Kepner-Tregoe Methodology

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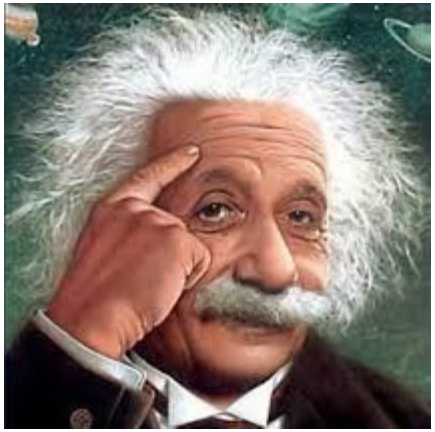
Feveloped by Charles H. Kepner and Benjamin B. Tregoe in the 1960s.

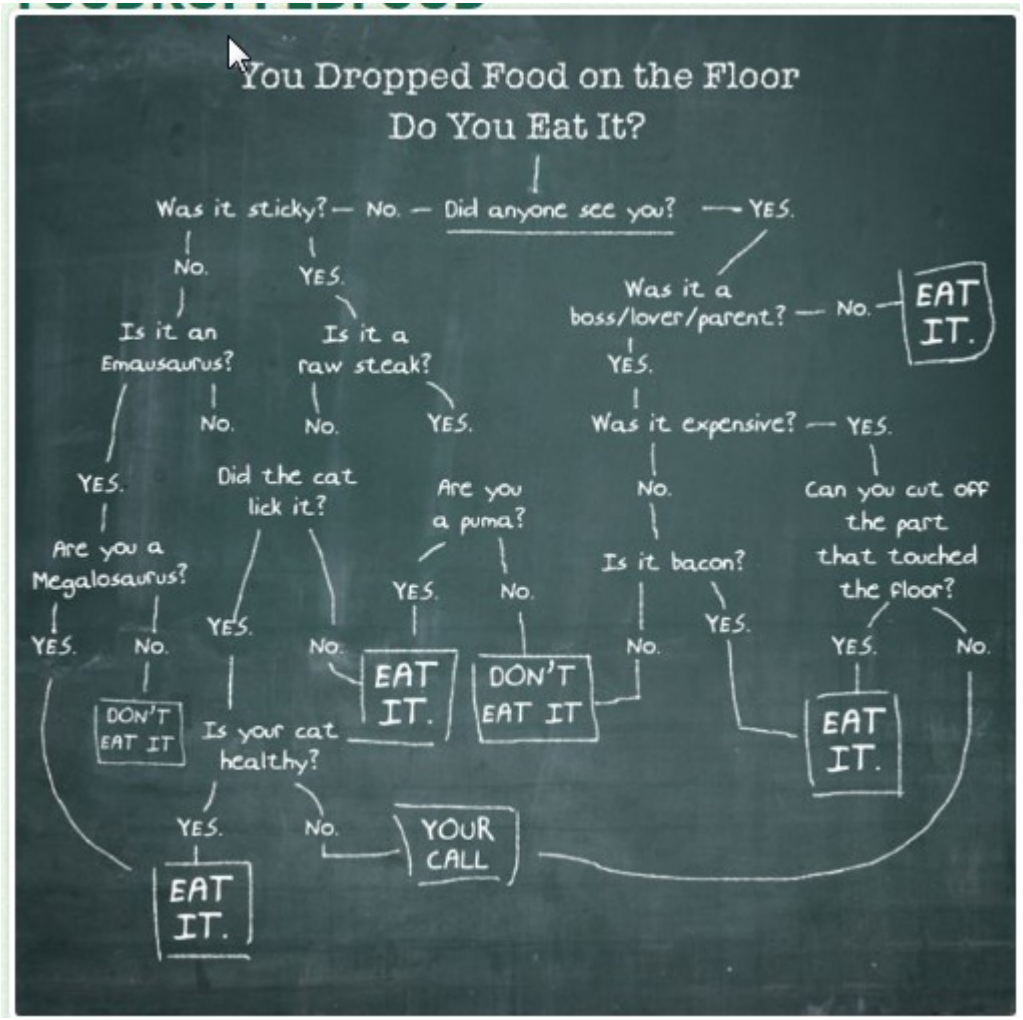
The formulation of a problem is far more essential than its solution, which may be merely a matter of mathematical or experimental skill”
- Albert Einstein



Apollo 13 – Houston, Houston, do you read me ? We have a big problem….!

The Apollo 13 team is famous for bringing back the astronauts stranded in space by solving difficult and complex problems. The teams solving the problems has used the Kepner-Tregoe (KT) methodology !

Decision Analysis –serious one



Sticky- lepkavý
Lick – olíznout

What is it K-T methodology ?

Kepner Tregoe is used for decision making .

It is a structured methodology for gathering information and prioritizing and evaluating it.

It is very detailed and complex method applicable in many areas, which is much broader than just idea selection.

It is called also a **root cause analysis** and decision-making method.

It is a step-by-step approach for systematically solving problems, making decisions, and analyzing potential risks.

