

Kepner-Tregoe Methodology

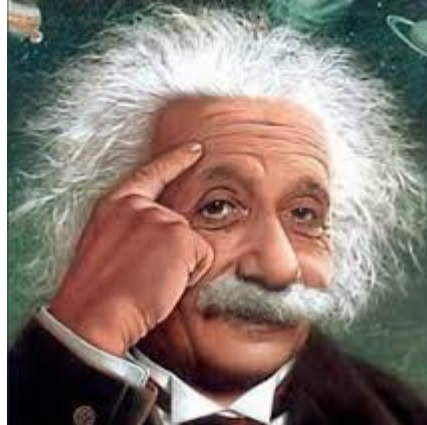
Skorkovský

Department of business economy

Developed by Charles H. Kepner and Benjamin B. Tregoe

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



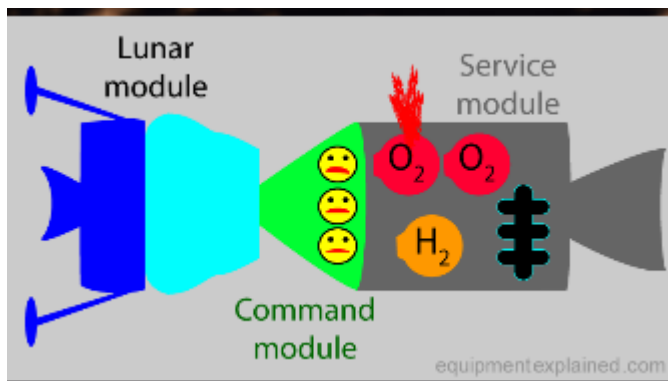
Apollo 13 – Houston, Houston, do you read me ? We have a big problem....!



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!

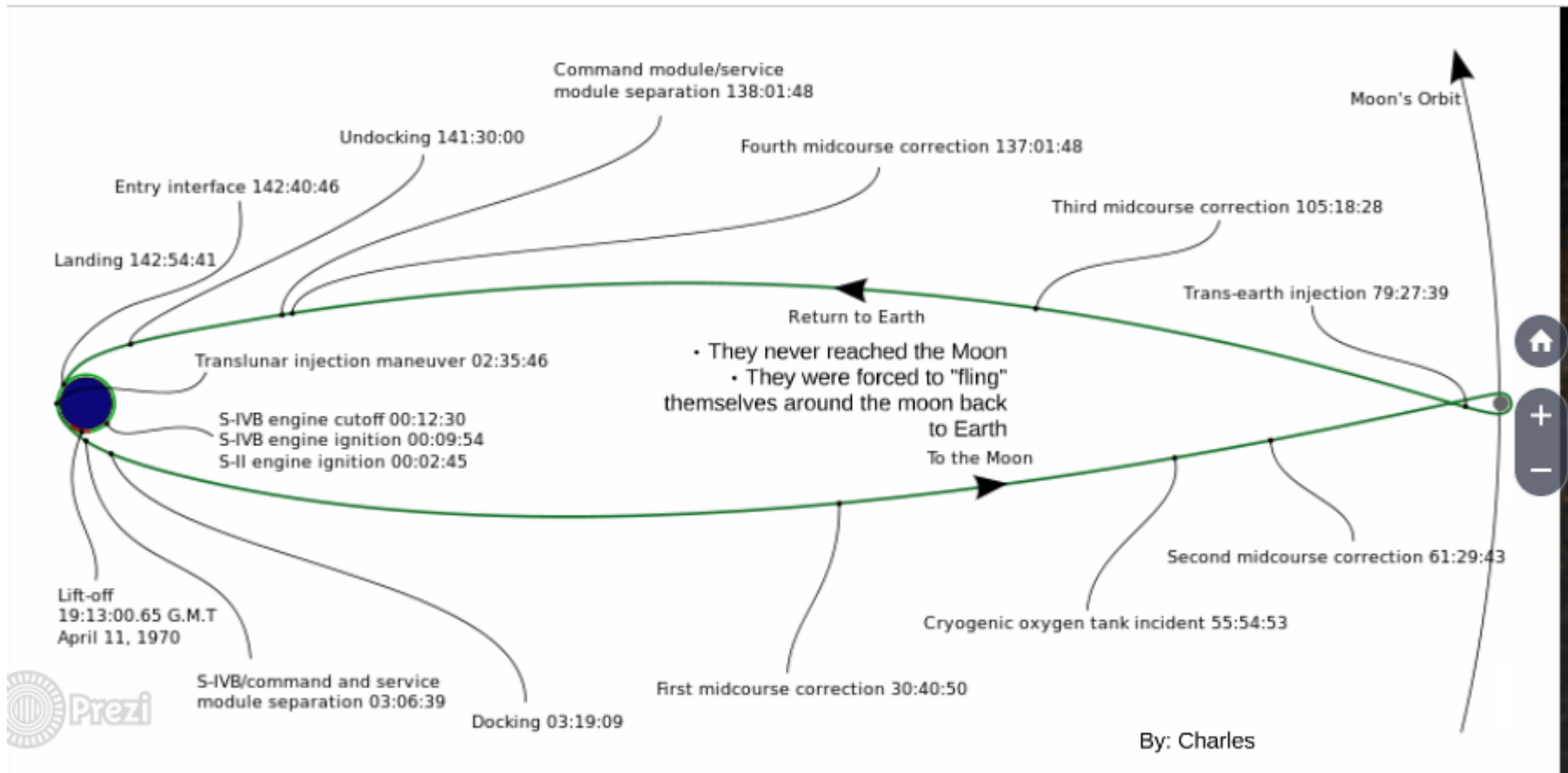
Apollo 13 – description (problem and solution)

<https://spectrum.ieee.org/tech-history/space-age/apollo-13-we-have-a-solution>



<https://prezi.com/ ohiqi4xzcxt/tier-v-problems-and-solutions-on-apollo-13/>

Appolo 13 – description (problem and solution)



What is it K-T methodology ?

