The Analyst's Red Book

Developing the Company's Information Component

Exploitation of the Company's Information

Implementing Information Capabilities

Innovation through Information

14/02/2020– Version: 1.151b

A Treasury Box

Deeper insights and innovative ideas

for

Corporate Information Systems Analysts

Contributors

Special thanks go to Frédéric Naisse and Germelyn Javier for the valuable contribution.

Versions

LATEST VERSION @

http://analystsredbook.net/Publications/The-Analysts-Red-Book--Axel-Vanhooren.pdf

Older Versions

14/02/2020

10/01/2020

17/09/2019

15/04/2019

15/03/2019

15/02/2019

10/01/2019

18/12/2018

30/10/2018

Notes:

The dates are mentioned on the pages. The dates can be used to find the pages that are new or which have significantly changed. A search on the new date allows to find them easily.

Table of Contents

Audience: **All types of Systems Analysts, ISE Analysts**

FOREWORD

The Analyst's Red Book (TARB) aims to strengthen and to boost the discipline of engineering information solutions in corporate environments.

In modern larger companies, the IT component plays a significant and critical role. Companies seek to automate and optimise their operations. Innovation is as important, not among the least, to stay ahead of the competition. IT has also the potential to transform companies and to drive business activities to achieve greater goals. But critical conditions are still far from ideal.

1) IT initiatives evolved from the development of small applications meant to be used by a limited number of users and having a specific function to the development of much larger tentacular systems in complex heterogeneous environments sharing and reusing information across the company and beyond. The IT discipline had to develop itself under pressure and in turbulent circumstances. The problems corporate IT encounters today are symptoms of a lack of thoughtfulness and maturity of the IT discipline.

2) The present underlying idea driving IT initiatives is to respond to business demand and to develop the software applications demanded by the business community. Responding to this demand and meeting their expectations should lead to beneficial results and customer's satisfaction. This way of thinking revolves around the demand, the business stakeholders, the developers, programming and technologies. This idea has been present since half of a century.

Lower goals lead only to lower results. Striving for higher goals leads to better and greater achievements. This requires a paradigm shift. A new belief system, a more solid thinking framework, a holistic view and approach and higher goals are essential.

There are two possible ways to evolve to another belief system. We can mature through repeating mistakes until, through crisis's, the right lessons are learned. This is a rather painful method and may take time. Or, we can evolve by thinking with an open, analytical and critical mind. TARB hopes to contribute to the latter.

It is hoped that TARB acts as a trigger and forms a basis for engaging in analysis, reflection and critical investigation to solve issues and obstacles and to renew and consolidate the discipline of Informatics, ISE, Systems Analysis, Business Analysis and other variants.

Axel Vanhooren

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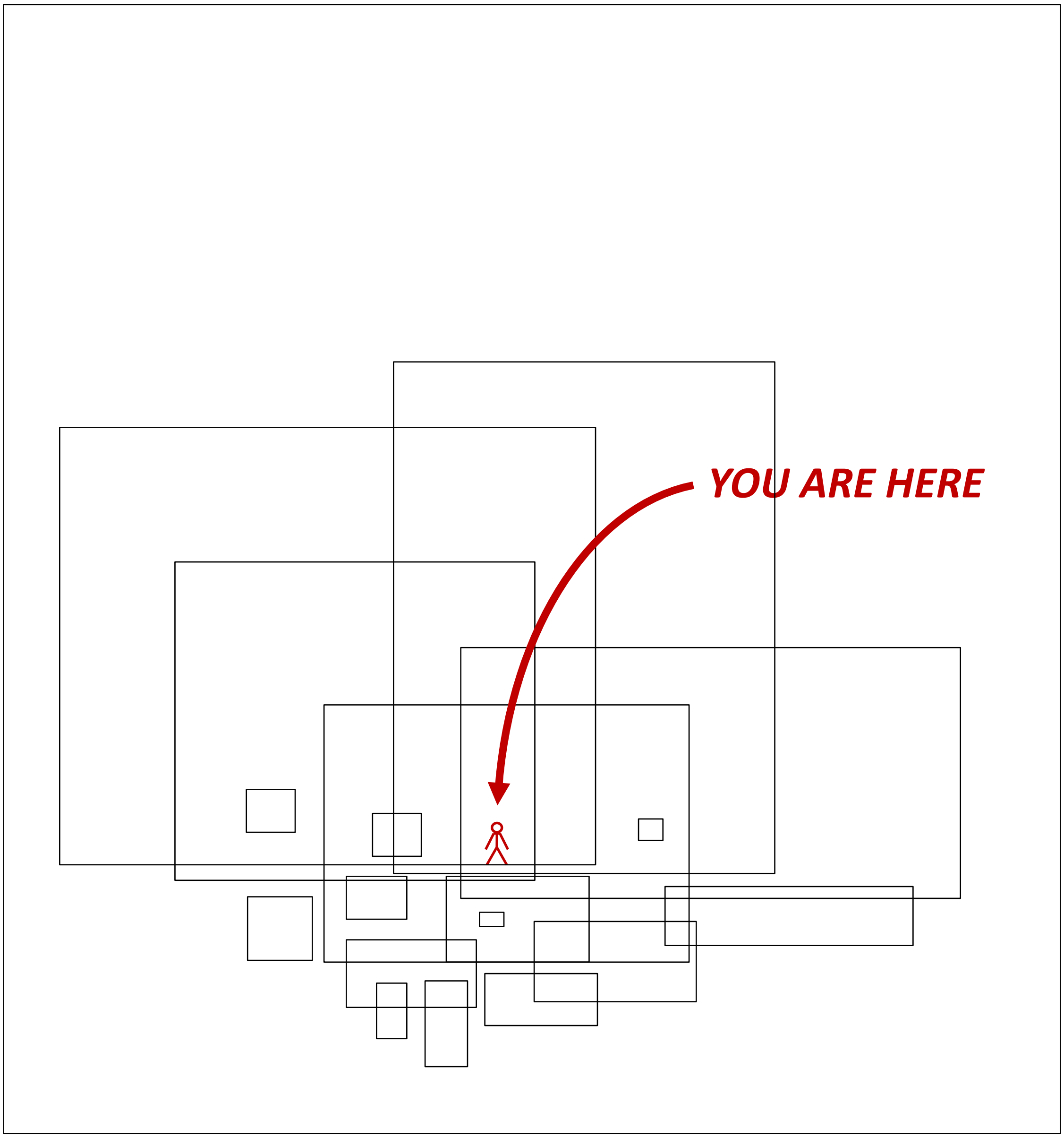

World of Systems

We live in a world of

- ORGANISATIONS
- STRUCTURES
- SYSTEMS
- PROCESSES

and in a world of INFORMATION

ranging from words, diagrams and pictures on paper or screen to thoughts and electrical nerve impulses.

War is a matter of vital importance to the state; a matter of life or death, the road either to survival or to ruin. Hence, it is imperative that it be studied thoroughly.

The Art of War, Sun Tzu

ABOUT
THE ANALYST'S RED BOOK

"A wise man will make more opportunities than he finds."

Francis Bacon

Variants of Analysis Disciplines

Systems Analysis

- → Business Analysis
- → Business Process Analysis
- → Information Analysis
- → Information Systems Engineering
- → Functional Analysis
- → Other related Analysis, Architecture, Engineering and Modelling disciplines

TARB is for any kind of Analyst
in the context of Business Informatics

Notes:

In TARB, the term Systems Analysis is used in the most general and broader sense as an overarching discipline which includes all different levels and variants of analysis and design within (Business) Informatics.

Systems Analysis also exists as a more specific discipline applied by the Systems Analyst inside projects. However, this is a more restrictive interpretation.

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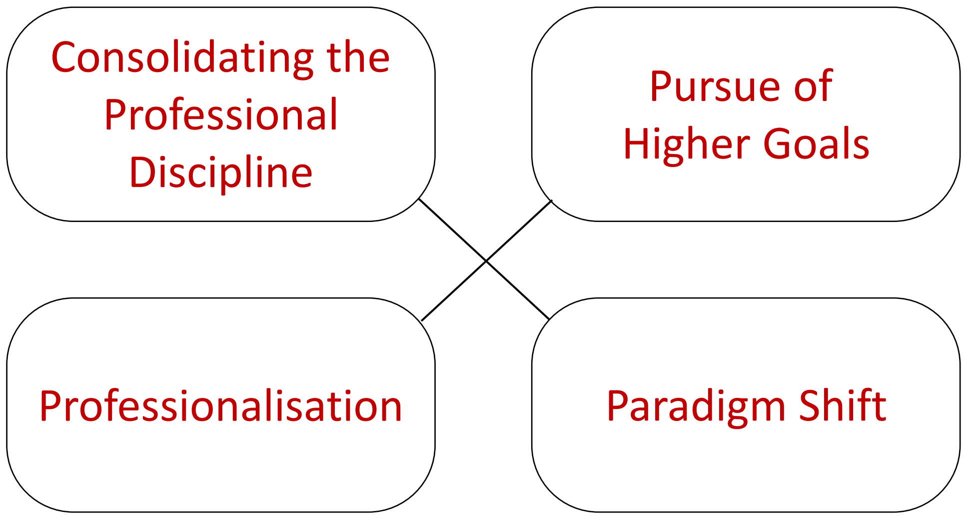


1. Consolidating the Professional Discipline

- Contributing to the development and progress of the discipline
- Strengthening its embedment into organisations

2. Pursuing Higher Goals

- Lower goals are easier. Lesser is learned. They require only basic competencies and produce limited results and smaller progress.
- Pursuing higher goals is more demanding, requires more learning, but allows greater progress and delivers better and greater results.

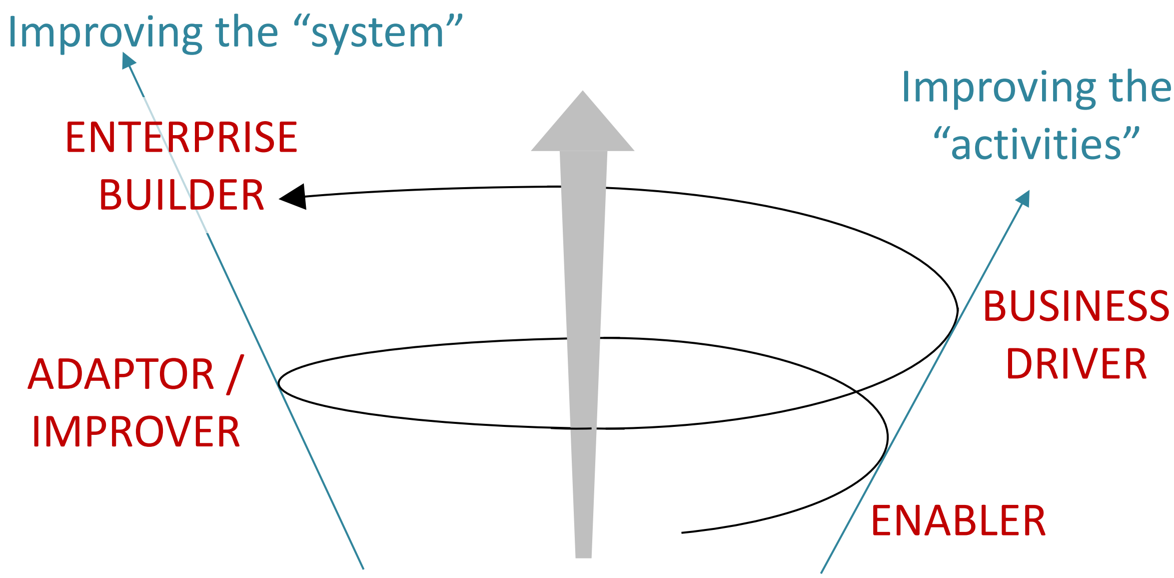
3. Professionalisation

- Sharing knowledge to reduce the gap between what is known of the discipline and what is (only) applied
- From HOW-TO to WHY (Deepening our knowledge)

4. Paradigm Shift

- A summary of shifts follows. These shifts are integrated in the content of TARB.

Ambitious Goals and Growth Path



ENTERPRISE BUILDER

Engineering and building that part of the company that exploits information with the intention of supporting and strengthening the company and satisfying customer's information needs.

BUSINESS DRIVER

- Maximising resource utilisation
- Increasing production volumes and business results

ADAPTOR / IMPROVER

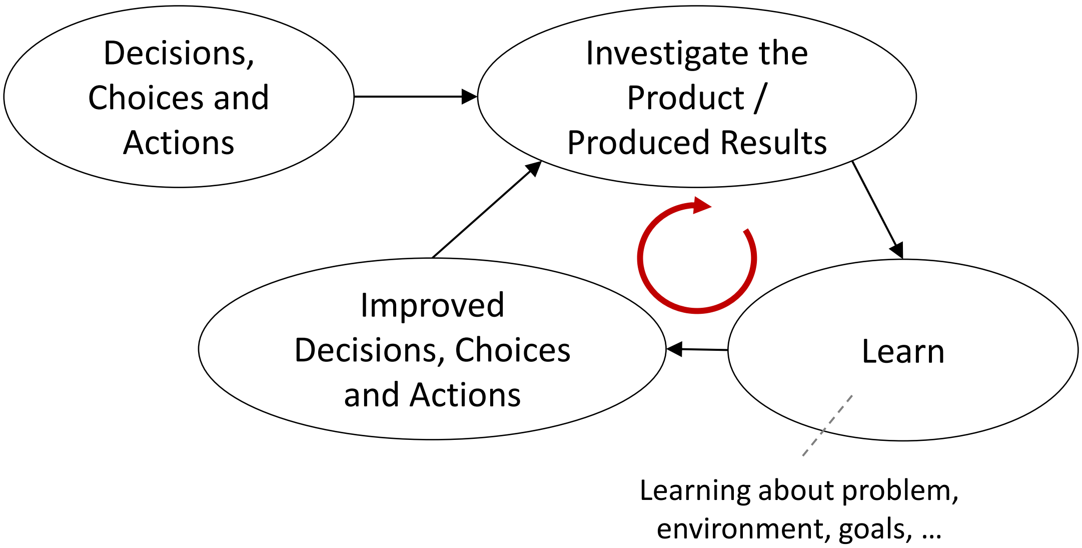
- Adapting to fit
- Reducing negative effects: limits, risks, costs
- Improving the system internally: controls, optimisation, structure, …

ENABLER

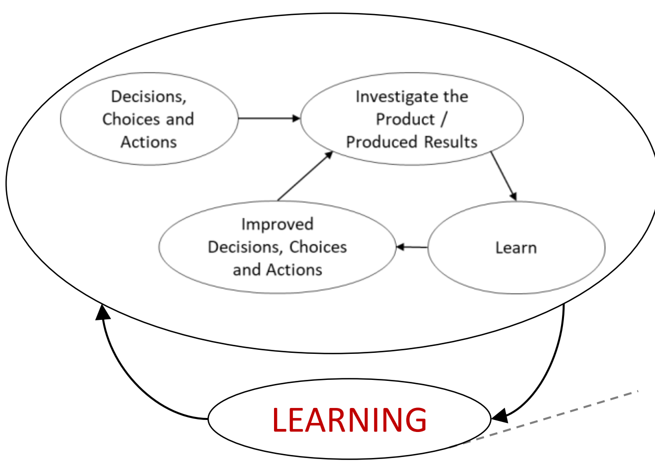
- Putting technologies at work
- Enabling the business community to work better
- Automating traditional ways of working
- Introducing new technologies
- Modernisation
- Demand-driven software development

Repeating History

Improving the Product / Result



Improving the Discipline and Skills



- Increase knowledge and insight in the discipline
- Increase techniques, methods
- Increase skills

"Who cannot remember the past are condemned to repeat it.";
George Santayana

Or, we are condemned to repeat our mistakes endlessly
until we learn the lessons we have to.

If we keep run into the <u>same kinds</u> of struggles and problems over and over again, until we learn that lesson that allows us to progress.

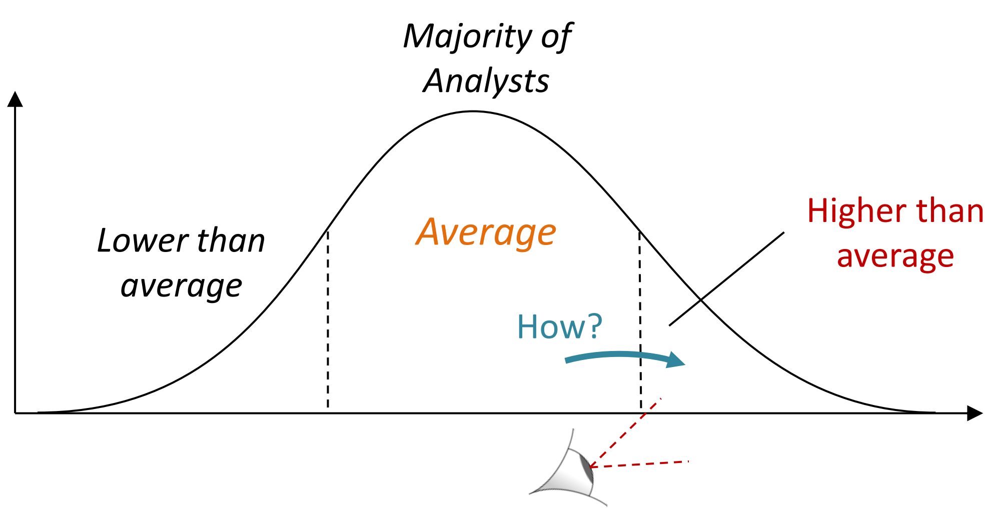
Professionalisation

“Insanity is doing the same thing over and over again, but expecting different results.“ (*)

Rita Mae Brown

Likewise

It is insane to do the same as everyone else and to think like everyone else while expecting superior results, results way above average.



Be careful by adopting the thinking and acting of the majority. The majority has, in the best case, an average understanding.

Follow the example of the top-level analysts.

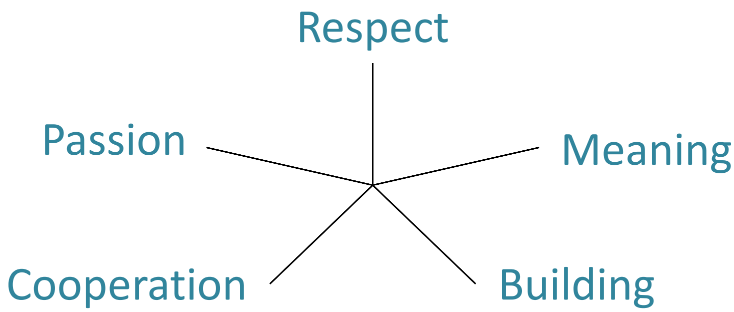
Notes:

(*): quote is commonly misattributed to Einstein.

Set aside of intelligence or skills, what are the differences between lower than average analysts, average analysts and significantly better analysts?

It is easy to align the thoughts with that of the majority. But if the majority is wrong, it is not always the best thing to do.

Five Key Values of TARB



Respect

Respect for people, nature, reality, truth, principles, ...

Meaning

Perform only activities that are meaningful. Do what makes sense. Build only things that are useful.

Passion

Do everything with passion. Be interested and motivated. Be kind.

Building

This value is key to progress. It can be studying, learning, teaching, thinking, creating relations, optimising, improving, creating, sharing, …

Cooperation

Work together. This does not exclude moments of individual work.

These 5 values have to be present all the time or most of the time. They don't stand alone.

Example: Teach with passion and respect meaningful matter.

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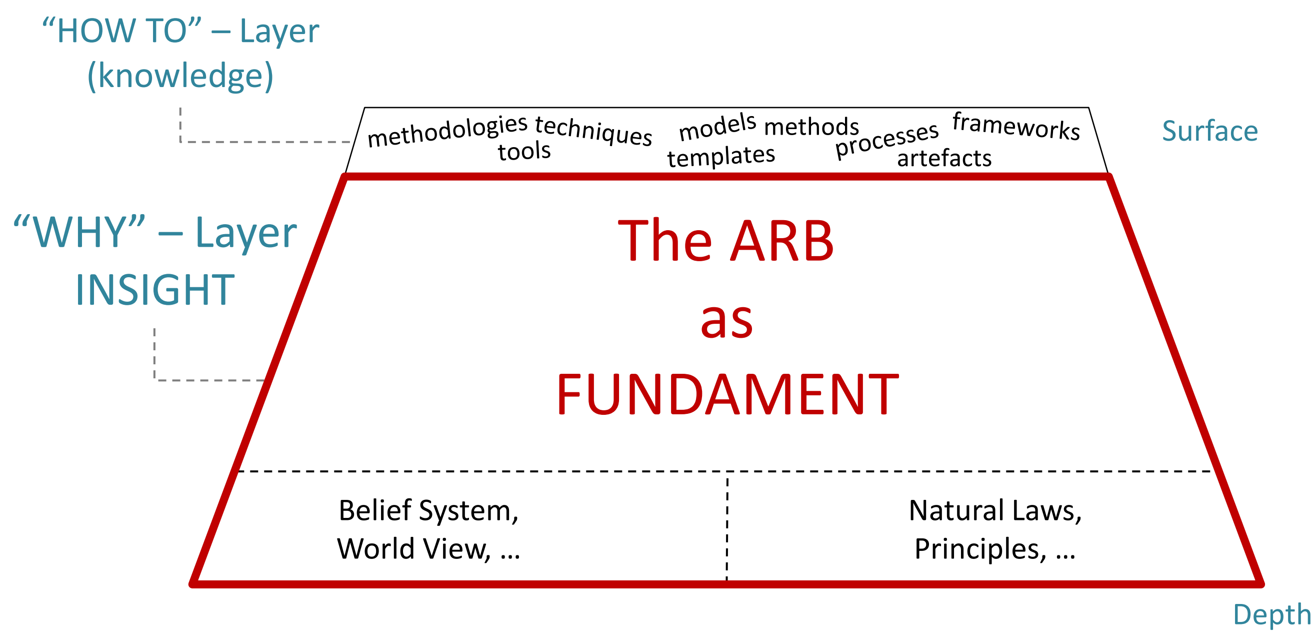


In Information Systems Analysis and Design,
no rule is absolute

Cooking by the book is a recipe for disaster

Understanding the FUNDAMENT is critical

Advantages:

- Ability to better identify and define initiatives correctly and to conceive better solutions
- Improved decision making
- Improved usage of frameworks, methodologies and methods and ability to adapt or conceive new ones suiting the initiatives.
- Ability to handle more complex projects and pursue higher goals

The ARB Document Organisation

Introduction & Various Core Ideas	
Fundamental Knowledge Areas	Systems; Process; Information; Company / Organisation; Problem Solving
General Background Topics	
Objective	Information Exploitation; Information System
Overall Organisation of the Informatics Engineering	Organisation; The Analyst; Projects; Work Environment; Roles & Collaboration
Informatics Initiatives	IS Development Framework; SDLC Phases; Techniques

The Analyst's Red Book

Proposes

- Principles
- Theories
- Concepts
- Relations
- Descriptions
- Solution elements
- Building blocks

and is

- adaptable
- improvable
- expandable

Reading the ARB:

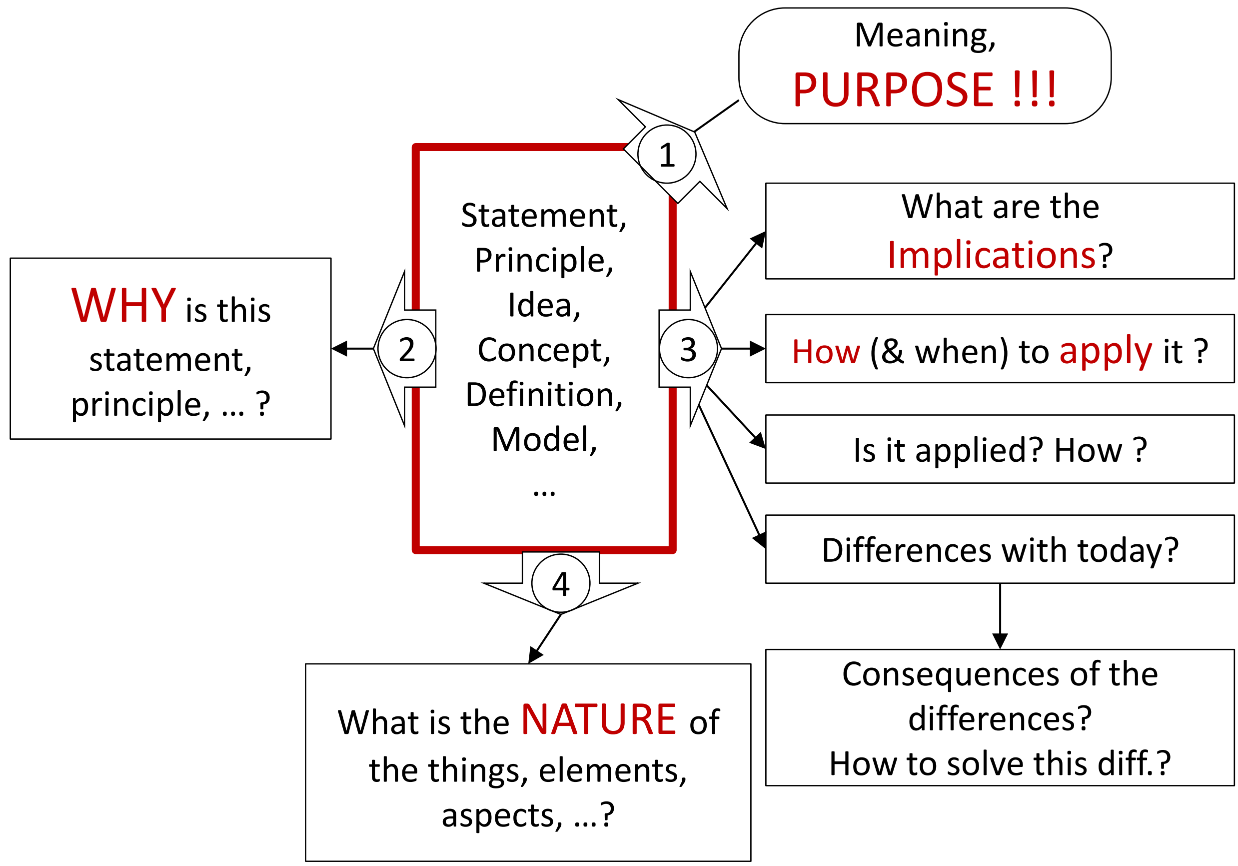
- Understand how it fits in the overall picture of TARB
- Is the statement true?
- How important is it?
- What are the implications ?
- How can I use it ?

