

# Conceptual Research Design

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- The modeling of the content of the research
- Determines what, why and how much is going to be studied
- 4 phases:
  - Objective of the research
  - Research framework
  - Research Question/Conceptual model
  - Definition & Operationalisation

# Why do we need a context?



**Without a context most research will become unstructured and not solve the problem at hand!**

# Context

- Most research is carried out to solve a problem from someone else.
- In order to avoid carrying out research on solving the wrong problem it is important to understand the context of the problem and formulate it clearly.
- Get confirmation from your client (industry, supervisor etc.) that you have fully understood the context.

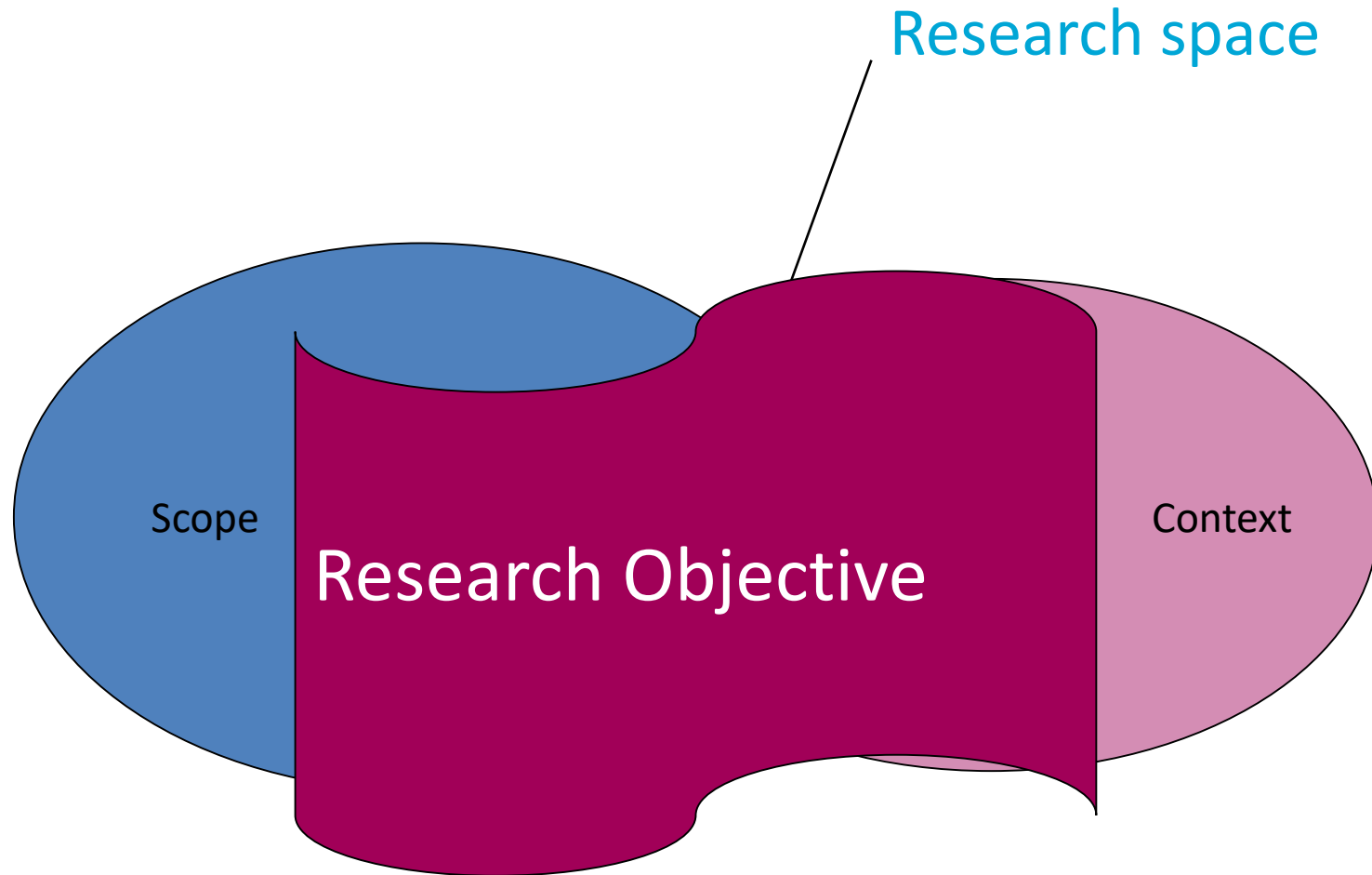
# Example

*An airport has been told it produces too much noise. A solution to this problem must be found.*

- What could the context be?



