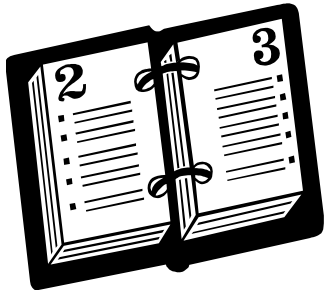
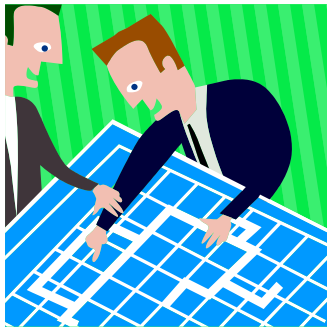
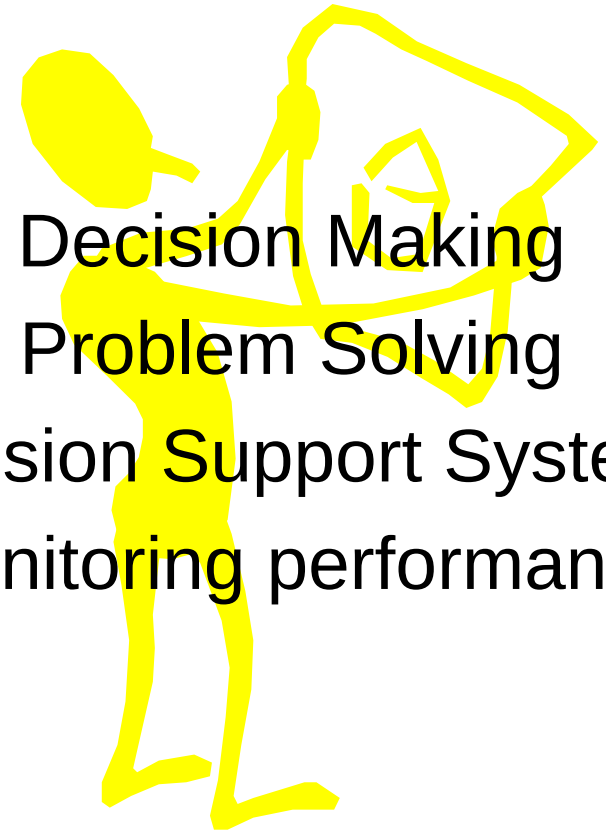
THE UNIVERSITY OF SYDNEY

INFO5990 Professional Practice in IT

Lecture 12A







Decision Making

Problem Solving

Decision Support Systems

Monitoring performance

Group assignment

- 22 marked
- 5HD
- 3D
- 12 Credit
- 2 Credit (had to try hard to get there)
- 3 not yet marked – wonder why ??

Next week

- Guest Lecture Roberto Donat
  - Executive Manager - Westpac
    - IT Management in the real world
- Review of the course
- Exam tips – let your friends who do not come to class know !

By the end of this lecture you will be able to:

- Understand the information cycle
- Describe the classic phases of problem solving and decision making
- Appreciate the characteristics of structured and unstructured decisions
- Explain the nature and purpose of metrics and key performance indicators for performance monitoring
- Understand the concept of a dashboard

Data & information

Representing the real world

Data representation of the real world

BMJ 67R
Maserati
200 km/hour
Tiger, female, 150 kg
Chen Xian, 25 yrs
15 West St
Latitude 44.5 S
Longitude 135.4 E
Sunny, 34 Cº

The real world

Data representation

The information cycle

The real world

Observed facts

Knowledge state

Encoding

Assimilation

Analog data

Output

Data representation

Report

Keeping in step

The real world

Data representation

Events

42 East St
$340,000
R J Jones
20 Sep 2012
…
…

Transactions

Changed world

New data representation

Is the new data representation correct?

Problem solving

A systems view

Case Study – the Pedestrian accident workshop

Problem Solving

- A problem occurs when a system
  - does not meet its established goals
  - does not yield the predicted results, or
  - does not work as planned
- To 'solve the problem' means 'to reduce the difference between the desired outcome and the actual outcome'
- Problem solving also includes the identification of new opportunities

Steps in problem solving

1. Define problem
2. Gather intelligence
   - This involves collecting information about the system
   - It may involve constructing a model of the system, which could be concrete or mathematical
3. Consider possible solutions to the problem and evaluate them
4. Choose preferred solution (can depend on objectives)
5. Implement the solution
6. Monitor success or otherwise of chosen solution