IMPORTANT NOTE:

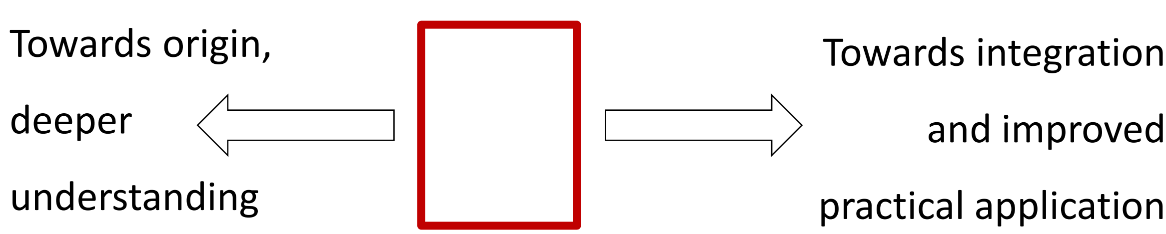
The ARB does not take new domains like Artificial Intelligence, Brain–Computer interface (BCI) (Neural-Control Interface (NCI)) and similar new domains into account. Some statements have to be reinterpreted when dealing with these specific contexts.

Smart Usage of TARB

Key Questions:



Encouragement to always question in these 4 directions



The ARB is not a methodology, process or structure.

The ARB is not a HOW-TO – Guide !!

It is not a solution that can be applied as is right away.

In general, solutions ready to apply, to be strictly followed are very unlikely in Systems Analysis.

Why? Every project, situation or problem is unique. There are no standard projects, standard situations or standard problems. So, there can not be a standard recipe.

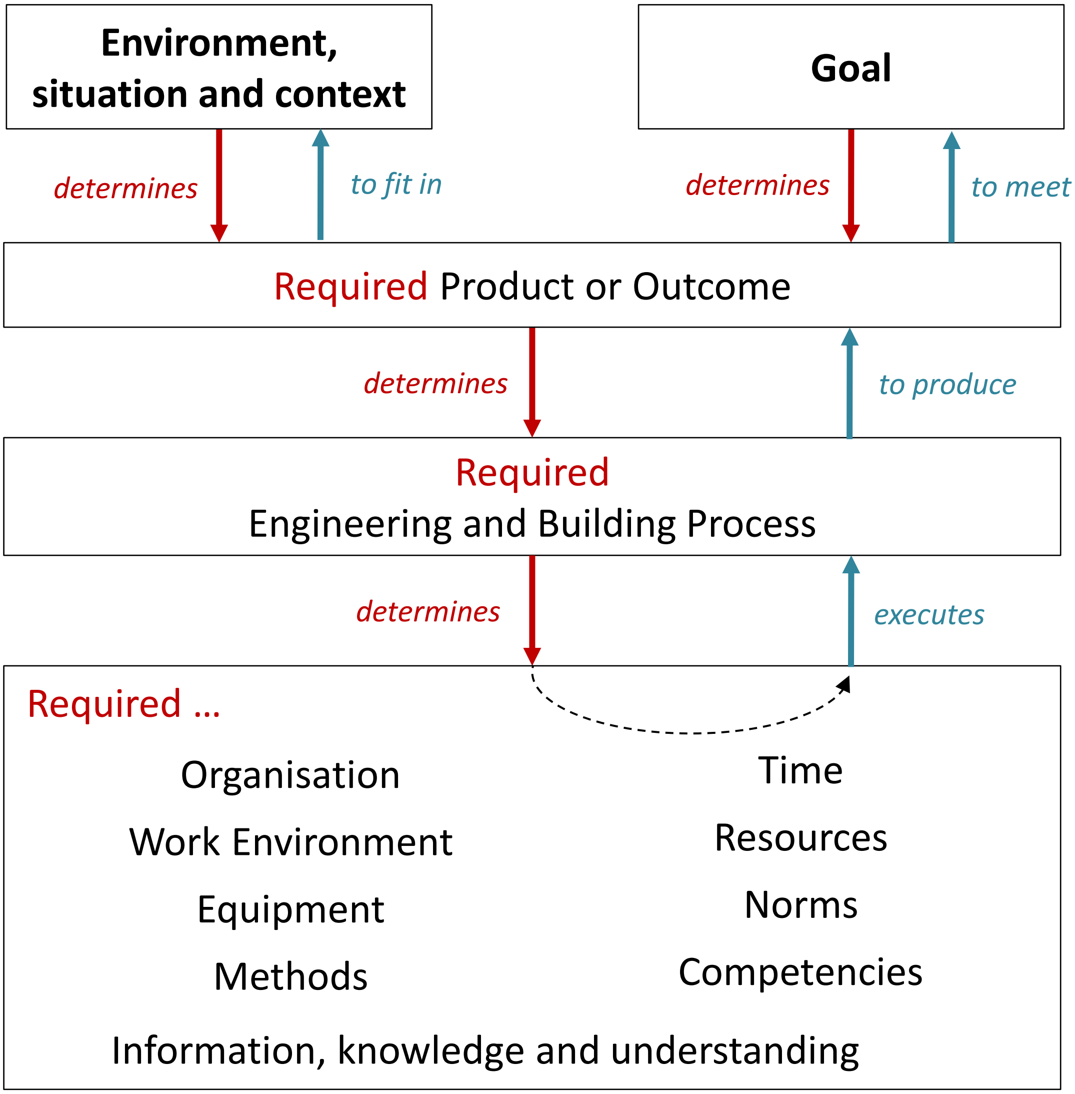
The Analyst has always to determine how to work, what preconditions must be met, what techniques to be used and how to adapt to the specific circumstances.

TARB (= The ARB)

- deepens the understanding
- organises knowledge
- provides patterns
- supports autonomous thinking
- incites further thinking and investigation

Uncritically following or applying TARB is
the exact opposite of the intention of TARB

“Begin with the End in Mind”



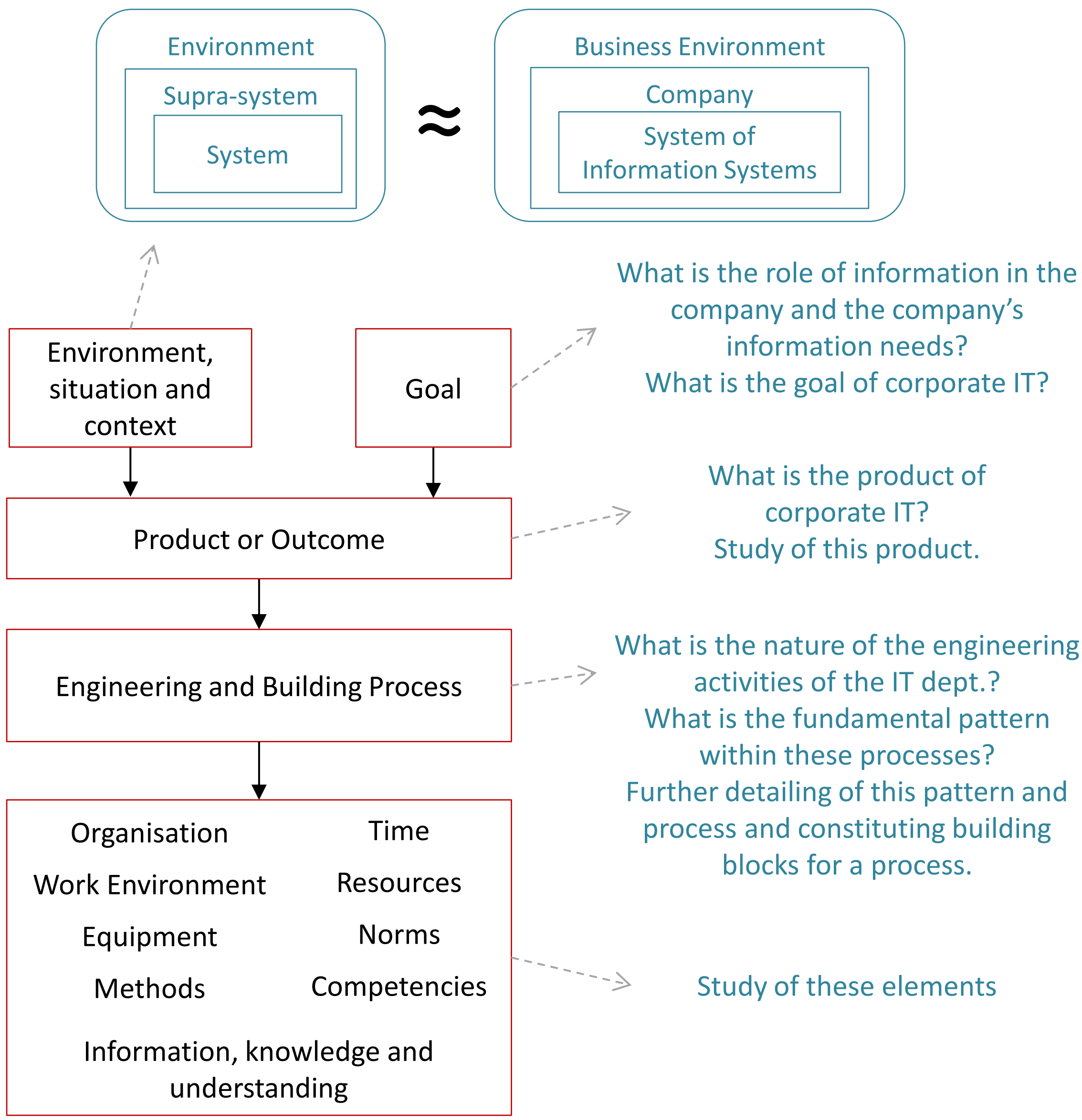
Our world view, beliefs and assumptions determine what we produce and deliver.

Though, it can hinder and even limit the ability to create value!

The environment, the situation, the context and the goal we seek to achieve will determine everything else.

This is thus the starting point.

Overall Approach of the Elaboration of TARB



Notes:

- Not all goals are expressed. Some are assumed. Or, we may not be aware of some goals and thus ignore them. Understanding the nature of goals (goal modelling techniques may help) is crucial.
- Many solution requirements will come from the study of environment, context, situation and goals.

KEY TO PROGRESS

"In times of turmoil,
the danger lies not in the turmoil
but in facing it
with yesterday's logic."

- Peter Drucker

"We cannot solve our problems with the same thinking we used when we created them."

- Albert Einstein

"There is no more neutrality in the world. You either have to be part of the solution, or you're going to be part of the problem."

- Eldridge Cleaver.

"If you don't understand it, don't mess with it."

- Louis Armstrong

"Nothing that results in human progress is achieved with unanimous consent. Those that are enlightened before the others are condemned to pursue that light in spite of the others."

- Christopher Columbus

"Science is a **way of thinking** much more than it is a body of knowledge."

Carl Sagan

"As to methods, there may be a million and then some, but **principles** are few. The man who grasps principles can successfully select his own methods. The man who tries methods, ignoring principles, is sure to have trouble."

Harrington Emerson

"I don't know what's the matter with people: they don't learn by understanding; they learn by some other way—by rote or something. Their **knowledge is so fragile**!"

Richard Feynman

"People mistakenly believe that IT failures are due to a technical problem or a software problem, and in fact it has its roots into the culture, **how people work together**, how they share knowledge, the politics of an organisation. The worse the politics, the more likely the failure."

Michael Krigsman

Source:
The Worst IT Project Disasters of 2013 (by Chris Kanaracus, IDG News Service)
The 6 worst IT project disasters of 2013
http://www.cio.com/article/744455/The_Worst_IT_Project_Disasters_of_2013
http://www.itworld.com/software/386675/worst-it-project-disasters-2013?page=0,0&goback=.gmp_29008.gmr_29008.gde_29008_member_5829606858213588992
http://www.pcworld.com/article/2071520/the-worst-it-project-disasters-of-2013.html

CORPORATE IT AND SYSTEMS ANALYSIS TODAY

Typical Recurrent Issues

Information

1. Information is not present or accessible when needed.
2. Unnecessary information being captured, while valuable information isn't.
3. The precise meaning of some information is unknown.
4. Information is duplicated and exists in various forms.
5. Information is incoherent and not updated everywhere.
6. Data is unorganised and hard to maintain.
7. Changing information at one place impacts other organisational units.
8. Poor data quality: outdated, unreliable, vague, insufficient, old and new data are mixed, various formats and encoding standards exist, …
9. Lack of control on data; difficulty to ensure data consistency and timeliness.
10. The company's information pool is growing. A lot of information is unrecorded, unmanaged, uncontrolled and known by a very few ones. Chaos is looming.
11. Much of the information is not or can not be exploited.
12. Information glut, information swamp, information overload

Processes

1. Cross-border business processes are slow, complex, awkward and inefficient.
2. Not all processes are inventoried. No overview (and management) of processes.
3. The whole processes aren't understood or only understood by very few.
4. Some steps are performed because they have always been done like that. It's assumed that it is of some value to another department.
5. Business processes may interfere with each other, resulting in unclear, unforeseen situations, exceptions and conflicts.
6. Not all business processes respect a same coherent logic.
7. Business processes are executed in different ways by different people. How can we then measure these processes in a coherent way?
8. No or irrelevant process metrics are collected, while valuable aspects aren't being measured. (not just about KPI's, but about all "PI's").
9. The metrics aren't fully exploited. Or, the right people don't receive these measures.
10. Production can't be planned, because of unknown processes, too much fuzziness, improvisation and variability in their execution.

Typical Recurrent Issues

Systems

1. Software solutions lack features or are awkward to use. Software features restrain the end-users activities.
2. Software applications contain too much unused features and logic.
3. The processes, the systems' architectures and the implemented concepts and the organisation of the data do not match with the real world.
4. Software systems are inflexible and not scalable.
5. Collaboration among software systems is limited and hard to achieve.
6. The software landscape and the technological landscape grew organically to an uncontrollable chaotic whole. Loss of insight in the implemented systems and in their interactions. A lot of corpses in the closets.
7. Adapting the systems became slow, hard and risky up to the point of paralysis.
8. Projects are late, cost more than estimated and, while matching the demand and requirements, they do not suit the needs and do not solve the problems. Often, they even create new problems.
9. Once operational, the systems underperform and do not meet the expectations.
10. Systems and projects do not create the intended business value.

Conventional Beliefs Driving Corporate IT

1. Responding to the business demands and delivering the software systems the business stakeholders wants or needs
2. The domain of IT is about technologies, applying these technologies and building software applications.
3. Building software applications which facilitate the execution of the business community's activities
4. Delivering accordingly to requirements within time, scope and budget
5. Obtaining business stakeholders satisfaction by delivering the desired solution: a software applications matching the demand
6. Finding solutions in the products offered by the market and improving performance by implementing more powerful hardware
7. Progressing by following the market's tendencies and innovating by acquiring the latest technologies

Conventional Reference Framework

Motivation: Obtaining end-users' or stakeholders' satisfaction by supporting business operations through the creation and delivery of software features and applications; accordingly to the demand, expectations, needs, wants and requirements; in order to facilitate the work performed by the business community.

Core questions in this line of thinking

- What is the client's demand?
- What are the client's needs?
- What does the client want? → Understanding what the client wants.
- What software do we need to build and to deliver to satisfy the client?
- What technologies can we use and what is the best way to use them to solve the client's problem or need?
- Is the client satisfied with the presented or delivered software application?

Conventional Beliefs: “the analyst”

The analyst is

1. Someone who helps the business community to implement the systems or solutions they think they need and want, and which they sometimes already conceived, at least to a certain degree.

2. Someone who has to meet the business demand and expectations, and who has to satisfy the business stakeholders.

3. An in-between, a bridge, an interface, a liaison between ‘business’ and ‘IT’

4. A facilitator, coach, guide, mediator resolving conflicting goals and incoherence’s or other issues.

5. Someone who looks inwards in a given subject and study its parts, the relations between these parts and the nature of all this. He or she refines (refiner) it and identify and eliminate incoherencies.

6. A Requirements Collector/Recorder, Requirements Analyst, Requirements Manager

7. A modeller (producing models)

8. An UML-specialist, BPMN-specialist, …

9. A specification writer / translator (translating business demand into specifications for the developers)

10. Someone who responds to the business demand by finding out what the business community and stakeholders need and want, as well as what their expectations are.

Conventional Beliefs: "Analysis"

Analysis is

1. About looking inwards of something, to the parts and to their relations. (≈ definition in dictionary) → the Analyst must be given something to analyse, to work with.
2. Looking at, verifying and working out the details.
3. The Analysis consists of looking at what the business demand, what they need and want in order to create value and satisfy the business stakeholders.
4. Translating the business demand into artefacts useable by developers.
5. The analysis is an obligatory step between business stakeholders and developers.
6. Analysis is about gathering, verifying, detailing and managing requirements. Requirements skills are crucial.
7. Analysis is about producing models (UML, BPMN, …) (representing the demanded solution) or specifications. UML or BPMN skills are crucial.
8. Everybody can do an Analysis or can become an Analyst.

"Don't believe everything you know"

The analyst Today

The analyst is an "*expert*" who

- receives an objective and a mission
- is being told what problem has to be solved
- is being told what is expected
- is being told how to work and what techniques to use
- is being told what the desired solution is

The analyst delivers business stakeholders the solution they want and asked for, knowing it won't meet the expectations, won't solve the real problem and which sooner or later will get the business into trouble.

He or she doesn't tell them that better solutions are possible, let alone that the wrong problem is being solved

- because (s)he has not been properly trained for and may not even be aware of it,
- because it is not what has been asked for,
- because it is not expected,
- because (s)he is not allowed to,
- because it would be upset the business stakeholders
- and because if (s)he did, (s)he would end up being the bad or negative person slowing down or even undermining the project.

In many organisations, Analysis is considered as an activity or a role which has as **purpose** and **goal** to meet demands and satisfy people.

The **role** of the Analyst is often defined

- as "**bridge** between business and IT" (communication),
- as **facilitator** (collaboration)
- or as **coach** to support the business community to identify issues and finding solutions.

This implies that Analysis is perceived and applied as a

- ➢ A **collaboration** & **communication** discipline (soft skills)
- ➢ A **facilitation** & **coaching** discipline
- ➢ A **set of administrative tasks**

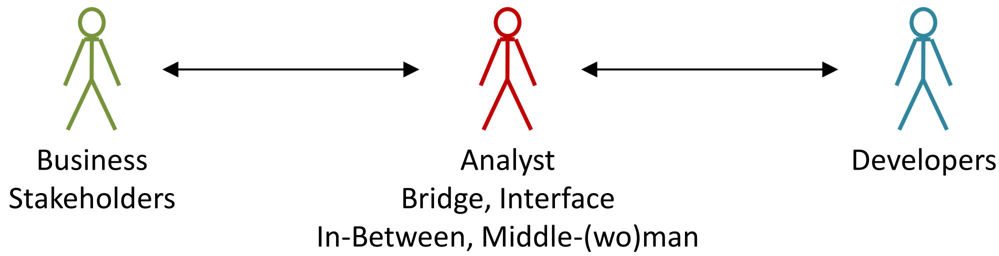
These considerations contribute in shaping the view, expectations and approach of business stakeholders.

This has a fundamental influence in the way Analysis is commonly employed and practised in companies.

Notes:

This should be kept in mind when the discipline of Systems Analysis is defined and when it's purpose is defined. Undeniably, communication, collaboration and facilitation are activities performed by the Analyst. This doesn't mean they are part of the essence of the Systems Analysis discipline.

Optimising the Business-IT Collaboration

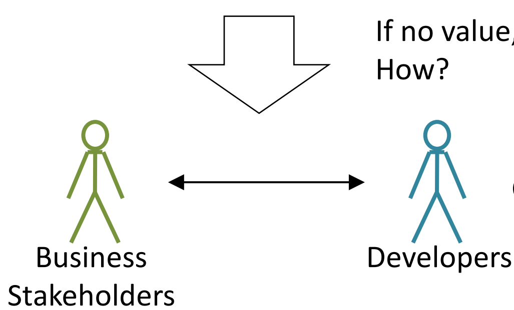


The middle-(wo)man makes sense if this model works, no additional delays and costs and if the middle-(wo)man creates value.

- Responding to business demands
- Initiative and process is triggered, defined and guided by business stakeholders
- Refining and detailing their demand
- Implementing the solutions the business stakeholders and the business community wants
- Producing models and analysis artefacts
- Recording and managing business requirements and specifications

What's the true value that is created and what are the drawbacks? After the Analyst's has done her/his work, do the developers know what they have to develop and does it solve the problem and needs, meet the expectations, allow to reach the objectives?