Access situation (situation appraisal)

- Identify concerns (problems) by listing them
- Separate the level of concern (**importance**, **magnitude** and level of **influence**)
- Set the priority level to measure seriousness of impacts (**influence**), urgency and growth potential
- Decide what action to take next (step by step approach)
- Plan for **who** is involved, **what** they will be doing, **where** they will be involved, **when** it happened and the **extent** of involvement (**magnitude**)

WHO WHAT WHEN WHERE EXTENT

Make decision *(A choice between two or more alternatives)*

- Identify what is being decided (quality, used methods, renumeration,..)
- Establish and classify objectives (main ones, minor ones,..)- *goals*
- Separate the objectives into **must** ***(must to have)*** and **want** ***(nice to have)*** categories (we have to assign **importance factors** from 1-10, where 10 is the most important **want** objective) and assign criterion rating (weights)
- Generate the alternatives (**we can do it that way or we can take another way as well**)
- Evaluate the alternatives by scoring the **wants** against the main objective – ***see next slides*** 
- Review adverse (harmful) consequences of your corrective steps (risk evaluation, risk assessment)
- Make the best possible choice **what to do**

Criteria rating

"Must" Criteria	Car 1	Car 2	Car 3	Car 4
Cost under $9,000	Yes	Yes	Yes	Yes
Available within one week	Yes	Yes	Yes	No

"Want" Criteria	Importance*	Car 1 Criterion rating	Car 1 Weighted score	Car 2 Criterion rating	Car 2 Weighted score	Car 3 Criterion rating	Car 3 Weighted score
Good gas mileage	7	5	$7 \times 5 = 35$	6	$7 \times 6 = 42$	8	$7 \times 8 = 56$
Sporty	8	5	$8 \times 5 = 40$	7	$8 \times 7 = 56$	4	$8 \times 4 = 32$
Color (blue)	3	10	$3 \times 10 = 30$	0	$3 \times 0 = 0$	0	$3 \times 0 = 0$
AM/FM stereo	5	7	$5 \times 7 = 35$	8	$5 \times 8 = 40$	3	$5 \times 3 = 15$
Good condition	10	5	$10 \times 5 = 50$	6	$10 \times 6 = 60$	8	$10 \times 8 = 80$
Low mileage	6	6	$6 \times 6 = 36$	4	$6 \times 4 = 24$	5	$6 \times 5 = 30$
Relatively new	7	3	$7 \times 3 = 21$	5	$7 \times 5 = 35$	5	$7 \times 5 = 35$
TOTAL WEIGHTED SCORE (WS)			247		257		248

See similar example on the next slide

Importance can be understood as a Satisfaction score,
meaning desirable but not essential.
Criteria rating is related to want criteria and every car property

Which car to buy ?

MUSTS	A	B	C	D
Power Brakes	GO	GO	GO	GO
Power Steering	GO	GO	GO	GO
AM/FM Stereo	GO	GO	NO GO	GO
Automatic	GO	GO	NO GO	GO
Under $15,000	GO	GO	GO	GO

WANTS	Weight	Score	W x S	Score	W x S	Score	W x S	Score	W x S
AirCon	10	10	100	0	0			10	100
Cassette	7	6	42	10	70			10	70
Antilock Brakes	9	0	0	10	90			0	0
Air Bag	8	5	40	10	80			5	40
Rear Demist	6	10	60	0	0			0	0
Engine Size	6	8	48	6	36			10	60
Central Lock	5	5	25	10	50			5	25
Metal Paint	4	0	0	10	40			10	40
Warranty	8	10	80	7	56			3	24
Resale Value	7	7	49	7	49			4	28
	TOTALS		444		471				387

Criterion rating

Importance score, meaning desirable but not essential.

go to slide 37 and then jump back

See the Upcoming (approaching, next to come) and **Potential Opportunity=Solution)**

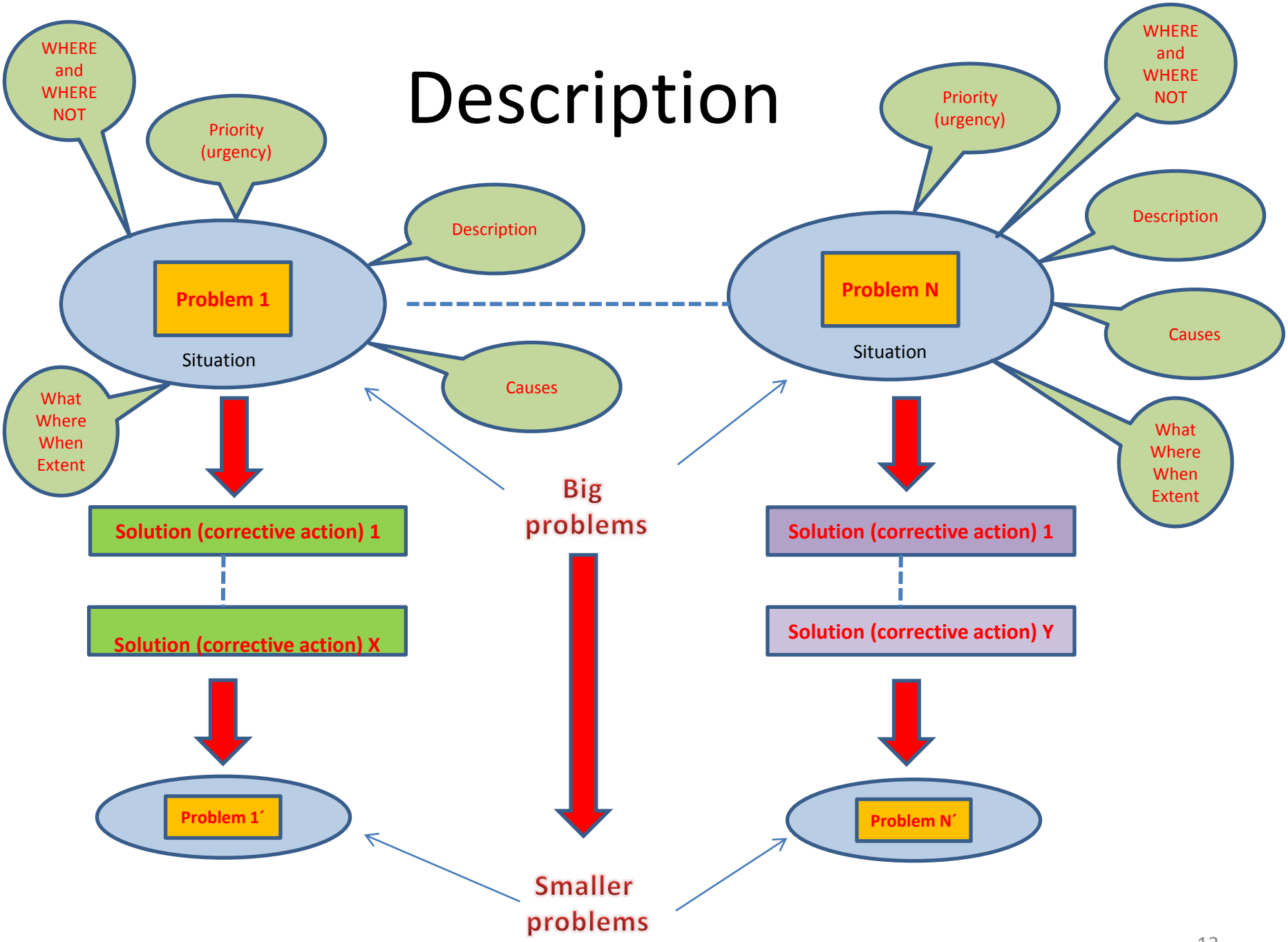
- List the potential opportunities **O**{op1,  ,..,opN}
- Consider the possible(suitable)solution (e.g. the second one)
- Take the action to address the likely cause/solution
- Prepare actions to enhance possible effects..

