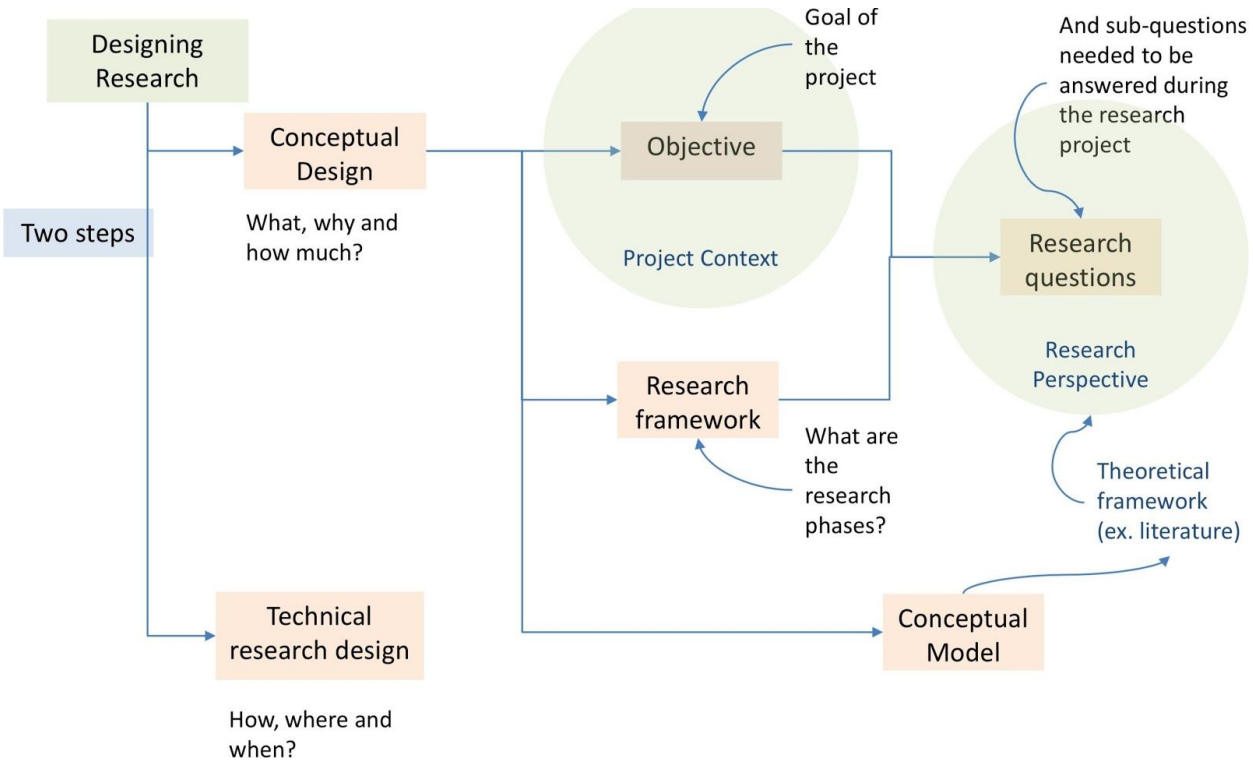
RDM

Chapter 1



Designing research involves two separate sets of activities.

I. Conceptual Design:

everything you wish to achieve through the research project- modelling the content of the research.

The most important purpose of the conceptual design is *steering*. others are the *motivational* and the *evaluative purpose*. Motivation is something the researcher will need when performing time-consuming activities. The evaluative purpose is generally realised by the conceptual design serving as a product specification.*What, why and how much* we are going to study?

It consists of 4 elements:

1. **Research objective** (goal of the research):
   - the contribution wishes to make to solve a problem outside the research itself (known as the **external aim**).
   - It concerns the use of the knowledge the research produces, not the knowledge itself.
   - Research objective has to be derived and embedded into the **Project context**.
2. **Research framework**:
   - schematic representation of the most important research phases.
3. **Research questions:**
   - The answers to the research questions provide the exact knowledge required in

order to achieve the research objective. This concerns the so-called **internal aim** of the research, the goal within the research project.

- Crucial in formulating research questions is determining which theoretical framework will be used to study the research object (**Research Perspective**).
- A theoretical framework often takes the form of a so-called *conceptual model.* A conceptual model consists of a set of assumed relationships between the core concepts of the project.

4. **Defining and Operationalising:**
   - It is a set of activities in which the core concepts of the research objective, the research questions and the conceptual model are defined, refined and made concrete (abstractly defined core concepts are translated into observable phenomena: indicators).

II. Technical Research Design:

it concerns **how** to realise all this during the implementation stage of the project. **How, where and when** we are going to do our research?
It consists of:

1. **Research strategy**: Is the researcher looking for breadth or depth? quantitative or qualitative approach? etc. amount/type of data
2. **Research material**: data gathering. Where is research material to be found, or how can it be produced?
3. **Research Planning**: Time schedule with deadlines for the products or deliverables.

Step-by-step approach

1. Explore the project context of the research project at hand and decide on a single and a feasible research objective.
2. Construct a research framework that gives a general indication of the steps that you plan to take to achieve the research objective.
3. Examine, partly on the basis of the research framework, which information will be useful or necessary in order to achieve the research objective. Then formulate this information into a set of research questions and - if appropriate - into a conceptual model.
4. Determine the core concepts of the project and tailor the definitions and operationalisations of the concepts to the research objective and set of research questions.
5. Determine what research strategy you are going to follow when gathering and processing the material into answers to the questions.
6. For each research question, examine what type of research material you need in order to arrive at sound answers.
7. Draw up a research plan that indicates the activities you are going to carry out, when this will take place, and which products will result during the separate phases of research.

Chapter 2 (Research Objective)

Project Context:

In view of the many requirements a research project must meet, it is important that the **subject of the research project** is **carefully defined** and embedded in the wider context of the consultancy project. We call this wider context the *project context* of a research project.
Put more simply. The **project context is a set of problems**. Usually the context is too wide,

therefore demarcation (isolating an area) is needed.

Step-by-step approach (formulation of project context and the objective)

1. Determine whether you will opt for a **theory-oriented or a practice-oriented research project**. Explore the project context on the basis of the questions on page 34. Determine who will be the commissioning person.
2. Determine which of the **two types of theory-oriented, or which of the five types of practice-oriented research you will opt for, based on the exploration of the project context.**
3. **Formulate the research objective** of the research.
4. Check the **research objective on its form and content.** The form should be: The objective of the research project is to ... (a) . by realising ... (b) ... (see page 38), The content must meet the criteria of **usefulness, feasibility and clarity and it should be informative**. Wherever appropriate, adjust your research objective.
5. Examine whether the research objective calls for reorientation. If so, carry out the reorientation and see if the research objective needs to be adjusted (iteration).

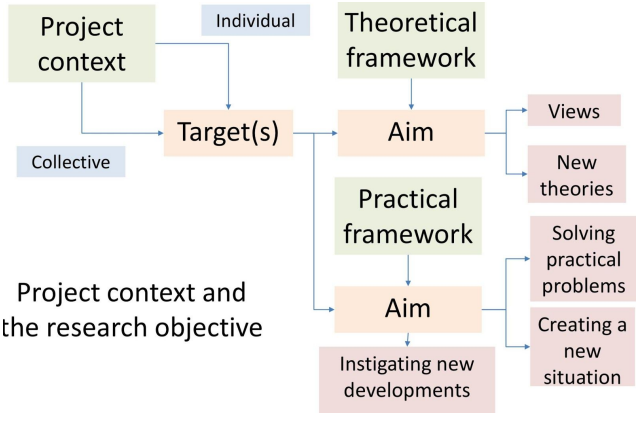
Step 1

Each research project aims to provide knowledge, insight and information that can ***contribute*** towards solving a problem.

- **Theory Oriented Project**: the project context is made up of the process (i.e. people and institutes involved in the knowledge formation) and product (i.e. libraries in which knowledge is stored in the form of books) of knowledge formation within the field in which the research project is to be carried out.
    - theory development/testing
    - empirical cycle/scientific method
- **Practice Oriented Project**: the project context is a practical problem in a public or private organisation
    - intervention cycle/problem solving cycle

Theoretical relevance: a research project, which was initially designed as a practice-oriented project, could directly or indirectly contribute to the development of a theoretical body of knowledge in this field.

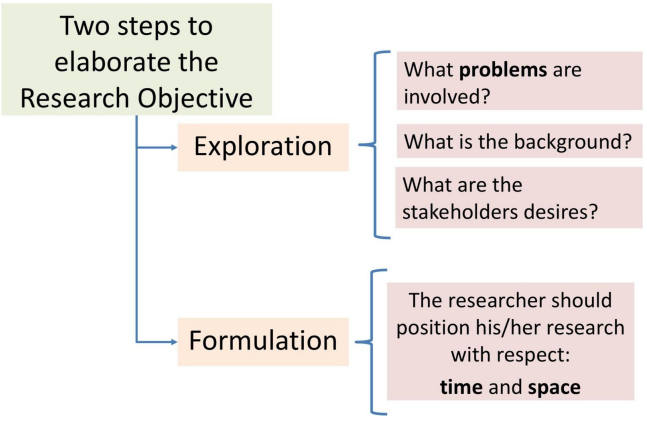
Practical relevance: a theory-oriented research which originally did not intend to be of any practical use, often may, one way or the other appear to provide information that can be very useful in practice.



Project context and the research objective

It is not difficult to understand that within a project context people pursue collective or individual, and sometimes conflicting, targets. Within a theoretical framework this aim usually means developing new theories and views. Within a practical framework, this usually involves solving a particular problem, creating a new situation or instigating new developments.