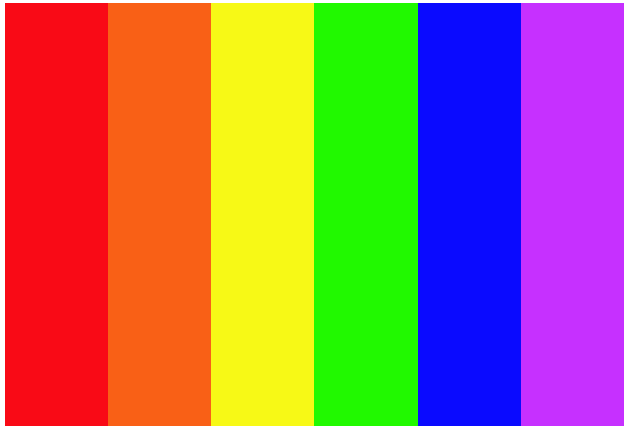
Satisficing

- A ‘good enough’ solution
  - Decision maker is satisfied with a reasonable level of performance as opposed to the “best” possible
  - May be sub-optimal but can be arrived at much more quickly
  - Simon’s idea of ‘bounded rationality’

Spectrum of problems

STRUCTURED

- Well-defined
- All relevant data known
- Encountered before
- Involving only one or a few people
- Involving one or two disciplines
- Standard models exist



SEMI-STRUCTURED

- Partially-defined
- Some relevant data known
- Similar problems met
- Can be decomposed
- Standard models exist for some parts

UNSTRUCTURED

- Ill-defined
- Not all data known
- Never encountered before
- Involving several stakeholders
- Involving many disciplines
- No known models

Question 1

A problem occurs in a system or organisation when the system

(A) does not meet its established goals
(B) does not yield the predicted results
(C) does not work as planned
(D) ceases to function
(E) ANY of the above

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Score / 6
A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	

Question 2

Which of the following best describes the process of problem solving?

(A) Finding someone to blame
(B) Identifying the cause of disruptions
(C) Choosing the best option for each action
(D) Overcoming discrepancies between actual and desired outcomes
(E) Being satisfied with a reasonable level of performance as opposed to the “best”

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Score / 6
A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	

Management Decision Making
and
Management Science

Management

- Management is a process by which organizational goals are achieved by strategic use of available resources
  - Inputs: resources – labour and materials
  - Output: attainment of goals
  - Measure of success: outputs – inputs
- Managers have to decide on best course of action in order to solve problems
- This involves making a decision

so,
Management consists largely of Decision Making

Management science is a discipline through which managers can improve their decision making by exploiting computer methods and techniques.

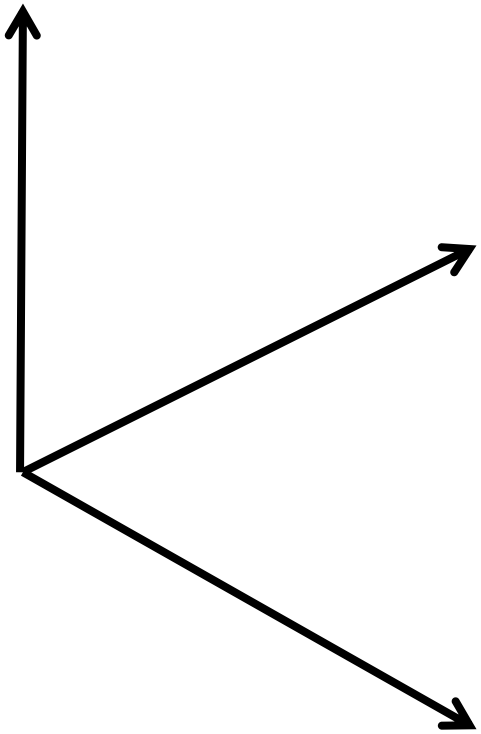
Decision making is not getting any easier

- **More alternatives from which to choose**
  - globalization, advanced information systems, internet, search engines, rapidly changing technology, business intelligence
- **Uncertainty makes it more difficult to predict**
  - political instability, global crisis, terrorism, changes to government regulations, increased competition, changing consumer demands
- **Greater need to make decisions rapidly**
  - the faster decisions are made, the greater the chance of error
  - but potential cost of making mistakes is high
  - ‘trial-and-error’ learning too difficult and too costly