If no value, then optimisation.
How?



Cutting out the middle-(wo)man

Elimination of the middle-(wo)man.
Direct talk and collaboration
between the business stakeholders and the developers

Common Causes of Project Failure

- ➢ Analysis issue (mainly)
- ❑ Project Management issue (mainly)
- • Other

- ➢ Unclear goals and objectives
- ➢ Loose scope definition
- ➢ Moving targets, changing objectives
- ➢ Conflicting interests of the stakeholders
- ➢ Changing decisions (until the right ones are taken, due to lack of insight)
- • Lack of active executive support
- ➢ Lack of SME (Subject Matter Expert) and end-user involvement
- ➢ Unrealistic expectations
- ❑ Poor planning or wrong or rigid usage of plans
- ❑ Unrealistic time and resource estimates
- ➢ Insufficient communication
- ➢ Tackling the wrong problem (consequences instead of causes)
- ➢ Bad quality of requirements
- ➢ Inappropriate skills
- ➢ Disappointing results
- ➢ Hidden wasted efforts, hidden costs, ...

> "God laughs at those who deplore the effects of which causes they cherish."
>
> Jacques-Bénigne Bossuet

Causes of the "Causes"

- People, skills, collaboration, thinking, dependencies, assumptions, belief system, abuses, ... Not technical/technological issues.
- Commonly, early failure warnings/symptoms are not identified or are simply ignored.

Notes:

To reflect: Why (root cause)? And how can we resolve this?
(Some answers are provided by TARB.)

Some issues can be solved through a collaboration of Project Manager, Analysts, Architects, project team and some stakeholders.

After more than half a century of “IT” …

- Project failures ?
- Satisfied customers ?
- Quality of implemented IT?
- Opportunity gap between “what is” and “what is possible” ?
- Degree of Business-IT alignment?
- Degree of information exploitation?
- Quality of the Business-IT relation (trust, collaboration, …) ?
- Still looking for better ways to develop software applications
- Newly created problems?
- Confusion about terms, concepts, roles, …
- Coherence among the definitions
- In search for the self, journey of growth, ‘maturing’(?): unstable; huge evolutions; development of EA; moving from Waterfall to Agile; prone to simple but wrong messages and slogans; hypes diverting it from its path, …
- Not building upon lessons from the past. Ignoring them.
- Introduction of overly of complex methods, waste, … ?
- …

The Grand Opportunity Gap

A lot has changed a lot during the last half of a century. More powerful hardware and infrastructure, new technologies and tools. New software development approaches and new professions appeared.

1) Despite these changes, “IT” is still struggling with its old demons. Some underlying widespread beliefs, assumptions, reasonings and mind-set didn’t change very much.

2) The overall approach, the role of analyst in this approach and the analysis activities are inline with the beliefs, assumptions and reasonings. There is no other choice than to note that the essence, the true purpose and the objective of Systems Analysis are completely absent. They are simply ignored.

Consequently, Systems Analysis is immensely underestimated and undervalued and its application very limited. This leads to limited results, a lot of problems, inefficiencies, waste, lost opportunities, and so on. Systems Analysis should be able to solve most of IT’s issues. If Systems Analysis is not applied in accordance with its purpose, with its spirit, the benefits can’t be reaped.

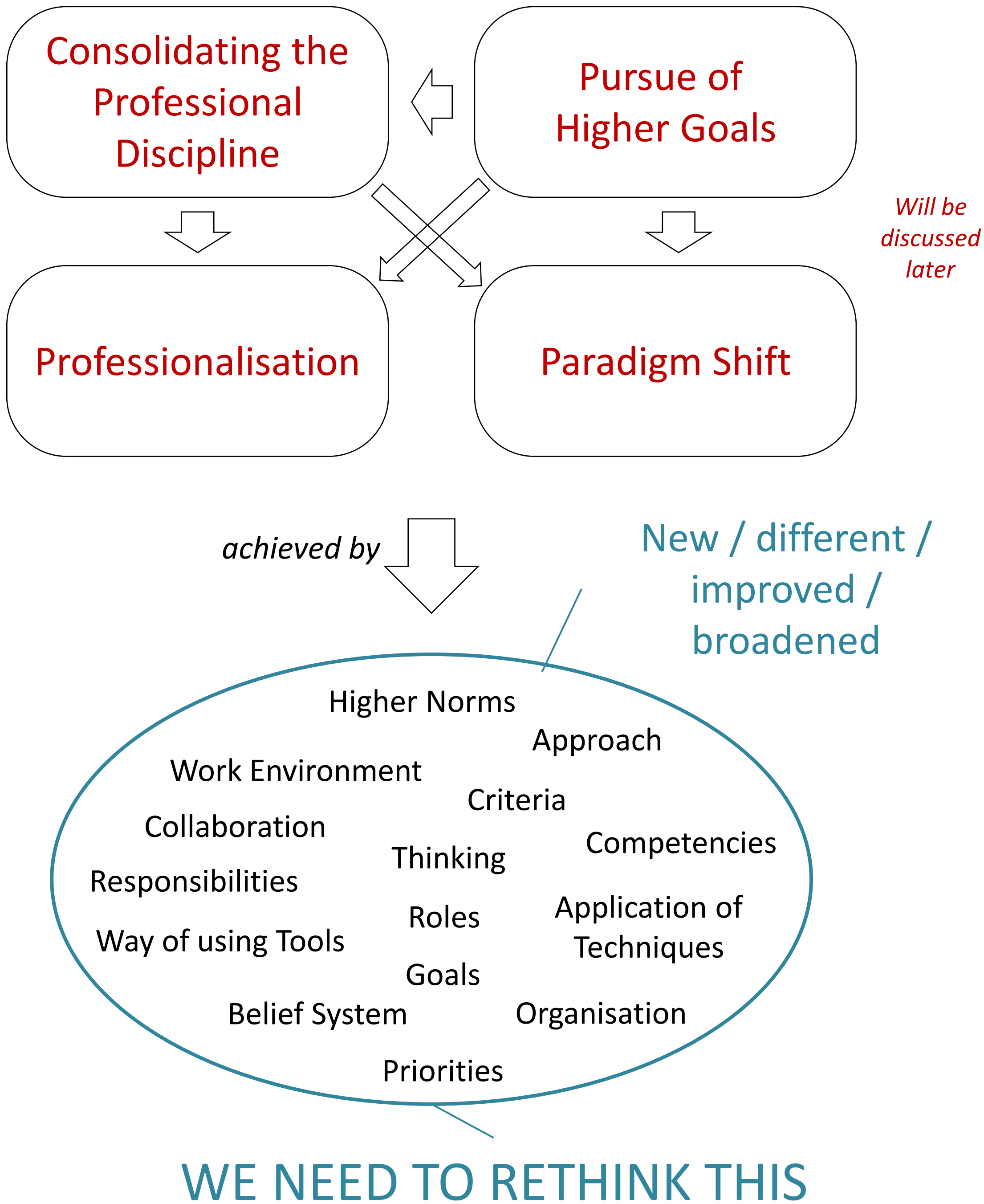
3) The change in scale and nature of the IT initiatives demands more from IT and forces it to progress.

4) IT and Software development are still in their adolescence.

Expecting a more effective use of “IT” and a better exploitation of information is then unjustified.

An immense opportunity for improvement

Opportunity Gap



Notes:

Progress is not achieved by not improving and not changing anything.

Every aspect needs to be in harmony with all the purpose, goal, level and with all other required aspects.

Opening the Mind for New Beliefs

Keys for Learning

Humility

- Humility of accepting not knowing everything, of accepting your limits and accepting the possibility of being.
- Maybe someone who might know more than we do, may know something we don't know or might be right.

Curiosity

- Curiosity of learning and of seeking what we don't know.

Empathy

- Trying to understand perspectives that differ from our own view and trying to understand why they do exist.

Courage and honesty

- Having the courage and honesty to evaluate information that differs with the own knowledge and insight fairly and with an open mind.

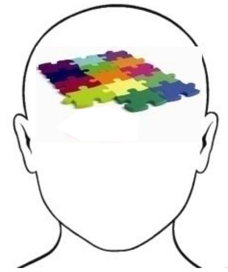
Being Critical

- Not accepting any information at face value (even if it is something "everybody knows" or something "obvious").
- Not rejecting information conflicting with our own ideas too quickly.

Valuing Truth over Being Right

- Finding out to be wrong allows to leave a false "truth" and is an opportunity to progress towards the real truth.

Mental Harmony Puzzle



PROCESS

The mental picture is created like a jigsaw being solved. Each idea or information element is like a piece.

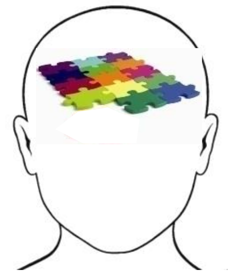
1. First, we have no mental image.
2. For each piece of information that is received, it is (or not) verified: Is it true? Believable? Does it fit with what I already know?
3. If the new piece of information doesn't conflict with what I know, I integrate it. If not, it is rejected.
4. Gradually, as new pieces are added, a picture is formed. This picture is the reference for all new incoming information. To obtain a harmonious picture, the new pieces of information have to be coherent with the global picture.

= "Mental Harmony Puzzle" (Dr. Chaesan So)

knowledge, map, mental picture, vision, arguments, thinking patterns, understanding, … already in our mind
(read "current mental picture we have about 'IT'")

New idea, new piece of information, new belief, …
(read "TARB")

Mental Harmony Puzzle



Problems:

- New information that doesn't match our mental picture, creates a discomfort and is likely to be rejected. It is filtered and ignored. Contradicting information is more likely to pass unnoticed.

- Information matching our picture is more likely to be noticed, to be searched for and to be integrated.

  Example: we are more inclined to select sources which are in line with what we already know and want to hear and are more likely to listen to them.

- It is more important that information is in line with what we know and with what we want to hear, than whether it is true or false.

- It is easy to construct a coherent picture with very little information and to be self-confident about it because of its coherence. This self-confidence may exist even though the information and/or the coherent picture is unreliable or false.

It is hard to change our mind, to change our puzzle, to change what we already know.

Mental Harmony Puzzle

Incoherent?

Known information forming a coherent mental picture

new piece of information

Is this false?

or

Is this false?

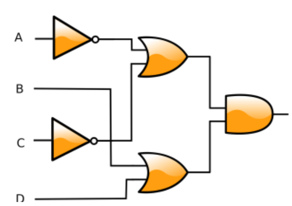
Ready to see information contradicting our puzzle. If there is an incoherence then we have to investigate what and why?

Need to be really ready, to be open-minded and to be willing to question our own knowledge, vision, understanding, belief system, … as well (even if we don’t like it)

Don’t believe that everything you know is true

Two ways:

Looking at real world, measuring, experimentation, ..



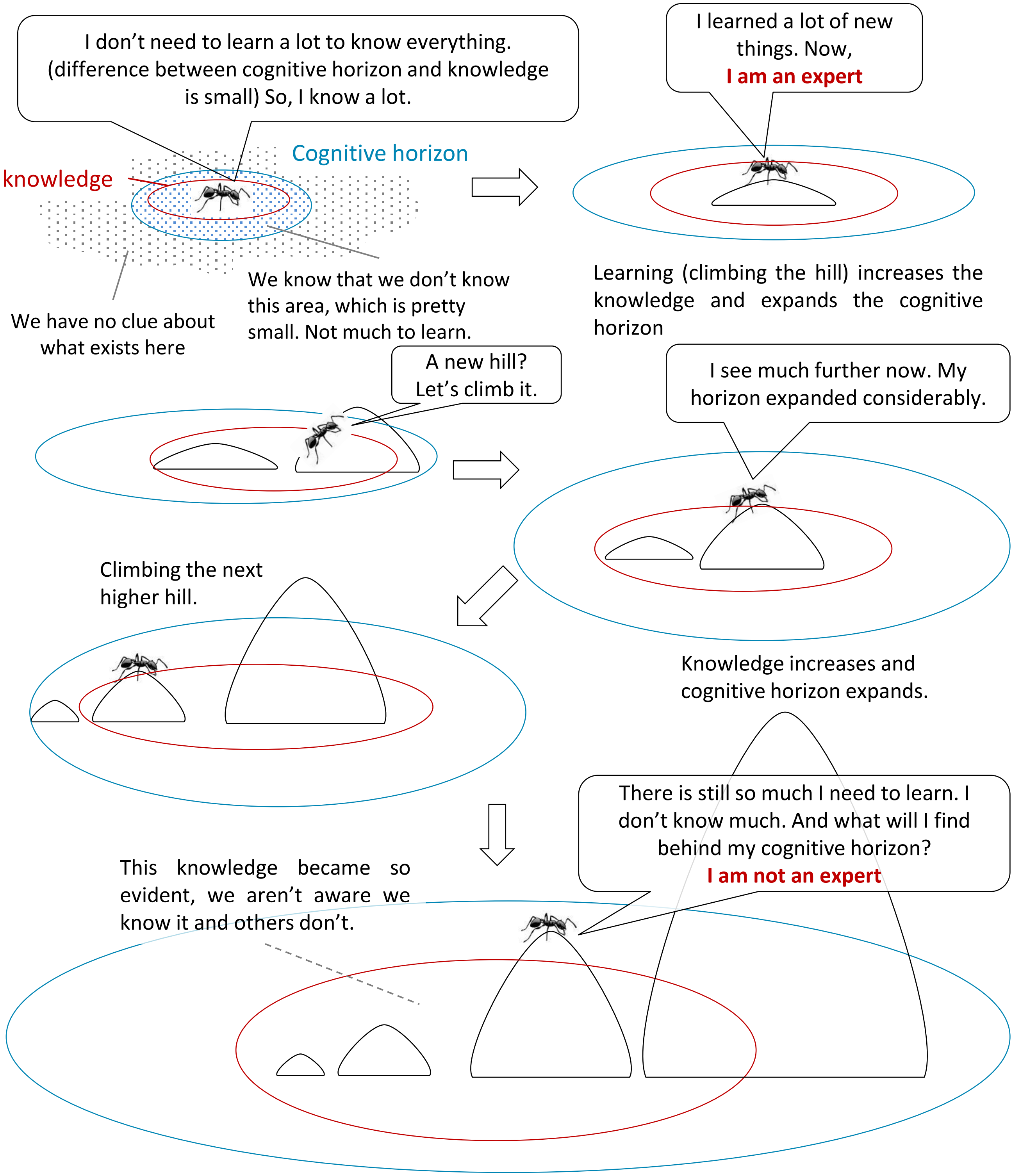
By thinking, by logic, by reasoning

or a combination of both

Important to keep questioning, correcting, adjusting and improving our mental picture, our mental map, our beliefs.

Having a coherent mental picture is important. But, keeping a vision of the world, a logic, a belief system that doesn’t reflect the reality, that is distorted, that has unjustified priorities, doesn’t make sense. You can’t build something lasting upon. The mental image and thinking patterns have to reflect the real world as much as possible. It is better to be a truth seekers, to truly try to know, rather than a protector of the own knowledge.

Knowledge & Cognitive Horizon



Lacking of knowledge is a problem. But, there is worse: ignoring the very existence of all the knowledge we still can and should learn.

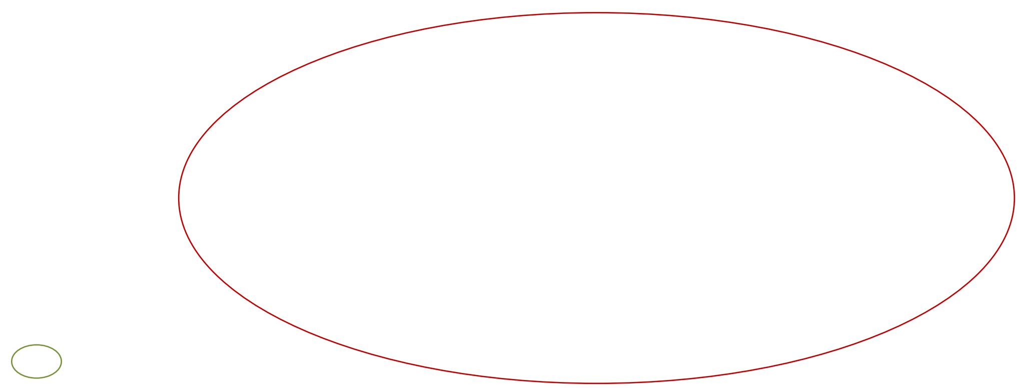
Dunning-Kruger effect: The one who knows little, thinks he knows a lot and is self-confident. And the opposite is true for the one who knows a lot.

Understanding of Words

Please, take the following into account:

Everybody understands words like ‘analysis’, ‘design’, ‘information’, ‘system’, ‘solution’, ‘process’, ‘engineering’, ‘project’ and ‘methodology’.

Most people understand the meaning of these common words. Their knowledge about the subject can be contained in a paragraph, in a few phrases. This creates only the illusion of ‘knowledge’ or understanding and adds confusion.



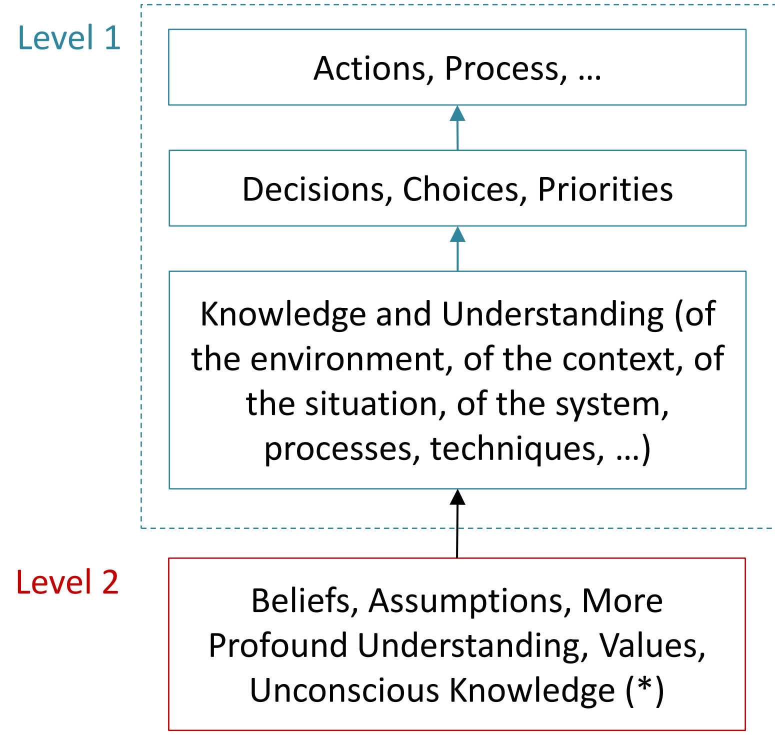
What they mean for a non-expert in the matter

What they mean for an expert in the matter

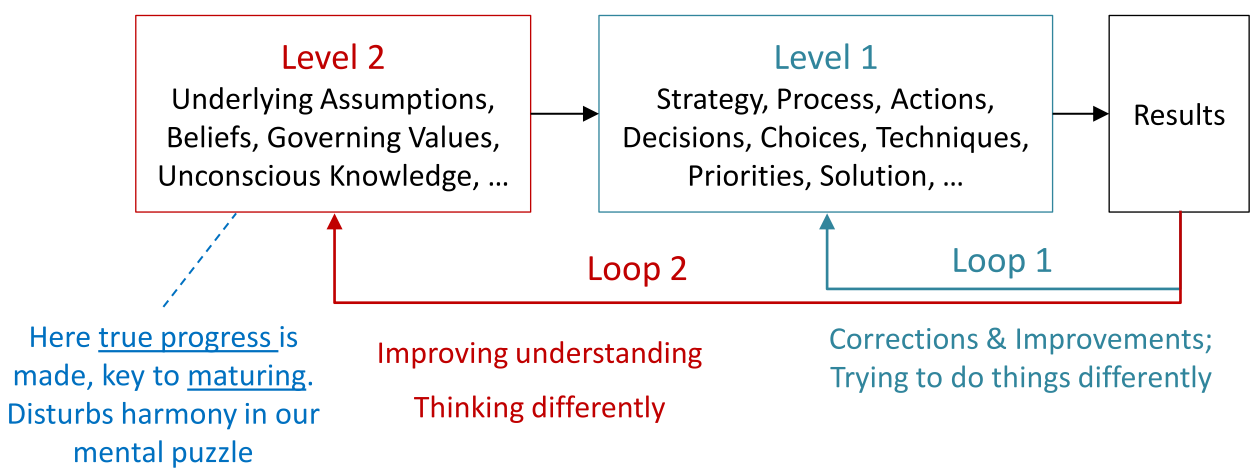
In the light of a **professional discipline**, such an explanation represents only an incredibly superficial understanding. Each of these terms is a subject that can fill books.

However, we are all on a learning path.

Double Loop Learning



Double Loop Learning: Chris Argyris & Donald Schön



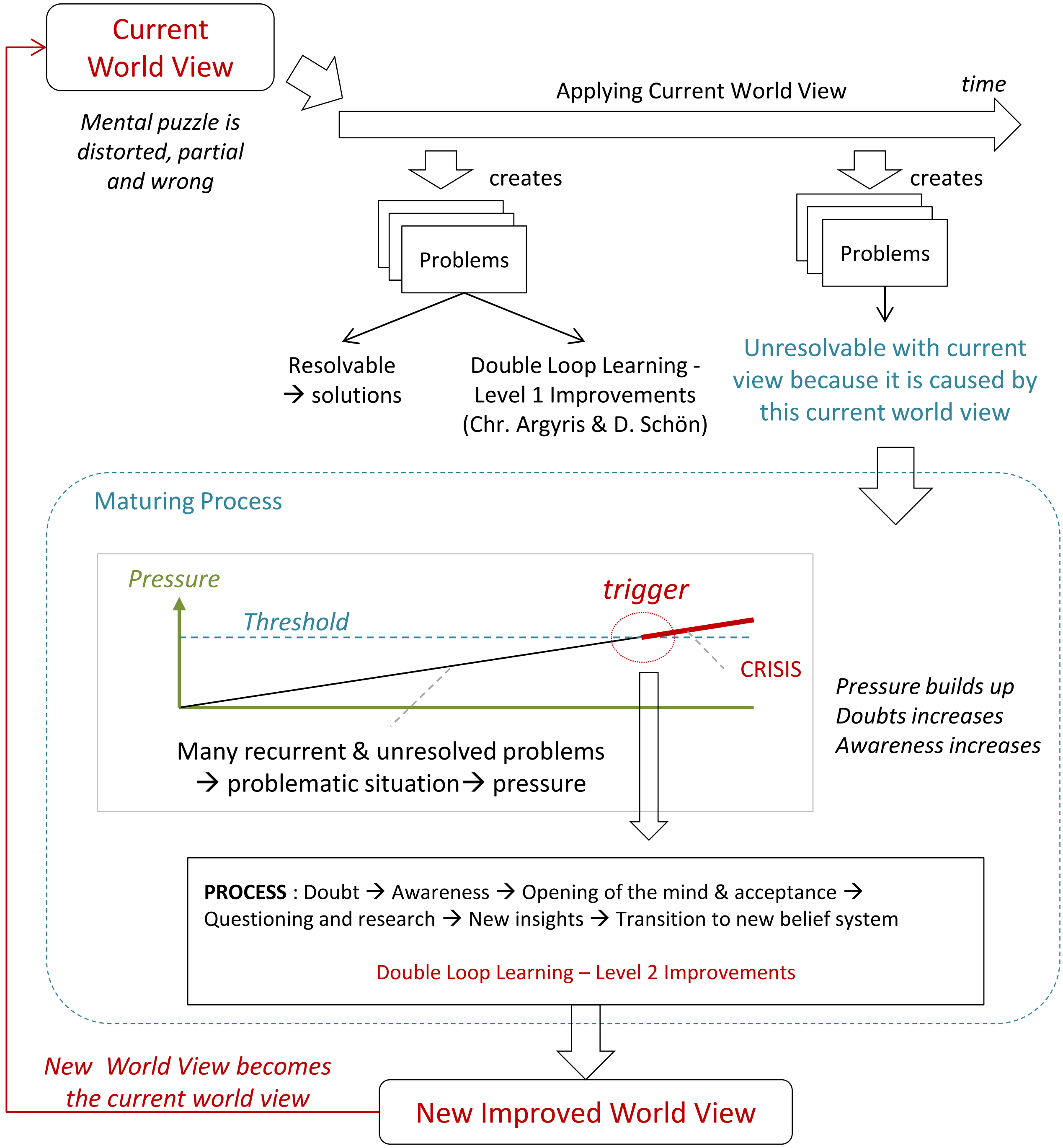
Notes:

"Unconscious knowledge": "we know, but we aren't aware we know it"

Without loop 2 learning, progress is possible, though limited.