In sum, the **first step** (I) in setting up a **research design** is to map the **project context**, the **problems relating to this framework** and the **target within this problem context** to which the researcher wishes to be linked. The **second step** (II) is to isolate a part or an **aspect of a target as the objective** of the project. (I) and (II) are the steps used to elaborate the **Research Objective**



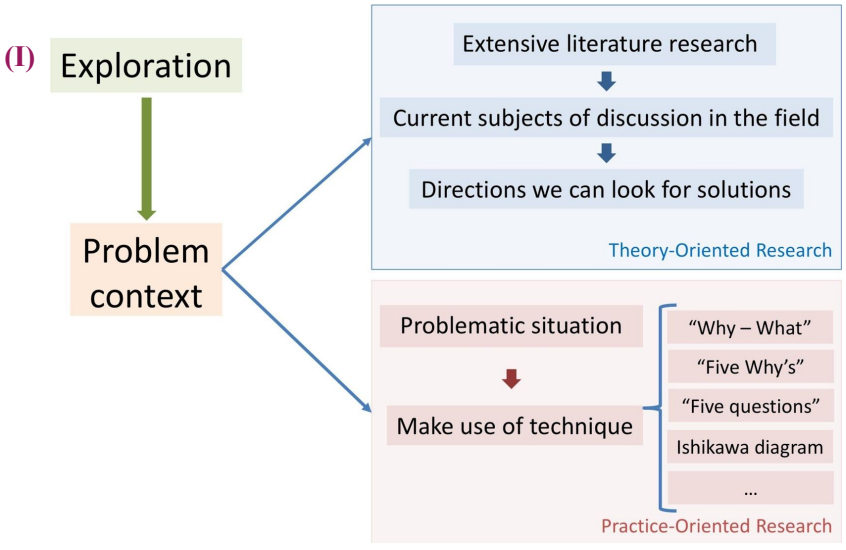
Step 2 and 4

(I) A given case might indicate that **further investigation** of the problems at hand is **necessary in order to clarify what the research project must include**, and **how it can contribute towards solving the problems** found in the case.

This requires an exploration of the project context

One possible way to accomplish this is to ask questions such as:

- ***What problems*** *are involved within the project context?*
- *What is the* ***background*** *to these problems?*
- *What* ***solutions*** *are the stakeholders considering?*



(II) In the case of a **theory-oriented** research, the **project context** is in fact always **too broad**,

because our craving for knowledge and the accumulation of aspects we would like to acquire knowledge about is **almost inexhaustible**. In the case of a **practice-oriented** research, the **project context** is often **extremely extensive** because we are usually confronted with a set of **interconnected problems** that has developed historically and is embedded in a cultural, social and/or political context.

An *effective research objective* is understood to be:

1. **Useful**: Relevant and contributive.
2. **Realistic**: concrete and scoped: "Don't bite off more than you can chew".
3. **Feasible**: in terms of:
    1. Expertise of the researcher,
    2. Accessibility of data, and
    3. Scheduled time.
4. **Clear**: precise language referred to the project's contribution
5. **Informative**: indicates the aim within the project and the knowledge, insights or information needed to achieve it.

Formulating a research objective

The sentence in which the researcher **formulates her or his research objective** consists of two parts,. (a) what one **can and cannot expect from the results** of the project, and (b) a **general idea of the research activities involved**.

There is a very helpful formula that can be used to verbalise a useful, feasible and clear research objective. This formula is: The research objective is ... (a)... by (realising, providing…) …(b)….

In the (a)-part, the unmistakable ***contribution*** **of the research project to the solution of the problem is comprehensively described**. We previously called this the **external goal** of the research project, in other words, the **aim *of* the research**.

The (b)-part of this formula entails a **clear description** of the **way the contribution will be provided**.This is the **internal goal** of the research project, in other words the aim *within* the project.

Part (b) of the research objective provides an indication of the **kind of knowledge, information and/ or insight that is needed** in order to achieve the intentions that are declared in part (a).

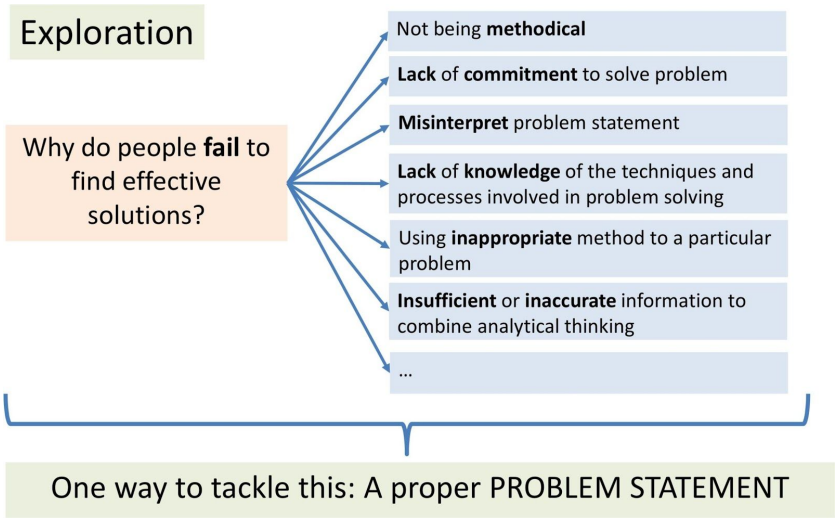
Examples

To indicate the **(a)-part** of a research objective, phrases should be used like:
The objective of the research project is:
(theory oriented)
…to further develop theory X of author Y, dealing with the issue Z;
... to fill the void in theory X, dealing with the issue Z;
... to test theory X based on a domain in reality (empirical findings) 2
(practice oriented)
... to help improve the existing policy X dealing with issue Z;
... to contribute to the development of a new policy X dealing with issue Z;
... to make recommendations to the commissioning organisation Y to solve problem Z.

To describe the **(b)-part** of the research objective

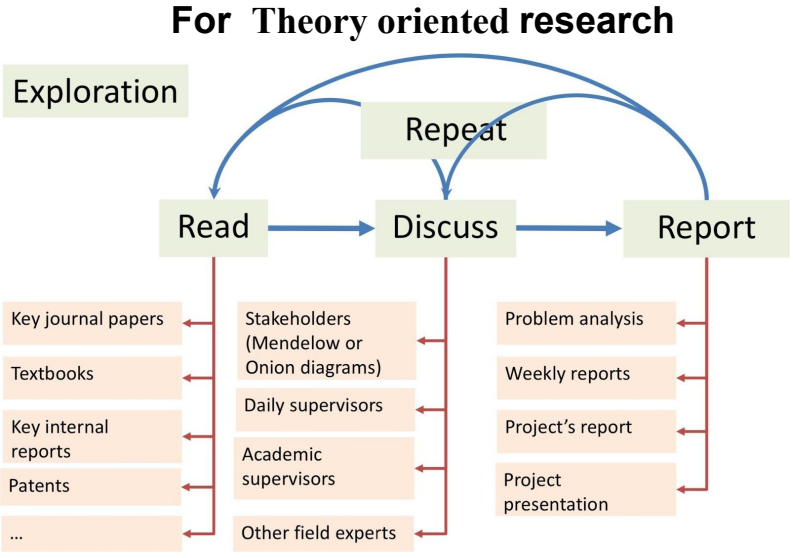
in **theory-oriented projects**, use phrases like:
... by testing a set of hypotheses, deduced from theory X
... by analysing the conditions for the validation of theory X ...;
... by comparing theory X and theory Y ...;
... by critically reflecting on the core concepts X and Y of theory Z.

In **practice-oriented** research, you can use phrases like;
... by providing an overview of the stakeholders' opinions of..
... by providing a clear insight into the problems of an organisation ...;
... by making an analysis of the factors which have caused the problem ..
... by making an analysis of the gap between the desired and the current situation ..
... by making a comparison between ..
... by making an assessment of ..., and so on.



Problem Statement:

- Its **purpose** is to focus the attention of the problem solving team.
- It is a **concise description** of the issues that need to be addressed before trying to solve the problem.
- **Ill-defined problems** are complex because it is difficult to define each of the elements of the problem space.



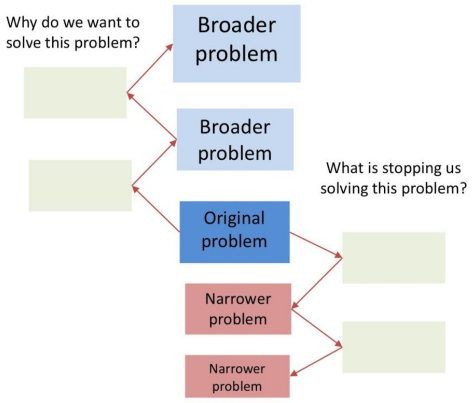
For Practice oriented research

Example 1

"Why-What" analysis model

We need to identify the broader problem context by understanding **why** do we want to solve the problem.

Similarly, we need to understand the narrower problem context by understanding **what** is stopping us to solve the problem.

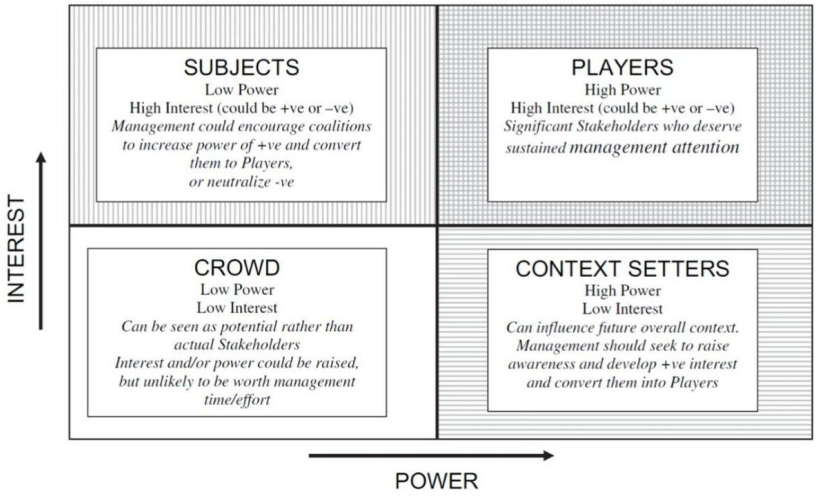


For both Theory and Practice oriented research

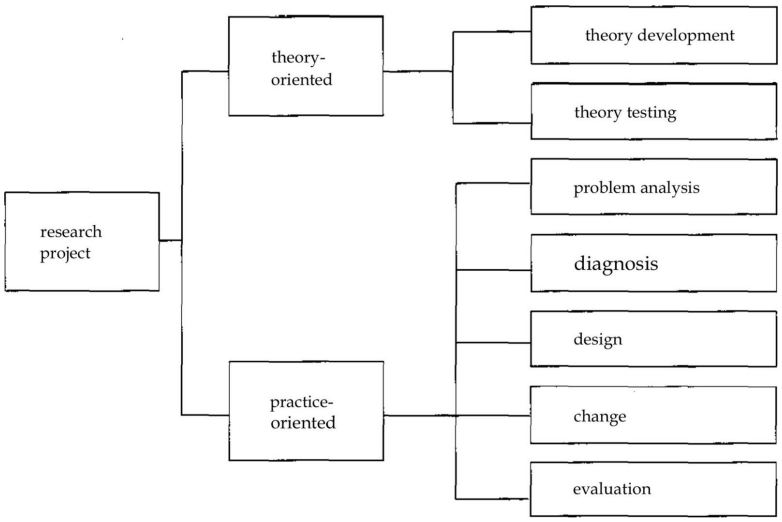
Exploration

Stakeholder analysis

Mendelow's diagram



Step 3 (Types of research projects)