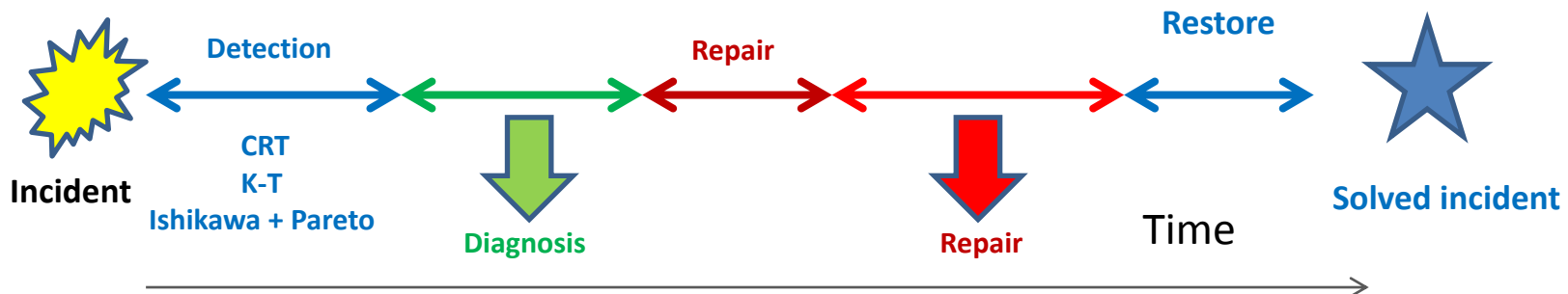
Kepner -Tregoe is used for decision making (**finding best possible choice**)

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

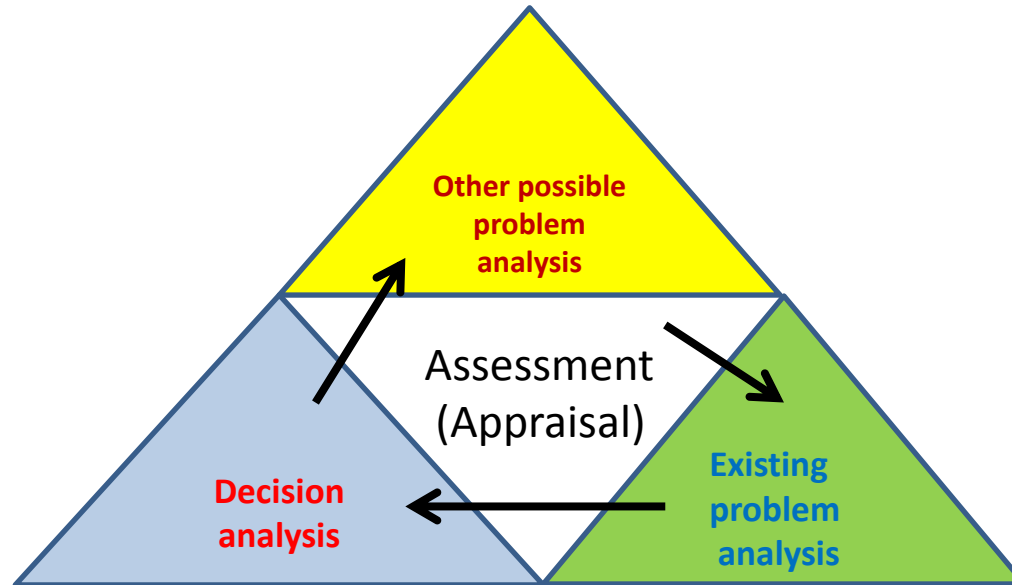
It is a detailed and complex method applicable in many areas, which is much broader than just **idea selection**.

It is also called 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.