Dimensions of decision making

Rational

Quantitative
Logical
Mathematical
Optimising



Organisational

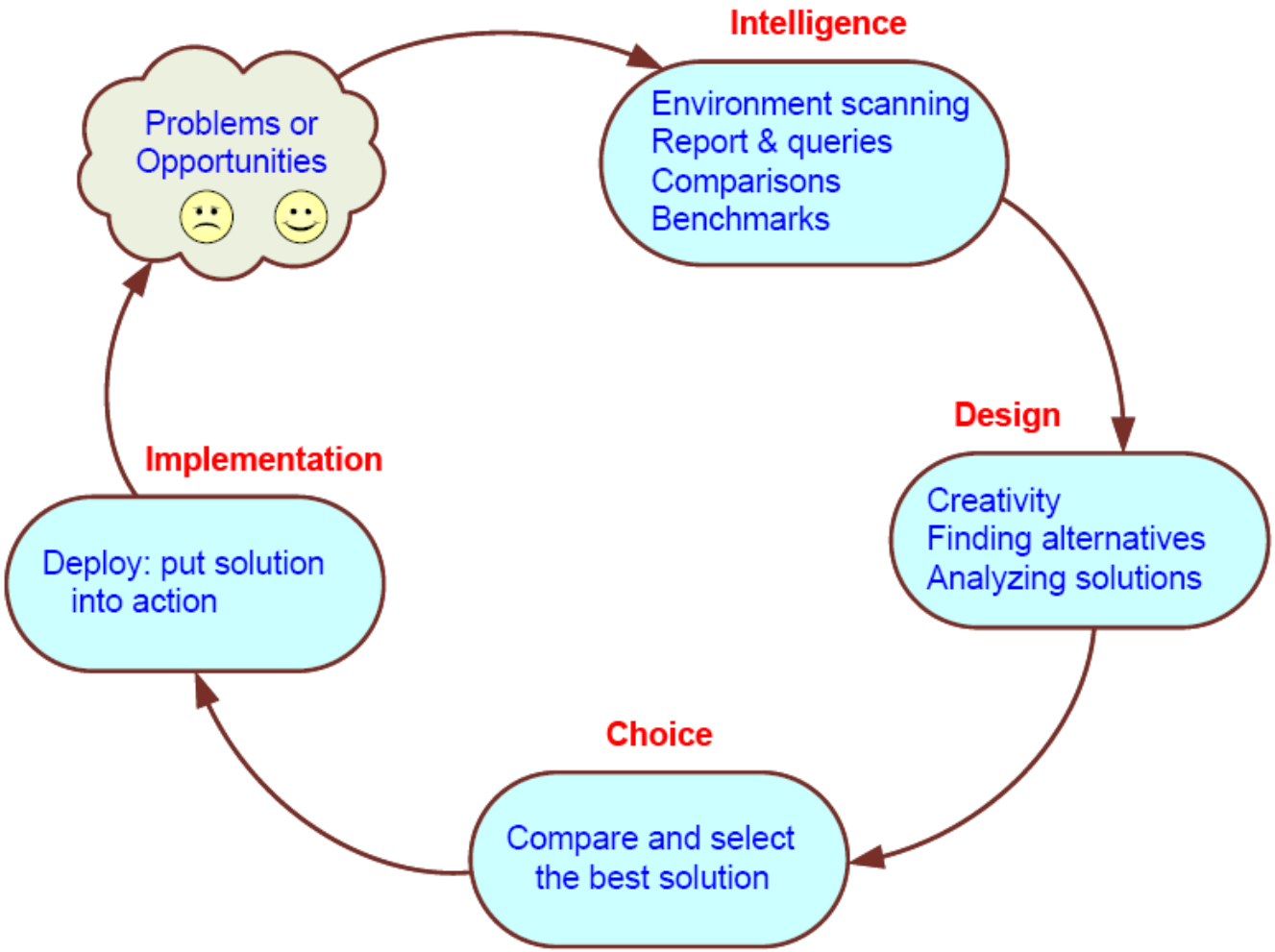
Policy
Rules
Peer pressure
Corp. image

Political

Politicians
Public opinion
Unions
Legal

The rational decision making cycle

(Simon, 1977)



Decision making v. problem solving

- Decision making and problem solving follow essentially the same steps
- So, problem solving, decision making and management are essentially the same thing

Structured v. Unstructured Decisions

- Structured decisions may be automated
  - e.g. place an order when stock level reaches reorder level, with reorder quantity based on three month moving average
- Unstructured/semi-structured problems often require customized solutions
  - may need to be subdivided and reorganized
  - may be partially supported by computerized quantitative methods
  - may involve intuition and judgment

Range of decision types

(Gory and Scott-Morten, 1971)

	Type of Control		
Type of Decision	**Operational Control**	**Managerial Control**	**Strategic Planning**
Structured	1 Accounts receivable Accounts payable Order entry	2 Budget analysis Short-term forecasting Personnel reports Make-or-buy	3 Financial management Investment portfolio Warehouse location Distribution systems
Semistructured	4 Production scheduling Inventory control	5 Credit evaluation Budget preparation Plant layout Project scheduling Reward system design Inventory categorization	6 Building a new plant Mergers & acquisitions New product planning Compensation planning Quality assurance HR policies Inventory planning
Unstructured	7 Buying software Approving loans Operating a help desk Selecting a cover for a magazine	8 Negotiating Recruiting an executive Buying hardware Lobbying	9 R & D planning New tech. development Social responsibility planning