+ Empirical cycle
+ Scientific method

This is the intervention cycle

THEORY ORIENTED

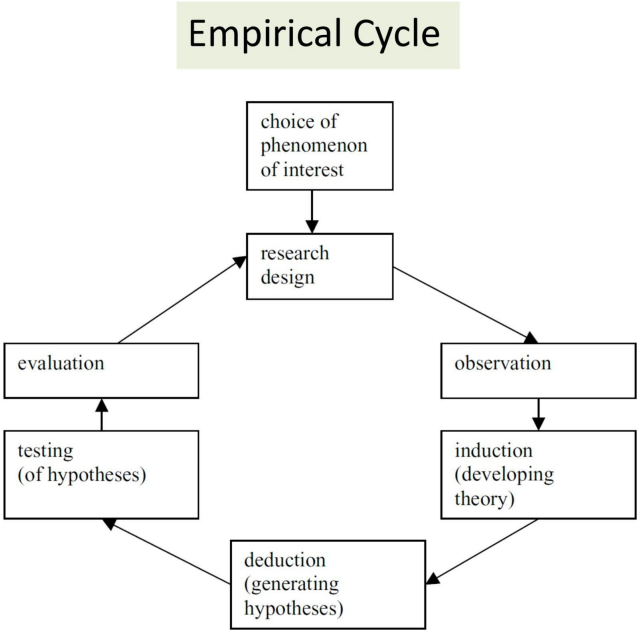
Theory developing research

- when there is existence of gaps in the construction of a theory. A new theory or a complementary part of the theory needs to be developed. Another strategy is to look at anomalies. When choosing an anomaly (i.e. empirical phenomena that do not behave according to the theory) as a starting point for empirical research, the prospect of making a real contribution towards the scientific *construction of a theory* can be achieved.

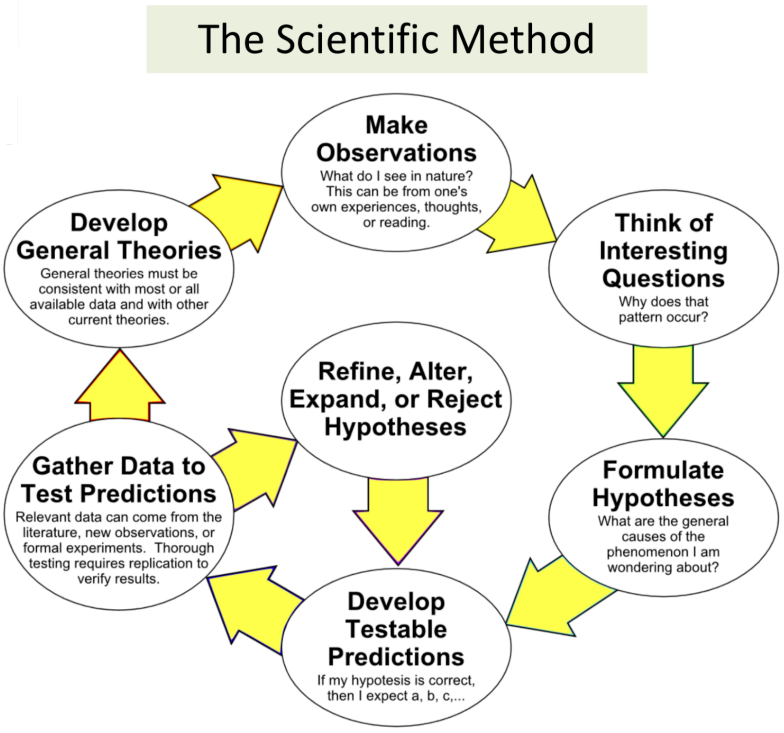
Theory testing research:

- In theory-testing research existing views are tested, adjusted if necessary and/or refined.

Empirical cycle: want to find a phenomena



Scientific method:



PRACTICE ORIENTED

The first two questions that must be answered when exploring the project context of a practice- oriented research are:

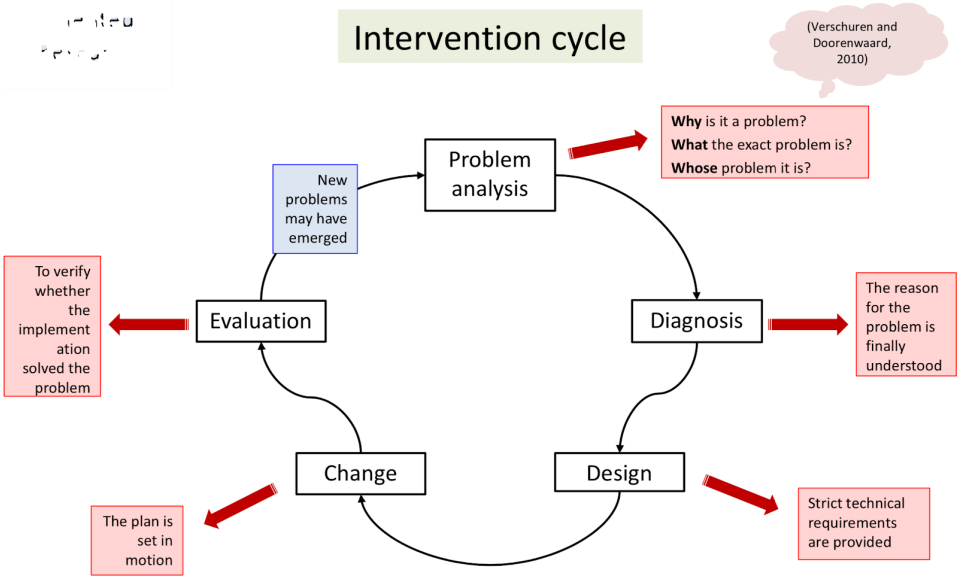
- *Who is the commissioning person?*
- *What does this person want?*

Include both the commissioning persons and the subject of your recommendations in the research objective.

During the project the *researcher* will **examine the situation** in detail in order to define the client's problem and to decide **which part of the problem we are going to study** as the **external goal of the research.** To explore the project context the intervention cycle can be used.

The intervention cycle

is a predefined set of steps to reach a solution relating to operational problems.



Problem analysing research

- it serves to **indicate that a certain factor** is a problem, what the problem **exactly entails**, **why i**t is a problem and **what the exact nature of the problem is**. The goal is to create **consciousness to set the agenda or to reach a consensus**.

Diagnostic research:

- Different types of diagnostic research: reason for prob is understood

1. **Background analysis:** Sometimes the researcher needs to study a problem that is relatively new or fairly complex. The existing theories and the clients' knowledge cannot adequately indicate which of the many possible factors have influenced this problem.
2. **Opinion research:** sometimes it is less important to indicate the exact causes of a problem than to learn more about the opinions shared by the different stakeholders with regard to the background and the causes of the problem. In these cases, insights into the opinions and perceptions are more important than objective knowledge of a problem.
3. **Gap analysis**: see box for example, p. 53

Design oriented research:

- strict technical requirements are provided
- When the researcher decides to develop a design-oriented research project, he or she needs to distinguish between four different types of requirements:

1. **Functional requirements**: requirements are the functions the intervention, or the artefact that must be produced, should fulfil.
2. **Contextual requirements:** are the requirements that stem from the environment where the object is to be installed and to be used.
3. **User requirements:** refer to the wishes and demands of the people who are going to use the object in the future.
4. **Structural requirements**

Therefore, a design-oriented research project implies both the collection and analysis of empirical data with regard to the functional, contextual and user requirements, as well as the structural requirements which can be deduced from the other requirements.

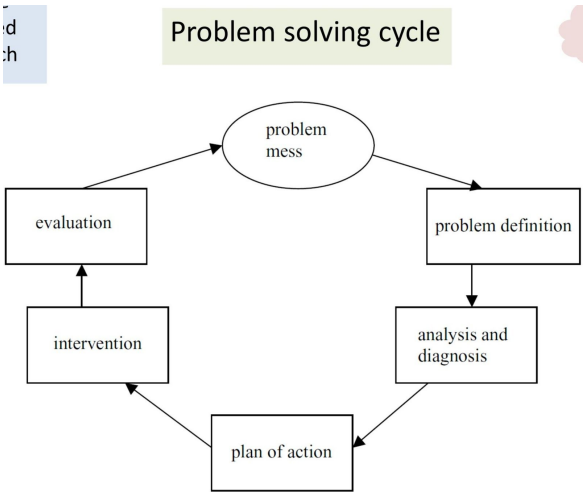
Intervention oriented research:

- the objective of providing data that the company can use for successfully implementing an intervention plan. This type of research is known as a *change-oriented* or *monitoring project.*

Evaluation research:

- To what extent has the intervention been successful? This involves ex-post evaluation research. In general, one can distinguish between three types of ex-post evaluation, depending on the research objective: plan, process and product evaluation. Has the plan proved feasible and expedient (plan evaluation), has it been well-implemented (process evaluation) and are the results satisfactory (product evaluation)?

Problem solving cycle:



Chapter 3 (Research Framework)

A **research framework** is a schematic representation of the research objective and includes the appropriate steps that need to be taken in order to achieve it.

