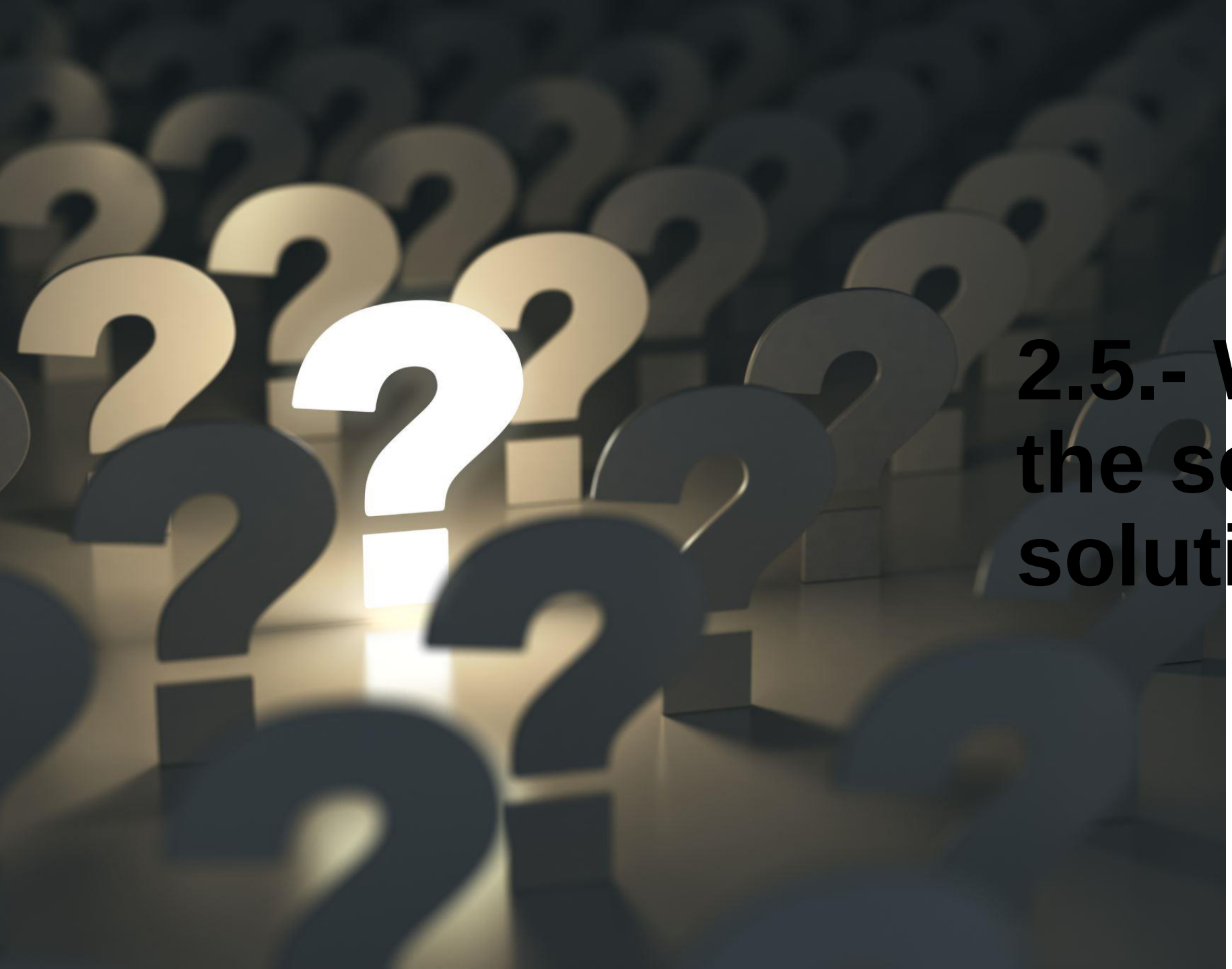
MODULE 3



2.5.- Widening the search for solutions

Concept Fans help you find new approaches to problem solving, when you have rejected all obvious solutions. Originated by Edward de Bono in his book Serious Creativity, they develop the principle of ‘taking one step back’ to get a broader perspective.(by using a concept map)

This is particularly useful when we are trying to think of new ideas and solutions to problems it is very tempting to stick with the very first ideas.

