Lectures Notes in Decision Support Systems (DSS)

Lecture (10)

Submitted By

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CHAPTER (4)

Decision Making Techniques

(Tools)

Ch 4. Decision Making Techniques (Tools)

OUTLINE (Part Two)

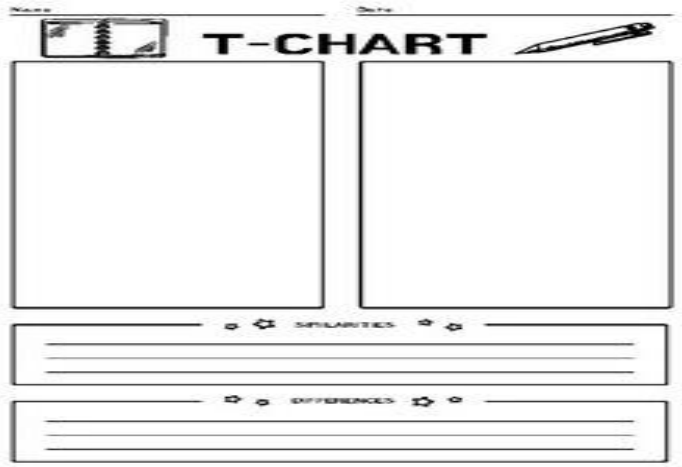
- Introduction.
- Top Decision-Making Tools for Business.

1. SWOT DIAGRAM.
2. DECISION MAKING DIAGRAM.
3. DECISION MATRIX.
4. PARETO ANALYSIS.
5. CAUSE AND EFFECT OR ISHIKAWA DIAGRAM.
6. FORCE FIELD ANALYSIS.
7. STRATEGY MAP.
8. BREAK-EVEN ANALYSIS.
9. PUGH MATRIX.
10. RATIO ANALYSIS.
11. T-CHARTS.
12. GRID ANALSIS.
13. DECISION TREE.
14. DELPHI TECHNIQUE.
15. PEST ANALYSIS.

4.2 Top Decision-Making Tools for Business

11) T-CHARTS:

T-Charts are a type of **chart**, a **graphic organizer** in which a student **lists** and **examines** two facets of a topic, like the **pros** and **cons** associated with it, its **advantages** and **disadvantages**, **facts** vs. **opinions**, etc.



Headings:

- Pros and Cons,
- Character and Traits,
- Before and After,
- Cause and Effect,
- Concept and Example,
- Word and Definition,
- Hypothetical Situations and,
- Potential Outcomes.

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For example, a student can use a **T-chart** to help graphically organize thoughts about:

- **Making** a decision by comparing resulting advantages and disadvantages (like **taking a new job**).
- **Evaluating** the pros and cons of a topic (for example, **adopting a new invention**).
- **Listing** facts **vs.** opinions of a theme (great to use after reading a **selection of text** or a **news article**).
- **Explaining** the strengths and weaknesses of a piece of writing (useful after reading a piece of **persuasive** or **expository** writing).
- **Listing** any **two characteristics** of a topic (like the main **ideas** for a **given topic** and a **salient detail** for each idea).

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AN EXAMPLE USING A T-CHART

Given the **equation** $y = 2x + 3$ we can use the **T-chart** to organize our information. Let's say we **randomly** select 0, 1, 2, -1, -2 and 3 as the values for **x**. We'll write those numbers in the left side of our T-chart, and then one at a time, plug them into our equation. This will allow us to solve for **y**, and we'll write our resulting **y** values in the right side of the chart, so it looks like this:

X	Y	
0	3	Because y = 2(0)+3 = 3
1	5	Because y = 2(1) + 3 = 2 + 3 = 5
2	7	Because y = 2(2)+3 = 4+3 = 7
-1	1	Because y = 2(-1) + 3 = -2 + 3 = 1
-2	-1	Because y = 2(-2) + 3 = -4 + 3 = -1
3	9	Because y = 2(3) + 3 = 6 + 3 = 9

4.2 Top Decision-Making Tools for Business

12) GRID ANALYSIS:

Grid Analysis is a **useful technique** to use for **making a decision**. It is **most effective** where you have **many good alternatives** and **many factors** to consider.