# Scope and Context



# Criteria for Research Objectives

- Useful (what is the benefit of your research to the problem/solution?)
- Realistic (contribute to the solution of the problem)
- Feasible (within time scheduled and within your capabilities & resources)
- Clear (be precise in what your project's contribution to the problem/solution is)
- Informative (rough idea of knowledge generated towards a solution)

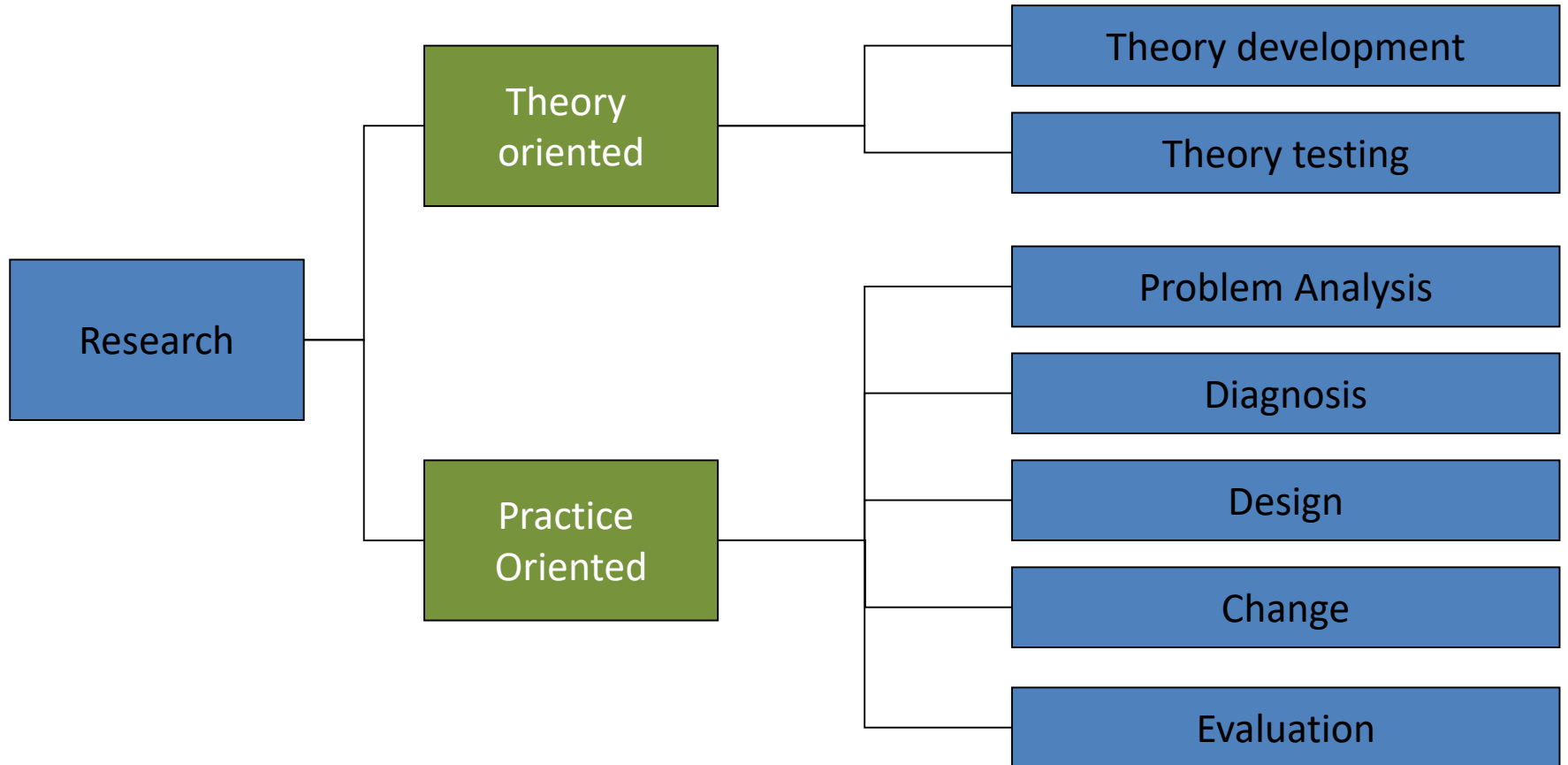
When formulating an objective ensure you can answer these questions!