Maturing Through Crisis

17/09/2019



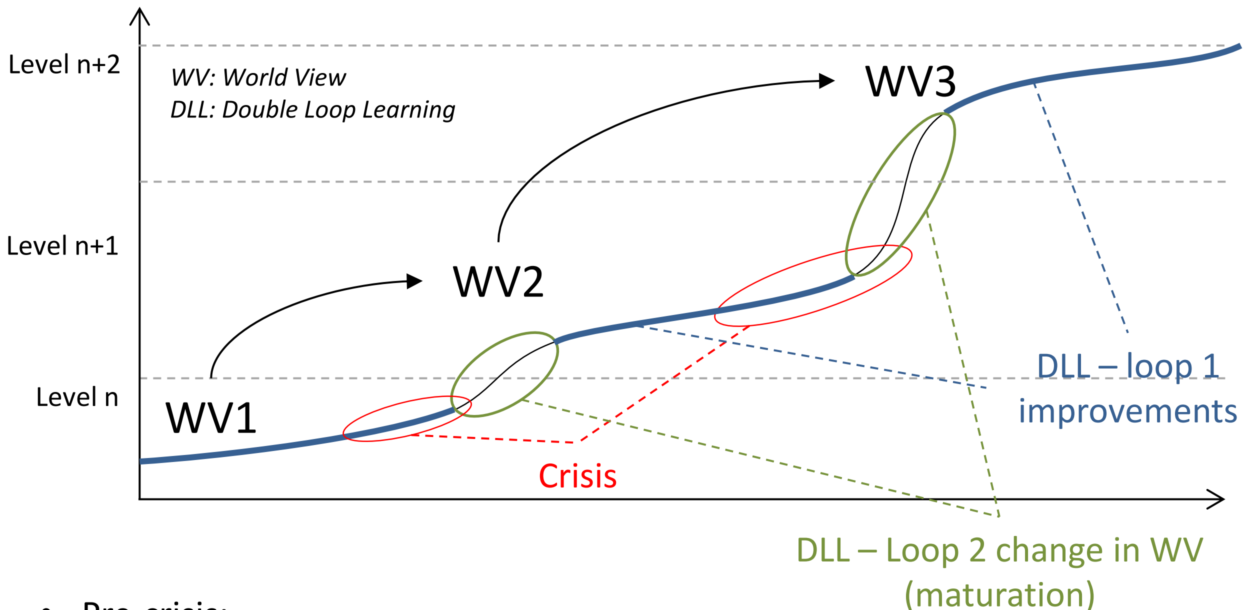
World View:

- View and understanding
- Beliefs and assumptions
- Values, norms and priorities
- Thinking patterns
- = distorted and incomplete

Notes

- The described process is a general process. In reality, it is somewhat messier and not necessarily nicely linear.
- Maturing may also happen through reading or any other source creating awareness and a greater understanding. (then not maturing through crisis)

Maturing Through Crisis

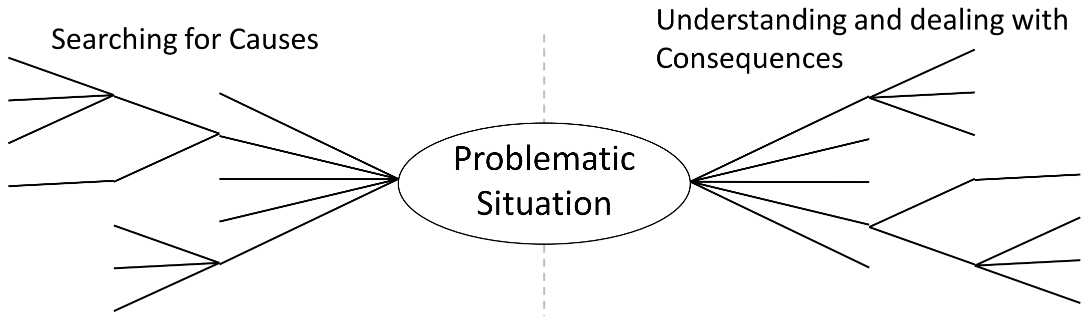


- Pre-crisis:
  - problems exists, inefficiencies, damage, loss
- Crisis:
  - Painful, stress
- Maturing World View (belief system, thinking patterns, …):
  - Acquisition of a new improved, deeper and/or more complete insight
  - DLL Level 2 improvement = a change in the core (not superficial) allowing a kind of significant breakthrough
  - Not anyone succeeds (imitating higher skills without appropriate beliefs, knowledge and thinking → cargo cult)
  - Not any change in 'belief' correspond with maturing. It isn't if the change in belief goes in the wrong way. (= Trap!)
- Level
  - Each level allow to solve types of problems that we weren't able to solve with the previous way of thinking

Notes

- The changes include changes in belief system, perspectives, thinking patterns, values, insight, understanding of importance, … They all influence the way of thinking.
- Improvements, be they DLL Level-1 or Level 2, happen irregularly and unexpectedly.
- Crisis is not an obligatory path for maturation.
- The chances for these improvements can be decreased or increased by an (in)appropriate mind-set, environment, atmosphere and actions.
- The more the mind is closed and blind or unwilling to change, the more crisis will drive maturation.
- Vigilant, open and curious minds have greater chance to evolve (mature) without crisis.

Causes and Consequences



Structure of CAUSES

… Why ← Why ← Why ← Why
= how to identify and navigate through the structure

Branched structure of CONSEQUENCES

THIS IS THE PROBLEM TO BE SOLVED!

Why?

Annoyances, hindrances and limits

Most consequences are known or easy to know. They are experienced and/or observable. We want to get rid of these. Therefore, it gets the most attention and highest priority (unfortunately).

Deeper understanding

RIGHT
WAY TO EVOLVE OR TO MATURE

Superficial understanding

WRONG
WAY TO EVOLVE OR TO "MATURE"

Notes

"Why" gives an answer. Then question the why about that answer.

Other questions: What else? What if's? What if it was different? …

Most of the time, we think we solve causes of problems,
while actually we solve consequences (Symptomatic Problems Solving).
This happens for most people and in most cases. It leads to CHAOS !!

Problematic Thinking Habits

- Partial or lacking understanding
- Ideas that do not correspond with the real nature of things and with the real situation
- Accepting seemingly obvious but unverified ‘truths’
- Hidden assumptions
- Valuing trying and exploring over learning and thinking
- Doing, activity, action is more important than thinking
- Knowing = Understanding
- Pre-cooked instant answers, relying on common and widely accepted ‘knowledge’ (preconceived ideas),
- Accepting ideas, explanations, arguments, principles, etc. at face value
- Aligning own opinion with the mind of the majority or group
- Inability to question one’s own view, ideas, beliefs, understanding, priorities, …
- Accepting interpretations, opinions, guesses, assumptions over understanding
- Rejecting contradicting information without prior careful investigation, without true understanding
- Allowing own opinion to be more important than the truth
- Choosing preferences and dislikes over true necessity and righteousness
- Single perspectives, local considerations, simplistic ideas, simple (but wrong) answers, oversimplifications, considering one step at a time, …
- Rejecting problems, complexity and everything one doesn’t like to hear, often in favour of simple, understandable, easy and quick ones.
- …

Notes:

These habits are contrary to the spirit of a true Analyst

A Few Words of Wisdom

… describing the mind-set of TARB

- Today's problems come from yesterday's solutions.

  Peter Senge

- If you only read the books that everyone else is reading, you can only think what everyone else is thinking.

  Haruki Murakami

- Mistakes are a great educator when one is honest enough to admit them and willing to learn from them.

  Alexander Solzhenitsyn

- You don't drown by falling in the water; you drown by staying there.

  Edwin Louis Cole

- Wrong does not cease to be wrong because the majority share in it.

  Leo Tolstoy, A Confession

- There is nothing wrong with change, if it is in the right direction.

  Winston Churchill

- Look deep into nature, and then you will understand everything better.

  Albert Einstein

- I'm trying to free your mind, Neo. But I can only show you the door. You're the one that has to walk through it.

  The Matrix

- There are no traffic jams along the extra mile.

  Roger Staubach

INTRODUCTION

Software Tool or Software Systems

Software as TOOL

- Customer / End-user centric
- Supporting work performed by business people
- Limited number of features (sometimes)
- Choice: Features are used (or not) by end-users (predilection)
- Simple, clear, local, not (too much) connected
- Worse: software perceived as a collection of features

INTEGRATED SYSTEM OF INFORMATION SYSTEMS

- Work-centric, Information-centric, reality-based
- Executing business operations (doing the work)
- Many features
- Solving more complex needs or problems
- Multi-disciplinary
- Crossing organisational boundaries
- Interconnected and collaborating with other systems
- Sharing & reusing information
- …
- In a more complex environment

Both endeavours are not comparable

Notes:

"All software is equal" NO! → website ≠ ERP ≠ missile software ≠ …

Some software applications are mainly a set of features for end-users. But for other systems the core logic is not in the features. The features are only supporting, secondary, peripheral, logic.

Simple and Large Endeavours

Small and simple endeavour

to solve a straightforward problem

- Easy to grasp
- Straightforward task
- To achieve lower goals
- Not risky
- Short term
- Small changes
- Quickly executed
- **Easy success**
- Lesser value creation
- No or insignificant competitive advantage
- No broader vision, little view ahead
- A company can't compete with small and easy software initiatives

No advanced techniques or advanced skills are required.
Anyone can do it and obtain results.

Large systems exists. A large system is more than simply an amount of small elements.

Larger and complex solutions

in complex environment
to solve more complex problems and/or pursuing higher goals

- Understanding is harder - much lesser insight
- More aspects to take into account
- More uncertainty, assumptions and contradictions
- Can not simply be executed based on superficial and easy to grasp knowledge
- Success is harder to achieve

and requires …

- a lot of investigation, thinking and planning
- more control, communication, organisation, collaboration, …
- more and better approaches, methods and techniques
- higher norms
- **true expertise**: requires developed competencies and test these skills
- specific prerequisites and conditions
- may require additional disciplines
- …

Simple and Larger Endeavours

Benefits of larger initiatives

- Greater efficiency and effectiveness
- Increased significance, things that really matter
- Greater amount of value created
- Realisation of a vision - Shaping the future
- Opportunity for significant innovation
- Greater competitive advantage
- More demanding → More learning & better practices

A company that is able to tackle only small and simple challenges is weak.

An organisation that is able to deal with larger and complex initiatives is strong. It is better able

- to transform itself,
- to innovate
- and to beat the competition.

Executing larger and more complex initiatives requires a higher belief system, holistic view, advanced thinking skills, higher norms, improved work environment, adapted approach. It also requires advanced competencies. → professionals

Notes:

- The development of larger, heterogeneous and more integrated systems creates challenges which aren't present (or not to that extent) in the development of small and simple systems. Hence, de development of larger systems requires, among others, a different work environment, approach, skills, and even a different way of thinking.
- These initiatives are more risky. However, risks can be limited and mitigated. Dealing with risks is also a competency based on analytical skills, flexibility, resilience and creativity.

End-User Software Application versus Company's Integrated System of Information Systems

continuum

User Software Application as Tool

Company's Integrated System of Information Systems

User-Oriented & Choice-based

- Users goals & intentions
- Users needs – driven
- Feature - driven
- Users wants
- Users preferences
- Users experience
- Keeping users interested and excited
- Focus:
  - What do users want ?
  - Do users like it ?
  - Do users use it ?

Using user-centric approach, principles, techniques and mind-set to develop the company's body and to solve company's needs is unlikely to be successful.

Company-Oriented Reality / Necessity-based

- Multiple objectives
- Multiple functions
- Specific information capabilities
- Multiple stakeholders & users
- Multi-disciplinary
- Operating in a broader complex environment
- Tentacular and geographically spread
- Inter-organisational systems
- Integrated - a lot of dependencies
- More than about features or software
- Shared information
- Different information usages
- Coherence
- Heterogeneous
- May have to be very scalable
- Reliable, manageable, flexible, evolvable, …
- Secure
- ….

Requires a complete different mind-set and approach

Requires a more advanced discipline

Notes :

- Software for a nuclear plant, an SCM-system or a company's website aren't built in the same way, with same mind-set.
- Keeping in mind the final overall product determines the approach. This goes beyond the individual project's mission and scope.
- Company-oriented systems don't need to be austere. The end-users aren't or shouldn't be ignored. Simply, other aspects have a greater priority.

CORE of ANALYSIS

Dealing with more larger and complex systems creates new challenges:

1. The knowledge fields of information and of systems (in general) become critical.
2. Increased capability to detect issues and opportunities and to rightly diagnose the problems.
3. Ability to learn a lot and quickly, and to have an organised insight in order to know what we do and to take better decisions
4. Ability to get a grip on the complexity of problems and systems and their environment.
5. Ability to solve information issues, systems design issues and process issues (more than software feature issues)
6. Supports for thinking activities.
7. Need to communication and collaboration
8. Avoiding to do unnecessary or inappropriate work (rework) that could have been avoided by learning and thinking.
9. Limiting the risks
10. Increasing the certainty
11. Increasing the control

Need for a professional discipline :

"SYSTEMS ANALYSIS"

Notes:

Systems Analysis, as general field, existed before IT. This is about "SA for IT".

A sloppy analysis or an imitation of an analysis is usually flawed and unusable. It allows the project to carry on. But flaws are then discovered late. Risks materialise. The product doesn't solve the problem or creates new ones. Many problems ahead.

CORE of ANALYSIS

SYSTEMS ANALYSIS

Systems | "Study"

- Software system
- Engine
- Car
- Nuclear plant
- Recycling system
- Financial system
- Ecological system
- Human body
- Group
- Company
- …

LEARNING

SYSTEMS ANALYSIS is

- the STUDY of SYSTEMS and their environment

+

- the **CONCEPTION** (DESIGN) of SYSTEMS

TARB considers SA within the domain, context and perspective of Corporate IT / Informatics.

Systems Analysis

A Simple Description

Systems Analysis is a professional discipline that studies systems and their environment, adapts them and creates new systems. The intention is to obtain well-functioning, suitable, effective, efficient and elegantly-designed systems that solve problems, facilitate work, create value and help reaching goals.

SA is especial needed for more complex situations.

Major Goals

- Detect issues and opportunities
- Improve systems
- Improve system's environments in order to allow a better functioning of a system
- Solve the right (root) problems and needs
- Obtain better systems designs

How to achieve the goals?

- Study goals, intentions, needs, plans, …
- Study systems and environments
- Evaluate them
- Design solutions

Systems Analysis, in corporate IT, is primarily (mainly) concerned by the information aspect.

Diagnosing, evaluating and innovating are also part of the discipline.

CORE of ANALYSIS

Systems Analysis (and Design) is a *professional discipline* that studies systems and their environment; identifies issues and opportunities for improvement; defines the adaptions for existing systems or for their environment or conceives new systems in order to obtain well-functioning, suitable, effective, efficient and elegantly-designed systems which achieve or contribute to a certain goal.

- Professional discipline → hard to master, steep learning curve, expert
- Studies processes, systems, environments and related aspects like structures, concepts, mechanisms, contexts and situations
- Identifies issues and opportunities for improvement
- Devises adaptations to structures, to processes, to systems and to their environment
- Conceives new structures, processes and systems
- Evaluates structures, processes, systems and their results
- In order to achieve or to contribute to goals → role, purpose

PRACTICALLY: SYSTEMS ANALYSIS spans

from

the detection and identification of issues and opportunities

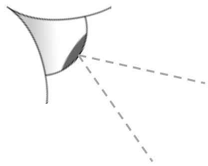
to

the definition of the solution to be built.

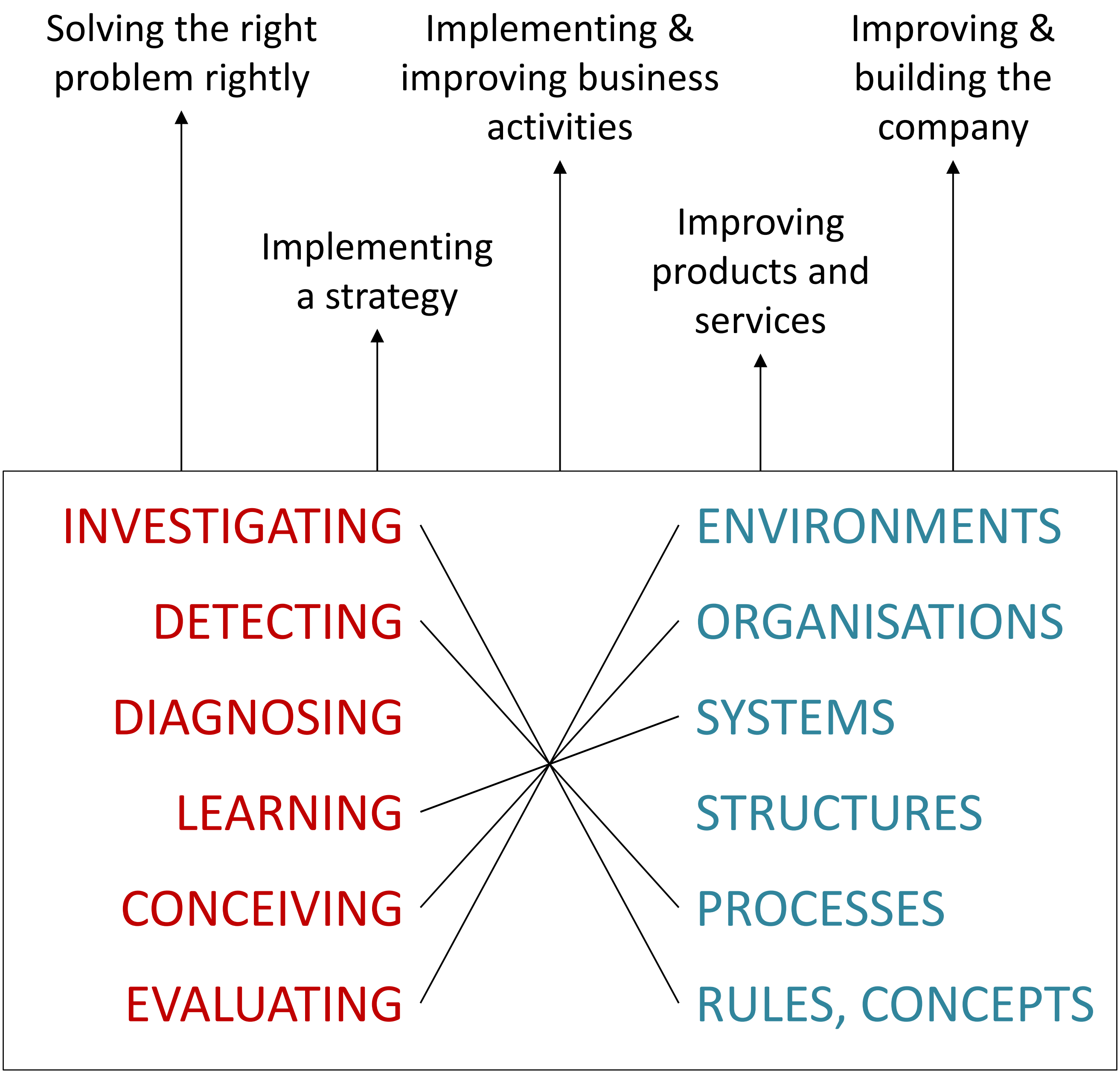
Notes:

- SA deals with systems, processes, structures, concepts, mechanisms, relations, principles, nature of things, evolutions, forces, obstacles, knowledge, skills, … anything that can be part of a system.
- Note that SA is not simply about looking inwards of a system, to its parts and their relations or only to something that exists (like analyse a document, a demand or given requirements).

CORE of ANALYSIS



Information perspective



.. and more

Analysis as Problem Solving

1. Identification of the Problem

The identification of the exact problem, as the **root cause** or **real objective**, is **mandatory** before further actions are taken.

2. Get understanding the existing systems, the broader context and the environment

It is impossible to conceive a submarine without a general understanding of submarines, of the systems the submarine is connected with, of warfare with submarines and without understanding of the ocean.

3. Conceive the solution

"If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions."