Uncover and handle problems

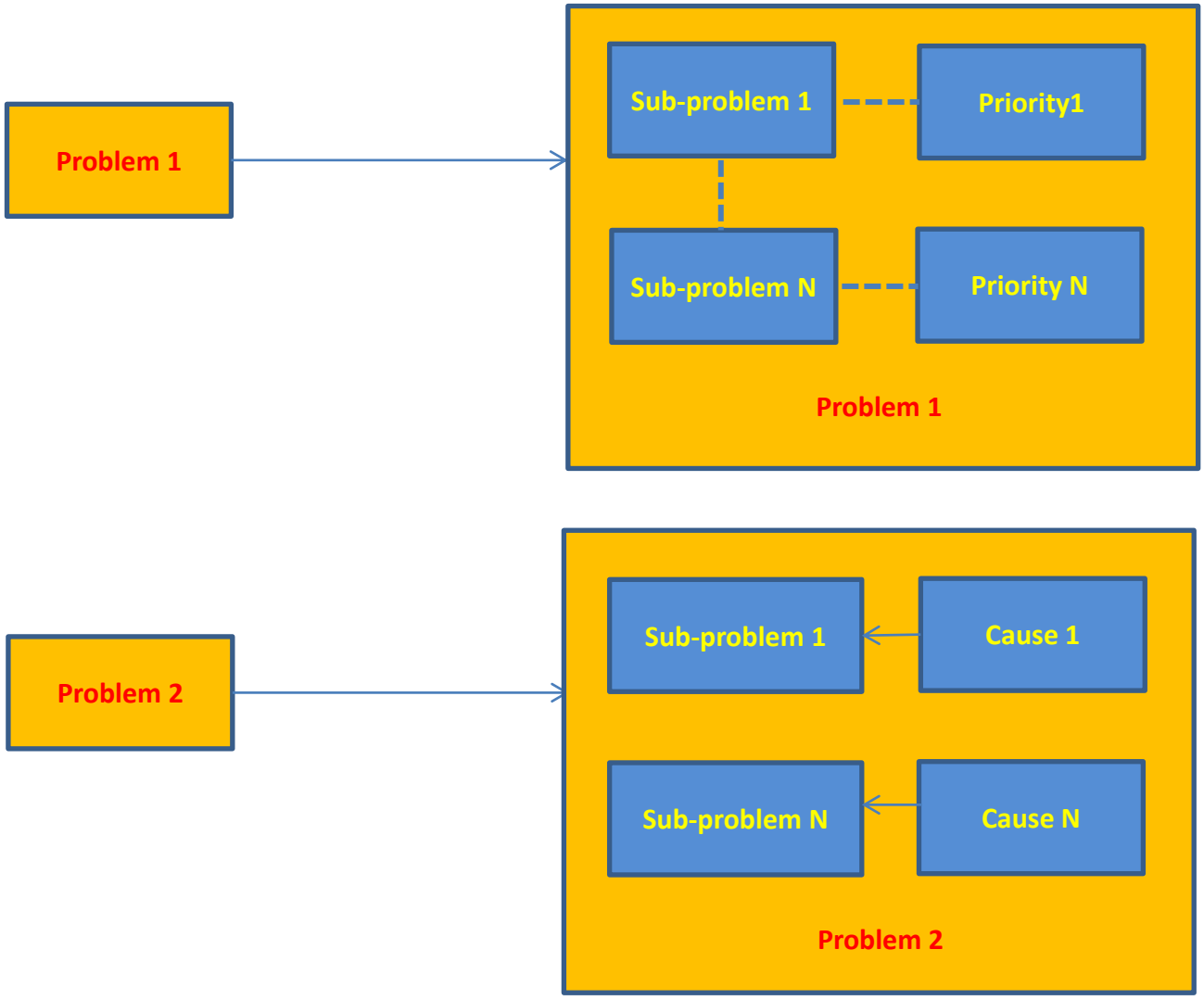
(problem analysis)