Decision Support Systems

- An interactive computer-based system, which helps decision makers utilize data and models to solve unstructured problems

Gorry and Scott-Morton, 1971

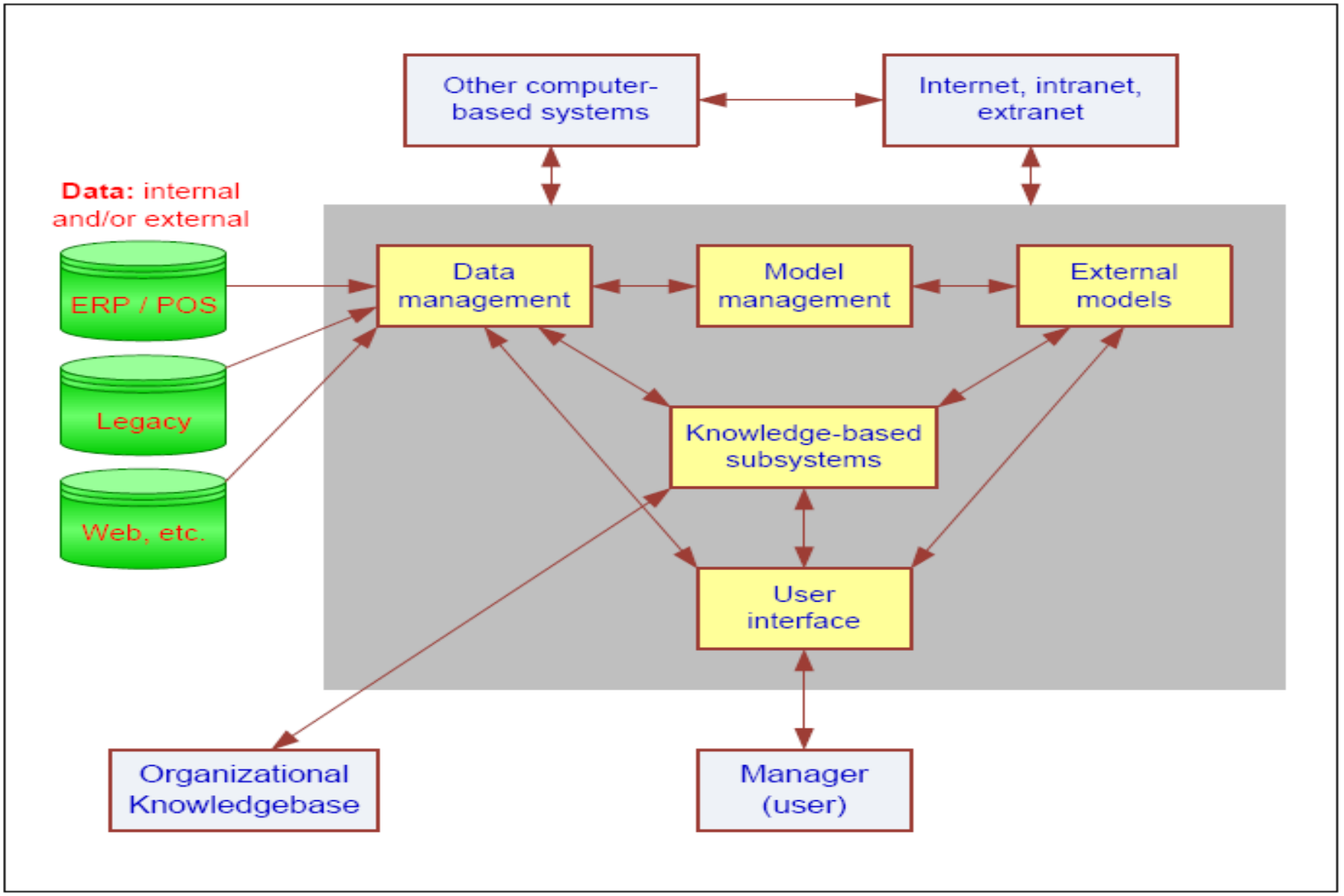
- A computer-based support system for management decision makers who deal with semi-structured problems

i.e. facilitates the Application of Management Science

A DSS couples the intellectual resources of individuals with the capabilities of the computer to improve the quality of decision making

Keen and Scott-Morton, 1978

Components of classical DSS



Question 3

Which of the following is NOT always a step in decision making?