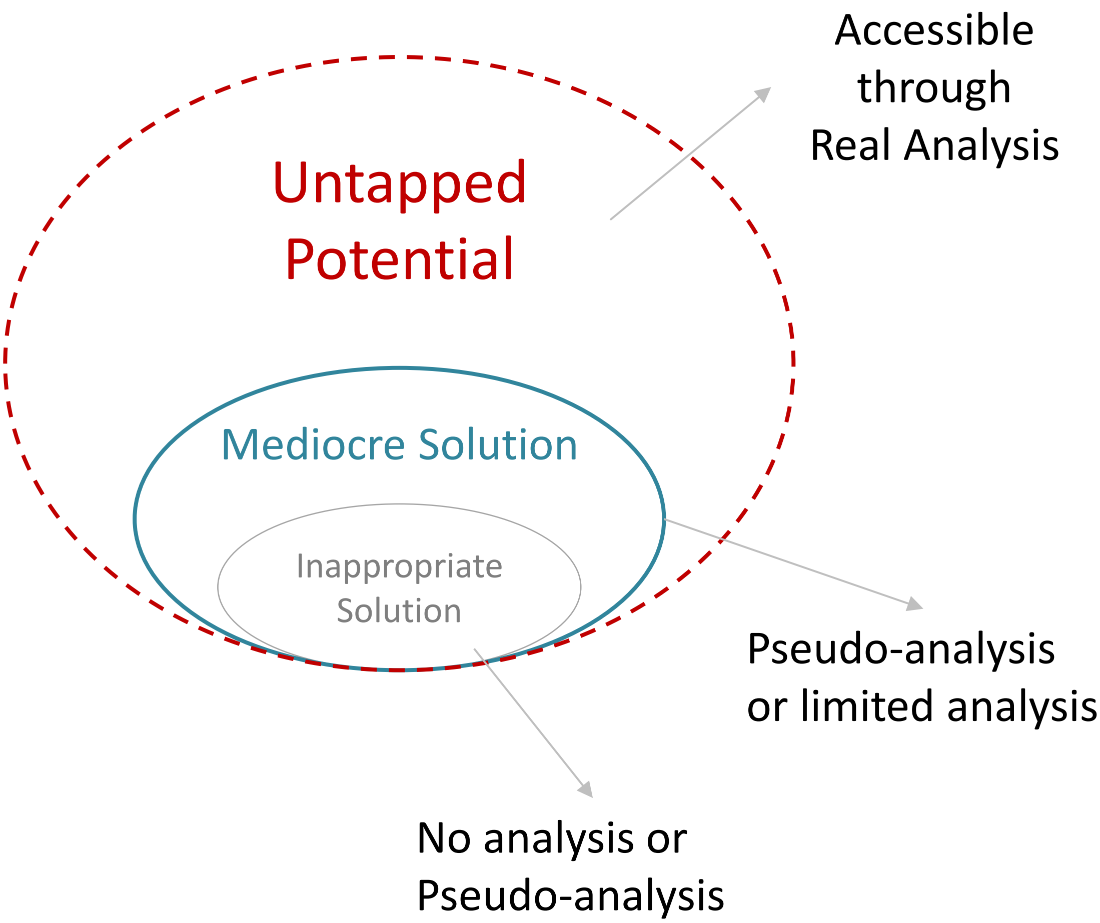
- Albert Einstein

Notes:

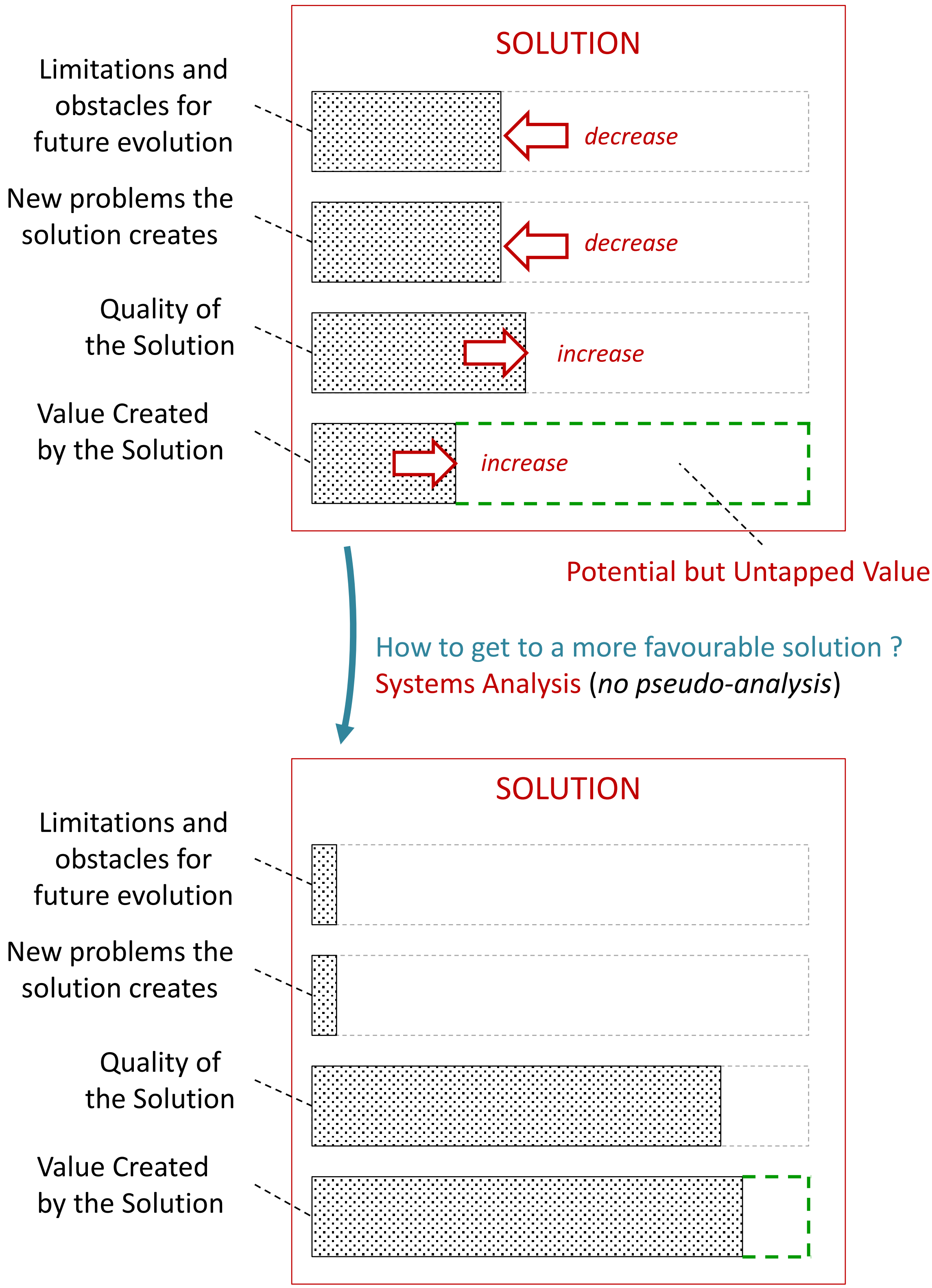
A chapter is dedicated to problem solving.

Systems Analysis is not a synonym of "*Business Demand Analysis*".

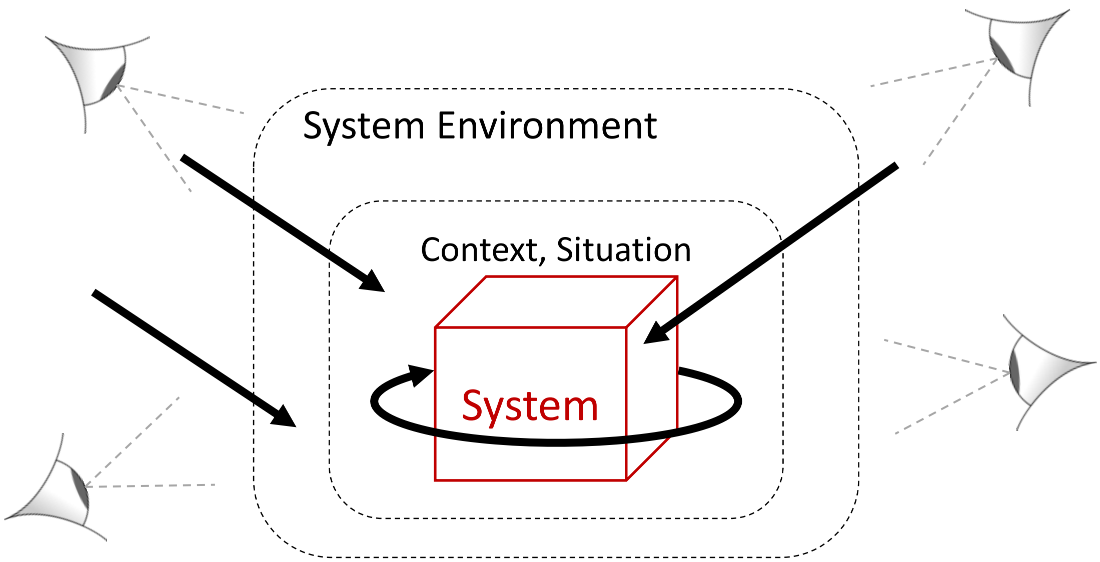
Appropriateness of a Solution



Appropriateness of a Solution



An Holistic Discipline



A system exists in a supra-system (example: the company). It exists in an environment. It operates in an environment, in a certain context and has to deal with situations.

If the system or solution doesn't exist yet, then the future supra-system(s), the future environment, the present and future context and aspects are studied.

The system depends of them. Therefore, this is crucial input for the design and must be studied. Different aspects and perspectives (including influences, forces, evolution, cost, …) have also to be investigated.

Systems Analysis is NOT and CAN NOT be reduced to a REDUCTIONISTIC approach (= looking inwards; studying the parts and their relations).

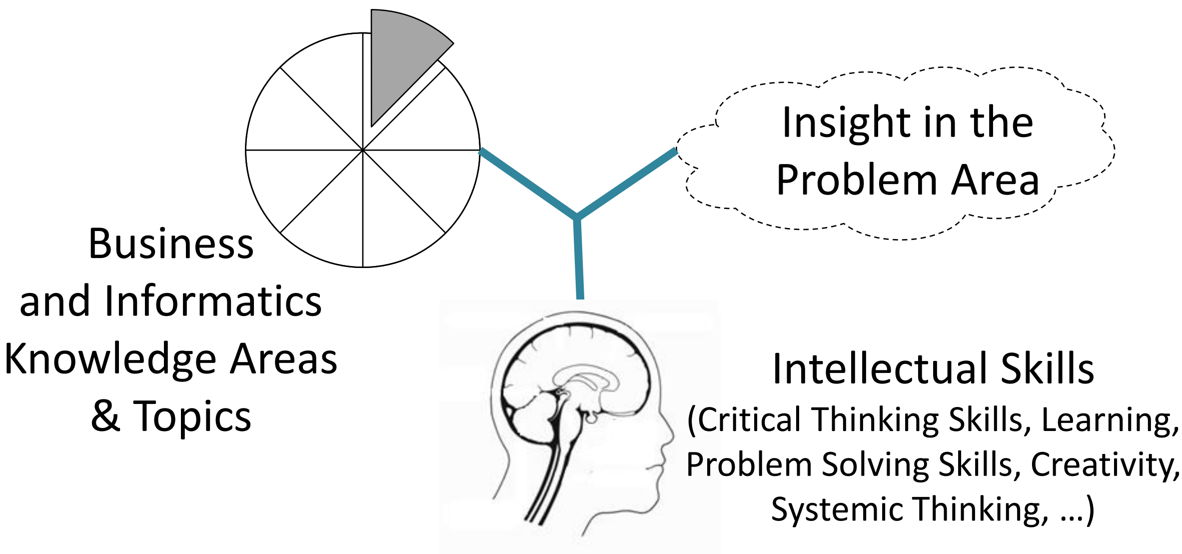
The design of systems operating in a company requires a fully HOLISTIC approach.

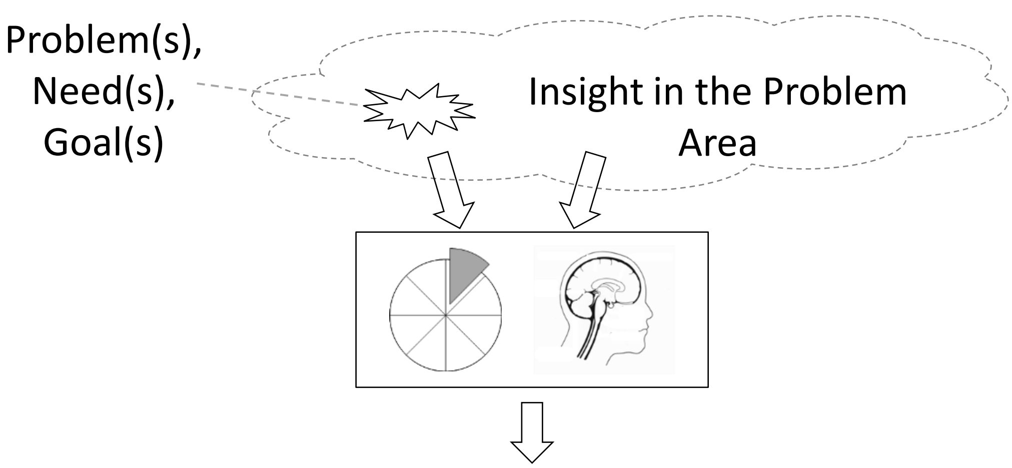
Core of Systems Analysis

- **All** necessary knowledge areas,
- a correct and profound insight
- and advanced intellectual skills

are critical

- to conceive a right and well-designed solution
- to evaluate a solution
- and to be aware of and grasping the possibilities and the (un)tapped potential.





Right Solution (+ Right Strategy)

The ANALYSIS Philosophy

The intent defining the Analysis philosophy:

“to conceive the right solution, often a system,
to solve the right problem correctly
from the first time”

*This is an idealistic goal which is indeed often out of reach.
The idea is rather to converge as quickly as possible and as much as possible towards this goal.*

It is a matter of real and genuine effort of a skilled Analyst, a matter of trade off, and a matter of true and justified confidence that the obtained solution is appropriate, elegant and rather definitive and that it will correctly solve the right problem.

BASED ON THE IDEA

- Better results can be obtained,
- the building process can go smoother and faster
- and risks can be reduced

by acquiring knowledge and insight and
by thinking before engaging in a building process.

LEARN & THINK FIRST, THEN ACT

Notes:

Doing work that doesn’t respect the Analysis philosophy can’t be called an Analysis.

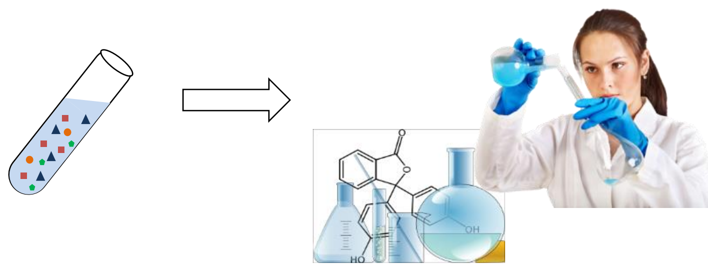
There might be clarifications, refinements, (minor) corrections, adaptations, additions and changes after the first version of the solution design.

Learning and thinking never ends. Analysis and design never really ends.

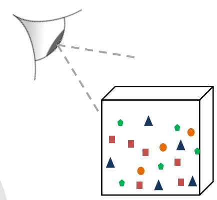
The solution will live its life and will continue to evolve.

Major Widespread Misconception about Analysis

Analysis of sample



Looking inside, study the constituents, looking at details



The Analyst must be told what information, information solution, information system and/or software application the Business Stakeholders want or need.

Practically: the Analyst has to receive something to analyse. Business stakeholders have to give something to the analyst to analyse, usually this is what they want, what they need, what they ask, their requirements, …

“The Analyst has to receive something to analyse. “

“Can you *analyse* my *Demand* *Requirements* *Document* ”

NOT at all aligned with the TRUE PURPOSE of Systems Analysis

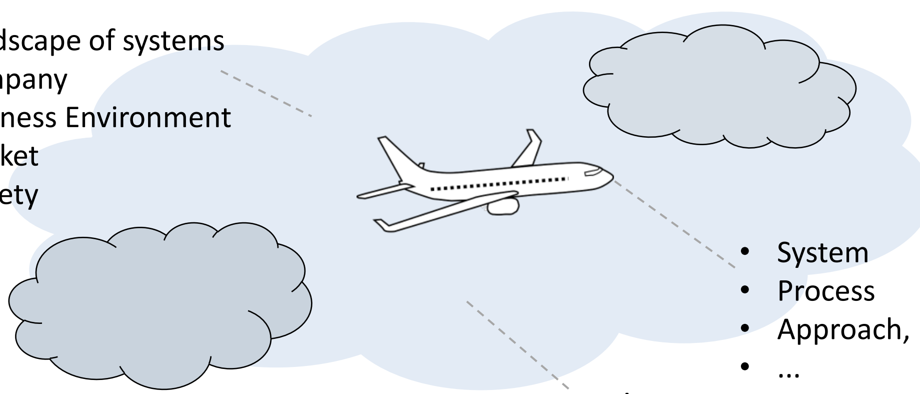
Systems Analysis

Studying Systems ? Looking inside ?

What happens if we ignore the environment:

We don't want to build a submarine in the desert,
even if the submarine is perfect and innovative.

- Landscape of systems
- Company
- Business Environment
- Market
- Society
- ...



- System
- Process
- Approach, Methodology
- ...

- Meteorology
- Laws of aerodynamics
- Laws of physics
- Gravity, storms, ...

- The environment must be studied and understood.
- The environment's nature has to be understood and respected.
- The environment's laws must be respected.

else you obtain a submarine in the desert

Raison d’être - Main Purpose of Systems Analysis

The core of the purpose is to define the WHAT

1. Determining problems, causes, gaps, issues and opportunities
2. Determining the solution

In reality, the raison d’être, the core of the purpose of Systems Analysis (in Informatics) is precisely to determine the necessary information, to diagnose the needs and to conceive what solution will solve the challenge, need or problem and how information can be used to drive business activities.

It is an approach, a discipline,
to solve more complex challenges !!!

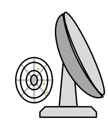
Analysis is often perceived as and reduced to a skill and/or set of activities. It is NOT. It’s much more than this.

Raison d’être - Main Purpose of Systems Analysis

The Analyst may receive a mission, an objective. Or, Analysis may happen as a continuous activity.

The Analyst

- determines the environment, the area, the subject, the matter and the perspectives to be studied.
- determines the approach and what is required to perform the work.
- works as a radar scanning the environment;



Radar

- as an investigator gathering information;

Investigator

- as a physician making a diagnosis;

Physician

- as a researcher finding solutions

Researcher
Innovator

- as an engineer conceiving those solution.

Architect / Engineer

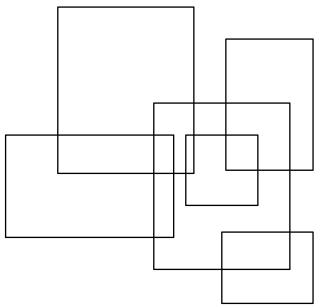
DEVELOPING SOFTWARE SYSTEMS **WITHOUT** (genuine) SYSTEMS ANALYSIS

- Solving the wrong problem
- Solving partial problems or solving problems partially
- Building "solutions" solving nothing
- Symptoms and consequences are solved
- Conception of inefficient solutions
- Creation of new problems elsewhere in the organisation and/or in the longer term
- Waste of time and resources in figuring out and in building non-solutions, inappropriate solutions or in solutions that put a burden on future developments and on the future of the organisation
- Critical insight is acquired only after software applications have been built and/or implemented, leading to a lot of rework.
- Creation of little value, of no value or even systems detrimental for the company
- Little exploitation of the available resources, the possibilities and the capabilities
- Critical insight is not built
- …

Notes:

If these complaints exist even when practising Systems Analysis, something is fundamentally wrong. (Double loop learning?)

Systems & People



World of Systems

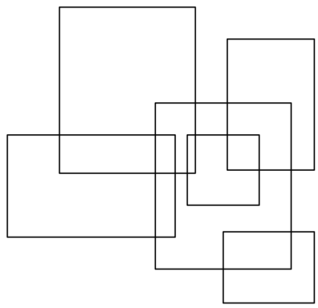
World of People

Clash of two worlds

- People create some systems (man-made systems vs natural systems)
- World of people is different from the world of systems.
- People need to understand systems and to adapt their thinking when conceiving and dealing with systems.

Remark:
Everyone can create simple and small systems or create somewhat larger systems by a lot of trials and corrections. It's better to make use of true competencies.

Systems & People



World of Systems

World of People

The system runs by obeying only to its own rules. Changing those rules implies changing the system.

- Inviolable principles
- Structure
- Mechanisms
- Interactions
- Processes
- Influences
- Triggers
- …

The beliefs and way of thinking of used in daily life are totally inappropriate to design systems because the internals and principles governing systems differ completely from what those governing daily life.

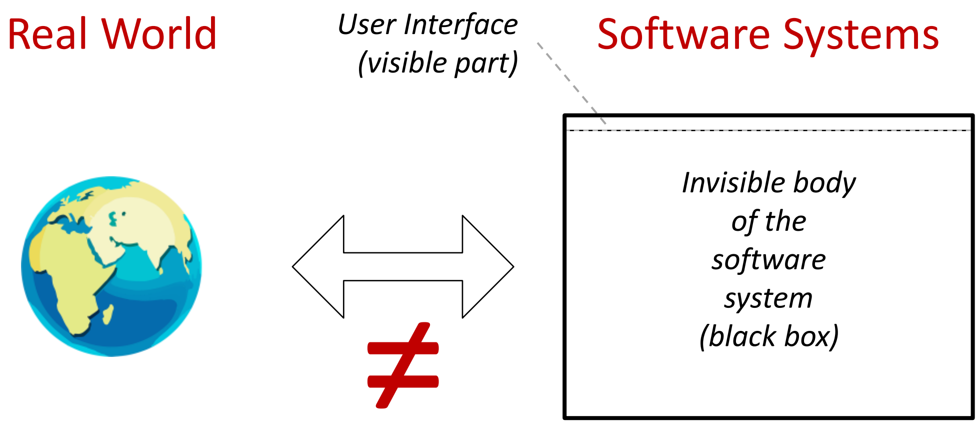
DAILY LIFE

How someone thinks, takes decisions and acts when meeting friends, lives at home, acts in the supermarket or at the sport club, …

KNOWN BY ALL

- Continuous exploration
- Continuous learning
- Volatility
- Ambiguity
- Experience-based
- Interpretation
- On-the-fly decisions
- Preferences
- Choices
- Adjustments of priorities
- Continuous adapting
- Highly unpredictable
- Influenced and influencing
- Emotions and feelings
- Intention
- Goal seeking
- …

Two Very Different Worlds



- “Known” by most
- The world we live in
- A lot is visible
- A part is concrete and touchable (material)

- Abstract - Immaterial
- Hyper-formal
- Hyper-detailed
- Complete
- Highly Logical
- Fixed (relatively)
- Invisible for users and business stakeholders (except UI & print-outs)

The two worlds are different in nature, in required competencies, in beliefs and in way of thinking.

A common mistake is to assume software systems can be understood and conceived with just habitual real-world knowledge, and without appropriate knowledge and insight in software.

You get what you created

Yesterday's solutions created today’s problems

AND

Today’s solutions will create tomorrow’s problems.

“Good” is “not good enough” and “not good enough” is appalling.

A system functions, behaves and delivers accordingly to its own capabilities, to its own logic and to its own characteristics.

Badly conceived systems deliver bad results and produce more adverse effects (limitations, difficulties, inefficiencies, other problems, …).

AND

Well-designed systems dealing with the right issues and fitting in their environment deliver good results.

Solutions have to do so much more than solving only today’s problems.

FOUNDATION

CORE IDEAS

The term "Analysis"

ANALYSIS is:

- about **studying** the parts and their relations – looking **inwards** into something
- a project **phase**
- a branch, a group of tasks, in a **WBS**
- a **phase** in an System Development Lifecycle (SDLC)
- a specific **type** of activities
- a **process**
- a **method** or technique
- a **set** of activities (that anyone can perform)
- a set of **deliverables** (documents and models) resulting from analysis activities ("the analysis")
- a **professional** discipline

All of these meanings are correct.
The meaning depends of the perspective, the context.

A single word having different meanings creates confusion.

The Term "Business"

What is "Business" ?

- The business community ?
- A part of the company or organisation ?
- Business knowledge, business logic, business expertise, field experience, … ?
- Something under the authority and responsibility of the business community ?
- Anything emanating from the business community ?
- Anything the business community deals with or should deal with ?
- Everything that is not IT ?
  - A way to indicate matters and issues IT don't want to deal with (not wanting to take responsibility over it, non interested in it, time pressure, …)

The Term "Business"

The label "Business" has two meanings

1. "Business" as activities deployed by the company directly related to a business domain.

2. "Business" related to the **Business Domain**

Business domain is the specific knowledge domain linked to the purpose or to the main functions of the company.

Examples: insurance, manufacturing, energy, accounting, marketing, production planning, …

Beware ! This label is very confusing !