- State the problem (definition and description of the problem)
- Specify the problem by asking **what is** and **what is not**
- Develop possible causes of the problem (similar to CRT)
- Test and verify possible causes
- Determine the most probable cause (root cause)
- Verify any assumptions
- Try the best possible solution and monitor what will be a situation after applied correctives step

Description

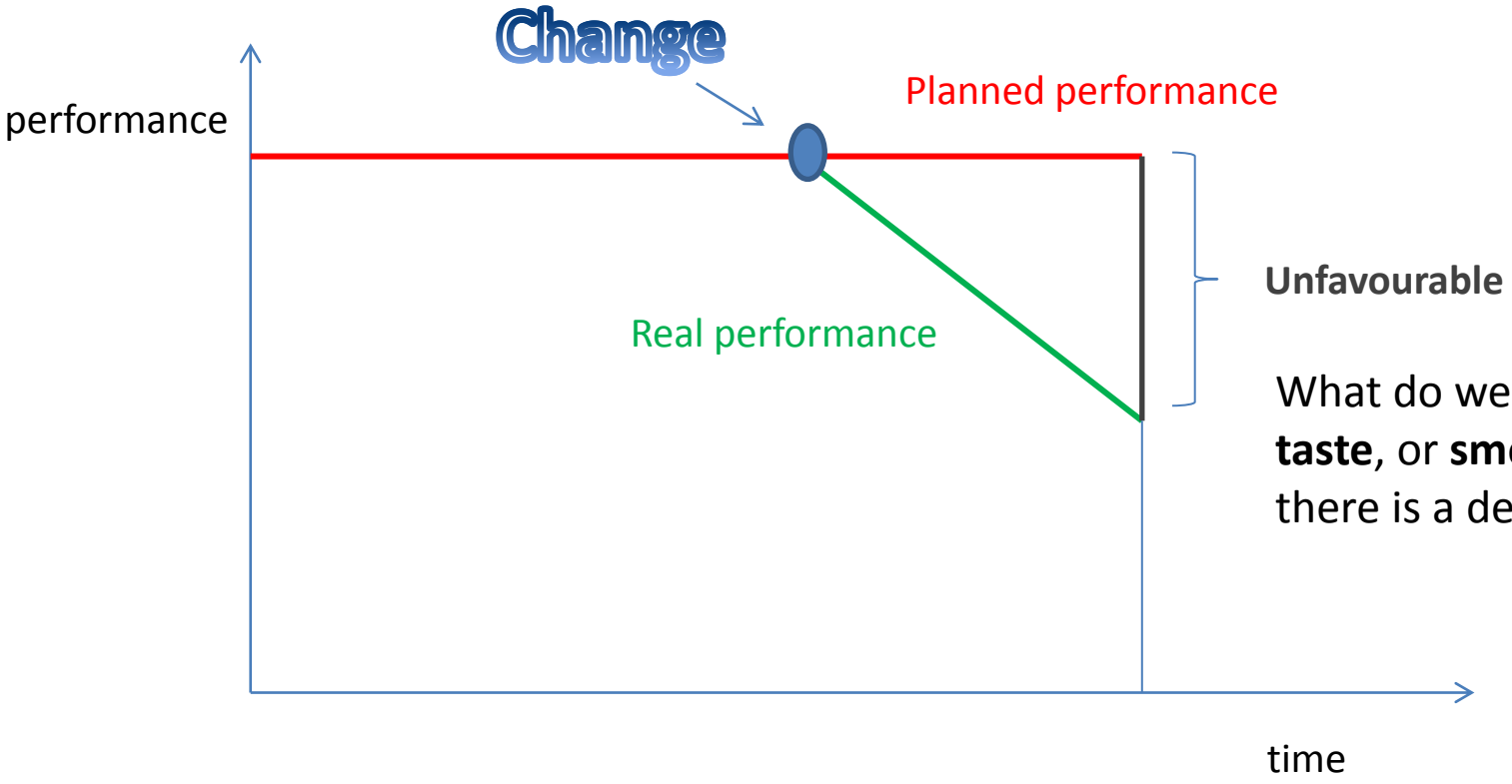


Decomposition, priorities and causes



Example of problem manifestation

(decrease of performance)



Final effect of the Change = PROBLEM (e.g. server crashed, hard disk with database crashed)

Then we have to ask : *What, Where, When*, and to what *Extent –Size (how much, how many)*?

Server crashed !!!! (home study !!!)

- **Server crashed** (this is a very poor problem definition)
- **The e-mail system crashed after the 3rd shift support engineer applied hot-fix XYZ to Exchange Server 123** (better definition of the problem)

	IS	COULD BE but IS NOT	DIFFERENCES	CHANGES
WHAT	System failure	Similar systems/situations not failed	?	?
WHERE	Failure location	Other locations that did not fail	?	?
WHEN	Failure time	Other times where failure did not occur	?	?
EXTENT	Other failed systems	Other systems without failure	?	?

	IS	COULD BE but IS NOT	DIFFERENCES	CHANGES
WHAT	Exchange Server 123 crashed upon application of hot-fix XYZ	Other Exchange Servers getting hot-fix XYZ	Different staff (3rd shift) applied this hot-fix	New patch procedure from vendor
WHERE	3rd floor production room without vendor/ contractor support	Anywhere else with vendor/ contractor support	Normally done by vendor	New procedure, first time 3rd shift applies hot-fixes
WHEN	Last night, 1:35am	Any other time or location	None noted	
EXTENT	Any Exchange Server on 3rd floor	Other servers		

History (and best practice) says that the root cause of the problem is probably due to some **recent change**. **WHAT, WHERE, WHEN and EXTENT will be shown on next slides**

Test the Most Probable Cause
(home study !!!)