For example:
However, the question remains how sound recommendations can be made. This question is not an easy one to answer. What exactly are you going to research? In other words: what is your research object? What sort of information will you need and where do you plan to get it from? What relevant literature is there?

Step-by-step approach (formulation of Research framework)

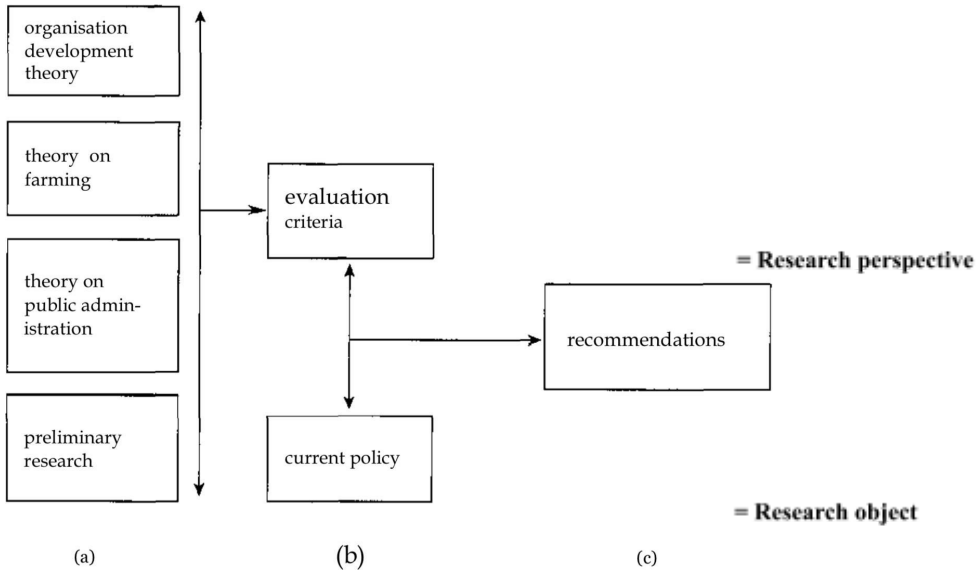
1. Characterise briefly the ***objective*** of the research project.
2. Determine the ***object* or objects of the research projec**t, in other words determine which part of reality that you are going to study.
3. Establish the ***nature* of the research perspective** (see pages 74-78).
4. Determine the ***sources* of the research perspective** (see page 79). Choose the relevant **literature** by making a first selection of scientific articles and reports, and/or outline the preliminary research, noting which experts will be consulted. Base these choices on the key concepts extracted from the research objective.
5. Make a ***schematic presentation*** of the research framework by using the principle of confrontation.
6. ***Formulate* the research framework** in the form of an e**laborate argument according to the pattern** (a, b, c and d) on pages 80-81.
7. **Check** whether the model developed necessitates any **changes to the research objective**. If so, change the research objective and subsequently determine if this means that the research framework needs changing, and so on (*iteration*).

Research Object:

- The research object is the phenomenon in **empirical reality** that you are going to study and that will lead to statements based on the empirical research to be carried out.
- It is proposed to **study this object from an explicit** ***research perspective,*** to be developed by the designer of the research project. This research perspective is called the ***theoretical framework*** of the research. It is like a **pair of glasses that will be used to observe the research object.**

Research framework

The **research perspective** is ready to be ***confronted*** with the research object. This confrontation can be presented in the usual fashion, which leads to a research framework as illustrated in Figure below.



There are **five identifiable principles that reoccur when designing a research framework** (a, b, c, d, e):

a. Working in *reverse;*

By working in reverse we mean that when constructing a research framework, we always **start with the final anticipated result**. We will then e**xamine which steps**, seen as the last intermediate result, lead straight to the final result. Once again, we ask ourselves **how can we reach this intermediate result**, and so forth.

b. Determining the research *object (or objects)*;

A research object is the phenomenon under study about which you will be making statements based on the research to be carried out. Conclusions will be drawn by ***confronting*** **the distinct results of the analysis.**

c. *Confronting* the issues mutually;

The principle of confrontation, which is **fundamental when drawing conclusions**. The most important specification is to place **some thing,** an observation or an object, ***in relation to something else.*** You may also confront two objects **(A and B)** with one another in order to view

their ***similarities*** **and** ***differences.*** A confrontation can also involve an *assessment* of A based on B. See p. 72 for examples.

d. Developing a research *perspective*;

The research perspective serves to the researcher as a **'spotlight'** that can be used to study the research object more closely. The research perspective specifies the **angle of approach towards the research object and roughly indicates which aspects will be studied or not.** See p. 73 for examples.

Three steps for the development of a research perspective:

1. Establish the nature of the research perspective; **(1)**
2. Determine the sources from which the research perspective will be derived; **(2)**
3. and develop the research perspective itself. **(3)**

(1) The nature of the research perspective

Depending on the type of research, various research perspectives can be used: (See p.74-78 for examples of the following)

For **theory** oriented research:

- Theory developing research:
- Theory testing research:

For **practice** oriented research:

- Problem analysing research:
- Diagnostic research:
- Design oriented research:
- Intervention oriented research:
- Evaluation research:

(2) Sources for deriving the research perspective

Several sources of information can be used when constructing a research perspective. Sometimes the research perspective results from a *pilot study* carried out in order to clarify the research objective and the research perspective. Within the scope of this preliminary study the researcher can conduct **interviews with experts in the relevant field**. Which experts should be consulted and exactly which documents and literature should be studied. How to make a useful selection? The most important way to achieve this is by finding the **key concepts in the research objective.** These key concepts can be used as r**eferences for finding relevant theoretical frameworks and documentation, for selecting cur rent experts and relevant expertise, as well as for choosing an adequate frame work for a short pilot study.**

e. *Presenting and formulating* the entire research framework schematically.

(I) Schematic presentation

The visualisation of a research project is realised in three steps:

1. The **components of the research frame work are represented,** using short labels.
2. These labels are **placed in a framework.**
3. All **frameworks are interconnected using double-headed arrows**, depending on the reciprocal confrontations of issues.

(II) Formulation

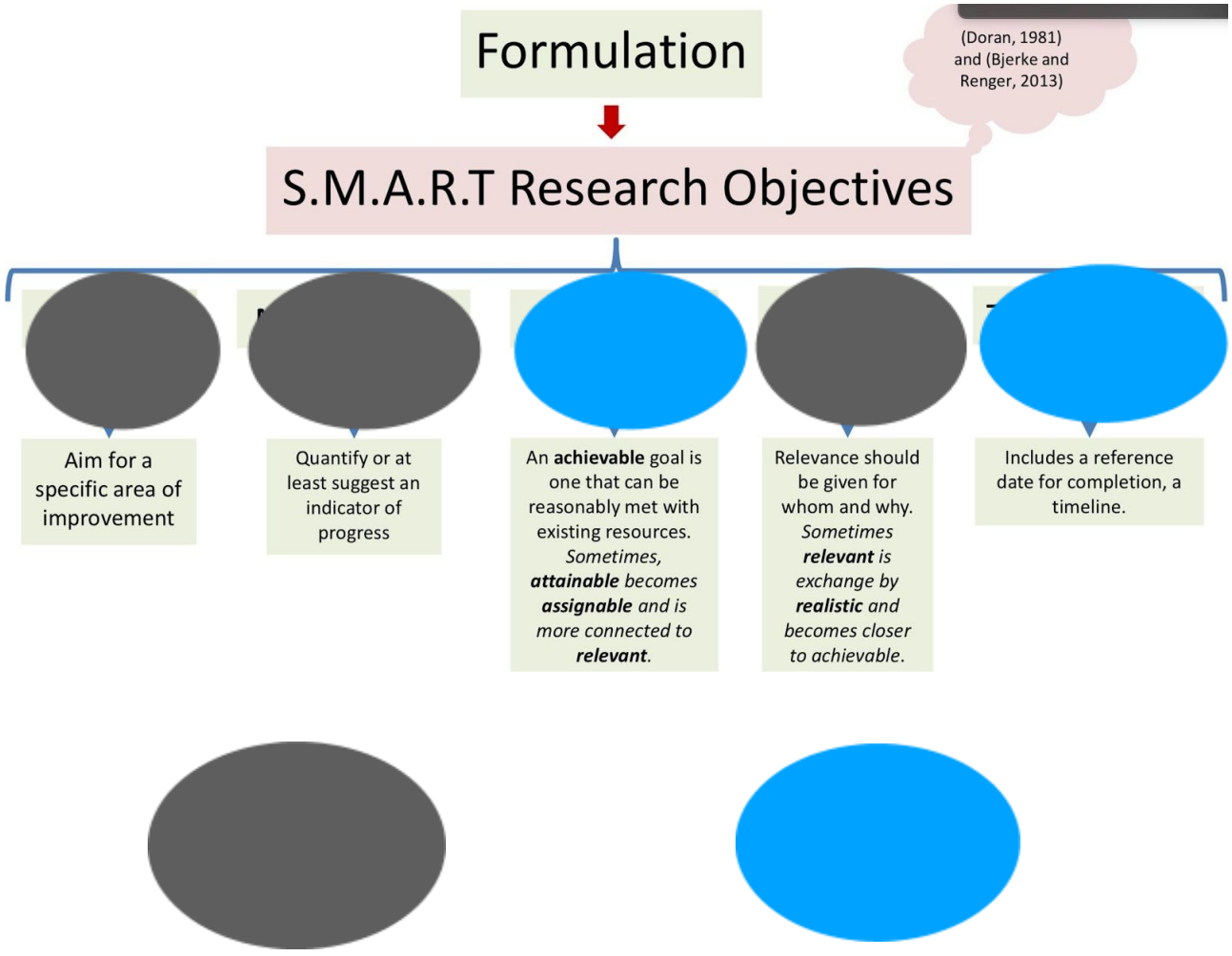
- The first phrase (a) concerns the **formulation of the sources from which the research perspective will be developed**.
- The second phrase (b) i**ndicates to which research object(s) the research perspective will be applied**.
- If there is more than one research object,
- the following phrase (c) then indicates in **what way the analysis of the individual research objects may be interrelated**.
- Finally, in the final phrase (d) you **state the research project's objective.**