- **The first step** is to **list your options and then the factors that are important for making the decision**. Lay these out in a **table**, with **Options** as **the row labels**, and **Factors** as **the column headings**.
- **Next work out** the **relative importance of the factors in your decision**.

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- **The next step**, scoring each option for each of the important factors in your decision. Score each option from 0 (poor) to 3 (very good).
- **Now** multiply each of your scores by the values for your relative importance. This will give them the **correct overall weight in your decision**.
- **Finally**, add up these weighted scores for your options. The option that scores **the highest wins**!

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AN EXAMPLE USING A GRID ANALYSIS:

A windsurfing enthusiast is about to replace his car. He needs one that not only carries a board and sails, but also that will be good for business travel. He has always loved open-topped sports cars. No car he can find is good for all three things.

His Options are:

- A four-wheel drive, hard topped vehicle.
- A comfortable 'family car'.
- An estate car.
- A sports car.

Criteria that he wants to consider are:

- Cost.
- Ability to carry a sail board at normal driving speed.
- Ability to store sails and equipment securely.
- Comfort over long distances.
- Fun!
- Nice look and build quality to car.

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AN EXAMPLE USING A GRID ANALYSIS:

Firstly, he **draws up the table** shown in the following figure, and **scores each option** by how well it **satisfies each factor**:

Factors:	Cost	Board	Storage	Comfort	Fun	Look
Weights:	4	5	1	2	3	4
Sports Car	1	0	0	1	3	3
4WD	0	3	2	2	1	1
Family Car	2	2	1	3	0	0
Estate Car	2	3	3	3	0	1

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AN EXAMPLE USING A GRID ANALYSIS:

Next, he decides the **relative weights for each of the factors**. He **multiplies** these by the **scores already entered** and **totals** them. This is shown in the following figure:

Factors:	Cost	Board	Storage	Comfort	Fun	Look	Total
Weights:	4	5	1	2	3	4	
Sports Car	4	0	0	2	9	12	27
4WD	0	15	2	4	3	4	28
Family Car	8	10	1	6	0	0	25
Estate Car	8	15	3	6	0	4	36

This gives an interesting result – despite its **lack of fun**, an Estate Car may be the best choice.

4.2 Top Decision-Making Tools for Business

13) DECISION TREE:

A **Decision Tree** is a **decision support tool** that uses a **tree** like **graph** or **model** of decisions and their **possible consequences**, including **chance event outcomes**, **resource costs**, and **utility**. It is one way to display an **algorithm** that only contains **conditional control statements**.

Decision trees are commonly used in **Operations Research**, specifically in **Decision Analysis**, to **help Identify a Strategy** most likely to **reach a goal but** are also a **popular tool in Machine Learning**.

4.2 Top Decision-Making Tools for Business

Decision Trees are tools that **help** choose between several courses of action **or** alternatives. They are:

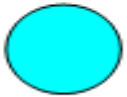
- Represented as **tree-shaped diagram** used to determine a course of action or show a statistical probability.
- **Each branch** of the **decision tree** represents a possible decision or occurrence.
- The **tree structure** **shows** how one choice leads to the next, and the use of branches indicates that each option is mutually exclusive.
- A **decision tree** can be used by a **manager** to graphically represent which actions could be taken and how these actions relate to future events.

4.2 Top Decision-Making Tools for Business

A decision tree consists of three types of nodes:

1. Decision nodes – typically represented by squares.
2. Chance nodes – typically represented by circles.
3. End nodes – typically represented by triangles.

Notation Used in Decision Trees

Box		is used to show a **choice** that the **manager must make**. (Decision Node).
Circle		is used to show that a **probability outcome will occur**. (Chance Node).
Lines		**connect outcomes to their choice** or **probability outcome**.