Clarifying problem Analysis (example)

Potential root cause:	True if:	Probable root cause?
Exchange Server 123 has something wrong with it	Only Exchange Server 123 has this problem	Maybe
Procedure incorrect	Same procedure crashes another server	Probably
Technician error	Problem did not always reoccur	Probably not

We have to ask (where Qi =QUESTION i) :

Question	IS	IS NOT
What (identify)	*Q1*	*Q2*
Where (locate)	*Q3*	*Q4*
When (timing)	*Q5*	*Q6*
Extent (magnitude)	*Q7*	*Q8*

See next slides

Problem Analysis - What

Is

- What specific object(s) has the deviation?
- What is the specific deviation?

Example for **Is** :

1. What specific **object** **IS** related to the defect?
   Inventory Valuation Objects in **database A**
2. What specifically is the defect (deviation)?
   Inventory Adjustment does not work

1-> see setup of the database and see differences
2->see algorithm used for calculation and parameters used.
You can see , that in production calculation related algorithm is not functional

Is Not

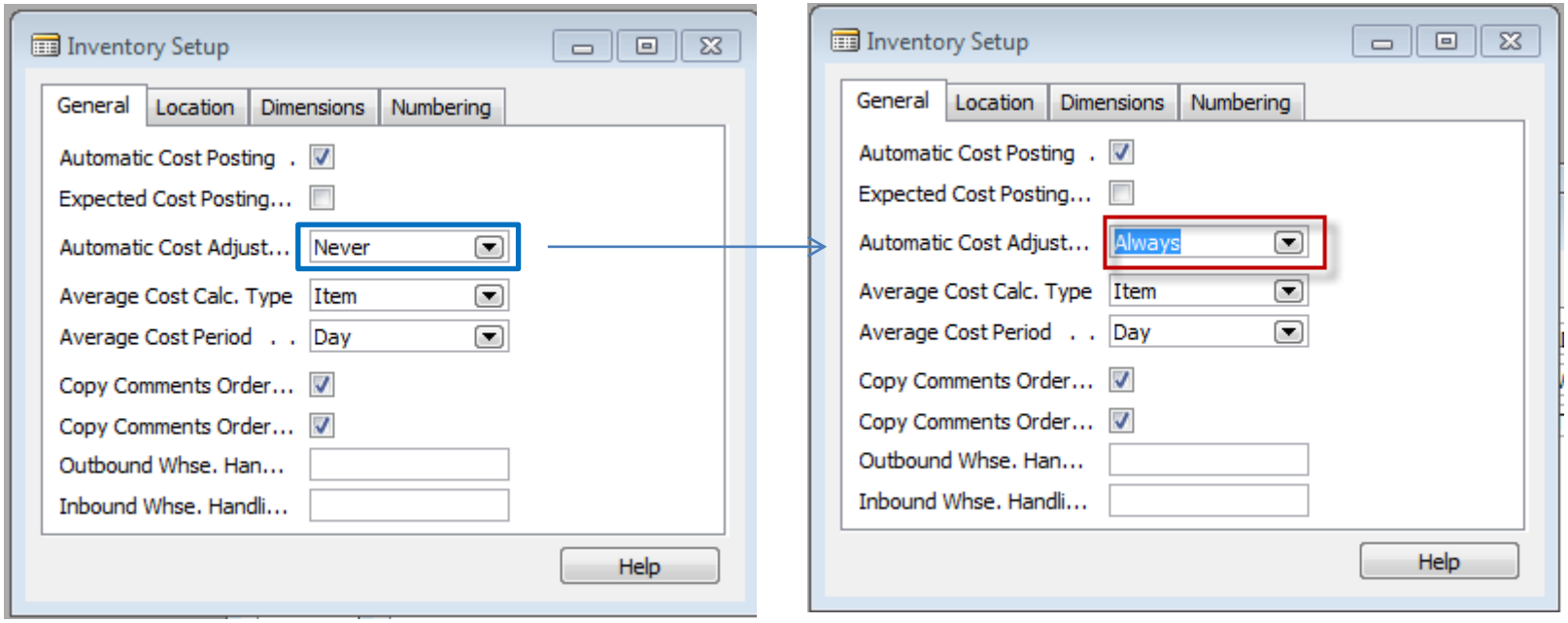
- What similar object(s) could have the deviation, but does not? (It did not happen)
- What other deviations could be reasonably observed, but are not? (It did not happen)

Example for **Is Not :**

1. What specific **object** **IS NOT** related to the defect?
   Inventory Valuation Objects in **database B**
2. What specifically is not the defect (deviation)?

1 -> Setup has another parameters **ON**
2-> Algorithm is used also for production where not error occurs

See two MS Dynamics Setup screens (related to the problem specified recently)



Back to vampires :Problem Analysis - What

Is

- What specific object(s) has the deviation?

- What is the specific deviation? - bites on the neck

Example for **Is** :

1. Nice young girl´s neck and strange look of anemic person

Is Not

- What similar object(s) could have the deviation, but does not? (It did not happen)

What could the specific deviation? but does not? (It did not happen) – bites, anemia

Example of **Is Not** :

1. Girl with garlic in her hands
2. No bites
3. Zaftig

Example for What IS and What IS NOT

Customer **X** and Customer **Y** both use product B but only to customer X was sent the wrong product so the object IS Customer X , but IS NOT Customer Y

Problem Analysis - When

Is	Is Not
• When was the deviation observed first (clock and calendar time)?	▪ When else could the deviation have been observed first, but was not?
• When since that time has the deviation been observed?	▪ When since that time could the deviation have been observed, but was not?
• When, in the object's history or life cycle, was the deviation observed first?	▪ When else, in the object's history or life cycle, could the deviation have been observed first, but was not?