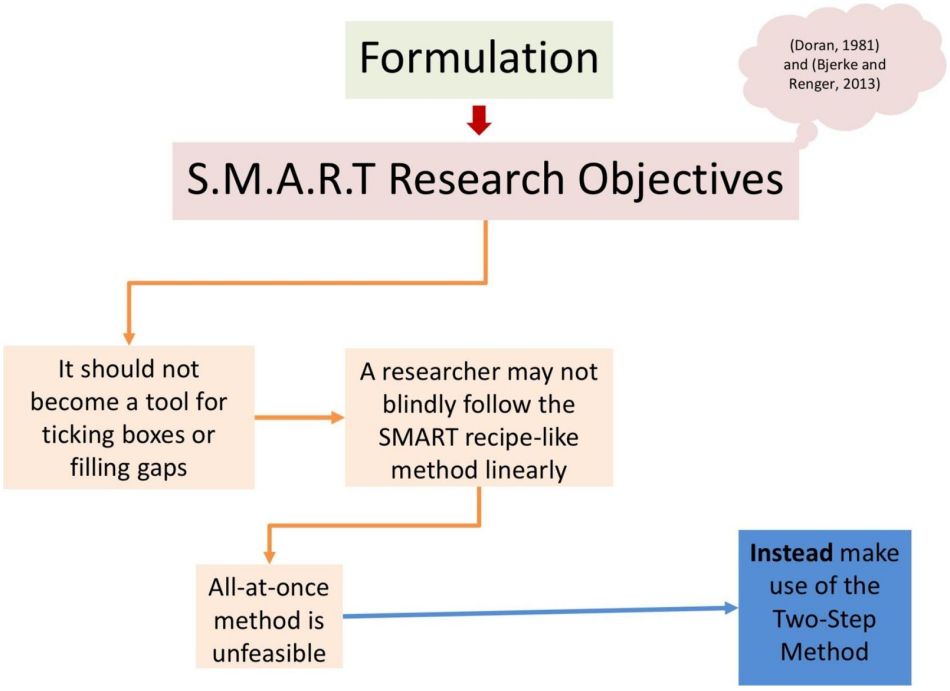
We have illustrated this in the example below. See p. 81 for example.

Advantages

- The **research framework presents all parties involved** (client, researcher, student and supervisor) with a **com pact and clear picture of the nature of the research project and the anticipated results.**
- The **schematic presentation** of the research framework has a very important **communicative purpose**. That is to say, all parties involved will be looking at the same representation of the research project.
- The construction of a research framework **prompts the researcher to select the relevant literature** and explains **how and from which perspective this literature should be studied**.
- The research framework helps to **formulate a set of research questions**.
- The research framework is **very useful for reporting purposes** (i.e. we know that a project will consist of at least five chapters).

Article (S.M.A.R.T. Research Objectives)





Chapter 4 (Research Questions)

- Research questions concerns the **knowledge that is useful or necessary to achieve the research objective.** They consist of at least **one central question**. If so, **at least two sub-questions per central question** must be formulated.
- Since the **research results (should) consist of the empirically based answers to the research questions**, the **quality of the set of research questions has a major influence on the quality of the research results.**
- these are not the QUs you ask your stakeholders. the stakeholder analysis is a tool to analyse the desires and then translate to tech requirements and then add these ingredients to your problem statement and later onto your research objective.

Function requirements: efficiency and steering capacity

The main requirements, which must be met in a set of research questions, are ***efficiency*** and a ***steering function****:*

- **Efficiency** refers to both the **degree of knowledge that yields the answer**s to the questions contained in the set of research questions, and the **degree this knowledge actually contributes to achieving the research objective**. It **refers back to the research objective.**
- The **steering** function refers to the e**xtent to which the set of research questions throws light on the activities which need to be performed** during the carrying out of the research. It **refers forward to the research activities, which are still to be conducted**.

The **contribution of the research questions' answers** to the **research objective should be clear** to any layman who has read the set of research questions. The formerly introduced golden rule, that the m**ore you have to explain the less clear the research design is**, holds true in this case too.

When using the term s**teering function of the set of research question**s, we refer to the following two criteria:

a. The questions indicate **which different types of knowledge** are required.
   - **Descriptive** knowledge: statements such as 'how reality is', or 'what it looks like' or 'how things work', are *descriptive* **statements.**
   - **Explanatory** knowledge: Statements about 'why things are the way they are' belong to the *explanatory* **statements**.

b. The questions will help us to **decide which material (data) needs to be gathered during the research project.**

With a set of research questions that does not meet these requirements, then the **researcher will not be able to derive from the set of research questions the information that needs to be found.**

In general, we argue that **'how can' questions** (intervention problem) should be avoided when formulating a set of research questions for a research project. A research question concerns a knowledge problem and not an intervention problem. they are often RQ in disguise. also avoid **to what extent is the design being properly ……..** provides insufficient info.

Research questions are focused on the **internal goal** (i.e. the type of knowledge that is to be produced) in order to achieve the **external goal** (i.e. what the researcher wants to achieve).

Form requirements: central questions and sub-questions

1. The researcher must find out **what type of knowledge could be useful** for realising the **research objective**. This is to be **followed by formulating one or more central questions**.
2. Next, the researcher asks himself or herself **what knowledge is necessary to answer this central question or these central questions.**

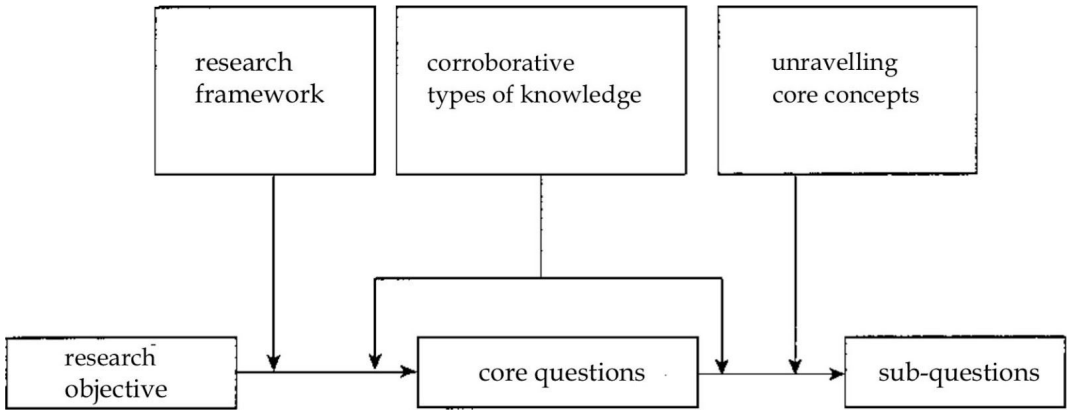
The aim in formulating a set of sub-questions is to make sure that the **combined answers to these sub-questions will roughly provide the information the researcher needs in order to answer the central question they belong to**.

The **most important function of the sub-questions is the steering function**. A second function of formulating sub-questions is that they serve as a **useful tool to *structure* the research activities themselves.**

To sum up, we can say that the formulation of a set of research questions, consisting of central questions and the subsequent sub-questions, must meet two strict requirements:

1. The **combined answers to the central questions are sufficient to help to achieve the research objective, no less, no more**.
2. The **combined answers to the sub-questions provide a satisfactory answer to the central question from which they have been derived.**

The methodology of subdividing the **research framework (I)** into various components is only suitable for formulating the central questions, whereas the methodology of **corroborative types of knowledge (II)** is both useful in deriving the central questions from the objective and the sub- questions from the central questions. The methodology of **unravelling and clarifying key concepts (III)** using a grid is especially suitable for deriving sub-questions from the central questions.



Step-by-step approach

It is an iterative process. If research questions obtained induces a change in the research objective or research framework, make these adjustments and repeat the steps of this step-by-step approach.

Central Question

There are two ways of formulating central questions. Both methods may even complement each other.

1. **Subdividing the research framework (I)**

2. **Identifying corroborative types of knowledge (II)**
   a. Decide which *type(s) of knowledge* is/are relevant in view of the research objective.
   2. Formulate one or more *central questions* of this type or these types of knowledge that play an *immediate corroborative role* in realising the research objective.

Sub-questions

1. **Corroborative types of knowledge (II)**
   For each central question, find the **corroborative knowledge and formulate *sub-questions of* this type of knowledge**. If you come across a 'higher-ranking' type of knowledge than that of the relevant central question, formulate either a 'higher ranking' central question, or another sub-question, or both.

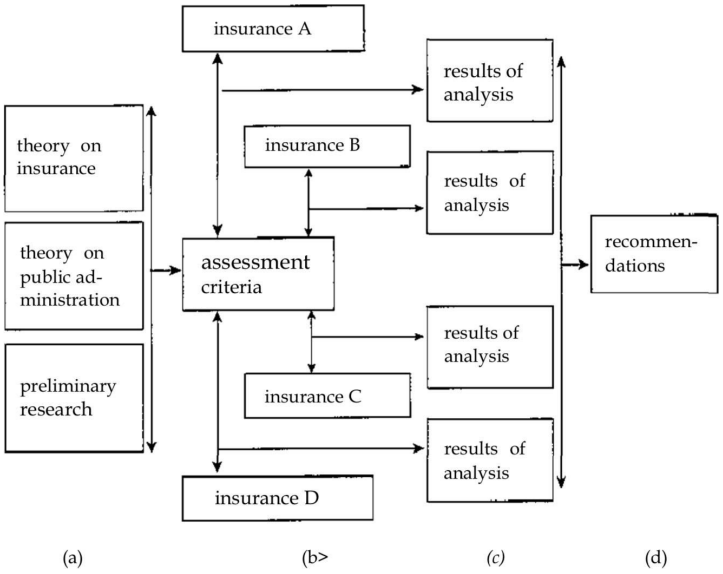
And/Or

2. **Unravelling of key concepts (III)**
   a. Select the relevant key concepts in the central question at hand.
   b. Using a tree diagram, unravel each key concept into components.
   c. Select the aspects and sub-aspects, parts and sub-parts, classes and sub-classes, types and sub-types, and categories and sub-categories from the tree diagram on the basis of feasibility of the research and formulate a sub-question for each component.