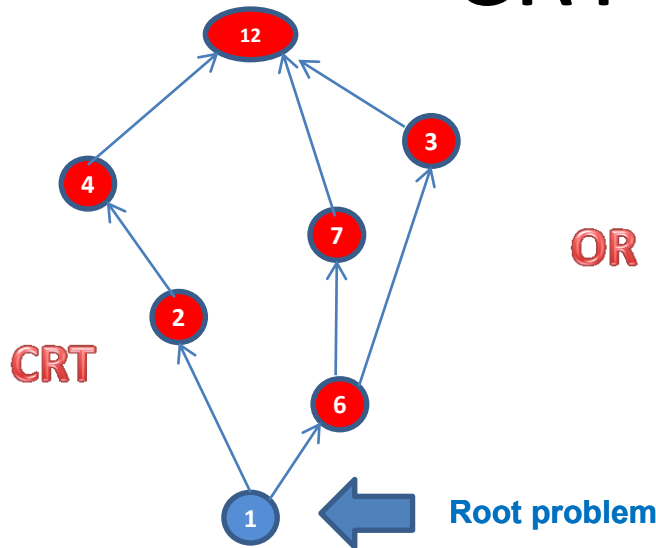


Kepner-Tregoe spheres

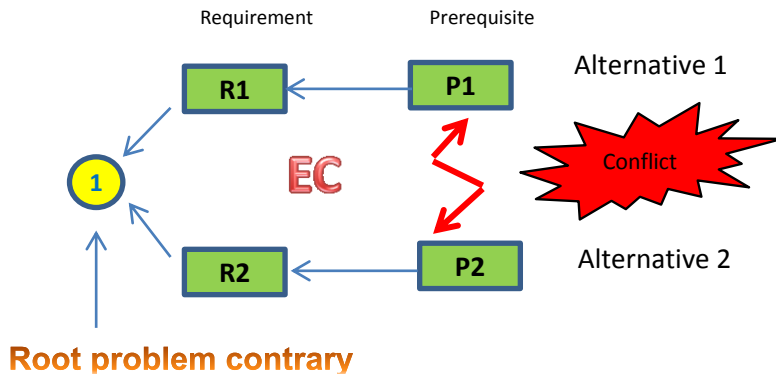
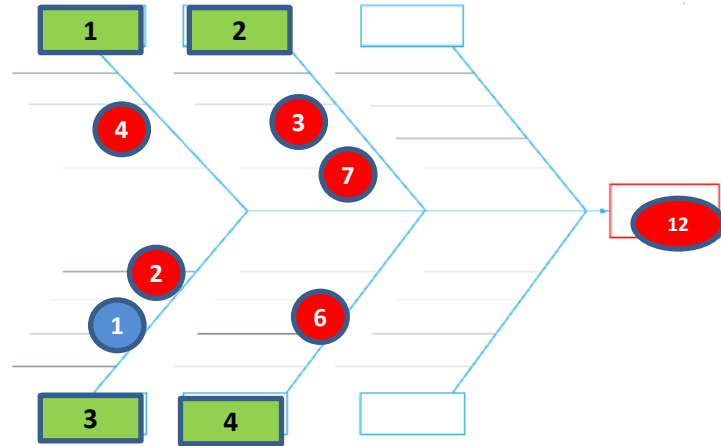


1. **Assessment (appraisal)** – priorities assigned to current situation
2. **Existing Problem analysis** – to find the root problem (cause)
3. **Decision analysis** – to select a way to react
4. **Future problem analysis** -risk analysis

CRT-Ishikawa



OR



	1	2	3	4	6	7
John	8	7	4	3	5	6
Caroline	9	5	7	8	5	6
Mean	8,5	6	5,5	5,5	5	6

- 1** = Nature (see, forest, mountains, jungle, river,...)
- 2** = Hotel type
- 3** = Amenities (pool, golf course, wellness,...)
- 4** = Period (spring, summer, fall, winter).

Alternative means how to solve problem and what kind of pay-off you will get

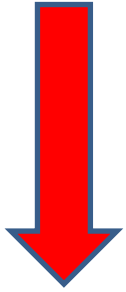
Access situation (situation appraisal)

- Identify concerns (problems) by listing them (**detection**)
- Separate the level of concern (**importance**, **magnitude**, and level of **influence**)
- Set the **priority level** to measure the 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**)


Used terminology

- Importance=magnitude=level of influence
- Priority level
- Step-by-step approach
- **Questions:**
 - Who
 - What
 - Where
 - When
 - Extent

WHO WHAT WHEN WHERE EXTENT



Make decision (A choice between two or more alternatives)

- Identify what is being decided (quality, used OM methods)
- 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**

Concise overview of the previous text

- Must-to-have
- Nice-to-have
- **Importance factor** =score (10-1)=satisfaction score
 - 10 – the highest importance
 - 1 – the lowest importance
- Risks
 - **Importance factor** could be also e.g. 100-1

Some statement of underestimation of Information Technology

- I think there is a world market for maybe five computers (IBM chairman 1943)
- There is no reason anyone would want a computer in his or her home (President of Digital Equipment 1977)
- I can assure you that data processing is a fad (craze), that won't last out the year (Editor Prentice-Hall 1957)
- Document management is nice-to-have, not must-to-have (Director of the company still burdened in manual business process)

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
		Car 1		Car 2		Car 3		
"Want" Criteria	Importance*	Criterion rating	Weighted score	Criterion rating	Weighted score	Criterion rating	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.