See example next slide

Example for When and IS and IS NOT

Customer X and Customer Y both use product B but only customer X was sent the wrong product if Salesman Tony was on holiday in this time and Saleswomen Linda was in charge, so the object IS Saleswomen Linda , but IS NOT Salesman Tony

Linda

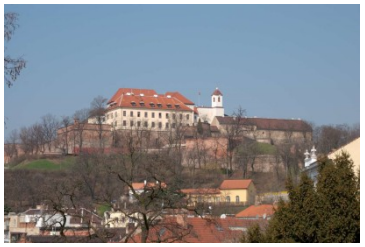
Tony

Another example for **What IS** and **What IS NOT** as well as **Where IS** and **Where IS NOT**

IS girl Sarah visited Dracula lower castle without a bunch of garlic, but **IS NOT** not the one (Emily) having bunch of garlic and visiting Špilberk castle in Brno

Dracula Castle
(Where IS)

Špilberk Brno
(Where IS NOT)



Sarah
(What IS)

Emily
(What IS NOT)

Problem Analysis - **Where**

Is

- Where is the object when the deviation is observed? (geographically)
- Where is the deviation on the object?

Is Not

- Where else could the object be when the deviation is observed, but is not?
- Where else could the deviation be located on the object, but is not?

Example for **Is** **:**

1. Old castle in the mountains (Romania)

Where IS : Romanian Carpathian mountains where **it is** very easy to meet a lot of vampires there

Example for **Is Not**

1. Brno castle Špilberk

Where **IS NOT** possible to meet vampires (only lovers and children and seniors)

Problem Analysis - Extent

Is	Is Not
• How many objects have the deviation?	• How many objects could have the deviation, **but don't?**
• What is the size of a single deviation?	• What other size could a deviation be, **but isn't?**
• How many deviations are on each object?	• How many deviations could there be on each object, *but are not?*
• What is the trend? – Occurrences? – Size?	• What could be the trend, **but isn't?** • Occurrences? • Size?

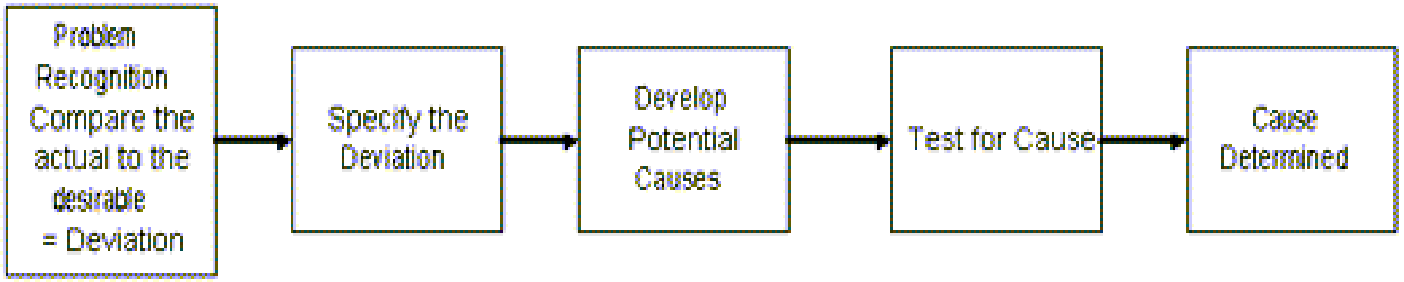
Problem Analysis
Confirm True Cause

- What can be done to verify any assumptions made?
- How can this cause be observed at work?
- How can we demonstrate the cause-and-effect relationship (e.g. Current Reality Tree or Ishikawa Fishbone Diagram)?
- When corrective action is taken, how will results be checked?

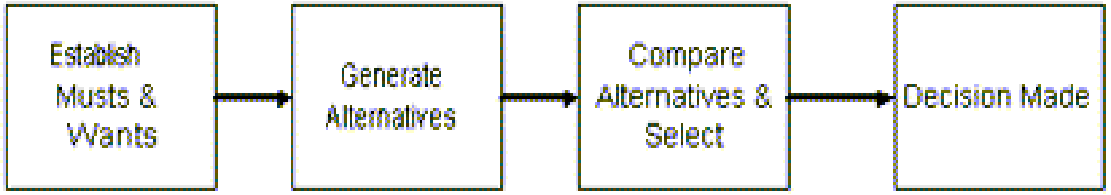
Let’s Look At Some Problems!

Systematic Problem Solving and Decision making Overview

Problem Definition Process



Decision Making Process



Planning the Next Steps

- Problem Analysis
  - Do we have a deviation?
  - Is the cause unknown?
  - Is it important to know the cause to take effective action?

- If the answer is **YES** to **ALL** three listed problems above, than you have a big problem, Huston !!!

Problem analysis table template (Home study)

		IS	IS NOT	Distinction	Cause
What	Identify:	What is problem?	What is not problem?	What difference between is and is not?	What is possible cause?
Where	Locate:	Where is problem found?	Where is problem not found?	What difference in locations?	What cause?
When	Timing:	When does problem occur?	When does problem not occur?	What difference in timing?	What cause?
		When was it first observed?	When was it last observed?	What difference between 1st, last?	What cause?
Extent	Magnitude:	How far does problem extend?	How localized is problem?	What is the distinction?	What cause?
		How many units are affected?	How many not affected?	What is the distinction?	What cause?
		How much of any one unit is affected?	How much of any one unit is not affected?	What is the distinction?	What cause?

Problem description (example)

On a new model of airplane, flight attendants develop rash on arms, hands, face (only those places). It only occurs on flights over water.

Usually disappears after 24 hours. No problems on old planes over those routes.