4.2 Top Decision-Making Tools for Business

AN EXAMPLE USING A DECISION TREE

Your **company** is considering whether it should tender for two contracts (**MS1** and **MS2**) on offer from a **government department** for the **supply of certain components**. The company has three options:

- tender for **MS-1 only**; or
- tender for **MS-2 only**; or
- tender for **both** MS-1 **and** MS-2.

4.2 Top Decision-Making Tools for Business

If tenders are to be submitted the Company will incur additional costs. These costs will have to be entirely recouped from the contract price. The risk, of course, is that if a tender is unsuccessful the company will have made a loss.

- The cost of tendering for contract MS-1 only is £50,000. The component supply cost if the tender is successful would be £18,000.
- The cost of tendering for contract MS-2 only is £14,000. The component supply cost if the tender is successful would be £12,000.
- The cost of tendering for both contract MS-1 and contract MS-2 is £55,000. The component supply cost if the tender is successful would be £24,000.

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For each contract, possible tender prices have been **determined**. **In addition**, subjective assessments have been made of the probability of getting the contract with a particular tender price as shown below.

Option	Possible tender prices (£)	Probability of getting contract
MS-1 only	130,000	0.20
	115,000	0.85
MS-2 only	70,000	0.15
	65,000	0.80
	60,000	0.95
MS-1 and MS-2	190,000	0.05
	140,000	0.65

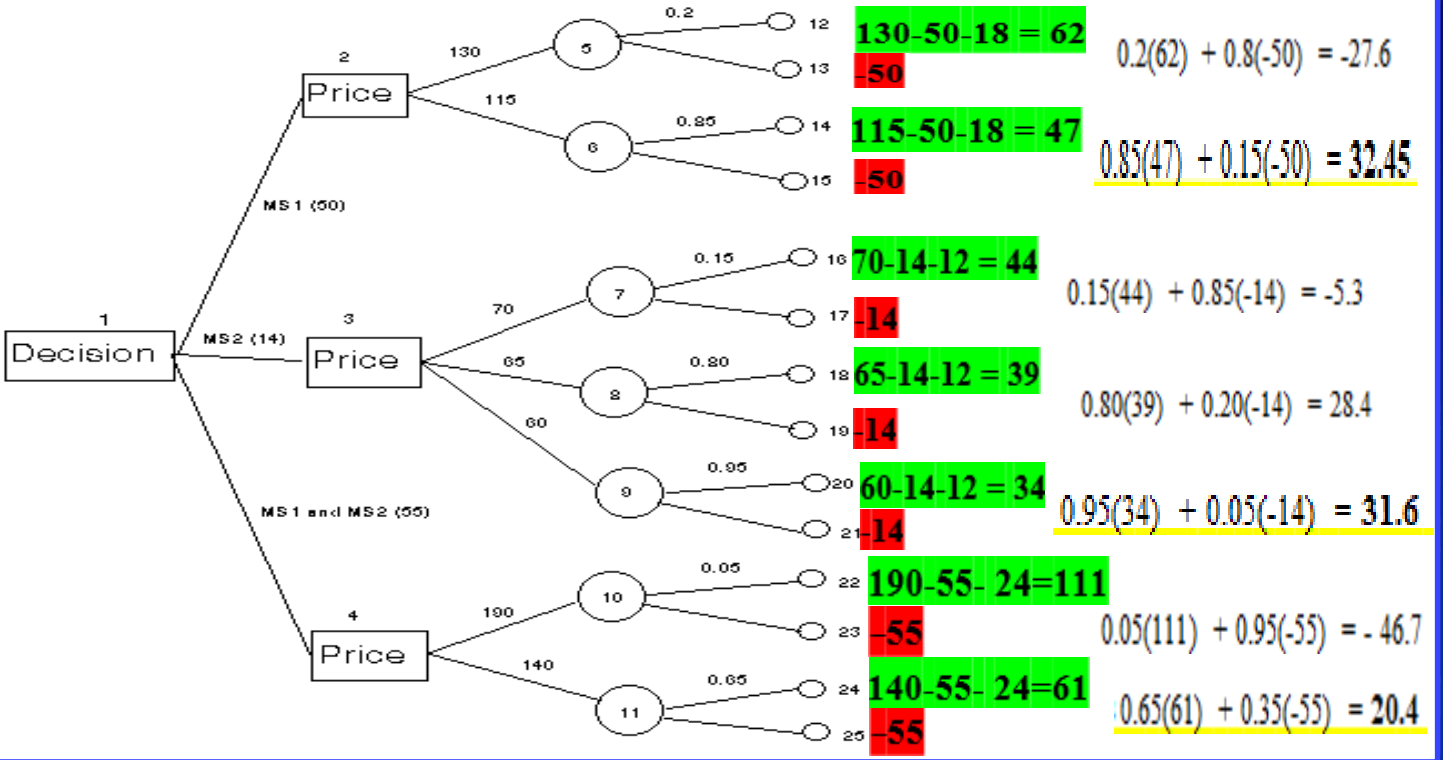
4.2 Top Decision-Making Tools for Business