However, the first ideas might not always be the best. As the concept fan is a useful technique for widening the search for solutions when you have rejected all obvious approaches.

1.To start a Concept Fan, draw a circle on a large piece of paper, just right of center. Write the problem you are trying to solve it. To the right of it radiate lines representing possible solutions to the problem.
2.Use this as the starting point to radiate out new ideas.

3.- If this does not give you the idea you are looking for then repeat the process by redefining the problem more broadly. Write this broader definition in a circle to the left of the first one.

Draw an arrow from the initial problem definition to the new one to show the linkage between the problems. Then radiate possible solutions from this broader definition.

4.-Keep on expanding and redefining the problem until you have a useful solution.

How to use the tool: This is shown in Figure 1: the problem is clean up the water at local beach.

FIRST STEP

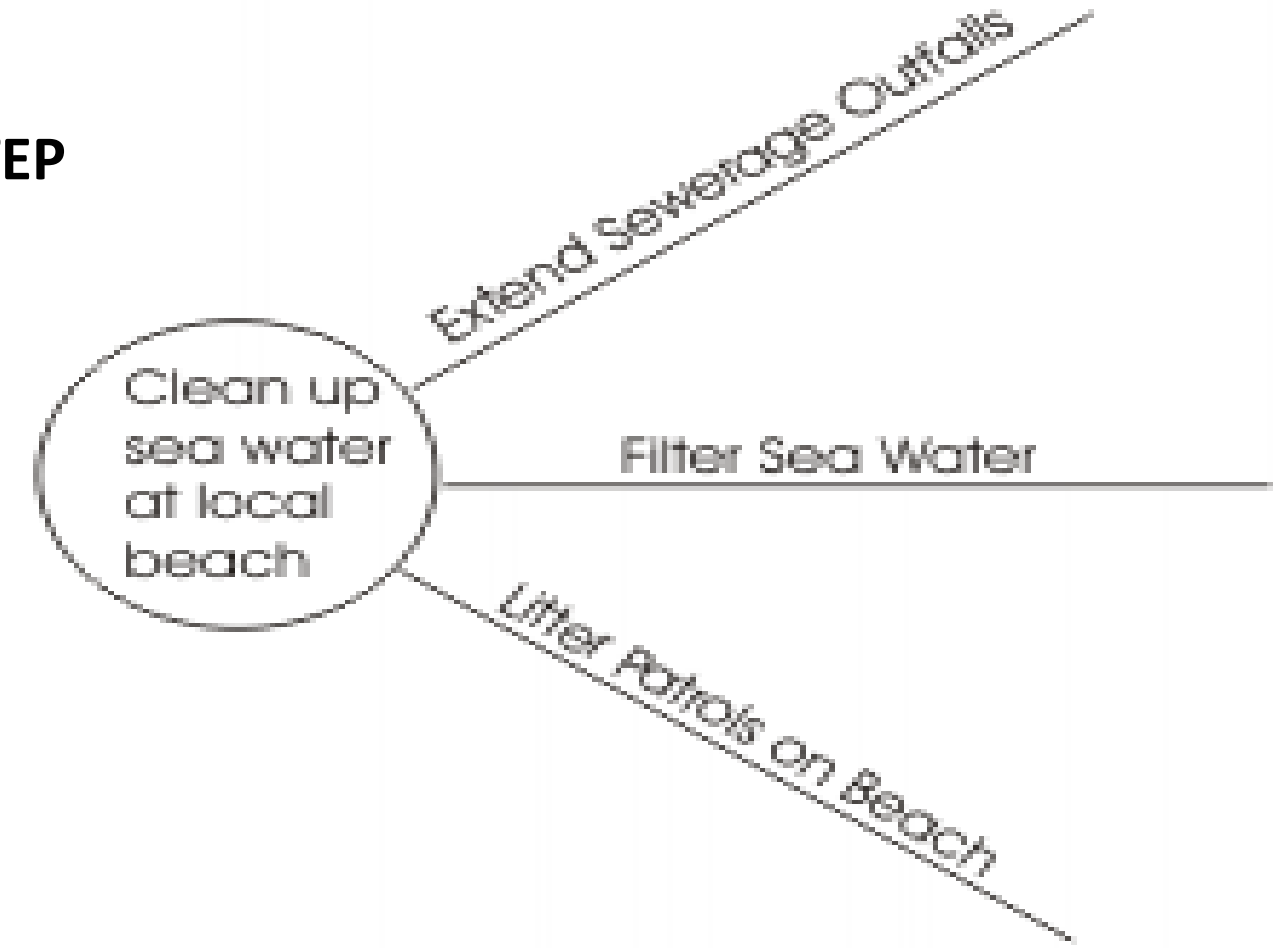


Figure 1: First Stage of a Concept Fan

Use this as a starting point to radiate out other ideas:

SECOND STEP

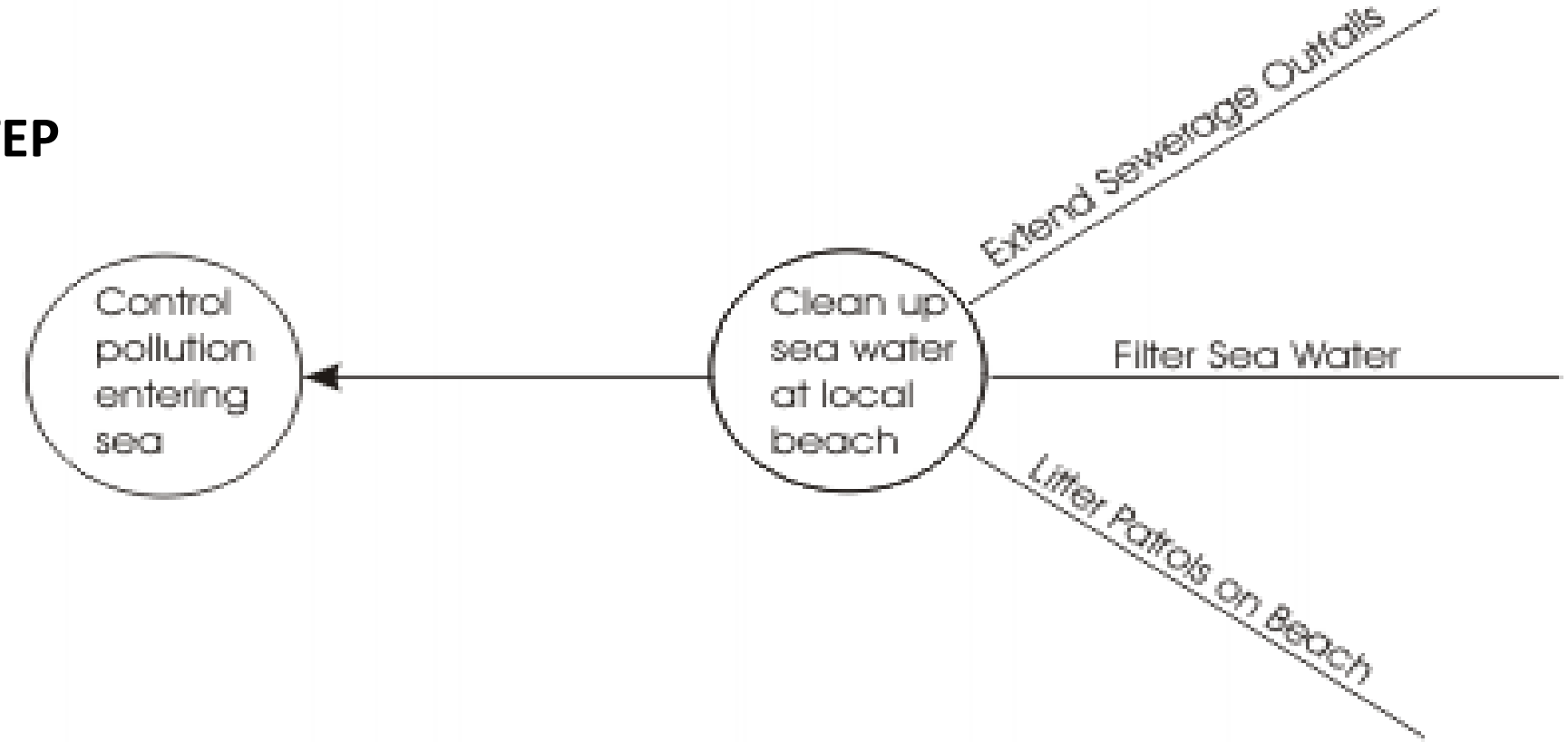


Figure 2: Broadening the Problem Definition on a Concept Fan

THIRD STEP

