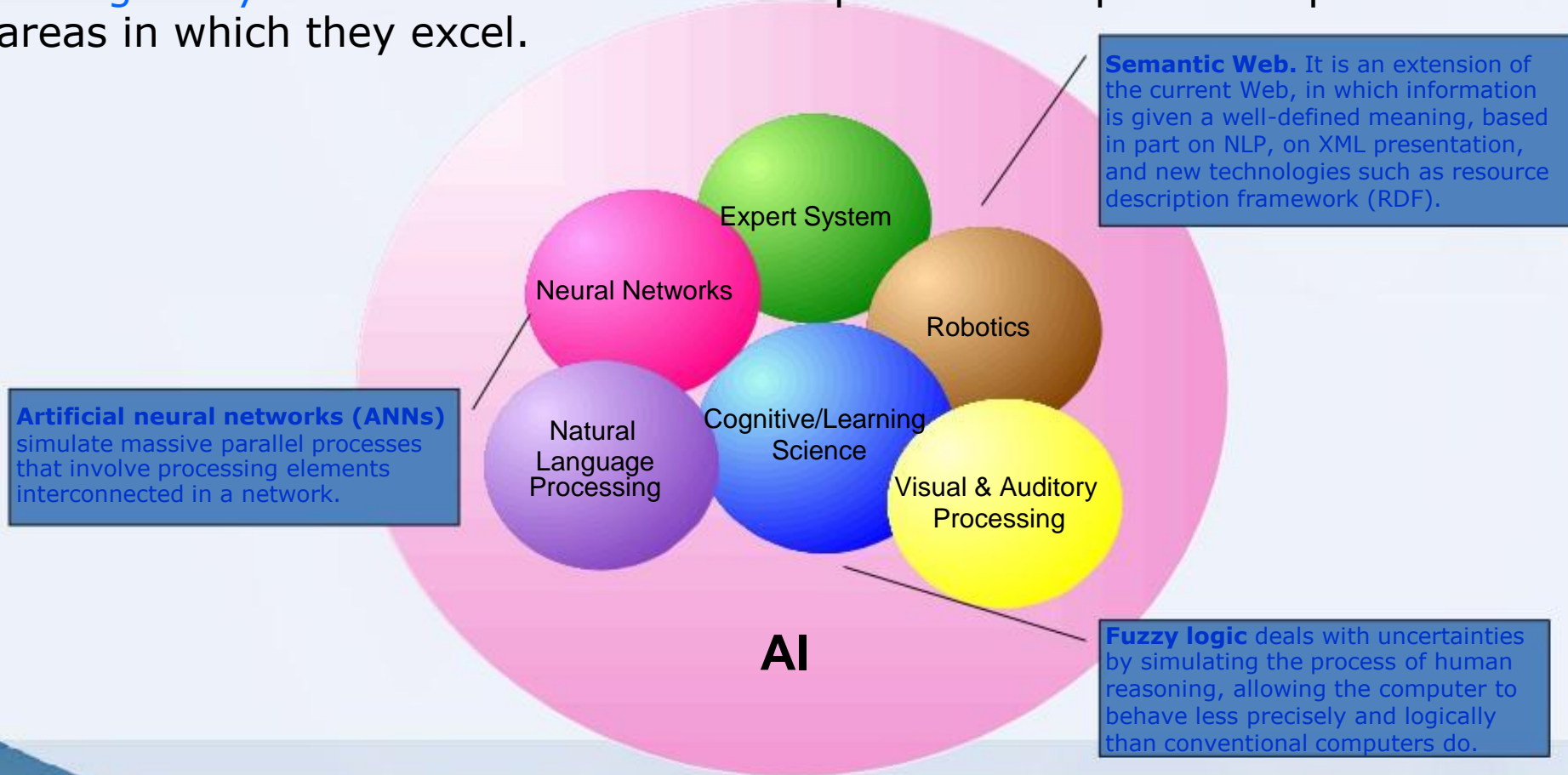
Benefits:

TABLE 11.5 Benefits of Expert Systems

Benefit	Description/Example
Increased output and productivity	At Digital Equipment Corp. (now part of Hewlett-Packard), an ES plans configuration of components for each custom order, increasing preparation production speed fourfold.
Increased quality	ESs can provide consistent advice and reduce error rates.
Capture and dissemination of scarce expertise	Physicians in Egypt and Algeria use an eye-care ES developed at Rutgers University to diagnose ailments and to recommend treatment. Advice is provided by top physicians.
Operation in hazardous environments	ESs that interpret information collected by sensors enable human workers to avoid hot, humid, or toxic environments.
Accessibility to knowledge and help desks	ESs can increase the productivity of help-desk employees (there are over 30 million in the U.S. alone), or even automate this function.
Reliability	ESs do not become tired or bored, call in sick, or go on strike. They consistently pay attention to details and do not overlook relevant information.
Increased capabilities of other systems	Integration of an ES with other systems makes the other systems more effective.
Ability to work with incomplete or uncertain information	Even with an answer of "don't know" or "not sure," an ES can still produce an answer, though it may not be a certain one.
Provision of training	Novices who work with an ES become more experienced thanks to the explanation facility, which serves as a teaching device and knowledge base. They also can play what-if scenarios.
Enhancement of decision-making and problem-solving capabilities	ESs allow the integration of expert judgment into analysis. Successful applications are diagnosis of machine malfunction and even medical diagnosis.
Decreased decision-making time	ESs usually can make faster decisions than humans working alone. American Express authorizers can make charge authorization decisions in 3 minutes without an ES and in 30 seconds with one.
Reduced downtime	ESs can quickly diagnose machine malfunctions and prescribe repairs. An ES called Drilling Advisor detects malfunctions in oil rigs, saving most of the cost of downtime (as much as $250,000/day).

Other Intelligent Systems

An expert system's major objective is to provide expert advice. Other intelligent systems can be used to solve problems or provide capabilities in areas in which they excel.

Semantic Web. It is an extension of the current Web, in which information is given a well-defined meaning, based in part on NLP, on XML presentation, and new technologies such as resource description framework (RDF).

Expert System

Neural Networks

Robotics

Artificial neural networks (ANNs) simulate massive parallel processes that involve processing elements interconnected in a network.

Natural Language Processing

Cognitive/Learning Science

Visual & Auditory Processing

AI

Fuzzy logic deals with uncertainties by simulating the process of human reasoning, allowing the computer to behave less precisely and logically than conventional computers do.

System	Users	Description
Transaction processing System (TPS)	All Employees	Processes an organization's basic business transactions (e.g., purchasing, billing, payroll)
Management Information System (MIS)	All Employees	Provides routine information for planning, organizing, and controlling operations in functional areas.
Decision support system (DSS)	Decision Makers , managers	Combines models and data to solve semistructured problems with extensive user involvement.
Executive support System (ESS)	Executive senior Managers	Supports decisions of top managers.
Group support system (GSS)	People Working in Groups	Supports working processes of groups of people (including those in different locations
Expert system (ES)	Knowledge workers (non Experts)	Provides stored knowledge of experts to nonexperts and decision recommendations based on built-in expertise.
Knowledge work system (KWS)	Managers, knowledge workers	Supports the gathering, organizing, and use of an organization's knowledge.
Neural networks, casebased reasoning	Knowledge workers, professionals	Learn from historical cases, even with vague or incomplete information.