

Challenges of making decisions

- Decision making is a daily occurrence for business managers
- Factors making business decisions challenging
 - Uncertainty and complexity
 - Information overload
 - Data quality

Information Overload

- Storage capacity ↑
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- Cost decreases ↓
- Basically unlimited today
- Exponential growth
 - both inside and outside of organizations
 - used to improve decision making

Information Overload

- Ability to store any size customer data
- Allows for a better understanding of the customers
- Data can be used for forecasting
- →Competitive strength
 - when making decisions

Information Overload

- Business Manager's Challenge
 - Find appropriate data
 - Incorporate this data into decision making
- Information Systems
 - Help
 - Hinder

Data Quality

- (Processed) Data from operational systems can be used for
 - Basic reports
 - Example: current sales, sales projections
- Raw data unsuitable for sophisticated reporting or data mining

Data Quality

Raw data usually unsuitable for sophisticated reporting or data mining

- Dirty data
- Missing values
- Inconsistent data
- Data not integrated
- Wrong granularity
 - Too fine
 - Not fine enough
- Too much data
 - Too many attributes
 - Too many data points

OLTP – support for decision making

- Online Transaction Processing (OLTP) system
 - Collects data electronically
 - Processes the transactions online
- Backbone of all functional, cross-functional, and interorganizational systems in an organization
- OLTP systems support decision making
 - Provides raw information about transactions
 - Provides information about status for an organization

Transaction Processing

- Real-time processing
 - Transactions are entered and processed immediately upon entry
 - Examples: airline reservation, banking
- Batch processing
 - System waits until it has a batch of transactions before the data are processed and the information is updated
 - Example: transfer of all daily branch transactions to the central office for processing

Data Resource Challenge

- While data may be collected in OLTP, the data may not be used to improve decision making
- Data as an Asset?
 - Asset: resource from which future economic benefits may be obtained
 - How is data valued in an organization?
 - Who manages it?
 - Where is the data?
 - Need to treat Data as an important resource

OLAP – Online Analytic Processing

- Focus on making OLTP-collected data useful for decision making
- Provides the ability to sum, count, average, and perform other simple arithmetic operations on groups of data
- Report has measures, or facts, and dimensions

Business Intelligence (BI) Systems

- Provide information for improving decision making
- Primary systems:
 - Reporting systems
 - Data-mining systems
 - Knowledge management systems
 - Expert systems

Reporting Systems

- Integrate data from multiple sources
- Process data
 - Sorting
 - Grouping
 - Summing
 - Averaging
 - Comparing
- Results formatted into reports
- Improve decision making by providing right information to right user at right time

Data-Mining Systems

- Process data using statistical techniques
 - Regression analysis
 - Decision tree analysis
- Look for patterns and relationships to anticipate events or predict outcomes
 - Market-basket analysis
 - Predict donations

Data Mining

- Application of statistical techniques to find patterns and relationships among data
- Represents convergence of disciplines
- Takes advantage of developments in data management to process enormous databases

Unsupervised Data Mining

- Analysis run before model created
- Data-mining technique applied and then results are observed
- Hypotheses created after analysis to explain the results
- Example: cluster analysis
 - Technique to identify groups of entities that have similar characteristics

Supervised Data Mining

- Model developed before analysis
- Statistical techniques used to estimate parameters
- Examples:
 - Regression analysis
 - Measures impact of a set of variables on another variable
 - Neural networks
 - Predicts values
 - Makes classifications (good/poor prospect customers)
 - Market –basket Analysis
 - Computes correlations based on past performances

Market-basket Analysis

- Technique for determining sales patterns
- Creates probabilities that two items will be purchased together
 - Customer buying "X" tends to buy "Y", so when a customer buys either "X" or "Y" sell them the other product.
- Confidence: probability of purchasing two items
- Lift: ratio of confidence to the base probability of buying an item
- May need to consider multiple item purchases

Knowledge-Management Systems

- A process:
 - Creates value from intellectual capital
 - Collecting & Sharing human Knowledge
- Supported by:
 - Information System technology
 - Five components of an information system
 - Emphasis on People (knowledge & sharing)

Knowledge-Management Systems

- Fosters innovation
- Improve Customer Service
- Increases organizational responsiveness
- Reduce Costs

Expert Systems

- Encode human knowledge
 - Gathered from human experts in the domain
- Rule-based systems
 - IF/THEN
- Improve diagnosis & decision making in non-experts