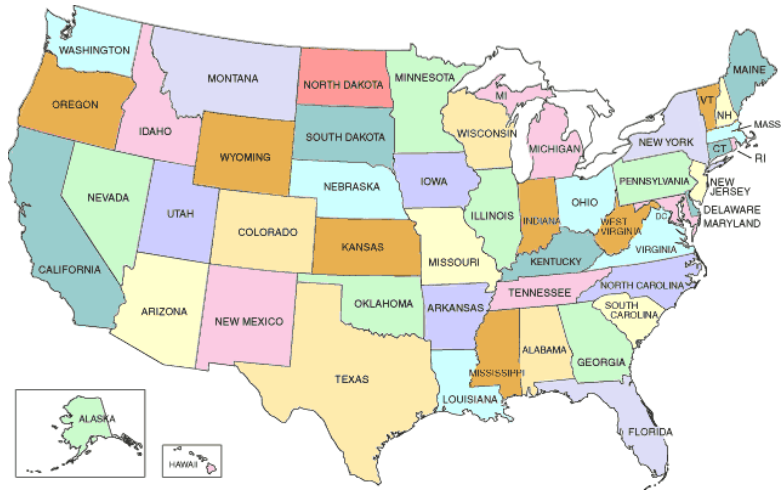
Another similar problem to be solved

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

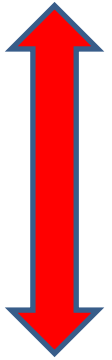
The definition of the problem dictates the requirements. As the vehicle is for a motor pool, the requirements will differ from those for a family car, for example.

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	<i>Arrow</i>	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
		<i>Baton</i>		
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
		<i>Carefree</i>		
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
		<i>Dash</i>		
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 !!!