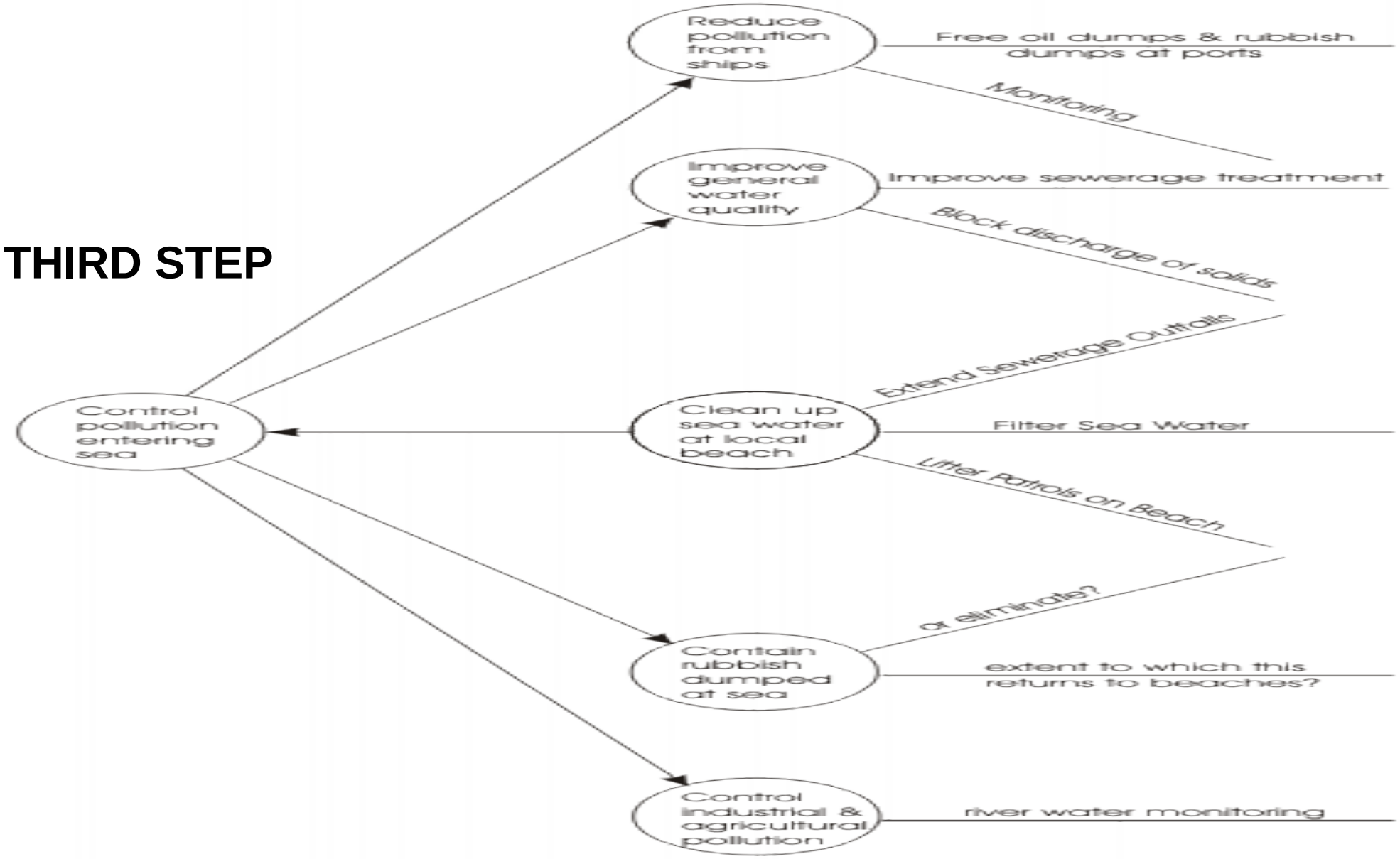


Figure 1.6.3: Radiating Ideas from the Broader Problem Definition

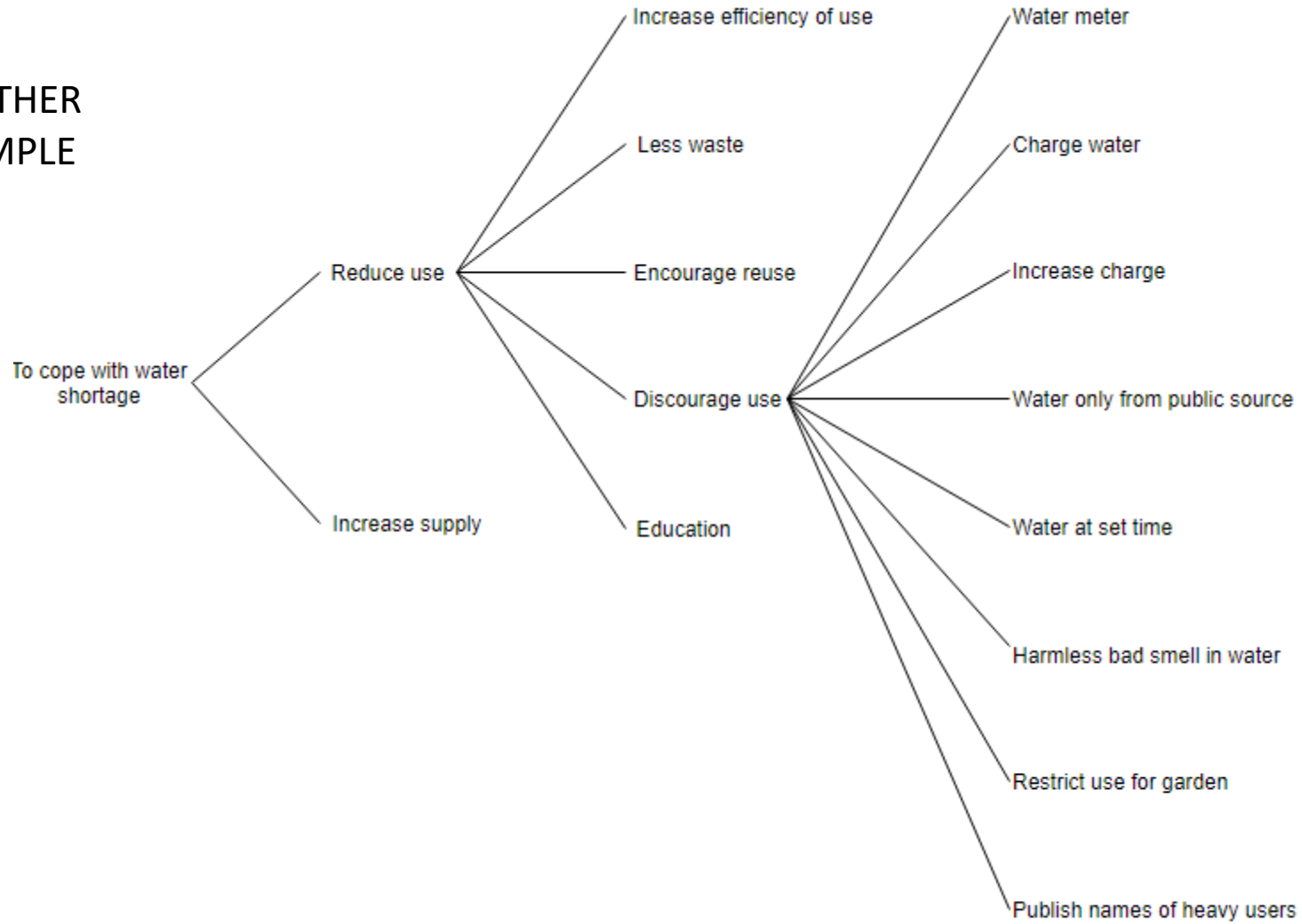
FOURTH STEP

If this does not give you enough new ideas, you can take yet another step back (and another, and another…):