# Formula for Research objectives:

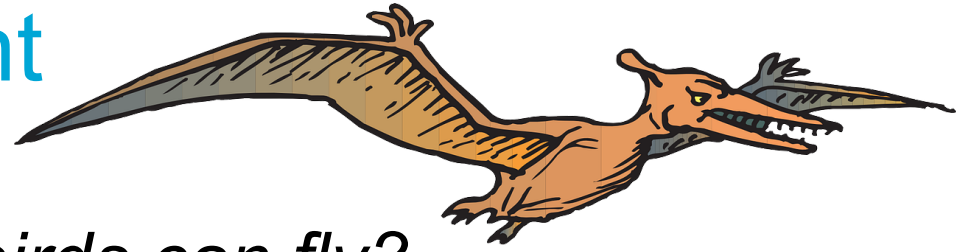
- The research objective is ... (a) ... by ... (b)...
- (a) = the contribution of the research project to the solution of the problem
- (b) = description of the way the contribution will be provided
- Note: without (b), statement (a) is too generic!!



# Types of theory oriented and practice oriented research



# Theory Development



- *How is it possible that birds can fly?*
- The objective could be to develop a theory about generating lift from the moving wings of a bird **by** measuring their wing & anatomic analysis of the dynamic motion



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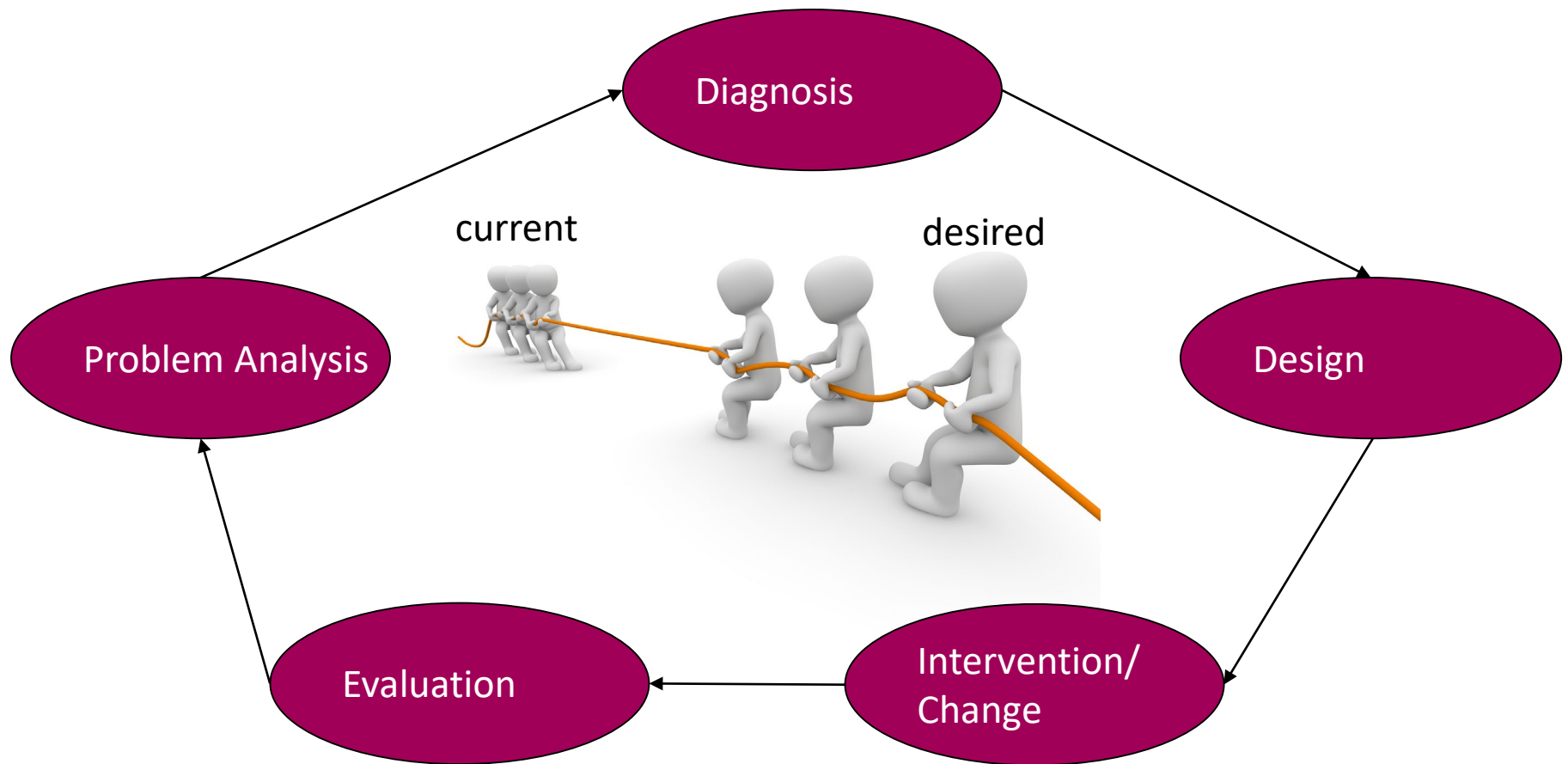
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# Theory Testing