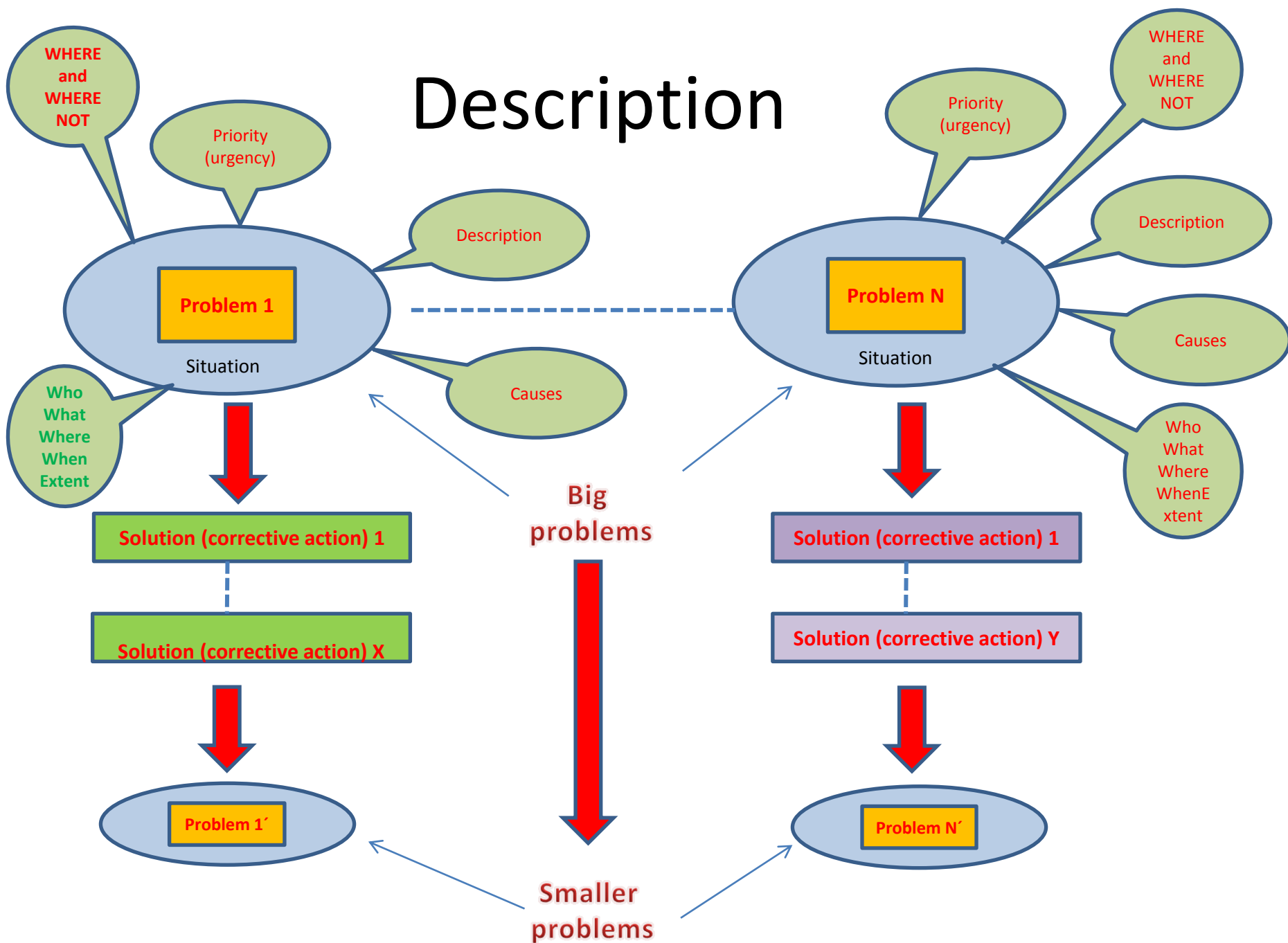


Uncover and handle problems

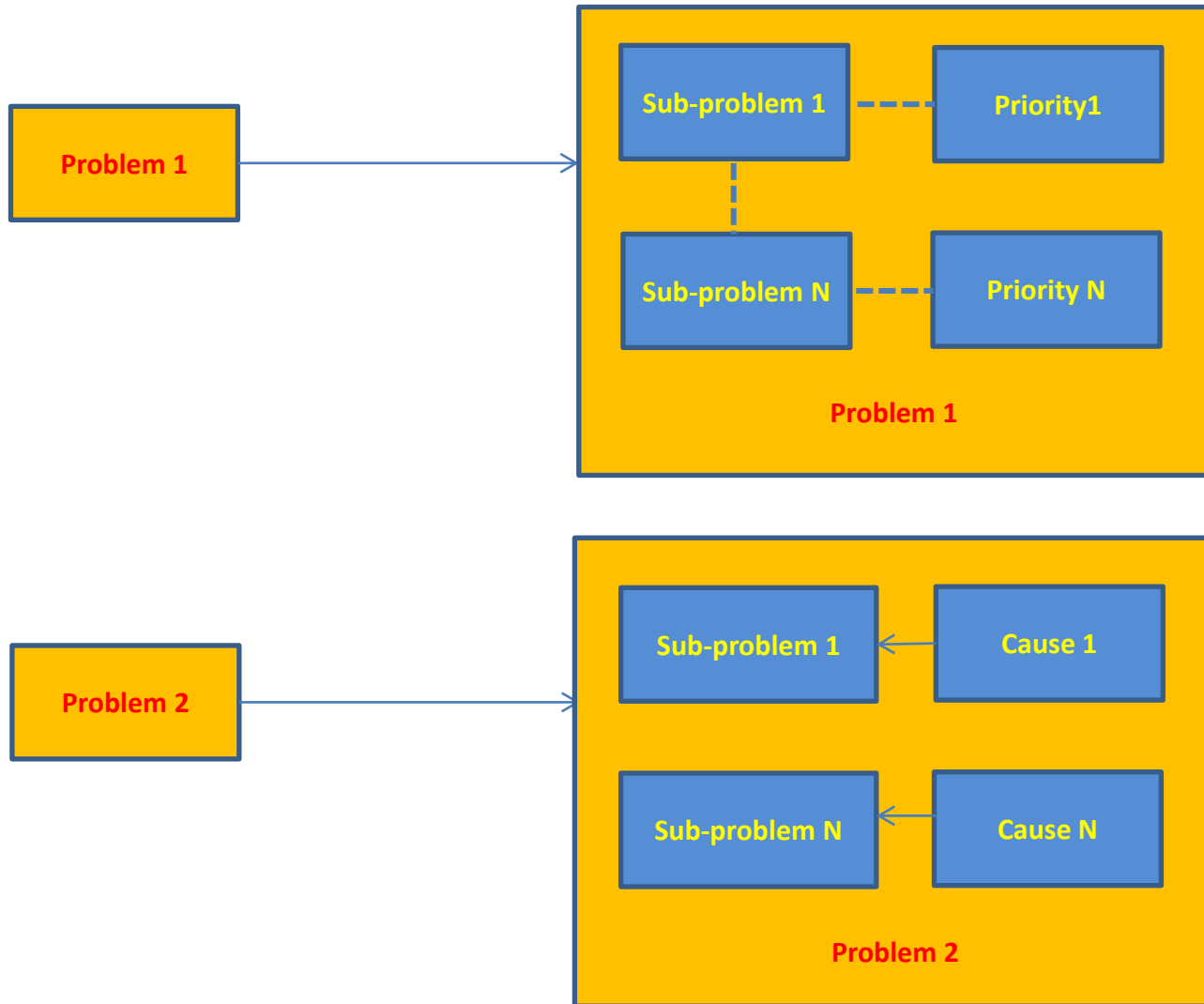
(problem analysis)

- State the problem (**definition and description of the problem**)
- Specify the problem by asking **what is** and **what is not, who is and who is not...**
- Develop possible causes of the problem (similar to CRT or Ishikawa approaches) - > (**detection**)
- 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