(A) Define the problem
(B) Gather intelligence
(C) Consider possible solutions
(D) Choose optimal solution
(E) Implement decision

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Score / 6
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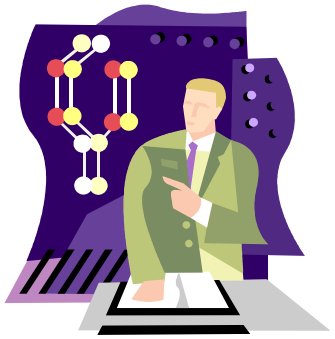
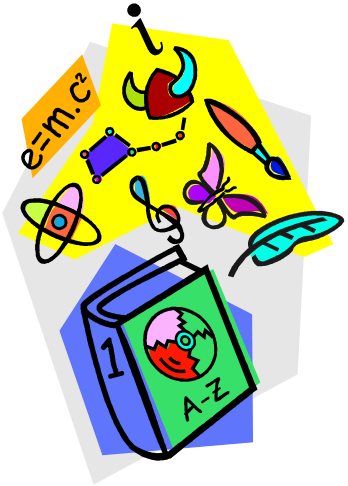
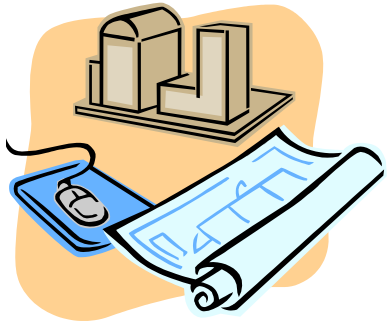
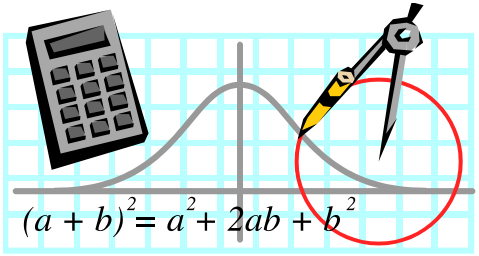
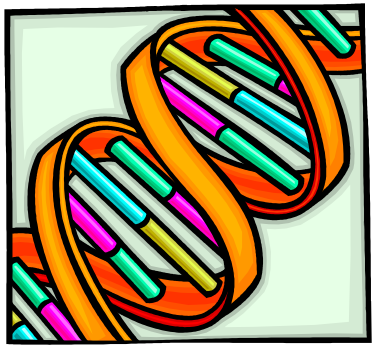


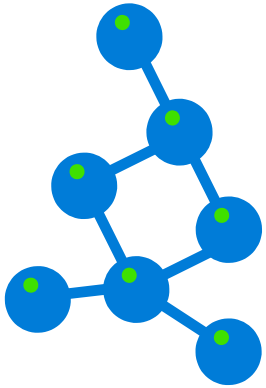


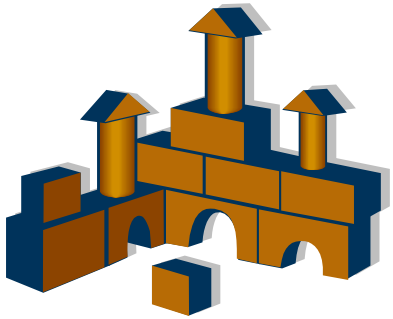


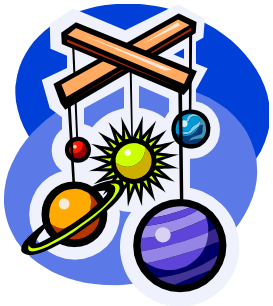


Modelling reality









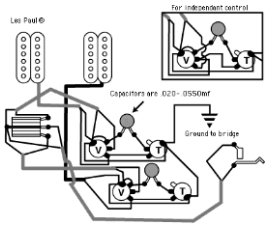
Modeling reality

- The real world is too complex to describe, but, much of the complexity may be irrelevant to solving a specific problem

- A model is a representation of reality incorporating some essential aspects of an object or event

Classification of Models

- Physical
  - Iconic: scale models, test dummies
  - Schematic: maps, diagrams
- Symbolic
  - verbal description,
  - financial statement,
  - specification
- Mathematical
  - equation or formula
  - representing problem space at various degrees of abstraction



$$s = ut + \tfrac{1}{2}at^2$$

Benefits of Mathematical Models

- Easy to manipulate
- Facilitate compression of time
- Permit evaluation of many alternatives, “what-if” analysis, goal seeking
- Cheaper than building scale models
- No cost for making mistakes in experiments
- Also possible to build in risk and uncertainty (stochastic models)

Classical mathematical models

Optimization models

- Linear programming
  - Constraints define a feasible solution space
  - Objective function defines the object of the optimization
  - Allows sensitivity analysis
  - Very useful in ‘product mix’ problems

Example: Manufacturing Company

	Tractors	Cars	Limited number of Hours Available
Profit Contribution	$7 ‘000	$5 ‘000	
Finishing	3 hrs	4 hrs	2400
Testing	2 hrs	1 hr	1000

Other constraints:

- Orders for at least 100 tractors
- Materials for no more than 450 cars

‘What if’ analysis

- Input parameters of the model varied to see what is the resultant output
- Easy to test a wide range of possible inputs
- Demo: ‘Research Portfolio’ example in Supplementary material for week 12