It does NOT mean "executed by", "experienced by", "emanating from" or "established by" or "managed by"

the Business Community (BC)

And does not imply ownership, responsibility or authority

Not all problems experienced by the BC are *business* problems

Not all processes executed by the BC are *business* processes

…

The Term “Enterprise”

THE COMPANY

Company’s Identity

Company’s Intangible Assets

ENTERPRISE

=

Company’s Body

Company’s Resources

There is a need to differentiate different concepts:

Company: Commercial and non-commercial organisation

Organisation : Usually the human organisation (in ARB, the term ‘organisation’ may indicate a company or a non commercial organisation)

Business: the activities deployed by the company or a field of expertise

Enterprise: the body of the company, the system performing the company’s activities essentially comprising of people, buildings, systems, machines, processes and infrastructure

This way of defining the terms allows to distinguish more easily different parts and concepts

Notes:

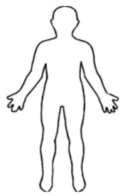
(human) **organisation** *is part of* the **enterprise** *is part of* the **company**.

The company is the supra-system of the Enterprise.

Heterogeneous inter-organisational systems having the same nature as the company’s body may also be defined as an ‘Enterprise’. They require same knowledge and skills to be engineered.

Commonly: company = organisation = enterprise = business. In TARB, these terms are used for different concepts.

Dealing with Systems



Understanding people → Dealing with people

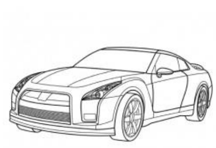
≠

Understanding cats → Dealing with cats

≠

Understanding bears → Dealing with bears

≠



Understanding cars → Dealing with cars

The way (the 'How') we deal with a system has to correspond with the nature of that system.

Understanding the nature of systems

is required

to deal correctly with systems.

AND …the way we deal with <u>a system</u> has to correspond with the nature of that type of systems and with the particular system.

<u>Notes</u>

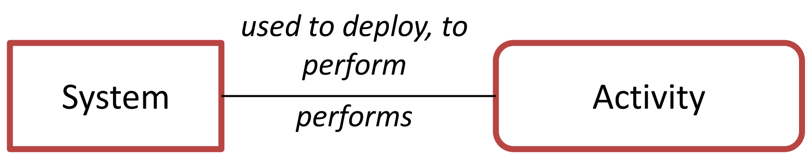
This is rather a profound principle worth more reflecting about it.

Understanding the "nature of systems" should not be confused with understanding a specific system (usage, behaviour, capabilities, logic and structure of a specific system)

Systems

A system is a set of regularly interacting or interrelated entities that form a unified whole and which exists for a period of time.

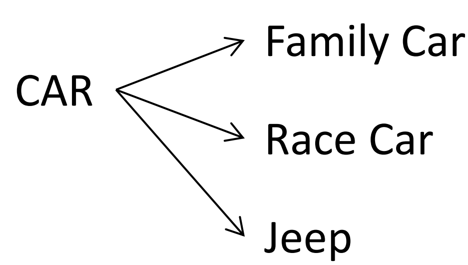
Many man-made systems are created with a purpose in mind, to perform a function, to achieve a goal and used to perform/deploy activities.



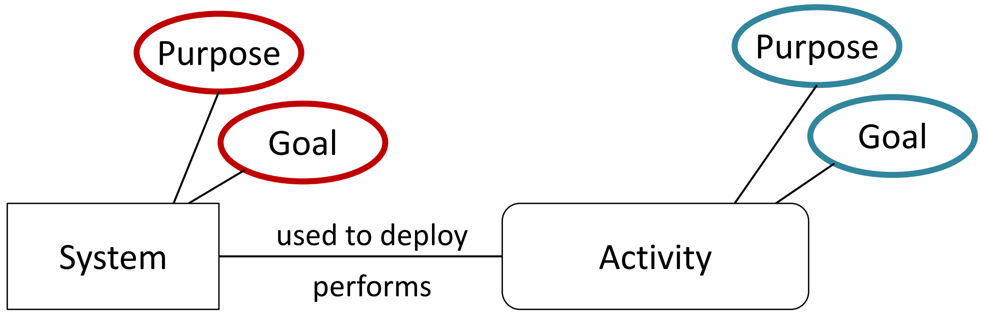
Systems		Activity
Army	→	War
Body	→	Running a marathon
Car	→	Taxi activities
Company (Enterprise)	→	Deployed business activities

“Same” system, but different …

- USAGES
- ENVIRONMENTS
- PURPOSES

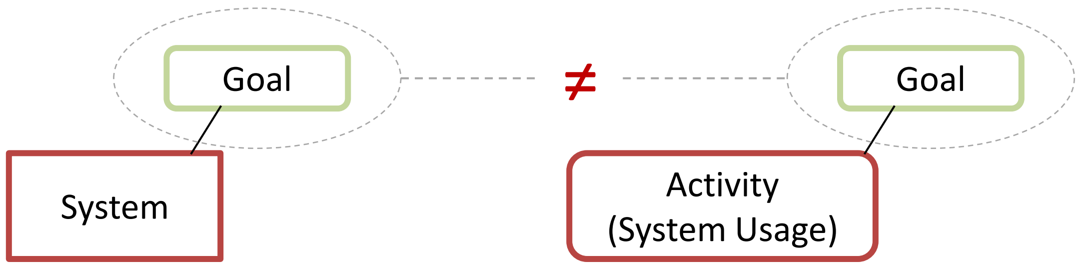


Differentiation between a System and its Usage



- A system has a purpose and, through this purpose, it plays a role in an environment and in a situation.
  - The purpose of a car is to transport a limited amount of people and smaller goods over the road or over land. It should be able to drive on certain types of roads of different qualities, in different weather conditions, safely and for several years and for 150, 200 thousand kilometres or more.
- A system performs itself activities
  - Example: A car drives. Its engine runs.
- A system can be used to deploy activities
  - Example: A car (system) is used by the taxi driver to deploy taxi activities, to transport people to where they want.
  - Note: a car is a system; but a car + driver is also a system
- Activities are performed with a certain intend, to get an outcome, to reach a goal.
  - The taxi-company should make profit.

Goals of System and Goals of Usage



A system has a goal:
"SELF-PRESERVATION"

>

Activities are executed with an intend, to get a result, to reach a goal

Long term	Short(er) term
SURVIVAL **PROSPERITY** Growth Continuing existence Maintaining increasing the system's qualities & environmental fit	Successfully execute activities Obtaining a specific result

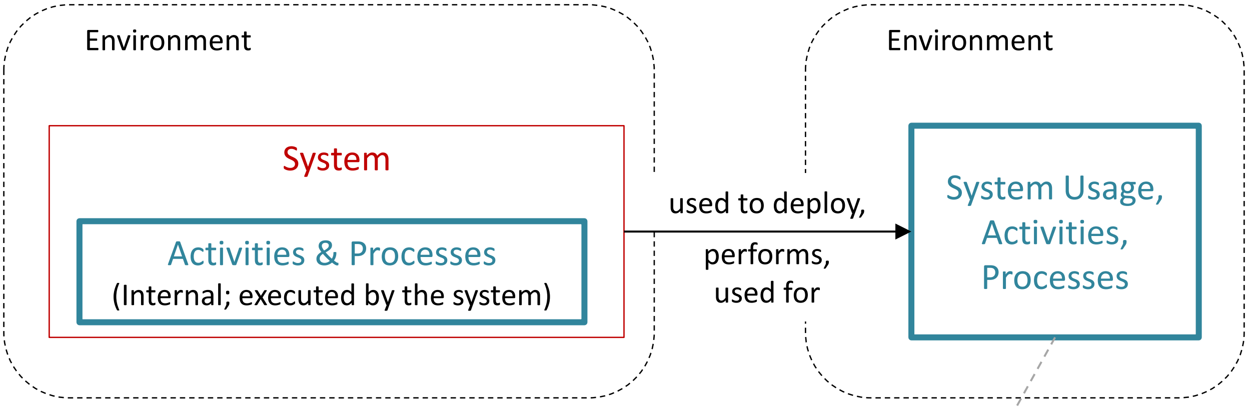
If the long term has a low priority or is ignored, then there is no solid foundation to build upon, let alone to build something sustainable.

Anything threatening the long term systemic goals, undermines the system's chances for survival and sustainable prosperity.

Reflection:

- Can a person deploy activities with a system, if that system is weak or broken?
- What will happen if the focus is only on activity results while the system's objectives are ignored?
- Who is interested in system's objectives and who's is much more focussed on the activity objectives?
- Which type of objectives is the most important? Why?

Basic Model



Examples:
- Riding a bicycle
- Usage of software in an office
- Usage of a car on the road, in traffic a system
- Usage of a company and deployment of activities in a market
- Usage of a battalion on a battlefield

This is a basic model (simplified).

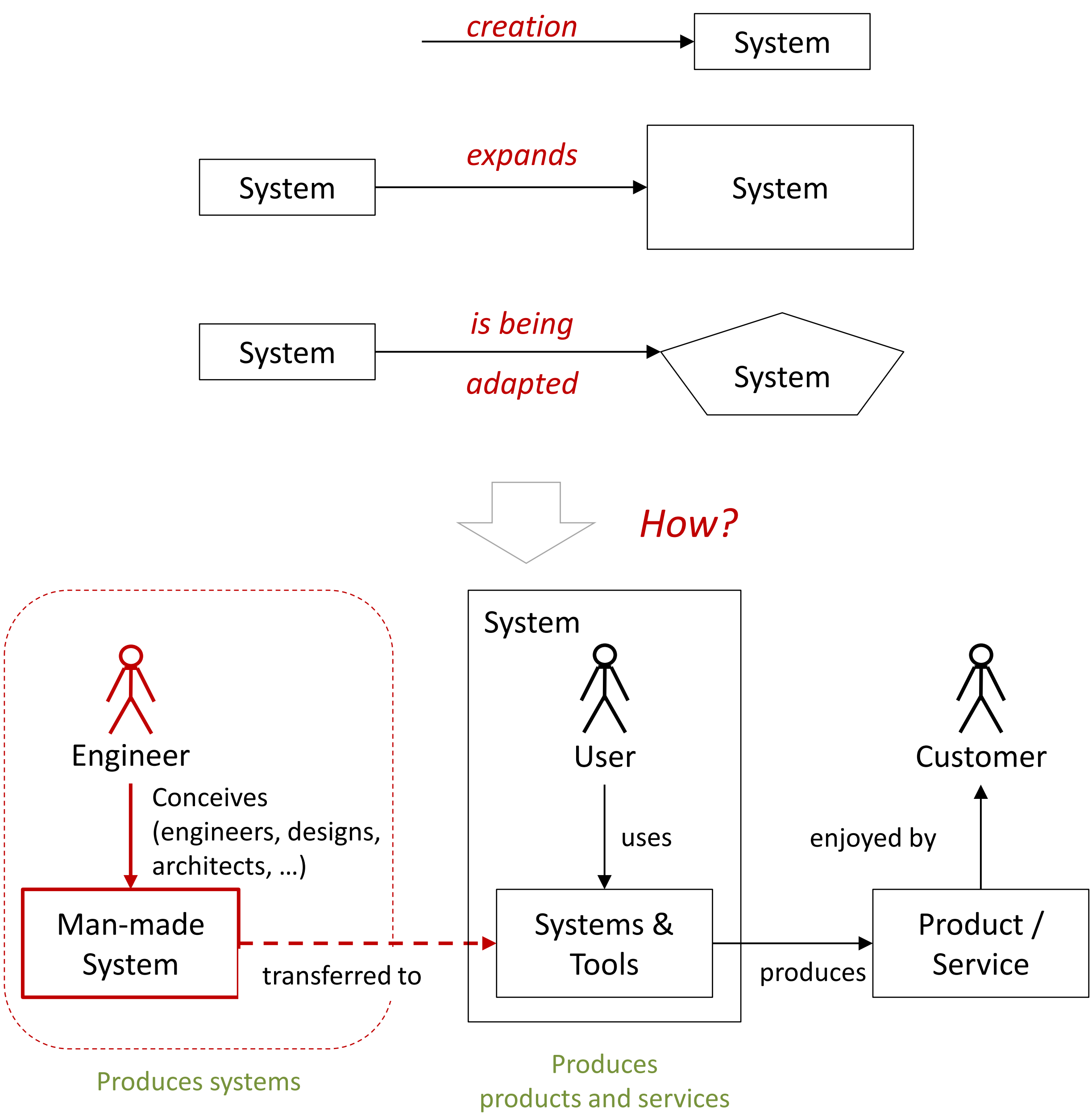
Later we'll see that

- Systems are often parts of supra-systems
- Systems often contain sub-systems
- System's environments may be common to different systems.
- The environment of a system is a subset of the environment of the supra-system.
- The system can be used by people. A system may contain people performing activities <u>in</u>, <u>of</u> and <u>for</u> the system.

and much more.

Not all systems can be used in a same way as man-made systems and/or tools are used (users).
Example: eco-system, water cycle, climate system, tidal system, …

Engineering of Systems



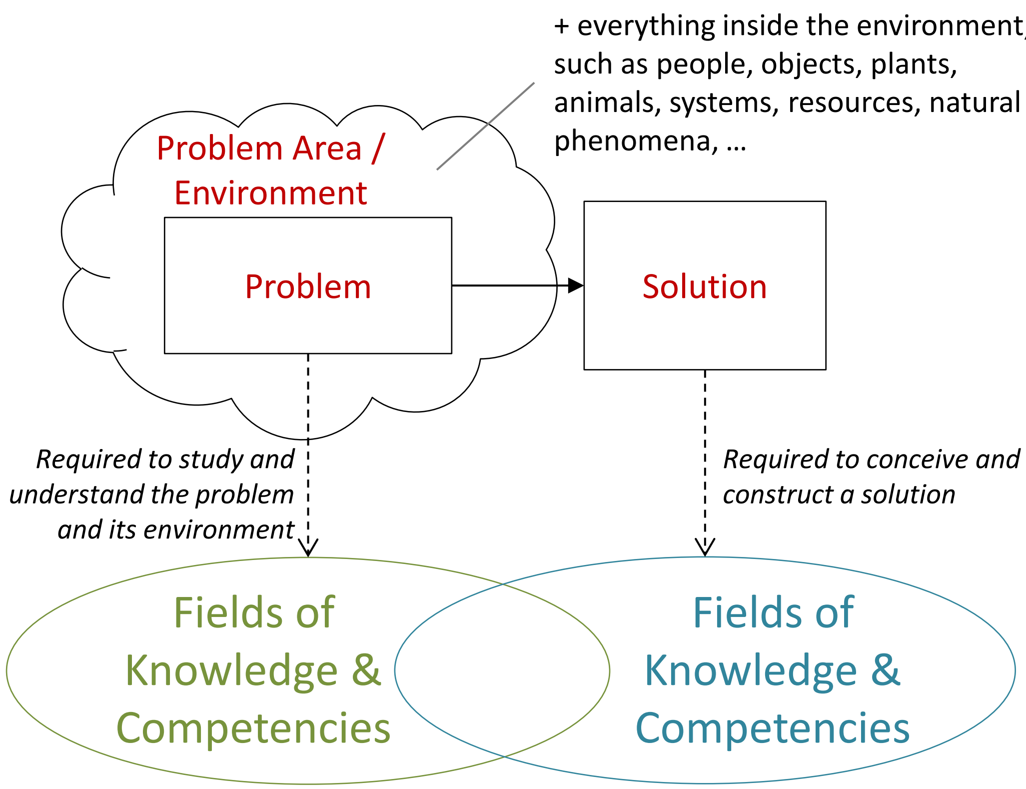
Notes:

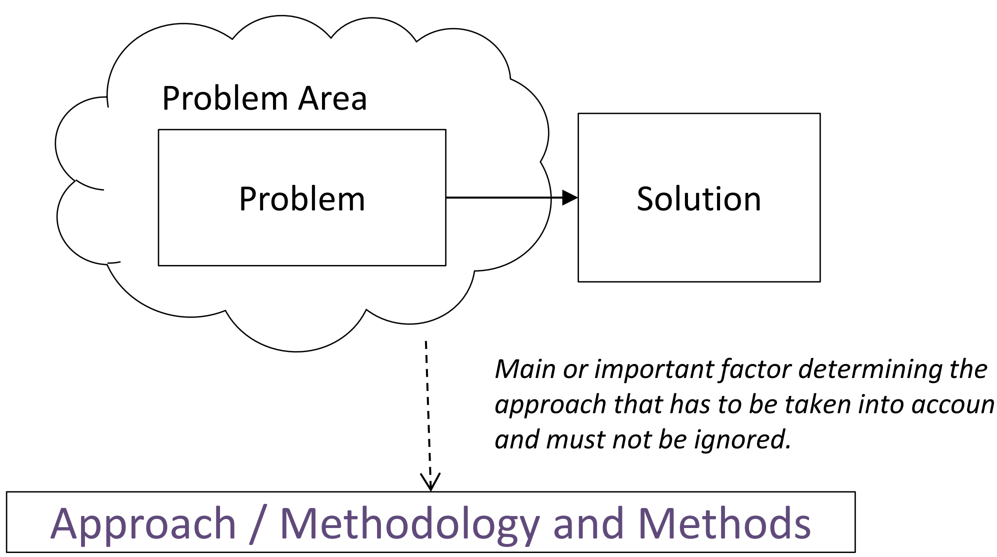
Engineer, user and customer are roles. They may indicate a group of people or a person.

A person can have different roles.

This model is not a collaboration model. It doesn't represent the collaboration. This model doesn't exclude or prevent it. Collaboration is critical and advised.

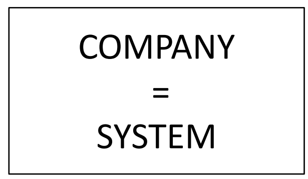
Engineering Approach and Skills

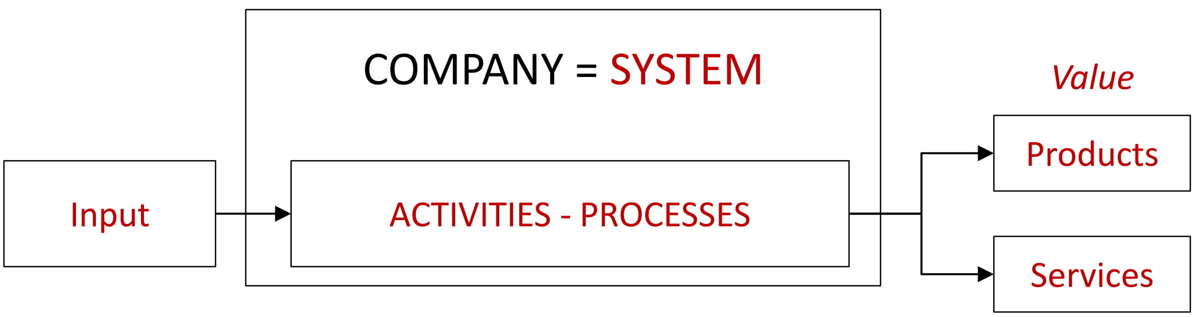




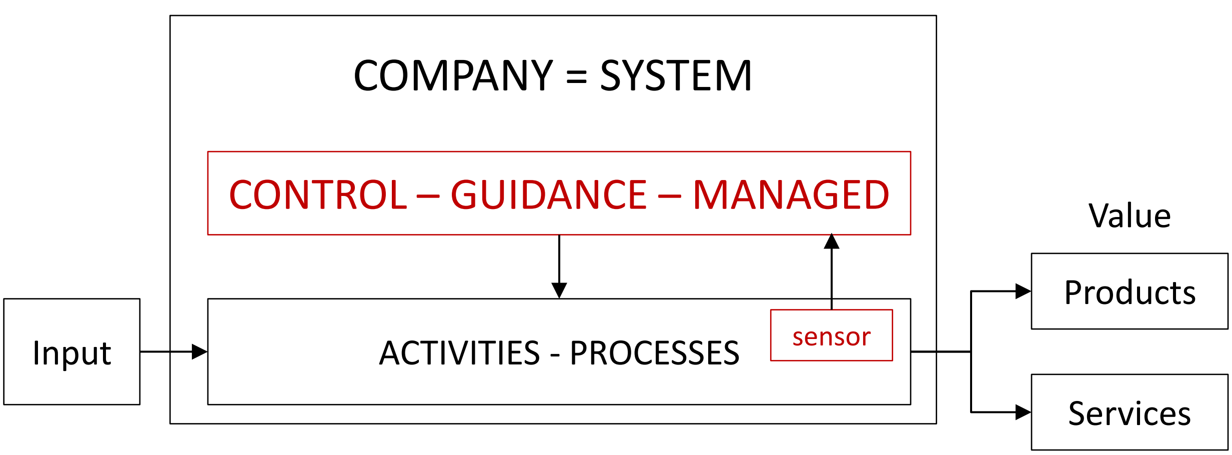
Company

A COMPANY is a SYSTEM

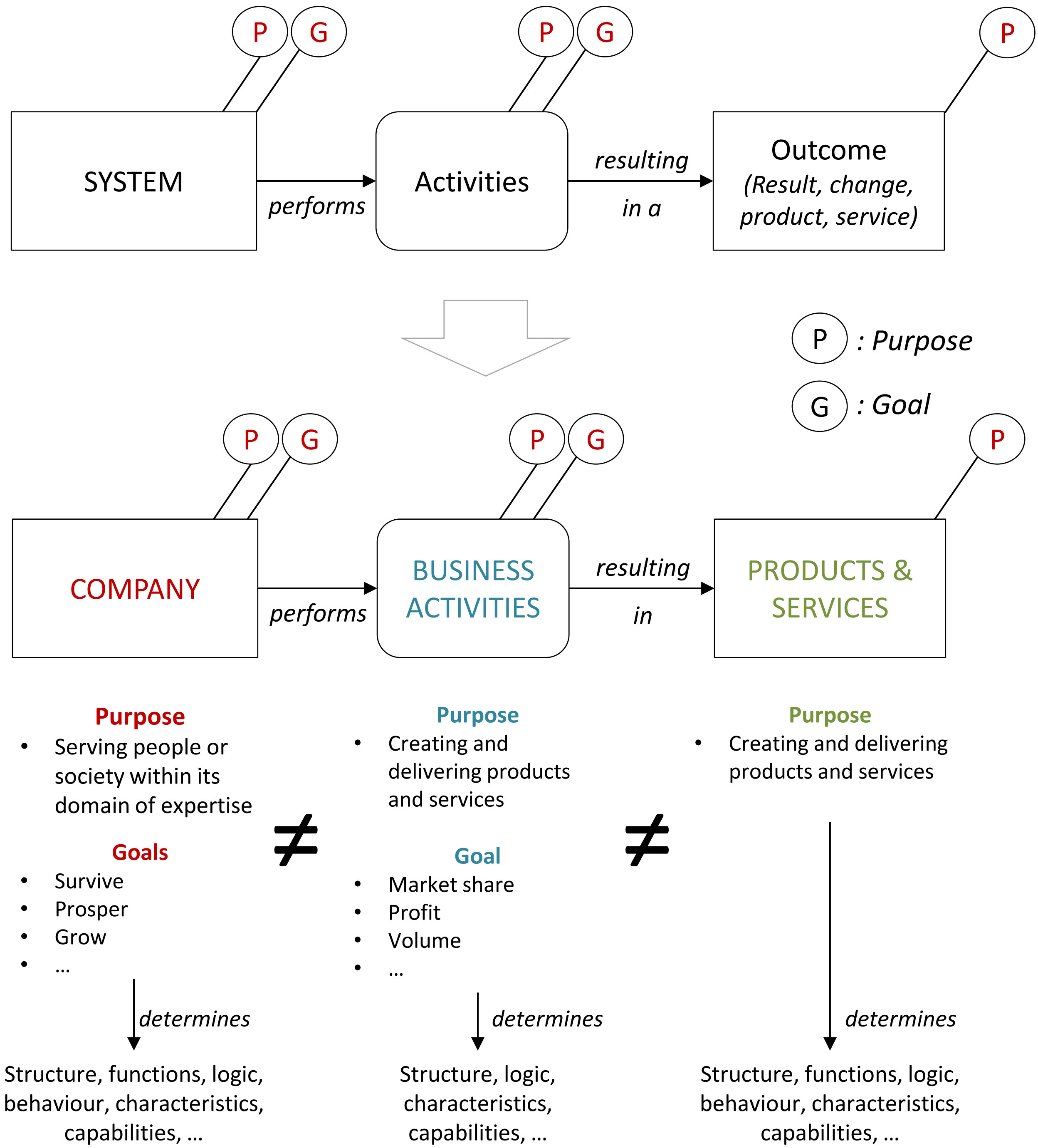




A GUIDED, CONTROLLED & MANAGED SYSTEM



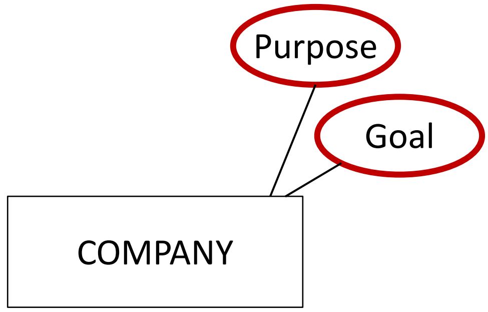
Company



Notes

The purpose, as intended function critical to play a role, is the main element (but not the only one) driving the design. The purpose is (or should be) reflected in the design. It is embedded in it.