FOURTH STEP

Figure 4: A Developed Concept Fan

ANOTHER EXAMPLE



(*Source: Edward de Bono, 1992)

3.- Decision-making techniques

3.1.- Decision-making which affects sustainability and circular economy

Circular economy enables to restore product value at the end of life i.e. when no longer used or damaged. Thus, the product life cycle is extended and this economy permits to reduce waste increase and resources rarefaction.

There are several revaluation options (reuse, remanufacturing, recycling, …). So, decision makers need to assess these options to determine which is the best decision.

The techniques in this chapter help you to make the best decisions possible with the information you have available. With these tools you will be able to map out the likely consequences of decisions, work out the importance of individual factors, and choose the best course of action to take.

3.2.- Helping you to choose several courses of action.

Grid Analysis
Making a Choice Where Many Factors Must be Balanced

Grid Analysis is a useful technique to use for making a decision. Also known as decision matrix analysis

Example:

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 also vey concerned with climate change. He has always loved open-topped sports cars. No car he can find is good for all three things.

His options are:

- An hibrid SUV/4x4, hard topped vehicle
- A comfortable 'family car'
- A station wagon/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
- Concerned to climate change. Not pollute
- Fun!
- Nice look and build quality to car

Firstly he draws up the table shown in Figure 1, and scores each option by how well it satisfies each factor: 0,1,2,3. **Figure 1: Example Grid Analysis Showing Unweighted Assessment of How Each Type of Car Satisfies Each Factor**

Factors:	Cost	Board	Storage	No pollute	Fun	Look	Total
Weights:	4	5	1	5	3	4	
Sports Car	1	0	0	1	3	3	
SUV/4x4	0	3	2	2	1	1	
Family Car (hybrid)	2	2	1	3	0	0	
Station Wagon(hybrid)	2	3	3	3	0	1	