Example: Cardiac Risk Factor

Other rules here...

```
IF CardiacRiskFactor = 'Null' THEN Set CardiacRiskFactor = 0
IF PatientSex = 'Male' THEN Add 3 to CardiacRiskFactor
IF PatientAge >55 THEN Add 2 to CardiacRiskFactor
IF FamilyHeartHistory = 'True' THEN Add 5 to CardiacRiskFactor
IF CholesterolScore = 'Problematic' THEN Add 4 to CardiacRiskFactor
IF BloodPressure = 'Problematic' THEN Add 3 to CardiacRiskFactor
IF CardiacRiskFactor = 'Male' THEN Add 3 to CardiacRiskFactor
IF PatientSex = 'Male' THEN Add 3 to CardiacRiskFactor
IF CardiacRiskFactor >15 THEN Set EchoCardiogramTest = 'Schedule'
```

Other rules here...

Expert Systems Shells

- Program that process the rules
- Process IF side of rules until no value returned
- Reports values of all variables

Expert Systems Drawbacks

- Difficult and expensive to develop
 - Labor intensive
 - Ties up domain experts
- Difficult to maintain
 - Changes cause unpredictable outcomes
- Didn't live up to expectations
 - Can't duplicate diagnostic abilities of humans
 - Constantly needing expensive changes to programs to reflect new knowledge

Example: Expert System for Pharmacies

- MYCIN developed in early 1970's
 - To diagnose certain infectious diseases
 - Never routinely used
 - Basis for many other medical systems

**Example:
Expert System for Pharmacies**

- Dosechecker
 - Verifies appropriate dosages
- PharmADE
 - Ensures patients are not prescribed drugs that have harmful effects
- Both used when prescriptions ordered
- An alert is issued as necessary
- Pharmacist screen the alert and passes it to the Doctor if required.

**Pharmacy Clinical Decision Support
Version 2.0**

Developed by The Division of Medical Informatics at Washington University School of Medicine
for the Department of Pharmacy at Barnes Jewish Hospital.

Data as of: Mar 10 2000 4:40 AM Alert #: 13104 Satellite: CHNE

Patient Name	Registration	Age	Sex	Weight(kg)	Height(in)	IBW(kg)	Location
SAMPLE,PATIENT	9999999	22	F	114	0	0	528

Creatinine Clearance Lab Results (last 3):

Collection Date	Serum Creatinine	Creatinine Clearance
Mar 9 2000 9:55 PM	7.1	14

DoseChecker Recommendations and Thoughts:

Order	Start Date	Drug Name	Route	Dose	Frequency
295	Mar 10 2000 12:00 AM	MEPERIDINE INJ 25MG	IV	25 MG	Q4H
Recommended Dose/Frequency:				0.0 MG	PER DAY

Comments: 0 <= CrCl < 20. Meperidine should not be used for more than 48 hours or at doses > 600 mg per day in patients with renal or CNS disease. Serious consideration should be given to using an alternative analgesic in this patient population.

BI & Competitive Advantage

- Data mining techniques should be incorporated into complete information systems
- Understand the difference between the tool and the complete system:
 - Data mining tool creates equation to compute the probability that a customer will default on a loan, while the system, uses the equation for bankers to approve or reject a loan.

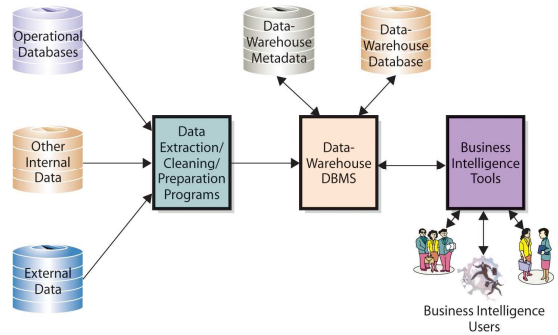
RFM Analysis

- Way of analyzing and ranking customers according to their purchasing patterns
- A simple technique that considers
 - How recently (**R**) a customer has ordered
 - How frequently (**F**) a customer orders
 - How much money (**M**) the customer spends per order

Data Warehouse

- Extracts & cleans data from operational systems
- Prepares data for BI processing
- Data-warehouse DBMS
 - Stores data
 - May also include data from external sources
 - Metadata concerning data stored in data-warehouse meta database
 - Extracts and provides data to BI tools

Data Warehouse Components



Data Mart

- Data collection
 - Created to address particular needs
 - Business function
 - Problem
 - Opportunity
 - Smaller than data warehouse
 - Users may not have data management expertise
 - Knowledgeable analysts for specific functions

Data Mart Example