Draw the Decision Tree and Find out the most appropriate option should be taken?

Option	Cost of tendering	Component supply cost	Possible tender prices (£)	Probability of getting contract
MS-1 only	50,000	18,000	130,000	0.20
			115,000	0.85
MS-2 only	14,000	12,000	70,000	0.15
			65,000	0.80
			60,000	0.95
MS-1 and MS-2	55,000	24,000	190,000	0.05
			140,000	0.65

4.2 Top Decision-Making Tools for Business

The Decision Tree for the problem is shown below:



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Below we carry out **step 1** of the decision tree solution procedure which (for this example) involves working out the total profit for each of the paths from the initial node to the terminal node (all figures in £'000).

Terminal node	Total profit £'000
12	62
13	-50
14	47
15	-50
16	44
17	-14
18	39
19	-14
20	34
21	-14
22	111
23	-55
24	61
25	-55

4.2 Top Decision-Making Tools for Business

STEP 1:

- path to terminal node 12, we tender for MS-1 only (cost 50), at a price of 130, and win the contract, so incurring component supply costs of 18, total profit **130-50-18 = 62**
- path to terminal node 13, we tender for MS-1 only (cost 50), at a price of 130, and lose the contract, total profit **-50**
- path to terminal node 14, we tender for MS-1 only (cost 50), at a price of 115, and win the contract, so incurring component supply costs of 18, total profit **115-50-18 = 47**
- path to terminal node 15, we tender for MS-1 only (cost 50), at a price of 115, and lose the contract, total profit **-50**

4.2 Top Decision-Making Tools for Business

- path to terminal node 16, we tender for MS-2 only (cost 14), at a price of 70, and win the contract, so incurring component supply costs of 12, total profit **70-14-12 = 44**
- path to terminal node 17, we tender for MS-2 only (cost 14), at a price of 70, and lose the contract, total profit **-14**
- path to terminal node 18, we tender for MS-2 only (cost 14), at a price of 65, and win the contract, so incurring component supply costs of 12, total profit **65-14-12 = 39**
- path to terminal node 19, we tender for MS-2 only (cost 14), at a price of 65, and lose the contract, total profit **-14**
- path to terminal node 20, we tender for MS-2 only (cost 14), at a price of 60, and win the contract, so incurring component supply costs of 12, total profit **60-14-12 = 34**
- path to terminal node 21, we tender for MS-2 only (cost 14), at a price of 60, and lose the contract, total profit **-14**