(I) Subdividing the research framework

This method entails subdividing the research framework into identifiable components. For each of these components a central question must be formulated.

Example.



The ***first*** central question concerns part (a) and **focuses on the sources** the researcher **needs i**n order to **establish the research perspective** (see Figure above). The answer to the first question is the **detailed research perspective**.

The ***second*** central question concerns part (b) of the research framework, which entails an **analysis of the data gathered on the objec**t, or objects, of the research project.

A distinction should be made between projects involving a single research object and those involving several objects. In the first case, the second central question is also the final question. In the second case, the answer to the second central question provides sufficient information for answering the third central question (see below).

The ***third*** central question concerns part (c), in which the **researcher compares the results** of **analysis for each of the research objects.**

(II) Corroborative types of knowledge

In order to develop a generally useful method for formulating research questions, we first need to make a **distinction between a number of different types of knowledge**.

1. **Descriptive knowledge**: The researcher who wants to produce descriptive knowledge intends to **describe** a certain object, phenomenon, situation, event or development as **accurately and comprehensively** as possible.
2. **Explanatory knowledge**: The researcher intends to demonstrate **how**, or through which process, a phenomenon originates. In particular, theory-oriented and diagnostic research projects are characterised by explanatory knowledge. One difference between both is that in theory-oriented research the researcher seeks generally valid ***causal*** explanations of phenomena. In diagnostic research, however, one tries to discover what originated or caused this ***particular*** problem, restricted in time and place.
3. **Predictive knowledge**: Based on knowledge of the current or the past situation, the researcher tries to **predict future situations or events**. In a theory-testing research project, the researchers intend to **derive from a theory - that is, to predict** - what one is **supposed to find in reality for the theory to be valid**.
4. **Evaluative knowledge**: Evaluative knowledge is used to compare a current situation with a desired situation. This type of research takes place during the fifth and final stage of the

intervention cycle and in problem-analysing research projects.

5. **Prescriptive knowledge**: Prescriptive knowledge provides **instructions** on how a situation can be changed. Generally, prescriptive knowledge will be the goal of practice-oriented research

A higher-ranked type of knowledge can play a corroborative role with regard to creating a lower-ranked type of knowledge, but *not* vice versa (i.e. descriptive knowledge, for example, can support explanatory knowledge, but not the other way around).

Comparison is a very fundamental principle in methodology. In order to understand how descriptive knowledge can help in finding an explanation for an event, one should know how **scientific research tries to find the causes and effects of a particular phenomenon**.

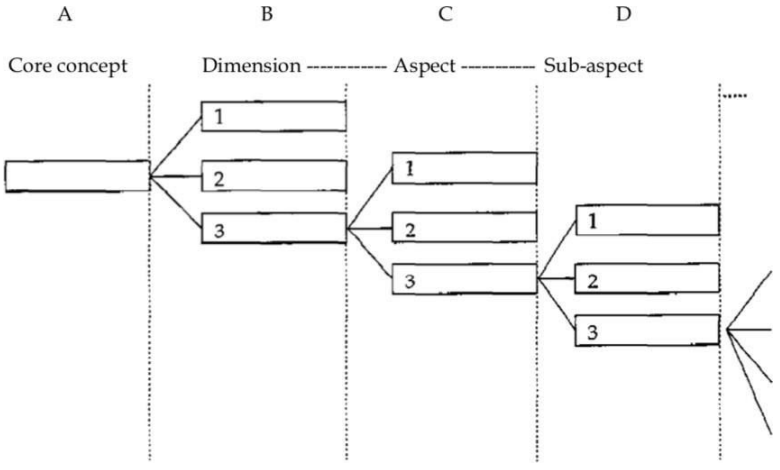
Rules for the **method of corroborative types of knowledge**:

1. When there is a **central question of the explanatory type**, we should formulate **sub-questions of the descriptive type**.
2. A **central question of a predictive nature** can be unfolded in a series of **sub-questions of explanatory and/or descriptive nature**.

It is good practice when researchers reduce one or two complex central questions to a series of sub-questions of a preferably descriptive nature because descriptive questions are generally the most steering of all types of knowledge.
Based on a research objective or central question of a given type of knowledge, central and/or sub- questions can be formulated that are higher or equally ranked in the list of the five types of knowledge shown above.

(III) Unravelling and clarifying key concepts

The method of unravelling boils down to **unfolding a particular phenomenon** into either (a) **dimensions and aspects (abstract and theoretical concepts)**, (b) p**arts and sub-parts or (physical objects, such as a building)** (c) **classes and sub-classes, categories and sub-categories or types and sub-types** (phenomena that show substantial variety in reality, such as staff). A **practical instrument for unravelling key concepts is the drawing of a tree diagram** (see below).



The technique of unravelling involves **selecting the key concept**s in the **(b) part of the research**

objective or in one of the central questions and, subsequently, subdividing this concept into various dimensions or aspects, parts and sub-parts, classes and sub-classes, and so on.
The line which links two boxes is called a *connector.* This connector stands for 'is a dimension of' or 'is an aspect of', or 'is a part or sub-part of', or "is a class or sub-class, a type or sub-type, a category of sub-category of'.

Chapter 5 (Defining concepts)

Before constructing the **technical design**, one **intermediate step** still needs to be taken and that is **defining and elaborating the key concepts of the project.**

Key concepts of the project do not only have a **major influence on the progress of the research project** but, to the **detriment of the steering capacity of the research questions,** they can be defined in many different ways as well. The longer the researcher waits to define the key concepts, the more probable it is that her or his work will turn out later to be useless, or to focus on irrelevant research results.

Without having an exact definition of the key concepts we **do not know where and what to look for** in the library and in when undertaking fieldwork, and thus we **do not know what our research project should focus on.**

The initial definition of key concepts cannot be postponed until the implementation stage, except of course in those cases in which it is the research objective to find an adequate definition of an initially vaguely defined concept.

Formulating stipulative definitions

A **stipulative definition** is a type of definition in which a **new or currently-existing term is given a new specific meaning for the purposes of argument or discussion in a given context**.
Typical of stipulative definitions is that neither the truth, nor an accepted formulation is a criterion for their adequacy, as is usually the case with definitions. Only the *usefulness* of the selected definition is relevant. The researcher has to **formulate a definition that fits within the purpose of the research**.
In **theory-oriented** research the researcher will usually find **well-detailed** and sound definitions in the **specialist literature which are perfectly useful**. In **practice-oriented** research, definitions from **literature are not advised,** as the descriptions of concepts are **usually too general,** too **complex** and/ or too abstract for this research.

The following conditions have to be met in a stipulative definition:

a. ***delineating*** the concept to manageable proportions; **(I)**
b. clarity on the question of which ***observable*** entities are covered by the definition; and **(II)**
c. ***a linking up*** to the research objective and the set of research questions. **(III)**

(I) Delineation

Delineation: The action of **describing or portraying something precisely.** An effective delineation of a research project is foremost a matter of conceptual design and it is related to a far lesser extent to the *technical* design.

Domain and assertion

The **domain** is that part of the real world about which you want to say something on the basis of the research project. The **assertion** is what you want to say or make known about this domain. (i.e. in the statement 'ravens are black', for example, 'raven' is the domain and 'are black' is the assertion).

The **size o**f a research project refers to all the activities that are to be carried out to **obtain** ***valid*** **and** ***reliable*** **answers to the research questions**.
In general, we can say that the size of a research project can be expressed as a *multiplication* of the number of units in the Domain and the number of qualities the Assertion refers to. This concludes that we can reduce the size by delineating either the domain or the assertion, or both.

In symbols:

$S = DxA$

The sum total of all the domains of **all the research questions** altogether is sometimes labelled the **research population** or simply, the ***population***. The population is that part of reality the researcher wants to make statements on, based upon the results of a research project.

Apart from striving to be able to make general statements, scientific research should also meet the demands of *internal* validity. If researchers fail to delineate the research project substantially, they could not make any valid statements at all.

In order to **delineate the domain and the assertion of the various research questions, the tool introduced in Chapter 4 of unravelling and clarifying via tree diagrams is used.** We apply this tool to the concepts in the set of research questions which indicate the domain and the assertion. Delineating the research domain makes it easier, if not feasible, to acquire sound and new knowledge.
An important demarcation of the domain concerns the specification of *place* and *time.*

(II) Operationalising

The second condition for a **sound formulation of a stipulative definition** concerns the ***perceptibility*** of what is called in the stipulative definition the '**characteristic of a phenomenon**'. In other words, it is important to indicate **when, or under which conditions, a certain concept is applicable in reality.**
An indicator can be described as a **sensory observable phenomenon** that **provides us with information** on the (**not directly observable**) phenomenon **to which the concept that is to be defined refers**. The process of **choosing and accurately describing the indicators for complex and/or** abstract concepts is called ***operationalising***. **In other words,**

operationalisation is a translation of abstract concepts into indicators, instruments and instructions.

Steps in operationalising:

1. **Select indicators**

If a **phenomenon is not observable**, it is a **useful strategy to consider the observable consequences or effects of this phenomenon in reality instead.** The consequences become **indicators** (i.e. the concept commitment, indicator: employee shows an interest in the organisation).

2. **Define instruments and instruction**

After having selected indicators, the researcher subsequently needs to transfer them into instruments.
How can the values of the indicators be observed? We are referring to the actual process of measuring (quantitative research) or registration and description (qualitative research). In order to do this, we need (a) a **set of instruments** and (b) **instructions** for the researcher to use.

- **Quantitative research**: (a) the set of instruments often consists of a series of so-called **closed questions,** which are questions having a **limited number of answer possibilities** (i.e. questionnaire) (b) The instructions for the researcher usually help him or her to **code and to interpret the observations**. This entire process is often called *measurement.*
  System of **self rating**: when each question offers the respondent closed answering categories, in terms of "always', 'often', 'every now and then', 'hardly ever' and 'never'. And, instructions are not necessary, since the **respondent is able to choose the answer that best suits him or her.**

- **Qualitative research**: (a) set of instruments often consists of a series of so- called **open questions**, which are questions **lacking a pre-structured set of answer possibilities.** (b) The instructions help the researcher to **carry out the interviews, the observations, or the analyses of documents successfully**.
  Semi-open or open questions: for example, may start with phrases such as **'to what extent ...'** and so on. In the case of a more open approach, it is a requirement that: (a) the research topics indeed will be **brought up** during the interview, (b) the **expressions of the interviewee are unambiguous and to the point**, and (c) the interview **results of all the respondents are comparable.**

Per indicator we need at least one question. However, if we want to make sure that the set of answers is valid, then we should choose **more than one question per indicator.**

3. **Create an operational definition**

This can be done by **simply including the indicators in the description**. An *operational* definition has a stipulative character, for the indicators were chosen on the basis of the research objective and the set of research questions pertaining to the research project.