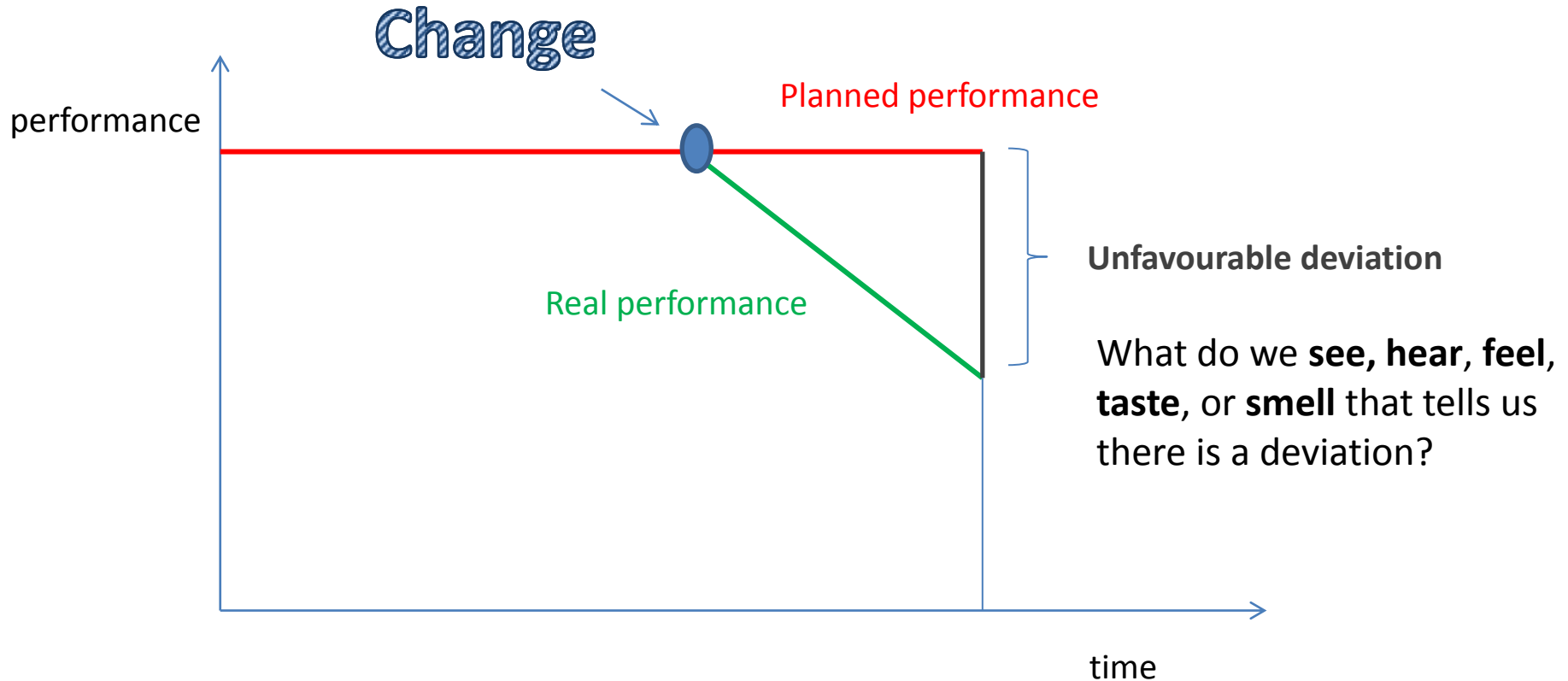


Decomposition, priorities and causes



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: Who, What, Where, When, and to what Extent –Size (how much, how many)?

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

- **Server crashed** (this is a very poor and not clear 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)
- **Comment** : WHO is not mentioned here but could be : Different staff (3 shift) –see table

	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
<i>What (identify)</i>	Q1	Q2
<i>Where (locate)</i>	Q3	Q4
<i>When (timing)</i>	Q5	Q6
<i>Extent (magnitude)</i>	Q7	Q8



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 parameter 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)?
Adjustment is working – good setup in **database B**
- 1 -> Setup has another parameter **ON**
2-> Algorithm is also used for production where not error occurs

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

Inventory Setup

General Location Dimensions Numbering

Automatic Cost Posting .

Expected Cost Posting...

Automatic Cost Adjust... **Never** ▼

Average Cost Calc. Type Item ▼

Average Cost Period . . Day ▼

Copy Comments Order...

Copy Comments Order...

Outbound Whse. Han...

Inbound Whse. Handli...

Help

Inventory Setup

General Location Dimensions Numbering

Automatic Cost Posting .

Expected Cost Posting...

Automatic Cost Adjust... **Always** ▼

Average Cost Calc. Type Item ▼

Average Cost Period . . Day ▼

Copy Comments Order...

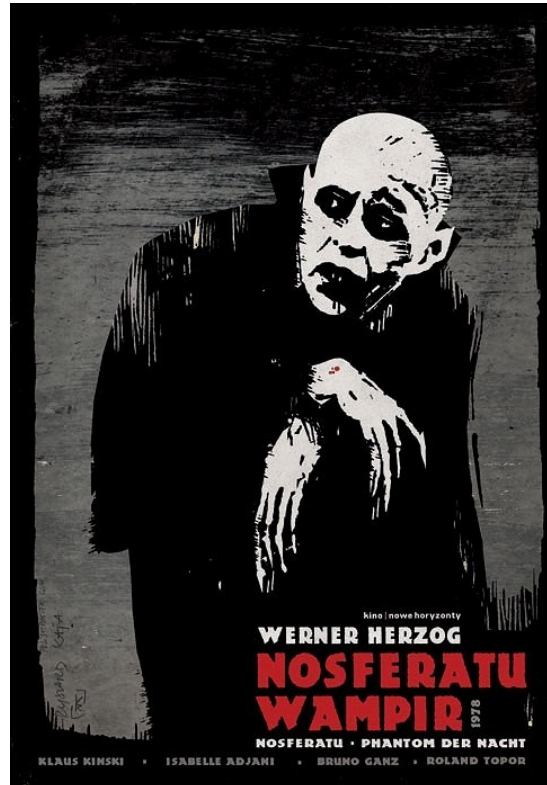
Copy Comments Order...

Outbound Whse. Han...

Inbound Whse. Handli...