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- path to terminal node 22, we tender for MS-1 and MS-2 (cost 55), at a price of 190, and win the contract, so incurring component supply costs of 24, total profit **190-55- 24=111**
- path to terminal node 23, we tender for MS-1 and MS-2 (cost 55), at a price of 190, and lose the contract, total profit **-55**
- path to terminal node 24, we tender for MS-1 and MS-2 (cost 55), at a price of 140, and win the contract, so incurring component supply costs of 24, total profit **140-55- 24=61**
- path to terminal node 25, we tender for MS-1 and MS-2 (cost 55), at a price of 140, and lose the contract, total profit **-55**

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STEP 2:

- For chance node 5 the EMV is 0.2(62) + 0.8(-50) = -27.6
- For chance node 6 the EMV is 0.85(47) + 0.15(-50) = **32.45**

Hence the best decision at decision node 2 is to tender at a price of 115 (EMV=32.45).

- For chance node 7 the EMV is 0.15(44) + 0.85(-14) = -5.3
- For chance node 8 the EMV is 0.80(39) + 0.20(-14) = 28.4
- For chance node 9 the EMV is 0.95(34) + 0.05(-14) = **31.6**

Hence the best decision at decision node 3 is to tender at a price of **60** **(EMV=31.6).**

- For chance node 10 the EMV is 0.05(111) + 0.95(-55) = - 46.7
- For chance node 11 the EMV is 0.65(61) + 0.35(-55) = **20.4**

Hence the best decision at decision node 4 is to tender at a price of 140 (EMV=20.4).

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Hence at decision node 1 have three alternatives:

- tender for MS1 only EMV=32.45 (The Best Decision).
- tender for MS2 only EMV=31.6
- tender for both MS1 and MS2 EMV = 20.4 (The Worst Decision).

Hence the best decision is to tender for MS1 only (at a price of 115) as it has the highest Expected Monetary Value of 32.45 (£'000).

The downside is a loss of 50 and the upside is a profit of 47.

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14) DELPHI TECHNIQUE:

Delphi Technique is a **method** used to **estimate the likelihood (probability) and outcome of future events**. It is **Unique** because –

- It is a **group process** using **written responses** to **a series of questionnaires** instead of **physically bringing individuals together to make a decision**.
- **Individuals** are **required to respond to a set of multiple questionnaires**, with each **subsequent questionnaire** built from **the information gathered in the previous one**.
- The **process ends** when the **group reaches a consensus**.
- The **responses** can be **kept anonymous if required**.

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Delphi Technique is an iterative process, and first aims to get a broad range of opinions from the group of experts. The results of the first round of questions, when summarized, provide the basis for the second round of questions. Results from the second round of questions feed into the third and final round. The aim is to clarify and expand on issues, identify areas of agreement or disagreement and begin to find consensus.

Step 1: Choose a Facilitator.

Step 2: Identify your Experts.

Step 3: Define the Problem.

Step 5: Round Two Questions.

Step 6: Round Three Questions.

Step 7: Act on your Findings.

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15) PEST ANALYSIS:

PEST Analysis (Political, Economic, Socio-Cultural and Technological) describes a framework of macro-environmental factors used in the environmental scanning component of Strategic Management.

4.2 Top Decision-Making Tools for Business

It is a strategic tool for **understanding market growth** or **decline, business position, potential** and **direction for operations**.

Two additional factors are also occasionally added to the analysis, **Environmental** and **Legal**, to make a broader **PESTEL analysis**, but these factors are not required to be separated into **individual categorical analysis** as they can **easily** be amalgamated **within** the other categories.

Ch 4. Decision Making Techniques (Tools)

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Exercise

Draw the Decision Tree and Find out the most appropriate option should be taken?

Option	Cost of tendering	Component supply cost	Possible tender prices (£)	Probability of getting contract
MS-1 only	80,000	25,000	140,000	0.35
			120,000	0.70
MS-2 only	40,000	15,000	85,000	0.20
			60,000	0.95
MS-1 and MS-2	110,000	35,000	180,000	0.05
			150,000	0.15

Thanks!

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