Does not affect all attendants on these flights, but same number of attendants get it on each flight. Those who get rash have no other ill effects.

No measurable chemicals, etc., in cabin air.

Rash arm ->

Results ????

Problem analysis real table

	IS	IS NOT	DISTINCTION
WHAT:	Rash	Other illness	External contact
WHEN:	New planes used	Old planes used	Different materials
WHERE:	Flights over water	Flights over land	Different crew procedures
EXTENT:	Face, hands, arms	Other parts	Something contacting face, hands and arms
	Only some attendants	All attendants	Crew duties

Distinction=Difference

Example of analysis

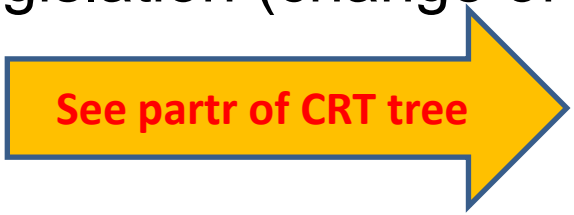
Table III
Problem-solving worksheet applied to analyse World Cup match problem

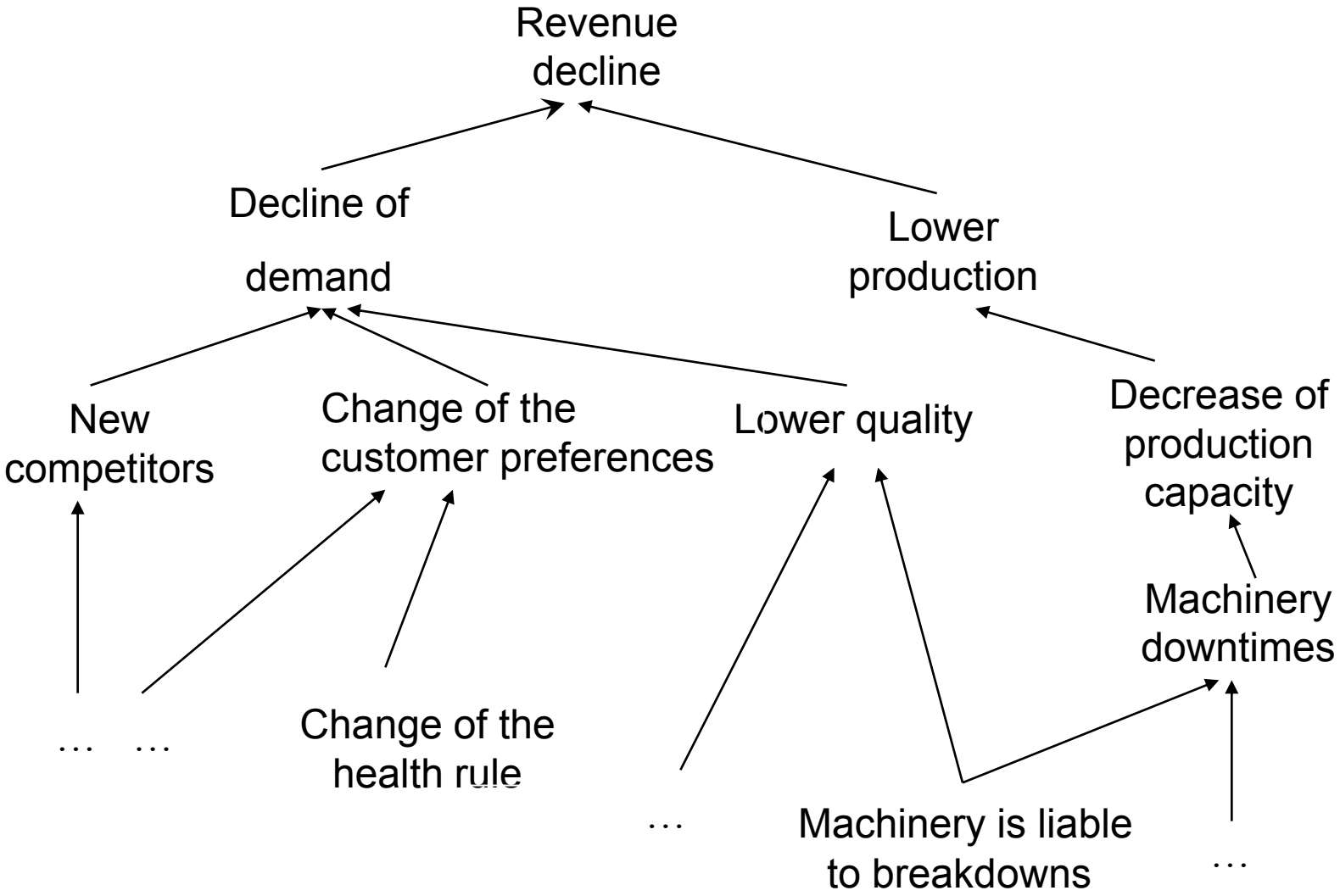
	Is the problem?	Is as expected?	The point of change
What	Weak penalty shooting	Performance during the match	Difference in penalty shoot-out tactics
Who	Two out of the five England players	German players	The way some players struck the ball
When	After 120 minutes of football	During the match	Penalty shoot-out took place after a long and tiring match
Where	At the points easily reached by the goal-keeper Above the bar	At the positions near the posts, inside the goal (E2 and E3)	Ball easily caught by the goalkeeper or ended up outside the goal
How significant	Two failures out of five attempts	The German team did not miss out of four attempts	Very significant
Possible causes	1 Some players not following rule 1 2 Certain players are incapable of shooting the ball at the right spot 3 Some players are affected psychologically by the presence of the goalkeeper and have forgotten about rule 2 4 Lack of proper training based on rules 1 and 2		

Thanks for Your attention

Tree of the casual relationships I –example

- Decline of revenue due to :
- Lower merchantability of the items (list of UDE – see TOC)
  - New competitors
  - Change of the customer preferences
  - Poor (not sufficient) quality of the item
  - Restriction of capacity production
    - Downtime due to machine failure, obsolete machinery, irregular maintenance
  - Change of the legislation (change of the health rules)




Revenue decline
Decline of demand
Lower production
New competitors
Change of the customer preferences
Lower quality
Decrease of production capacity
Machinery downtimes
… …
Change of the health rule
…
Machinery is liable to breakdowns
…

Let’s Look At Some Problems again!