‘What if’ analysis (1)

RESEARCH PROJECT PORTFOLIO

Running Expenses Ratio	10%				
Total Budget	$1,200,000				
		Personnel Requirements			
	Salary $	Algae	Ragweed	Trout	Platypus
Chief Scientist	90,000	1	1	1	1
Research Scientist	75,000	2	1	1	2
Trainee Scientist	38,000	3	2	0	1
Technician	23,000	2	6	4	4
Total Salaries		400,000	379,000	257,000	370,000
Running Expenses		40,000	37,900	25,700	37,000
Total Cost		440,000	416,900	282,700	407,000
Vote Equivalent (VE)		73,000	66,000	31,000	37,000
Chosen/Not Chosen		1	1	1	1
Portfolio Total Cost	1,546,600				
Portfolio Vote Equivalent	207,000				
Within Budget (Y/N)?	Over budget				

‘What if’ analysis (2)

RESEARCH PROJECT PORTFOLIO

Running Expenses Ratio	10%				
Total Budget	$1,200,000				
		Personnel Requirements			
	Salary $	Algae	Ragweed	Trout	Platypus
Chief Scientist	90,000	1	1	1	1
Research Scientist	75,000	2	1	1	2
Trainee Scientist	38,000	3	2	0	1
Technician	23,000	2	6	4	4
Total Salaries		400,000	379,000	257,000	370,000
Running Expenses		40,000	37,900	25,700	37,000
Total Cost		440,000	416,900	282,700	407,000
Vote Equivalent (VE)		73,000	66,000	31,000	37,000
Chosen/Not Chosen		0	1	1	1
Portfolio Total Cost	1,106,600				
Portfolio Vote Equivalent	134,000				
Within Budget (Y/N)?	OK				

Goal seeking

- Given the desired value of the output, find out what value of input is required
- Example: If I do not want to have to repay any more than $900 a month on a loan of $100,000, what interest rate do I require?
- Excel function PMT gives payments on a given loan based on equal payments
  = PMT (rate, number of periods, $ loan)

Warning

Should you trust Mathematical Models?

- Users begin to ‘believe’ in their model
- Results are only as good as the model
- Essential aspects of reality may be inadvertently omitted
- Relationships between variables may not be ‘true to life’
- Benefits are not real $ until the plan is implemented and profit is realised

Question 4

An optimization model is one which

(A) allows ‘what if’ analysis
(B) facilitates goal seeking

(C) has an objective function that defines the object of the optimization
(D) uses a ‘rule of thumb’ to find an optimal solution
(E) BOTH (A) and (B)

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Score / 6
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Question 5

In problem solving, a ‘heuristic’ is an approach which

(A) uses a ‘rule of thumb’ to find an initial feasible solution
(B) can work where all other approaches fail
(C) is an example of ‘what if’ analysis
(D) is an example of a goal seeking function
(E) BOTH (A) and (B)

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Score / 6
A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	

More about monitoring organisation performance

Metrics and

key performance indicators

“If you don’t measure it, you can’t manage it!”

W. Edwards Deming

"Seven Deadly Diseases" facing management:

1. Lack of constancy of purpose
2. Emphasis on short-term profits
3. Evaluation by performance, merit rating, or annual review of performance
4. Mobility of management
5. Running a company on visible figures alone
6. Excessive medical costs
7. Excessive costs of warranty, fueled by lawyers who work for contingency fees

Types of metrics

- Financial metrics
  - sales, profit, return on investment
- Quantitative metrics
  - earned value, planning hours as a percentage of total labour
- Qualitative metrics
  - improved efficiency, employee morale, client satisfaction
- Directional metrics
  - trends: showing whether getting better or worse
- End result or success metrics
  - number of clients seen, products finished
- Actionable metrics
  - number of unstaffed hours, positions unfilled
- Milestone metrics
  - work packages completed by June, safety record this year

Key performance indicators

- A KPI is a metric that is tied to a target
- KPIs provide information on controllable factors appropriate for informed decision-making
- KPIs should be
  - Relevant: relate to some important aspect of business
  - Indicative: reflect success or failure of business
  - Measurable: can be expressed quantitatively
  - Predictive: able to predict the future of a particular trend
  - Understood: known relationship to performance

Choose the best KPI for you

- cost or schedule performance index (CPI or SPI)
- customer satisfaction,
- employee satisfaction,
- value of new business,
- net profit before tax,
- return on investment,
- comparison of this period with last period
- net cash flow,
- expenses as a ratio to revenue,
- health and safety record,
- manufacturing capacity and operational efficiency