Company : Purpose & Goal



PURPOSE: Creating and offering products and/or services

Usual Company's HIGH-LEVEL GOALS :

Long Term

- Survive - Staying alive
- Not be worse than …
- Do Well
- Remain ahead of the competition
- Grow
- Realise its Purpose
- Materialise a Vision
- Executing a Strategy
- Be a Market Leader
- Become "something"
- Bring Innovation
- Thrive - Be Prosperous
- … ?

- The purpose here is only expressed as a general statement. The real purpose is specific to each company.
- The HL-goals are expressed as possible, but general statement. A company should articulate them in (a) specific statement(s).
- A company can have more than one HL-goal.
- Implicit goals are often assumed and therefore not expressed. They are hidden and have to be brought to the surface.
- Long term goals have to be taken into account permanently, daily, even in small or short term decisions. Short term goals should be aligned with and contribute to long-term goals as much as possible.

Company's Goal vs Business Goal

Goal ≠ Goal

COMPANY

Business Activity
(System Usage)

"SELF-PRESERVATION" **>** Activities are executed with an intend, to get a result, to reach a goal

SURVIVAL **PROSPERITY** Growth of the company Continuing existence Strengthening Efficiency & Effectiveness Increase of capabilities Increase of capacity Responsiveness Adaptability …	Successfully executed activity Results as outcome of the activity Examples: • Facilitating the work of end-users • Increase business volume • Reaching a sales target • Dominating a market • Making an amount of profit
Internals & Long term Mostly invisible to users	Externals & Short(er) term Visible to users

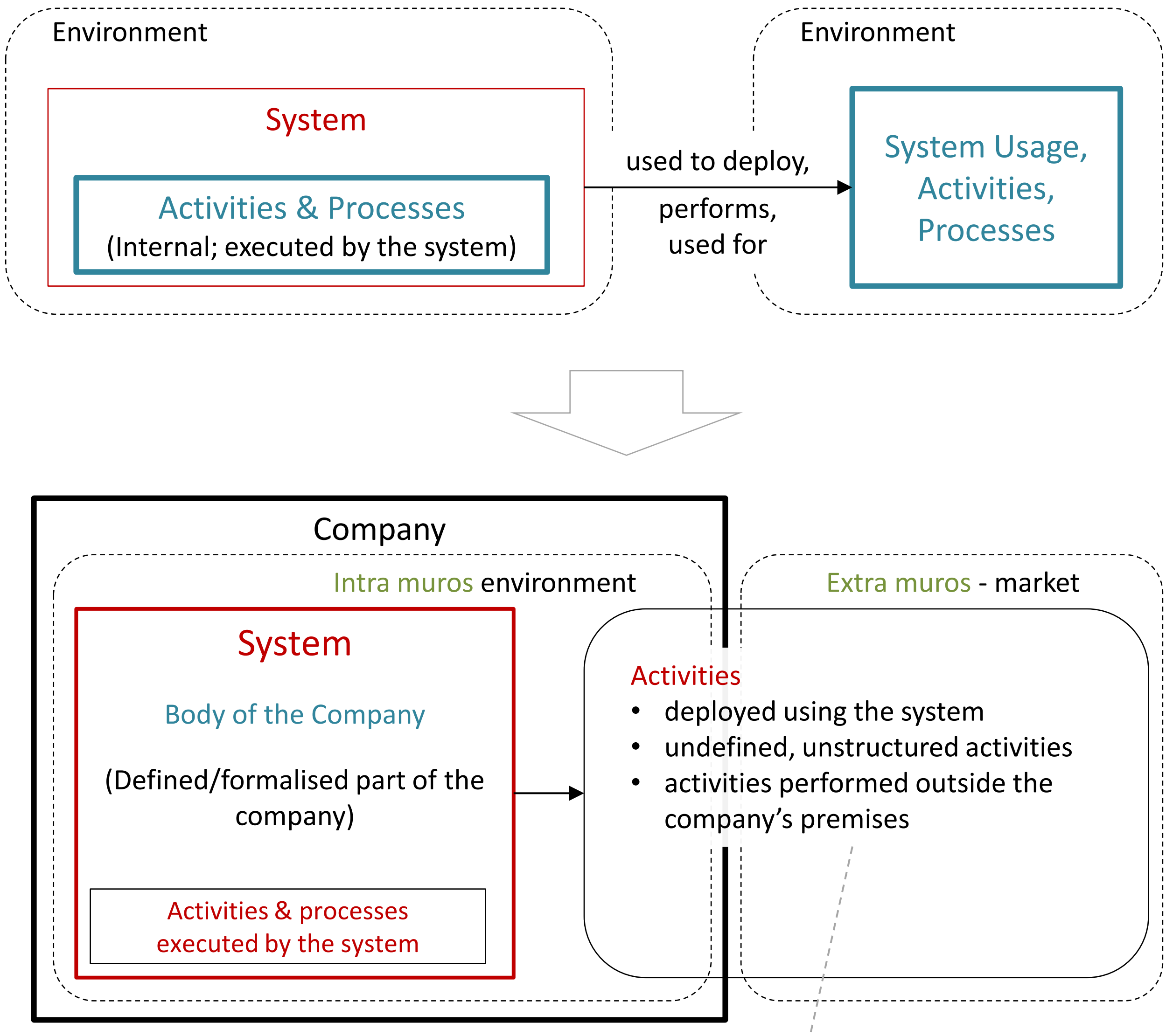
Systems, companies and societies have failed over longer period of time due to their inability to think on much larger time scales.

Even if activities and results are good,

- an abuse of the system
- and a weak system

endanger the sustainability.

Company : Activities

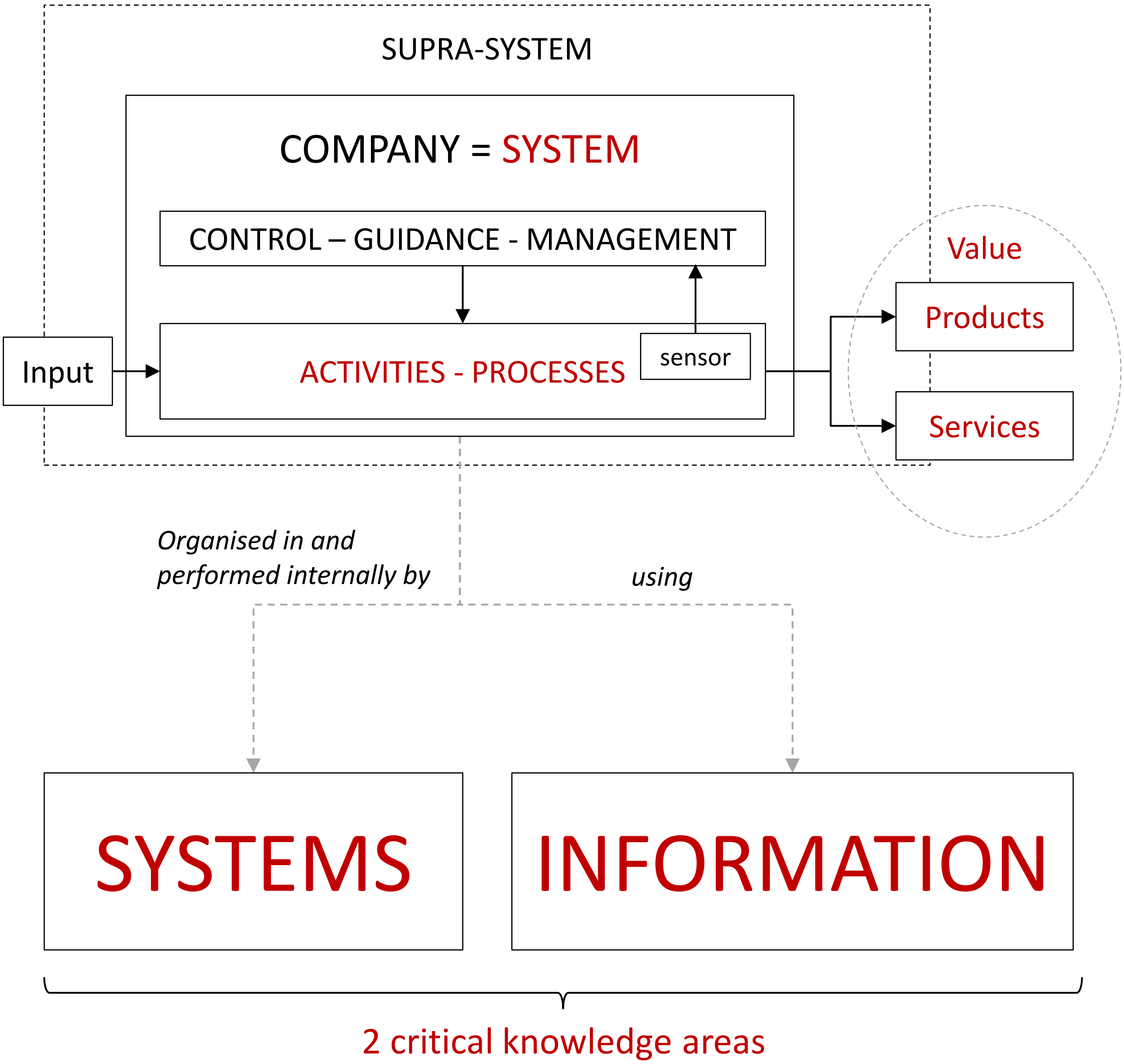


<u>A Few Examples</u>

- Meeting prospects, customers and (potential) business partners
- Spreading advertisement in the market
- Many Public Relations activities
- Many negotiations
- Many management activities
- Management decisions

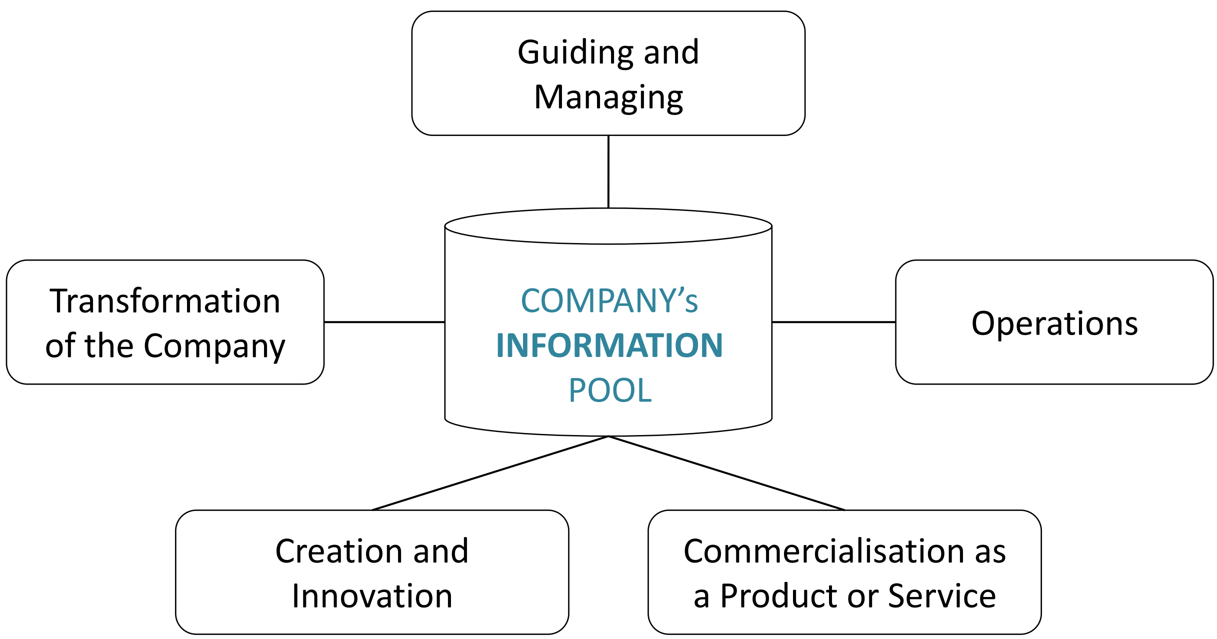
Strictly spoken, some formal systems and processes may reach way beyond the company's premises, for instance, such as supply chains. For the sake of simplicity, it's not showed in the model. The core idea of intra-muros and extra-muros activities represented by the model remains valid.

Company: Two Major Perspectives



Information – A Resource

A COMPANY CAN'T EXIST WITHOUT **INFORMATION**



Information is a CRITICAL RESOURCE

Information allows a company

- to execute its activities (operations)
- to be guided and managed
- To create and to innovate
- to sell it as a product or as services
- to transform itself

Information: A Critical Resource

CONSIDER

- A company needs to capture, identify, connect, organise, control, store, process, manage, share, disseminate information (and much more)
- Information pervades the company and has multiple usages
- Information provides plenty of opportunities. It's key to progress.
- Information has **Value**. The value decreases and/or increases. It can be preserved and increased, but it can also be destroyed.
- Information can be captured or created → **AMOUNT INCREASES**
- We tend to create, add and duplicate, but omit to maintain, to verify and to clean up.
- Tendency to **ENTROPY** (natural tendency to evolve towards chaos).

The SURVIVAL and PROSPERITY OF THE COMPANY depends on INFORMATION

Information must be **EXPLOITED**

Information must be **MANAGED**

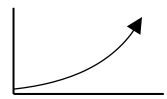
in an OPTIMAL WAY

Therefore, the company needs and must be adapted and equipped to deal with information.

To take up this challenge, the Most Skilled People are required

Information in Companies : RISKS

How is the company's information evolving?

Quantity  (probably)

Quality Known ? Fluctuating

Value Known ? Fluctuating

Organisation .....?

Manageability .....?

Exploitability .....?

Tendency to Entropy

Today:

Information Explosion

+

Communication Explosion

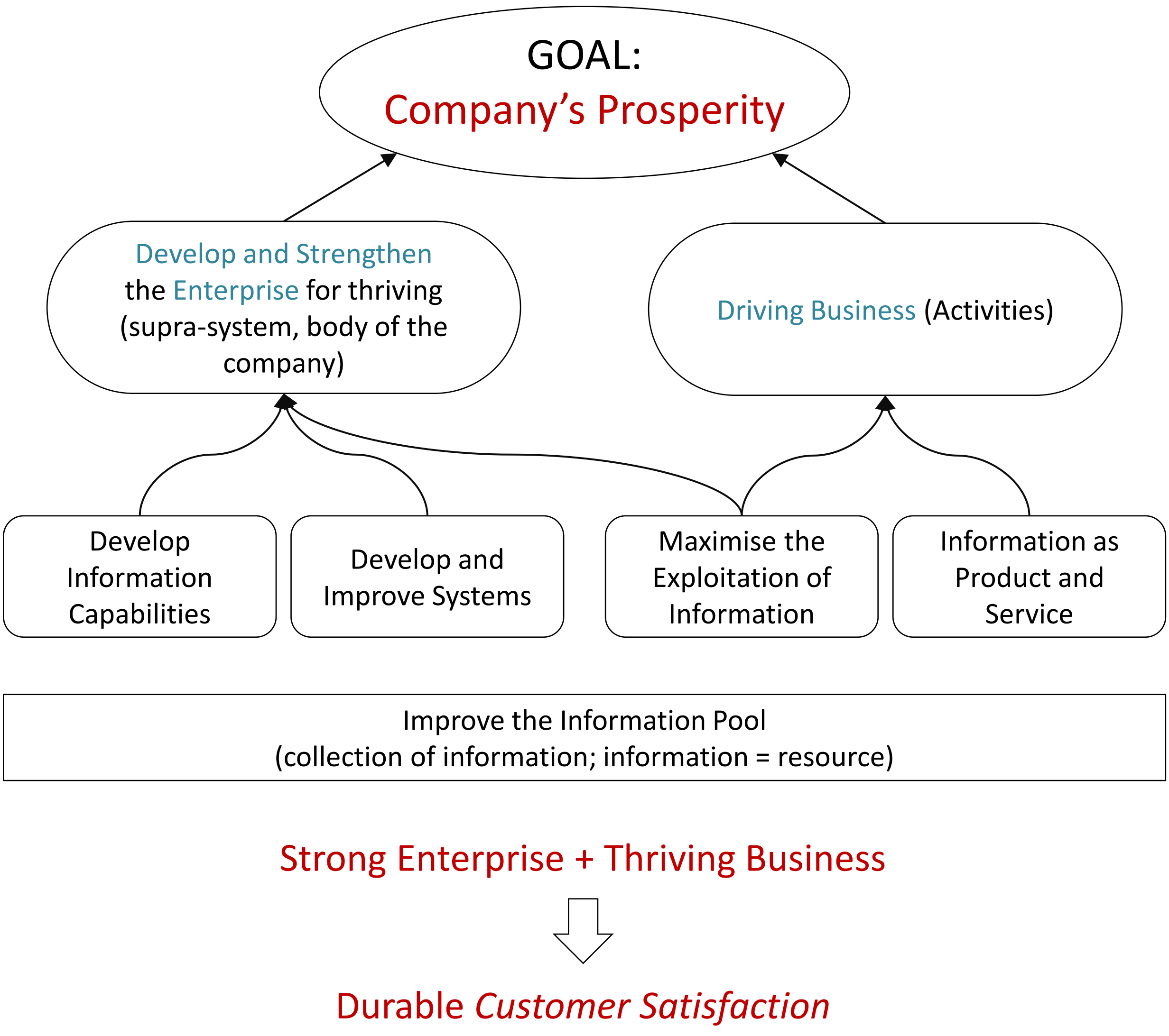
CHALLENGE : PREPARE FOR THE FUTURE

REFLECTIONS

Endless growth of information? Good or bad? To be managed? To be controlled? How to deal with it? How to adapt systems to it?

Financial means are managed in a formal and strict way. Why should this not be necessary for information?

Global Objective Related to Information



*Customer satisfaction **about systems** is an indirect goal, a desired consequence.*
(more about it later)

<u>Notes:</u>

How feasible is it to deploy profitable business activities with a weak enterprise? And over time?

How feasible is it to improve profitable business activities with a strong and well-designed enterprise?

Is a strong, well-designed, fit-for-purpose system or product more able to create customer satisfaction than badly designed and weak systems and products?

Customer satisfaction is discussed more in details in TARB.

Information in Companies

A COMPANY SHOULD

- Increase the amount of useful/valuable information
- Preserve and maximise the quality and value of information
- Maximise the exploitability of information

The COMPANY NEEDS an OVERALL IMPLEMENTATION allowing the company to perform these operations (see previous page) on information consisting of :

- Capabilities
- Processes
- Mechanisms
- Systems
- Structures
- Rules and Principles
- Information channels (flows)
- Concepts
- Competencies
- …

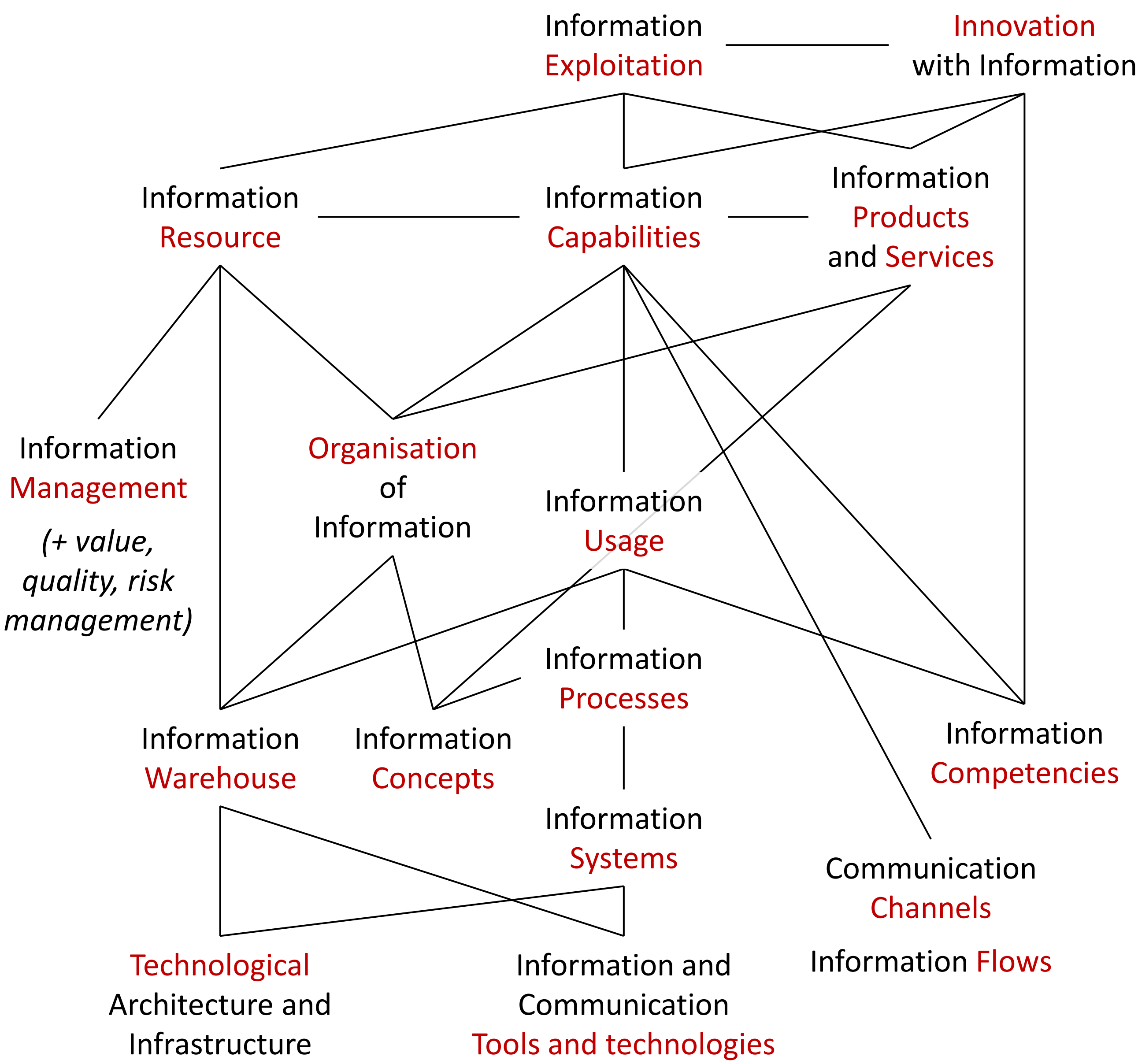
Information Component
(*defined later*)

HOW TO DEAL WITH INFORMATION?