Decision making process

- Problem definition
- Requirements identification
- Goal establishment
- Evaluation criteria development
- Select decision –making tool
- Apply chosen tool (K&T, Pros-Cons,…)
- Check relulst (P-D-A-C)

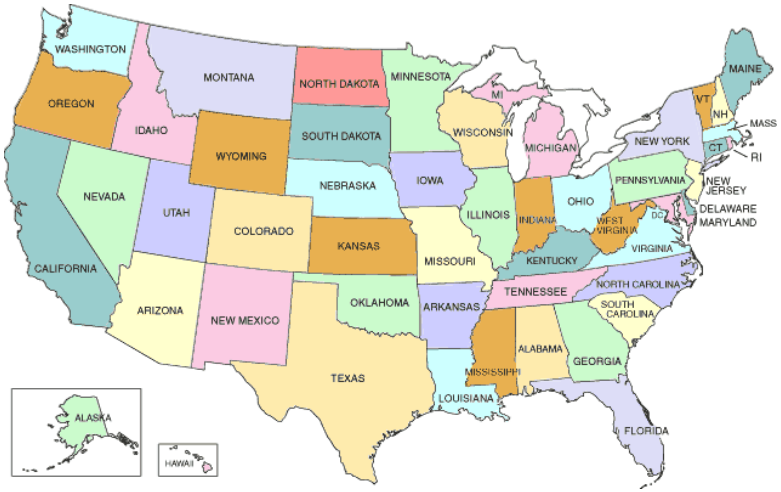
Step 1 and Step 2

Step 1 Problem: **Pick a replacement vehicle for the motor pool fleet**

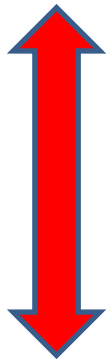
The definition of the problem dictates the requirements. As the vehicle is for a motor pool, the requirements will differ from those for a family car, for example.

Step 2 Requirements:

1. Vehicle shall be made in **U. S. A.**
2. Vehicle shall seat at least **four adults**, but no more than **six adults**
3. Vehicle shall cost no more than **$28,000**
4. Vehicle shall be **new and the current model year**



Min



Max

Max 28000 USD

New car (current model)

Step 3 and Step 4

Step 3 Goals:

· Maximize passenger comfort
· Maximize passenger safety
· Maximize fuel-efficiency
· Maximize reliability of the car
· Minimize investment cost

Step 4 Alternatives:

There are many alternatives but the requirements eliminate the consideration of a number of them:

Requirement 1 eliminates the products not manufactured in the USA
Requirement 2 eliminates vans, buses, and sports cars (Ferrari no !!!!)
Requirement 3 eliminates high-end luxury cars
Requirement 4 eliminates used vehicles

Step 5

Step 5 Criteria:

"Maximize comfort" will be based on the combined rear seat leg and shoulder room. (Note: front seat passenger leg and shoulder room was found to be too nearly the same to discriminate among the alternatives.) **5**

"Maximize safety" will be based on the total number of stars awarded by the National Highway Traffic Safety Administration for head-on and side impact. **10**

"Maximize fuel efficiency" will be based on the EPA fuel consumption for city driving. **7**

"Maximize reliability" will be based on the reliability rating given each vehicle by a consumer product testing company**. 9**

"Minimize Cost" will be based on the purchase price**. 10**

Weighted criteria vector C(5,10,7,9,10) are values assigned by decision makers !!!!

Kepner-Tregoe table

(for 4 cars : Arrow, Baton, Carefree and Dash)

Criteria/ Want objectives	Criteria Weight	*Arrow*	Alter-native Score	Total Score
Comfort	5	86 in. rear seat leg and shoulder room, seats 5	6	30
Safety	10	14 stars	5	50
Fuel efficiency	7	21 mpg	9	63
Reliability	9	80	9	81
Cost	10	$26,000	5	50
		Total		**274**
		Baton		
Comfort	5	88 in. rear seat leg and shoulder room, seats 6	9	45
Safety	10	17 stars	8	80
Fuel efficiency	7	19 mpg	8	56
Reliability	9	70	7	63
Cost	10	$21,000	8	80
		Total		**324**
		Carefree		
Comfort	5	80 in. rear seat leg and shoulder room, seats 5	4	20
Safety	10	15 stars	6	60
Fuel efficiency	7	22 mpg	10	70
Reliability	9	65	5	45
Cost	10	$17,000	10	100
		Total		**295**
		Dash		
Comfort	5	89 in rear seat leg and shoulder room, seats 6	10	50
Safety	10	19 stars	10	100
Fuel efficiency	7	21 mpg	9	63
Reliability	9	85	10	90
Cost	10	$24,000	6	60
		Total		**363**

Last step – Validation (check)

Last Step Validate Solution:

The totals of the weighted scores show that the **Dash** most nearly meets the wants/goals (or put another way, has the most “benefits”). Dash meets all the requirements and solves the problem !!!

Go back to slide 11