- Is there a relation between the cost per kilometer in a car and the total driven kilometers and is it significant enough to reduce traffic jams?
- The research objective could be to find out if the relationship exists between km cost and driven kilometers **by** testing existing hypothesis

# Practice Oriented Research: Intervention cycle



# Problem Analysis



- Can we make it to Mars by 2020?
- The research objective could be to make recommendations on what technological developments must be made in order to travel to Mars by 2020 **by** mapping out the technology readiness levels of current developments

# Diagnosis



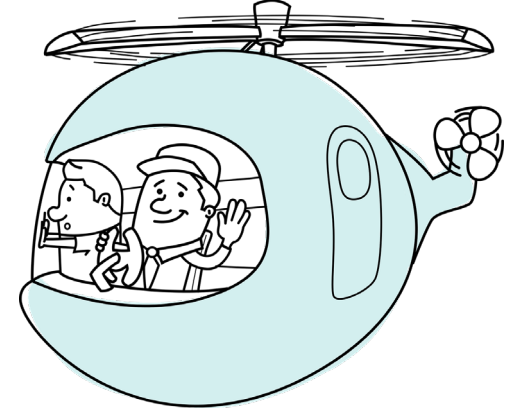
- Can airports compensate for the improvements in IT which causes that it is no longer needed to be on the airports three hours before the flight? How can they do this thinking of revenue generation?
- The objective could be to come to recommendations to increase airport revenue **by** analyzing what passengers want from airports these days

# Design



- How can we reproduce the sound of a Ferrari using composite materials for the exhaust instead of the usual metallic materials?
- The research objective could be to suggest a possible solution **by** designing an exhaust using composite material which has similar acoustic behaviour as metals

# Intervention/Change



- How to distribute your air taxi fleet effectively across major cities such that empty legs are minimized?
- Research objective might be to make recommendations to the air taxi company director about distribution of air taxis **by** closely following and describing the current distribution and suggesting improvements