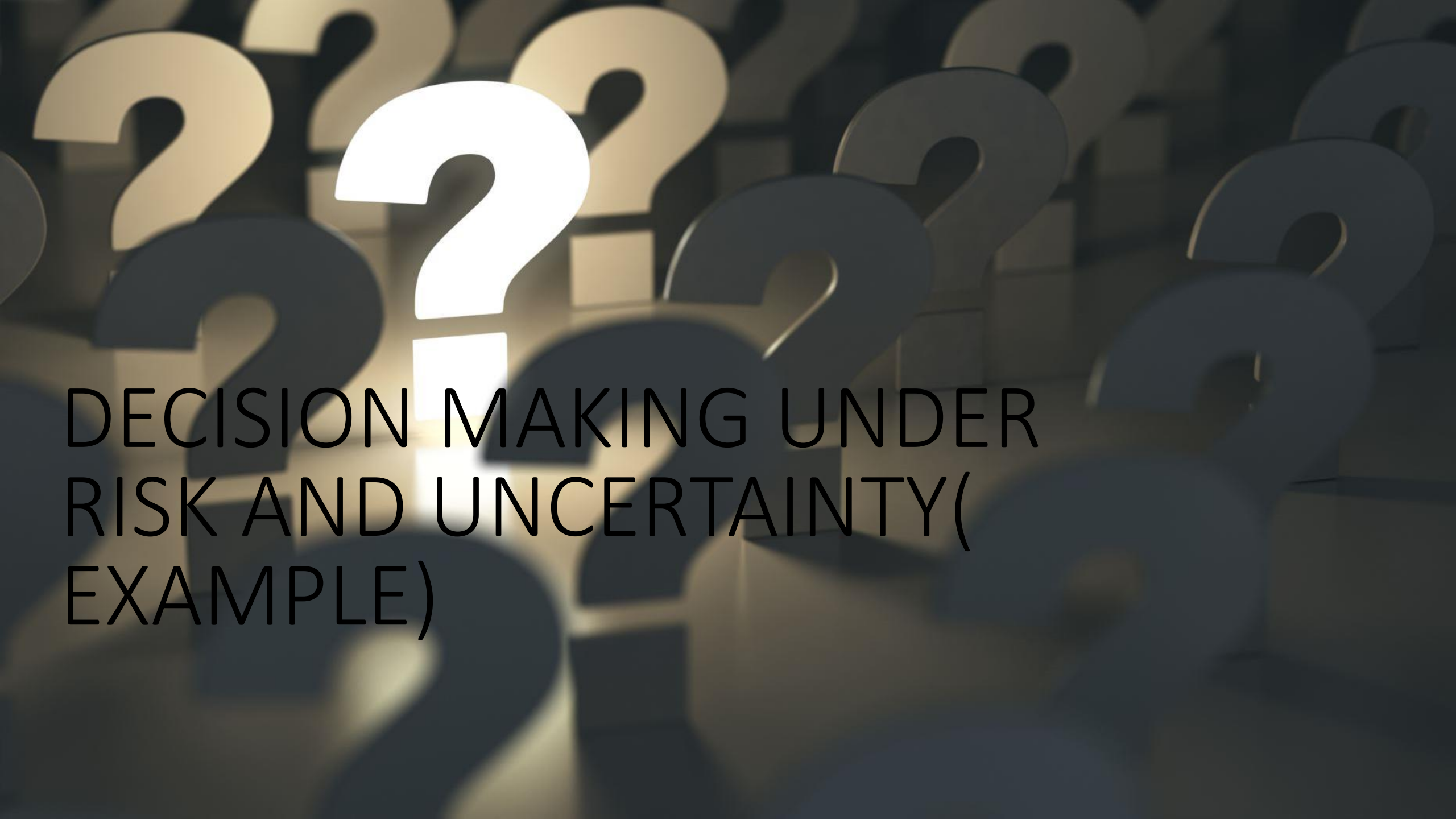
Next he decides the relative weights for each of the factors. He multiplies these by the scores already entered, and totals them. This is shown in Figure 2: **Example Grid Analysis Showing Unweighted Assessment of How Each Type of Car Satisfies Each Factor**

Factors:	Cost	Board	Storage	No pollute	Fun	Look	Total
Weights:	4	5	1	5	3	4	
Sports Car	1	0	0	1	3	3	30
SUV/4x4	0	3	2	2	1	1	34
Family Car (hybrid)	2	2	1	3	0	0	34
Station Wagon(hybrid)	2	3	3	3	0	1	45

This gives an interesting result: Despite its lack of fun, a station wagon may be the best choice.

If the wind-surfer still feels unhappy with the decision, maybe he has underestimated the importance of one of the factors.

3.3.- Decision making under certain risk and uncertainty



DECISION MAKING UNDER RISK AND UNCERTAINTY(EXAMPLE)

1.- DECISION CRITERIA IN RISK SITUATIONS.

QUESTION

A SUSTAINABLE OUTSIDE SECOND-HAND TRADE ticket seller expects to earn 16,000 euros if it does not rain for a local bank holiday. If it rained, he estimates that he would lose 5,000 euros. The meteorological information predicts a probability of 5/6 of no rain and 1/6 of rain. Calculate the expected value of profit for the seller.

- Solution:
- 16.000 euros if it does not rain➔ 5/6(0,833) probability
- (5.000 euros if it rains➔ 1/6(0,166) probability
- Expected monetary value= 16.000 euros (5/6) – 5.000 euros(1/6)= 12.500 euros.
- EXPECTATED MONETARY VALUE(EMV): sum of the products of the expected value in each scenario, multiplied by each probability of occurrence.

Decision criteria in a situation of uncertainty

- **Problem:**
- A farmer must decide to renew their SUSTAINABLE PLASTIC GREENHOUSES before the coming winter. Each weather situation will require a different type of coating and each one has a different cost. These are the **three possible alternatives:**

  a)insulating plastic

  b)resistant plastic

  c)perforated plastic.
- And **the weather situations that may occur** are:

  1.cold.

  2.rainy.