Difficulties encountered with KPIs

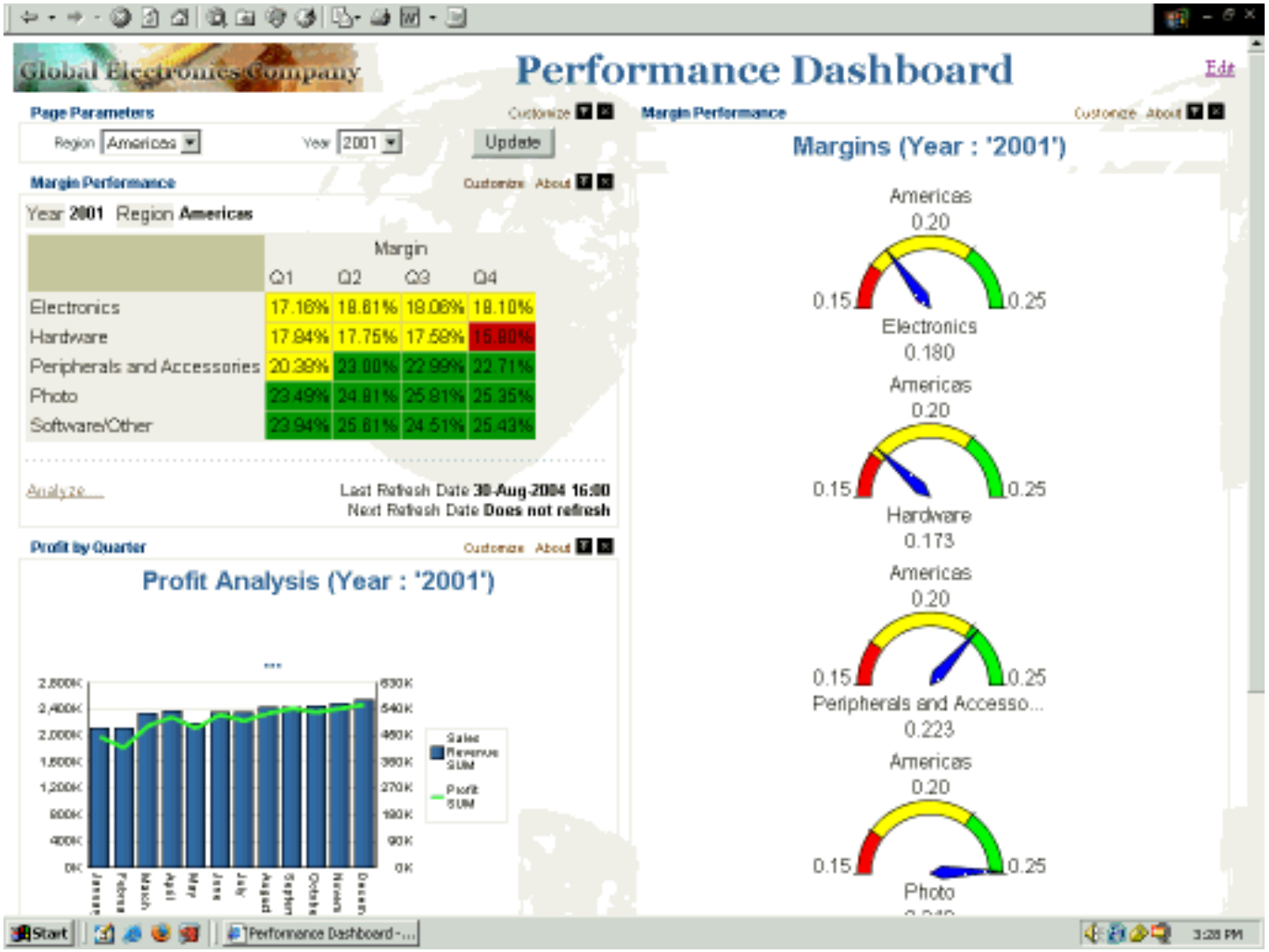
- Lack of agreement among stakeholders
- Not understood by stakeholders
- Not trusted by stakeholders
- Can effect team behaviour
- Team members believe that they are being spied on by management

The Balanced Scorecard (1992)