A **measurement scale**, or in short a scale, is a series of instrumentalised indicators, often called items or **scalc-items**, that aim to measure a particular abstract and theoretical concept.

Two different reasons why the aspects mentioned in a **stipulative definition do not meet the criterion of perceptibility** (being a**pplicable in reality**), therefore **necessitating further operationalising.**

1. The **interpretation of certain concepts** or aspects thereof is **strongly associated with prevailing opinions**, **standards and values**. We then need *criteria* to be able to **decide** whether the concept or aspect concerned **can be applied to a certain phenomenon**.
2. Many of the **concepts** are so *abstract* that **further operationalisation** is needed in order to **observe or to measure these concepts**.

It can be said that no operationalisation is **perfectly valid**. A c**ompromise must be sought between validity and feasibility.**

(III) Linking up to the research objective

The third condition for a **sound formulation of a stipulative definition** is that the definition must **relate to the selected research objective** and the **set of research questions** pertaining to the research project. In every research project additions concerning age and sex are required.

Step-by-step approach

1. Consider those concepts in the **set of research questions** which belong to the **domain** and those **belonging to the assertion**, including the r**esults obtained from the processes of unravelling and clarifying by means of tree diagrams**.
2. Make sure you have **no more than four or five key concepts.** In principal, if you find more concepts, you will have to simplify or delineate your set of research questions.
3. Attach a **stipulative definition to each of the key concepts** by **listing the dimensions and aspects you have chosen during the process of unravelling and clarifying.** (See your tree diagram).
4. Check the **size of the definitions (formula: S = D x A)**. If necessary, the unravelling and clarifying process may be performed in an even stricter way, or you can limit the domain by adding stipulations regarding place and time and/or characteristics of the research units.
5. Translate the definitions into **perceptible observations by choosing criteria and/or indicators for each of the core concepts.**
6. Formulate **operational definitions** of the **core concepts** by summing up the chosen criteria and or indicators.
7. Check whether these **operational definitions** have been **sufficiently attuned** to the **research objective** and the **set of research questions.** If not, adjust either these definitions, or the research objective and the set of research questions, or both. If you change your research objective or the set of research questions, repeat steps 1-6 (iteration).

Appendix (Conceptual Model)

A **conceptual model, or causal mode**l, consists of a set of **assumed causal relationships between the core concepts of a research project.** Conceptual models may be of particular interest in a **theory- oriented research study**, which aims at **obtaining knowledge for the sake of knowledge itsel**f, and in **practice-oriented research (in diagnostic and evaluation research**). A well-designed conceptual model should serve two **designing purposes**:

1. It helps the researcher to **demarcate clearly his or her research subject**
2. **It supports the researcher to formulate the assumed relationships between the core concepts correctly and to link the research project to an existing theory.**

1. Composition of a conceptual model

A conceptual model consists of two sets of elements: (a) a set of **core concepts** indicating phenomena in the empirical reality, and (b) a set of **assumed relationships** between these concepts.

Core concepts

(a) **Core concepts** refer to **phenomena that can occur** in **different variations** or modalities. Researchers often use the term *variables* **t**o **indicate the core concepts of their research** (ie. the concept 'sex' is a variable because it consists of the modalities 'man' and 'woman'). However, not all concepts are variables (ie. **'environment', for example, is** *not* **a variable**, **because we cannot define the variations of 'environment**'). Moreover, variables can assume the form of a ***modality*** or a ***gradation***.

- We speak of a **modality** when the variable can be presented **only in terms of distinct categories,** but not in terms of 'more' or 'less'. In this case, the core concept is called a *nominal variable* (ie. sex is a nominal variable because the modalities male and female cannot be ordered).
- On the other hand, we speak of a **gradation** when that variation can be **presented in terms of 'more' or 'less'**. These variables can be either *ordinal variables* (in which the variation can be **ranked in terms of a degre**e, for instance, the level of commitment) or *interval variables* (in which the **numeric distance between two ranking points can be fixed**, for example, age).

When **designing a conceptual model** we must first pay attention to the following two rules:

- **Rule 1**: to ensure that e**ach of the core concepts is a variable** (nominal, ordinal or interval) and that **non-variables or constants are excluded from the conceptual model.**
- **Rule 2**: to **define, precisely and exclusively, which modalities or gradations of the variables or core concepts will be included in the research.**

Relationships

(b) **Relationships:** We recognise a **causal relationship** in phrases such as **'X causes Y' 'X leads to Y', 'the consequence of X is Y', 'X influences Y' and so on**. Generally speaking, we define a relationship between two variables X and Y as a causal one if we assume that, as a **result of a manipulation of X, a change will occur in Y.** A causal relationship has two **properties**, the *direction* **and its** *strength.*

- The **direction** concerns whether we expect a so-called **positive causal effec**t (indicated with a + sign), or a **negative causal effect** (indicated with a - sign). In the case of a causal relationship of a **nominal nature, the direction of the relation cannot be defined.** In these cases, the researcher must define **which modalities of the one variable relate to the modalities of the other variable**, instead of wrongly defining the relationship as a positive or a negative relationship. The strength may range from '**no effect', via 'a weak effect'** (if a relatively large or extensive change in variable X leads to a relatively minor change in Y), to 'a strong effect' (a relatively minor change in X causes a relatively major change in Y).

2. Basic patterns of causal relationship

One can distinguish between **five basic patterns of causal effects**:

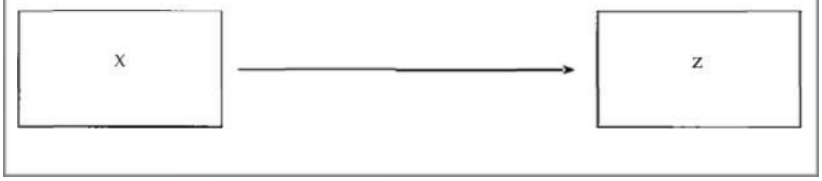
a. direct effect;
b. indirect or mediating effect;
c. interaction or moderating effect;
d. feedback effect;
e. confounding effect.

Each of these types of effect-patterns will be presented in detail.

a. Direct effect

We call **X t**he **independent variable** (cause) and **Y the dependent variable (effect)**. Independent means that, within the constraints of our research project, we will not be investigating the influence of those other factors. Figure A.2 suggests that this particular research we will only study the influence of variable X (cause) on variable Y (effect).

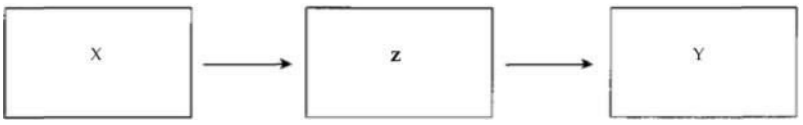
Figure A.2 A conceptual model consisting of a direct effect of X on Y



b. Indirect or mediating effect

When we explained the relationships presented in Figure A.1, we pointed out that variable X (the level of economic activity), apart from the direct effect, it **also affects variable Y** (the population's physical well-being) indirectly. This effect goes from variable X, **via variable Z,** to variable Y. The line of reasoning is, for example, that an increase on level of economic activity will lead to a higher quality healthcare system and that the latter, in turn, will increase the population's well-being. Hence we **call the variable Z the intervening or mediating variable** because this variable intervenes or mediates between independent variable X and the dependent variable Y (effect)

Figure A.3 Conceptual model constituting an indirect effect of X on Y, with Z as an intervening variable



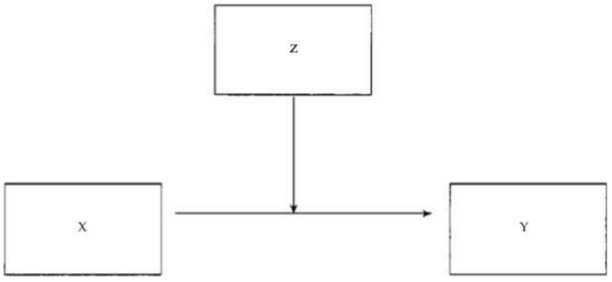
It is important to take a closer look at the **possible directions a mediating effect may have**. If a **positive effect is expected both X on Z, and Z and Y: an increase of X will lead to an increase in Z, and this increase leads to an increase of Y.** In this case the overall mediating effect of X on Y is positive. Considering other cases, when **both relationships are negative, the total mediating effect will also be positive. For example, if the level of stress (X) has a negative effect on traffic alertness (Z), and if the latter has a negative effect on the number of accidents (Y), the total mediating effect of stress on accidents will be positive,** as the reader can see: more stress leads to a lower alertness, and lower alertness induces a higher number of accidents. Please check this line of reasoning in the following case in which variable X stands for the quality of a product, variable Z for the price and variable Y for the sale of this product. We assume that there will be a positive effect of X on Z and a negative effect of Z on Y. Determining the direction of an indirect effect can be found in the same rule as is valid for multiplication in

mathematics: plus x plus = plus, minus x minus = plus, minus x plus = minus and plus x minus = minus.

c. Interaction or moderating effect

Here we talk about an ***interaction*** **or a** ***moderating*** **effect,** and Z is an interacting or moderating variable. That is, Z interacts with the effect of X on Y, or it moderates this effect. Let us take a look at the following expectation: the level of financial reward (X) will have a direct effect on the

Figure A.4 Conceptual model expressing an interaction effect of X on Y, with Z as an interacting variable



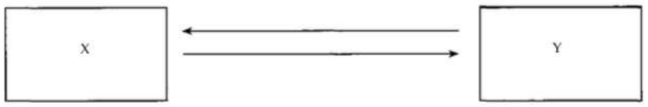
level of performance (Y). However, we expect that this relationship is stronger for men than it is for women. This expectation indicates that we expect a moderating influence of a third variable, i.e. gender (Z) on the relationship between X and Y. Here Z is the interacting or moderating variable. Please note that the relationship does not state that the interacting variable Z has an effect on either X or Y. It merely states that **it has an effect on the** ***relationship*** **between the two variables.** In Figure A.4 this moderating effect is depicted.