  3.windy.
- The farmer is considering the **following matrix** of profit and loss thousands estimations for each situation:

	1	2	3
a)	20.000	-5.000	-2.000
b)	6.000	10.000	-8.000
c)	-3.000	2.000	16.000

- **Determine** the most appropriate alternative on the basis of the following criteria:

a)Laplace (maximum likelihood)

b)Pessimistic or Wald

c)Optimistic or maximax

d)Hurwicz Criterion partial optimism for an optimism coefficient equal to 0.4

e)Savage

- Resolución:
- a) **Laplace Criterion (maximum likelihood):** the decision maker considers all states of nature to have the same probability, so it chooses the alternative that gives it a higher expected value.
- 20(1/3) + (-5)(1/3) + (-2)(1/3)= 4.33
- 6(1/3) + 10(1/3) + (-8)(1/3)= 2.66
- (-3)(1/3) + (2)(1/3) + (16)(1/3)= 5 ➔ **most favorable: perforated plastic**
- **In the table of the statement we add the last column with the expected values calculated, the largest is 5:**

	Cold	Rainy	Windy	Expected Value
Insulating plastic	20	-5	-2	4,33
Resistant plastic	6	10	-8	2,66
Perforated plastic	-3	2	16	**5**

- **b) Pesismistic or Wald Criterion (Maximin):** the decision maker thinks that, having chosen an alternative, the most favourable state of nature will be presented. Therefore, he or she chooses **the maximum of the minimum** values of each possible alternative.

- Insulating: -5; Resistant: -8; **Perforated: -3**.

- **c) Optimistic criterion (Maximax):** the decision-maker thinks that, having chosen an alternative, the most favourable state of nature will be presented. Therefore, he chooses **the maximum of the maximum** values of each possible alternative.

- **Insulating: 20;** Resistant: 10; Perforated: 16.

- **d) Hurwicz's criterion or partial optimism : the decision maker** thinks that there will only be extreme values (maximums or minimums) **so he weights his optimism index (α =0.4) with the maximum of each alternative, and his pessimism index (1-α) with the minimum**.

- Insolating: 0.4*20 + 0.6*(-5)= **5 (maximum) we choose the highest weighted value**

- Resistant: 0.4*10 + 0.6 * (-8)= -0.8

- Perforated: 0.4*16 + 0.6 (-3)= 4.6

- **e) Savage Criterion(regret):**

Consists of constructing a matrix of opportunity costs or matrix of repentance, which is elaborated from the initial matrix. **For each value, the opportunity cost is the difference between having chosen the best alternative, and having chosen the one actually chosen.** **Once this matrix is obtained, the minimum of the maximums is chosen, which represents the minimum possible opportunity cost.**

	Cold	Rainy	Windy	Minimax		
Insulating Plastic	20-20	10- (-5)	16-(-2)	0	15	**18**
Resistant plastic	20-6	10-10	16-(-8)	14	0	24
Perforated plastic	20- (-3)	10-2	16-16	23	8	0

- **To solve the exercise, in the minimax table we look by rows at the maximum, which are 18, 24 and 23 and from them we choose the minimum of the maximum which is 18**

EXERCISE

Decision-making in risk and uncertainty

- PROBLEM:

A farmer can analyse his strategies for crops depending on the weather. The states of nature can be rainy, normal or dry. You must decide whether to grow wheat, potatoes or beets.

a) Although he does not know how the year will be, he knows the likelihood of it being rainy (30%), normal (50%) and dry (20%). We have the following matrix of estimated income for every situation:

	Rainy	Normal	Dry
Wheat	250	290	200
Potatoes	150	200	250
Beet	-100	450	350

A) Calculate the expected monetary value (mathematical expectation) of each possible strategy growing,wheat, potatoes or beet) and determine which decision would achieve higher results.

B)Assuming the above profit and loss matrix, but in case the farmer did not know and could not estimate the probabilities of the states of nature of the climate (rainy, normal or dry). In this situation of uncertainty, determine the best alternative to choose according to the criteria of

1. Wald or pessimist.
2. Optimistic or maximax.
3. Laplace.
4. Hurwicz, with an optimism coefficient of 0.7
5. Savage.