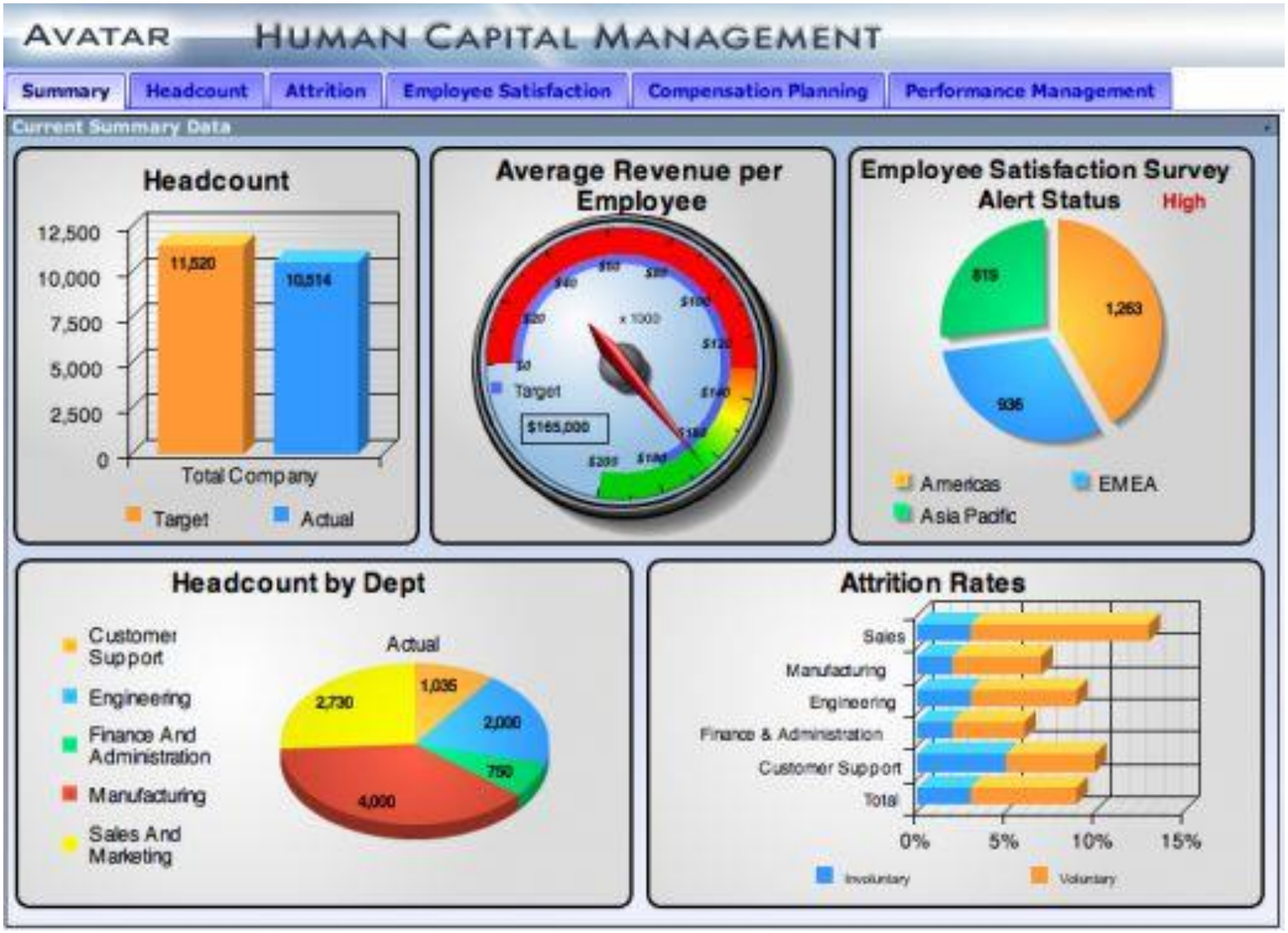
- "A set of measures that gives top management a fast but comprehensive view of the business."
- Complements the usual financial measures with various operational measures that are the drivers of future financial performance:
  - customer satisfaction, internal processes, market success, innovation and improvement activities
- "Think of the balanced scorecard as the dials and indicators in an airplane cockpit."

Kaplan, R.S., and D.P. Norton, 1992 The Balanced Scorecard: Measures that drive performance, Harvard Business Review (January-February): 71-79

The dashboard (2012)



Another example of a dashboard



Dashboard

"An easy to read, often single page, real-time user interface, showing a graphical presentation of the current status (snapshot) and historical trends of an organization's Key Performance Indicators (KPIs) to enable instantaneous and informed decisions to be made at a glance."

Peter McFadden CEO of ExcelDashboardWidgets , "What is Dashboard Reporting"

- http://www.schacterconsulting.com/documents/dashboard.pdf
- http://en.wikipedia.org/wiki/Dashboard_(management_information_systems)

Question 6

Write down your score

A ‘dashboard’ in a Decision Support System is best described as

(A) an optimization model of the organization
(B) a graphical presentation of the current status of an organisation
(C) a display of a key performance indicators
(D) a display of ‘what if’ analysis results
(E) a mechanism for improving management performance

Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Score / 6
A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	A B C D E	

Benefits of dashboards

- Facilitate recognition of problems before they lead to other problems
- Offer opportunity for early corrective action
- Help avoid
  - escalating costs
  - deteriorating value of benefits
  - missed deadlines
  - schedule slippages that cannot be corrected