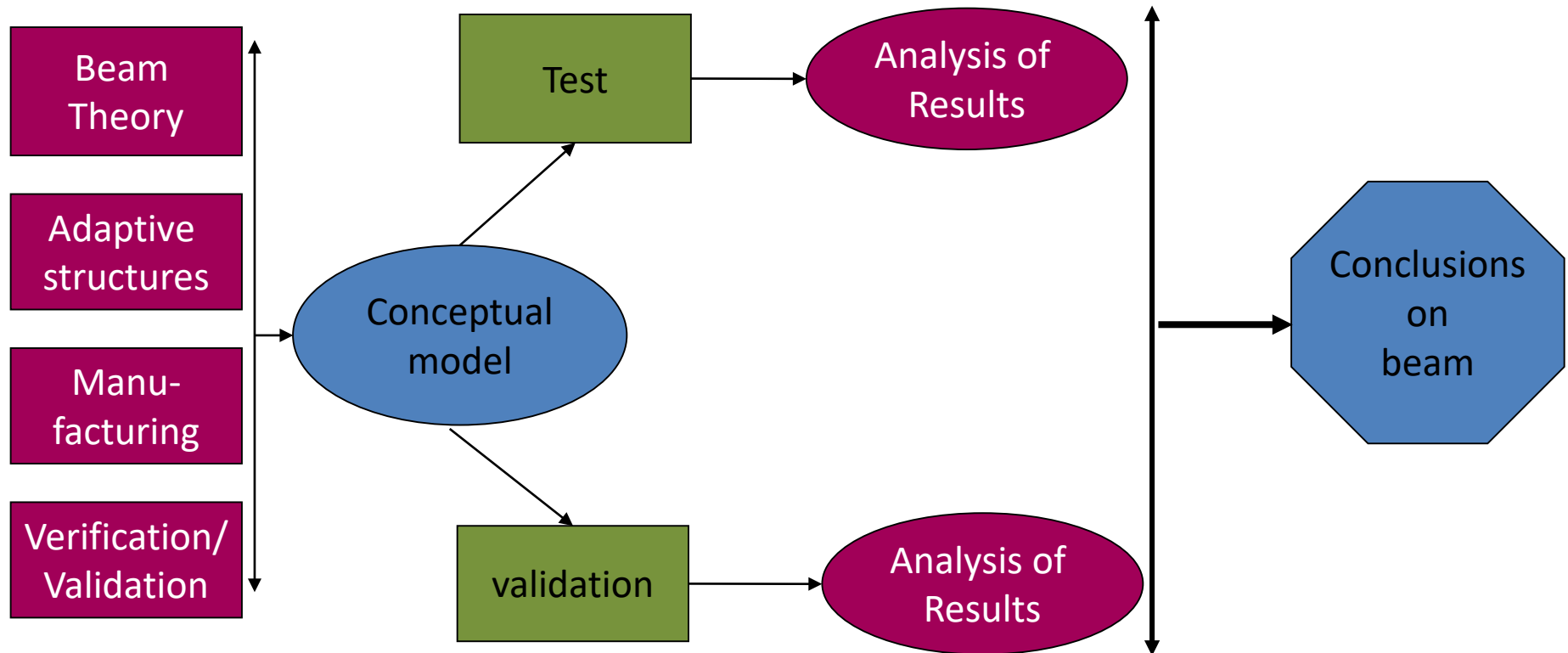
# Evaluation



- Did the change from hub-spoke to point-to-point improve airline X' s revenue?
- The research objective is to make recommendations to the airline with regards to the revenue improvement **by** carrying out an evaluation of the revenue since the change to point-to-point

# Research Framework

Schematic representation of research steps



# Research Questions

- Research Questions are questions that must be answered during the project
- The answers will yield information that is useful & necessary for accomplishing the research objective
- Research questions enable us to design the technical part of our research
- **TIP:** If you struggle with the technical design it is **MOST LIKELY** that your set of research questions is inadequate

# Formulating Research Questions

There are 3 methods:

- Subdividing of research framework -> key questions
- Unraveling key concepts -> sub questions
- Corroborative types of knowledge -> both

Each research question **MUST** meet two requirements:

- Efficiency:
  - Refers to the degree of knowledge required and the degree to which knowledge contributes to the research objective
- Steering function:
  - does the question indicate which type of knowledge is required?
  - does the question help decide what material data needs to be gathered during the project?

# How to formulate a Research Question?

- Identify the main issue that will be investigated by describing the key concept that will be the focus of the work.
- Think of this first in qualitative terms and then try to design the research question that can link to a research hypothesis based on quantitative evidence.
- Ensure that you at least identify and incorporate what the main drivers might be.
- Formulate and link or build towards to a main hypothesis that can be tested.
- Similarly, focus on knowledge capture at an appropriate level relative to the body of scientific knowledge

# How to formulate a research hypothesis?

- The missing link between qualitative highly intelligent research and scientifically proven quantitative research!
- A formulation that tests the proposed relationship between key variables, leading to the improved solution to some research problem.
- There are several classic structures:
  - Null and alternative constructs (relationship correlations are disproved or otherwise).
  - The if-then construct.
  - Directional and non-directional (positive, negative, more, less relationship included) constructs.

# Pitfalls

- The Research Questions are questions **YOU** the researcher must answer. **NOT** the questions the client has!
- You can **NEVER** have one sub question.
- Check you meet the requirements regarding efficiency and steering function
- **ITERATION: Check continually** whether the set of research questions obtained induces a change in research objective or framework. If so make **adjustments** and **repeat** the steps!

# SMART formulations

- **S**pecific
- **M**easurable
- **A**chievable
- **R**ealistic
- **T**ime-Constraint



# Example of Research Questions

Problem: Is it possible that rocket technology can be developed in an economically feasible manner in order to facilitate the vehicle requirements associated with moon tourism?

Possible Research questions:

- What are the technological success factors for space tourism to the moon?
- How will the actual situation of current feasibility be assessed in light of these success factors?

# Definition & Operationalisation

- Describe content of key concepts with exact definitions
- Which assumptions/limitations are you making and why!
- What are you neglecting and why?
- What indicators/variables will you use?
- How will you measure?
- The concepts you define will determine the type of material you will gather!
- **DON' T LEAVE IT TILL LATER!**