Help

Apology- we go back to strange individual habits od vampires



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. Healthy

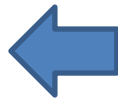


Example for **What IS** and **What IS NOT**

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**



Customer X



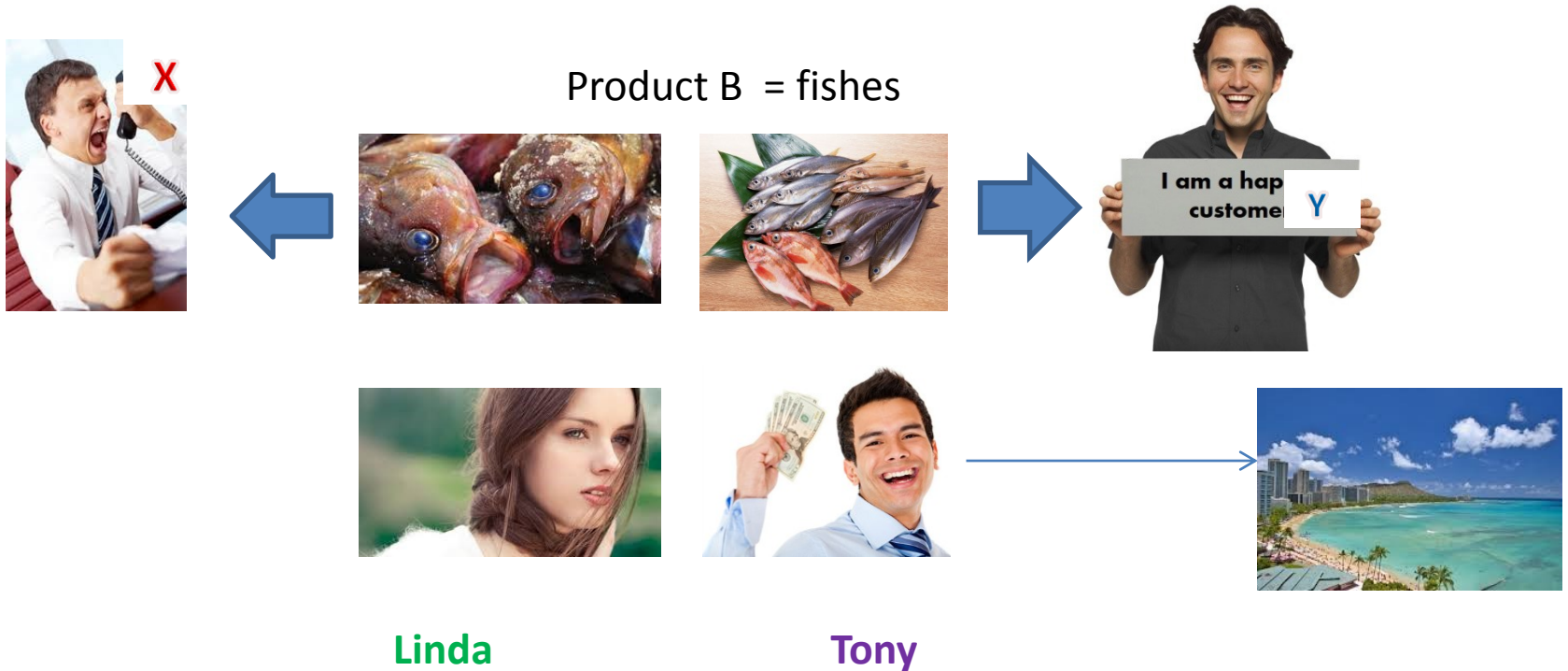
Product B



Customer Y

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



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 a bunch of garlic and visiting Špilberk castle in Brno



Dracula Castle
(Where IS)

Transylvanian Alps in Romania
(castle of Count Dracula)



Špilberk Brno
(Where IS NOT)



Sarah
(What IS)



Emily
(What IS NOT)



garlic



Problem Analysis - **Where**

Is

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

Example for **IS**:

1. The old castle in the mountains (Romania)

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

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 NOT**

1. Brno castle Špilberk

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

Problem Analysis - Extent

Is

- How many objects have the deviation?
- What is the size of a single deviation?
- How many deviations are on each object?
- What is the trend?
 - Occurrences?
 - Size?

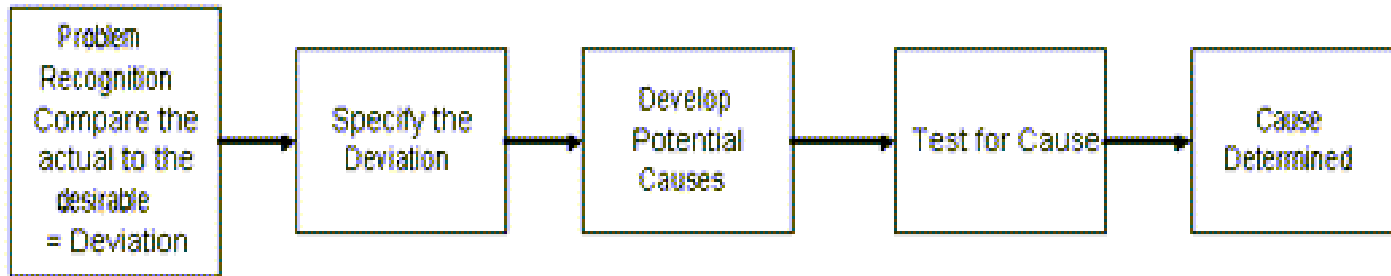
Is Not

- How many objects could have the deviation, **but don't?**
- What other size could a deviation be, **but isn't?**
- How many deviations could there be on each object, **but are not?**
- What could be the trend, **but isn't?**
 - Occurrences?
 - Size?