Due to its **specific nature,** a researcher who is **building a conceptual model** should always **be aware of the existence of interactio**n. It may occur that, at face value, a researcher will expect a relationship between the variables X and Y. However, a logical line of reasoning or a profound study of the existing scientific literature may reveal that this expectation is restricted, due to certain time and place constraints. Therefore, a researcher should always pay attention to a precise demarcation of his or her research subject by answering the following questions. What will the scope of the validity of the results of my research be? In other words, what will the level of generalisation be?

d. Feedback effect

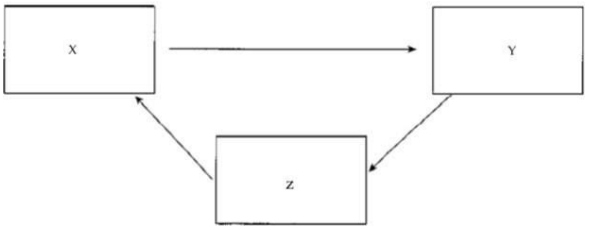
Sometimes, it occurs that a variable X has an effect on variable Y and that, in turn, variable Y has an effect on X. Such a conceptual model represents a so-called ***direct feedback effect***

Figure A.5 Conceptual model expressing a direct feedback effect between X and Y



There is also **indirect feedback, using a variable Z.** For example, the uncertainty about the exam result (X) has a positive effect on the number of hours spent studying (Y), which has, in turn, a positive effect on the knowledge of the exam subject (Z). Because we expect that Z will negatively affect X, we assume that this indirect feedback loop reduces the amount of uncertainty about the exam result. See Figure A.6

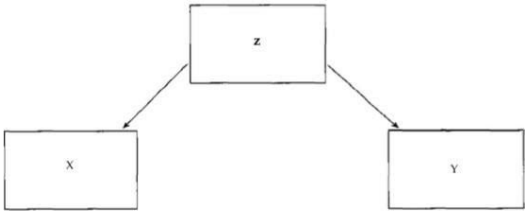
Figure A.6 Conceptual model constituting an indirect feedback effect from X on Y, via Z



e. Confounding effect

Despite the researcher's meticulousness with regard to the formulation of the assumed relationships in the conceptual model, there is always the possibility that an assumed relationship appears to be **partly or totally non-existent**. This is called **spurious correlation**. Consider for example the following situation. While studying patterns of fire prevention over the past twenty years, a researcher notices that whenever a large number of firemen have been appointed (X) to extinguish a fire, there is always greater fire damage (Y) than when only a small number of firemen have been mobilised. Apparently, there is a positive relationship between the number of firemen and the extent of the fire damage. Before jumping to the wrong conclusion that the number of fire men (X)

Figure A.7 Conceptual model with Z as a confounding variable; the relation between X and Y is spurious



causes the extent of the damage (Y), one must realise that in this case the relationship between X and Y is spurious. Obviously, there is a third variable at stake (Z), which is the scale of the fire.

The scale of the fire (Z) affects both the number of firemen assigned to extinguish the fire (X), and the extent of the fire damage (Y). In this case variable Z is the *confounding variable* causing the spurious relationship between X and Y. Figure A.7 represents a conceptual model with Z as the confounding variable.

3. Different uses of conceptual models

Quantitative and qualitative research

All said so far about the characteristics and types of conceptual models is applicable to both quantitative and qualitative research. There are some differences between the elaboration of a conceptual models in both types of research:

- the **nature of selected core concepts**
- the nature of the **process of *operationalisation:*** the whole process of specification or even translation of core concepts into sensory observations.
    - In quantitative research this entails selecting indicators, i.e. observable aspects of the core concept at hand, and the translation of these indicators into measurement instruments.
    - In qualitative research operationalisation takes place when selecting topics for interviews or systematic observations, and when giving instructions to the interviewer or observer in order to guide them to valid data.
- the **selection and specification of the data-sources** and **methods and procedures** used in **collecting or generating the data needed**.

With regard to the **nature of the core concepts** to be selected in a conceptual model there is a **difference between both types of research.** In **quantitative** research, these concepts preferably have a ***narrow*** and a ***closed*** meaning, and they are easy to quantify. In **qualitative r**esearch there is often a preference for ***global*** and ***broad*** concepts that are **complex and that are open to all kinds of qualifications.**

Testing versus exploration

a. **Testing**: Testing of theories is an **important part of the use of conceptual models in empirical research.** In this case, we distil from existing literature (theories) a conceptual model, and we check whether the **relationships in the model**, i.e. the causal hypotheses, are **not falsified by empirical data**. If they are falsified, the **validity of the model can be questioned. T**his is the ***hypothetical-deductive approach.*** The way the testing is conducted differs slightly in quantitative and qualitative research.
    - In **quantitative research** we apply **statistical analysis** in order to monitor how **great the chance is that the results are purely accidental.**
    - In **qualitative research**, however, more stress is put on the **reliability and validity** of the research material, the arguments that are given for propositions, and the triangulation of methods and researchers.
b. **Exploration**: An exploratory use of conceptual models differs in two respects from a testing approach.
    - First the aim is **not to do an empirical check** on the **validity and reliability** of the model. The aim is to **further elaborate on the conceptual model,** to make it **more detailed and more precise**.

- A **second difference is that in an exploratory approach we start with a generic and more abstract model than is the case in a testing approach.**

One of the most important functions of conceptual models is showing this type of refinement in causal relationships. Models can be **refined by looking for intervening or mediating variables.** Another option for the refinement of a generic conceptual model is the **search for *deeper* causes and *multiple* causes of a phenomenon**. The reader is **well advised to first elaborate a generic conceptual model by unravelling and specifying its core concepts** (variables), and subsequently by searching for **mediating, and especially confounding variables.** This elaboration can then be followed by a search for interaction and feedback effects.

4. Demarcation and steering

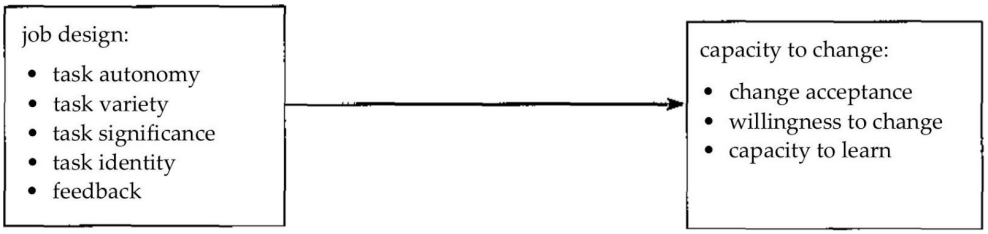
A well-thought-out and well-demarcated set of core concepts forms the basis for a successful research project.

The designing process of a conceptual model starts by defining a *generic conceptual model*. The next steps involve a further *specification* of this generic model. The process ends with the construction of the *final conceptual model*, including the formulation of the assumed relationships to be studied.

Unravelling core concepts

The researcher has to further specify the core concepts of the generic conceptual model. He needs to further unravel each of these concepts into elements which are less ambiguous, less encompassing and more concrete. The researcher unravels each of the core concepts into the *dimensions, parts or classes* that are the constituting elements of these core concepts. The reader is advised to make use
of the unravelling technique by means of a tree diagram.

Example: the two concepts *job design* and *capacity to change* are unravelled in different variables



Selecting variables to study

A thorough selection of variables is needed in order to decide which of them will be included in the research. This choice is based mainly upon:

1. The research objective, which also includes the wishes of the commissioning parties,
2. The interests and the capacities of the researcher,
3. Research constraints regarding time and budget.

All of these choices should result from an explicit and sound line of argumentation, in order to improve the credibility of the research.

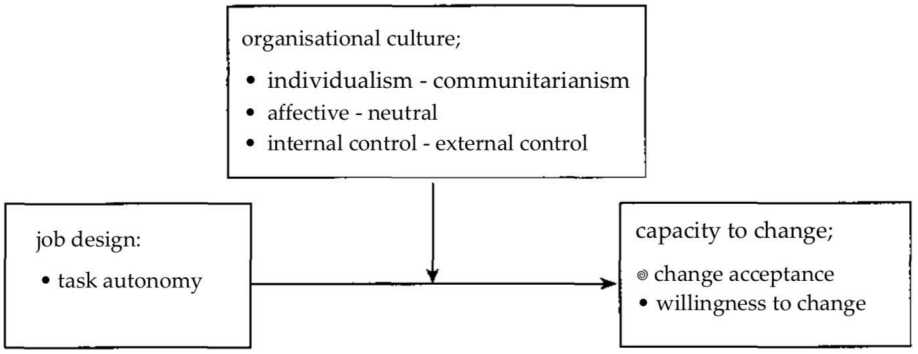
This selection takes place in a ***preliminary research project***. The result of this preliminary research is the selection of the variables that will be included in the research project.

Example: Figure above indicates that the core concept 'job design' consists of five variables, and the core concept 'capacity to change' of three variables. If the researcher wants to study the

effect of each of the independent variables on each of the dependent variables, this first step regarding the further specification results in the study of 5 x 3 = 15 relationships (maybe too many).

Other influences and feedback effect

The final step in the completion of the conceptual model concerns the accurate formulation of the assumed relationships, represented by the arrows in Figure below.



Example. The researcher assumes that 'task autonomy' will have a positive effect on 'change acceptance' and on 'willingness to change'. In addition, the assumption is that aspects of 'organisational culture' will affect the strength and/or direction of the impact of 'task autonomy' on both dependent variables.

The researcher formulates the assumption for each of the relationships, presented in Figure above. The direction of the assumed relationship is indicated by the symbols [+] if the researcher expects a positive effect and [-] if the researcher expects a negative effect. See page 288.