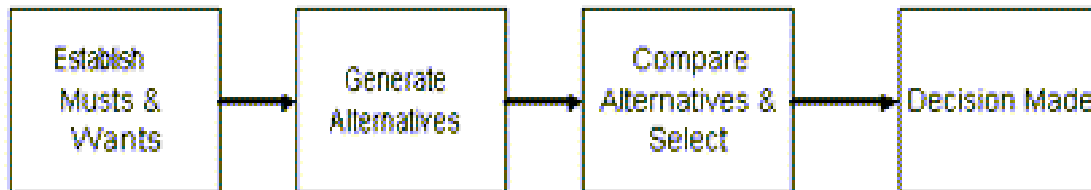
Let's Look At Some Problems!

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 ->the most important issue)

		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 1 st , 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 ->



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

Comment: specification is very simplified-> all aircraft use life jackets regardless Of the type of fly (over water or over land)

Results

Only a part of the cabin crew shows how a life jacket is worn over their heads. In new airplanes, the life jackets were treated with powder chemicals that cause a rash on contact with the skin.

Moreover, the deployment of life jackets is not presented on-air routes outside the oceans and seas.



WORLD CUP & QUALITY MANAGEMENT

SAMUEL K. M. HO

Keywords: Quality Management, World Cup, problem solving

Abstract: In the semi-final World Cup 1990, England lost to West Germany in the penalty shootout. The Italian team had similar experience when they lost to Brazil in the World Cup final 1994. History repeats itself -- in WC'98, England lost to Argentina and Italy lost to France by the same mistakes. In an attempt to audit the defeats, the author developed the S-H Method of managerial auditing and used the World Cup match examples to illustrate the significance of the S-H Method in auditing managerial processes.

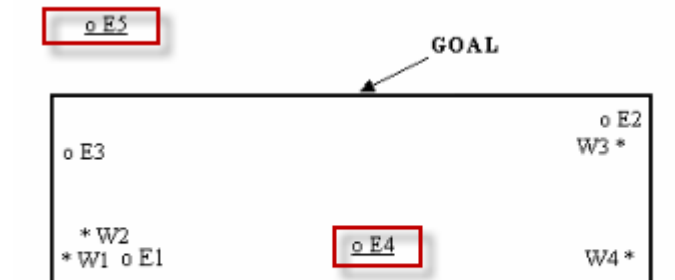
Author: prof. Samuel K.M Ho, School of Business, Hong Kong Baptist University, Hong Kong

Rule #1: In a successful penalty-shoot, the ball ends up in the goal away from the goal-keeper's reach. The most likely positions are those along the inside edges of the goal-posts, the higher the better, provided that the ball does not go over the bar. The football player must target these points.

Rule #2: The shooter should assume that there is nobody at all in the field, and concentrate on shooting the ball into the positions defined as the best.

ENGLAND			WEST GERMANY		
Goal	Player	Result & Analysis	Goal	Player	Result
E1	Lineker	In	W1	Brehme	In
E2	Beardsley	In	W2	Matthaeus	In
E3	Platt	In -- despite being touched by the goal-keeper	W3	Riedle	In
E4	Pearce	Ball caught by the goal-keeper (violating Rule #1)	W4	Thon	In
E5	Waddle	Ball flew above the goal (violating Rule #2)	WON		

Table 1 Score Table of Penalty-shoot Knock-out -- World Cup Semi-final 1990: England vs. West Germany



*Figure 3
Approximate Positions of Penalty-shoot Goals -- World Cup Semi-final 1990:
England (E) vs. West Germany (W) (Underlined balls indicate missing shoots)*

Example of analysis (only as an interesting example)

	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 goalkeeper 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	<ol style="list-style-type: none"> 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 		

- **WHAT** -- Lack of proper training led to the weak penalty-shooting, mostly due to players not adhering to Rule #1 (see).
- **WHO** -- A significant number of players were making the mistake as a result of insufficient training.
- **WHEN** -- When players are tired, the physical condition may affect their decision making. This is why training is important.
- **WHERE** -- More stringent training on correct shooting (Rule #1).
- **HOW SIGNIFICANT** -- The importance of the match makes the problem very significant. Therefore training must be thorough.

Example of K-T problem analysis

	Is	Is Not	Differences	Changes
What	Remote access running slowly	Local access	Use of WAN	
Where	In Germany	In other countries	Different WAN links and routers	
When	All the time Since 20-Jan	At particular times or days. Before 20-Jan		Firmware on German routers had a security patch on 20-Jan
Extent	All transactions take about twice normal time	More than twice normal time. Complete failure.		

<https://www.youtube.com/watch?v=dUtoOUWnJY0>

https://www.youtube.com/watch?v=TEc_FZhRoro

Thanks for Your attention