HOW TO CONCEIVE SYSTEMS AND INFORMATION SOLUTIONS?

Company's Needs

What does an organisation need
to get the most out of information ?



Explanation of the graph on next page.

All these aspects form a single whole in which everything is related. The grey lines represent only the most important relations.

Company’s Needs

A company (organisation) needs to be able to exploit information and to innovate with information.

Therefore, it needs the resource ‘information’, the capabilities to deal with information and to deliver information as a product or service.

As much ‘information’ as possible has to be organised, managed and stored in a warehouse (the organised ensemble of all the means capable of storing information; not to be confused with a ‘*data warehouse*’ – BI concept).

The information capabilities require organised information. These capabilities are defined by the potential of “information usage”, which can be a real usage, a possible usage or an expected or intended one. This usage can be manual or it can be through defined information processes.

A correct use of information necessitates two competencies: subject matter knowledge and information competencies.

The execution of processes can be supported by systems or they can be executed, fully or partially, by them. Communication channels and information flows transfer information among different entities and systems.

Innovation with information is done through the information capabilities, more precisely, how the information is organised and used. And innovation can be realised through the offered products and services. Information innovation requires strong information competencies. Innovation in information is primarily achieved by filling in a need or by new concepts and new algorithms. Information innovation, information concepts and information competencies are actually strongly related to each other.

The concrete *Information Component* contains, among others, a technological architecture and infrastructure and information and communication tools and technologies.

IT Component

	COMPANY		
EXECUTING ENTITY	**INDUSTRIAL COMPONENT**	**HUMAN ORGANISATION**	**IT COMPONENT**
Way of execution	Automated	Manual	Automated
Processing	Material, Energy	Material & Information	Information
Nature of processes / processing	Pre-defined processes	Interpretation, variable logic, ad hoc decisions, explicit and implicit knowledge	Pre-defined processes

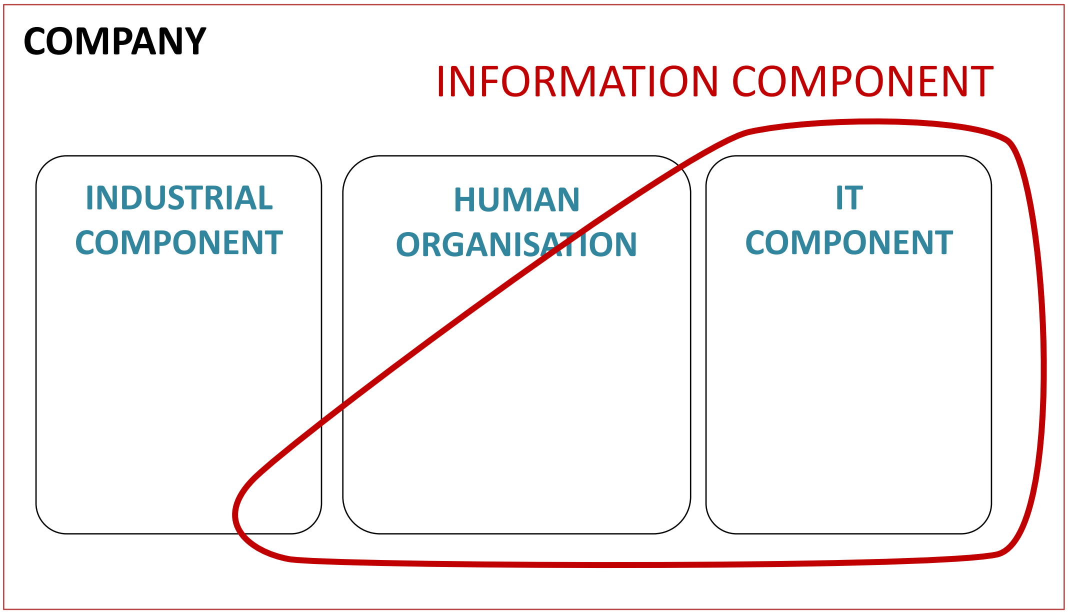
The IT Component is
the ensemble of software systems and all computers and other hardware processing, storing or transmitting information.

Note:

Robots and people can handle information and matter.

This model represents a general view. It is an abstraction of reality, a rough classification based on some characteristics. In reality, these components are intertwined. There is an exchange between them. These components collaborate. They are aligned and to fit with each other. They share the same environment. They are not strictly separated.

Information Component



The Information Component is
the whole organised environment and means
allowing the capture, the storage, the management and the exploitation of Information

The *information component* resolves the company's information needs. The information needs determine the information component. But this is the minimal viable objective for the short term. Continuously and actively seeking to maximise the exploitation of information, to innovate, keeping the internals of the information component right and a seamless integration are necessary for the long term survival and for prosperity.

Note:
-

Information Component

Key Areas of the IC

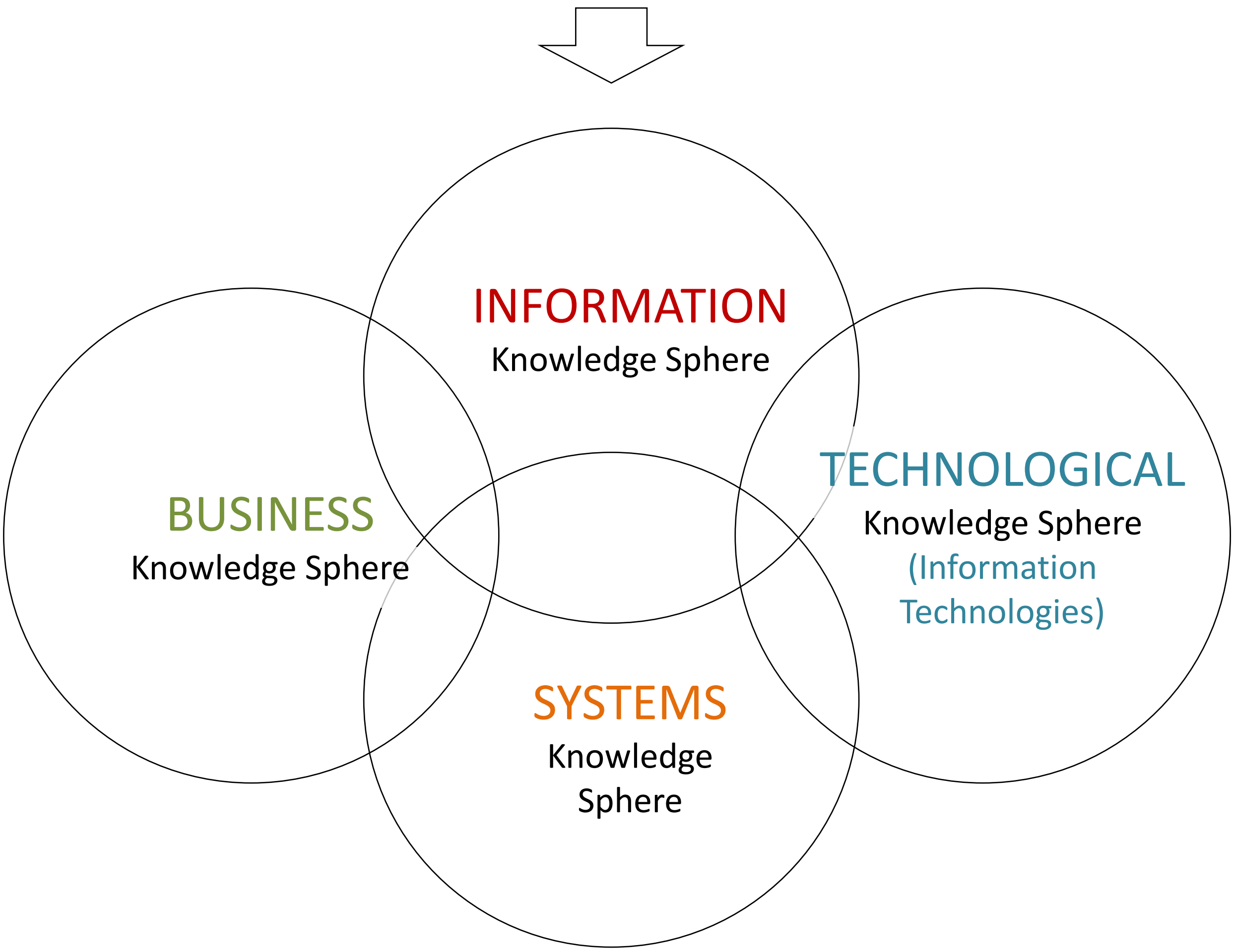
- Information Products
- Information Services
- Information Exploitation
- Information Capabilities
- Information Value
- Information Resource
- Information Usage
- Information Systems
- Information Processes
- Information Concepts
- Organisation of Information
- Information Warehouse
- Information Management
- Information Risk Management
- Innovation with Information
- Information Competencies
- Technological Architecture and Infrastructure for Information and Communication
- Information and Communication Tools

Notes:

The list is not exhaustive. It can be extended.

Key Areas Implemented in the Information Component

INFORMATION COMPONENT



These knowledge sphere can be neither ignored nor underestimated

Notes:

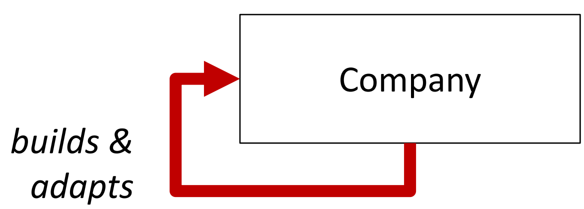
Expertise in Organisational Behaviour and Development is another very useful knowledge sphere, particularly if organisational changes are part of the solution.

Evolving Company

A Company

- is created
- grows
- adapts
- shrinks
- moves

Who transforms the company?



The company is a system that adapts itself

but not anyhow!

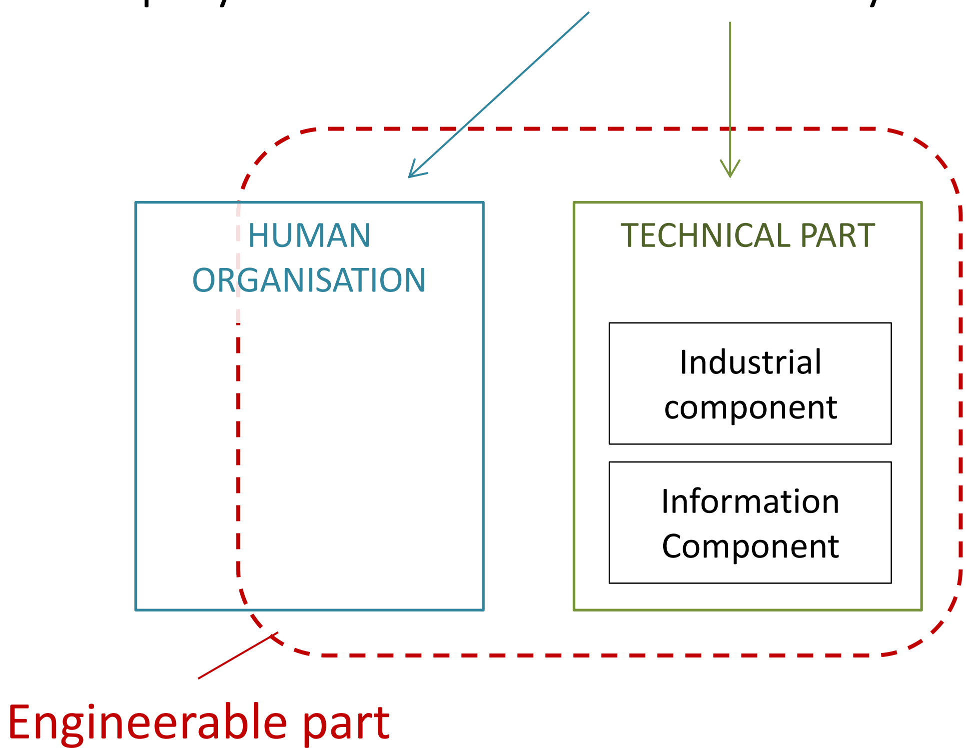
Notes

This doesn't mean that any component or element can adapt itself or that adaptation may occur freely or in any way.

A company can also merge, expand, split up, decrease in size, …. But this is, at this point, implicitly included in the shown cases.

A Company Can Be Engineered

A company is a man-made socio-technical system



If it is man-made and it can be represented with models, then it can be engineered.

A huge part of the company can be engineered.

- Some parts or sub-systems can be fully engineered.
- Other parts can be engineered up to a certain point.
- A company is a living system. This doesn't imply that all its parts are living systems as well. Some of its parts are complex and will evolve, but are not complex adaptive systems or not living systems.
- Some qualities, aspects or behaviours may still be unexpected, either because of lack of knowledge and thinking, because users are more creative than builders or because they were (really) unpredictable (should be very rare).

Importance of a Well-Engineered Company

Half (*) of the results determined by

- Engineered systems and processes;
- Appropriate, performant, reliable equipment
- availability of resources; …

Other half(*) of the results

- Culture
- Leadership
- Collaboration
- Communication
- Values
- Norms
- Attitude
- Interpersonal relations
- Social skills
- Competencies
- Motivation
- Intellectual skills
- …

can inhibit each other

Notes:

(*) “half” is figuratively.

A good leadership, culture, collaboration, etc. (right column) doesn’t guarantee a excellent engineering and well-designed systems and processes (left column).

Psycho-social issues can completely prevent a good system to function properly.

An inappropriate organisation, system or process can block skilled and motivated people to deliver results.

A Company (Re-)Engineers Itself

A company has to adapt. It has to REINVENT itself.
It defines its own structure, systems and processes.

Harmony among components (sub-system)

↓

Strong collaboration among engineering disciplines (and among engineers)

↓

Engineering ≠ Usage

↓

COMPANY = SYSTEM

COMPONENT "ENGINEERING"	SYSTEM'S USERS
Engineering of the company Engineering of its products and services	Business community are the users using the system (the company) to deploy business activities

Engineering Roles & Disciplines

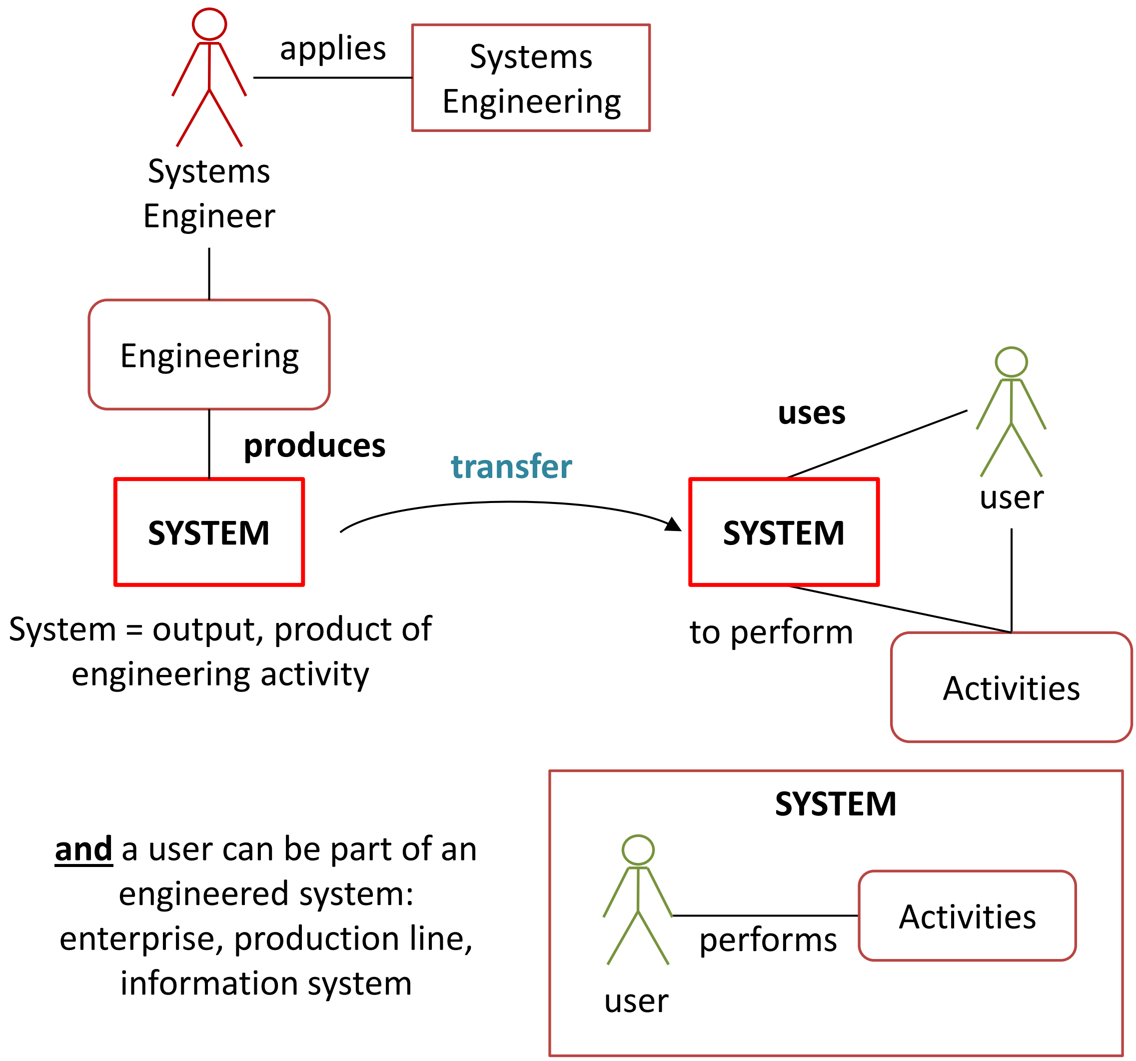
- R & D
- Product Development
- Organisation Development
- Industrial Engineers
- All architect, analysis, engineering, modelling, developers roles of Informatics

Note:

Collaboration with business community remains crucial as well.

Business people are part of the system (enterprise) and they use the system (enterprise).

From Conception to Usage of Systems



<u>Man-made</u> system is the outcome, the product, of an engineering activity.

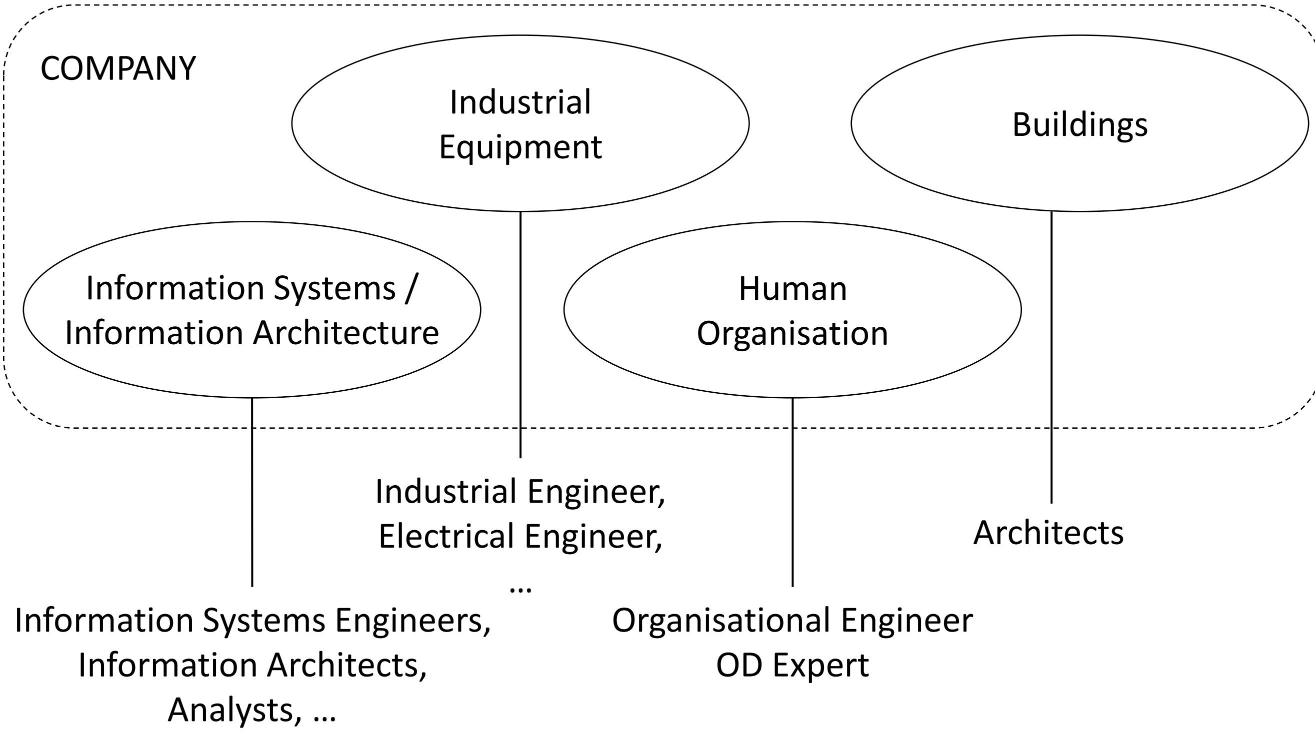
Once conceived and built, the system is transferred to the user.

using a system ≠ engineering a system

The user's perspective is a very shallow and limited perspective.

Using and engineering a system requires very different knowledge, competencies, goals, priorities and thinking.

Engineering the Company



Many more Engineering disciplines and Engineers

- Products → Product Engineer
- Services → Service Engineer
- Processes → Process Engineer

All systems form a coherent, integrated, aligned, efficient, effective, manageable, secure, evolvable whole.

Is a loose, sporadic, improvised collaboration among engineers sufficient to conceive this whole ?

A very close and intensive collaboration among all types of engineers is paramount.

There are still more sub-systems and many more engineering disciplines.

Engineering

Engineering is the application of science and technologies to design and build machines structures, systems and other things.

- Science
  - Knowledge + understanding + thinking + principles + methods + techniques + tools
  - Way of thinking (methodical, abstract, logical, …)
  - Attitude (curiosity, sceptical, doubting, truth seeker, sharing, seeking confirmation, …)
  - Specific intellectual skills
- Design and build

  Conception (decision making) + specific intellectual skills
- Structures, systems, …

  Understanding of structures, mechanisms, systems, processes, …

Notes

Can all building activities be called 'engineering' ?

Often, engineering is limited to imitating the visible actions of engineering and to produce a concrete outcome. This completely misses the essence of it.

Myth: Users can engineer the system they use.

Systems Analysis

is an

Engineering Discipline

Conceiving systems and solutions

to solve more **complex** problems

(solving problems we otherwise wouldn't be able to solve)

Informatics

is

the science of information applied in the real world.

Informatics is a science and engineering disciplines studying the usage, the organisation, the processing and the distribution of information in natural and artificial systems while pursuing the effective uses of it.

It studies information and knowledge in organisations as well as in society at large.

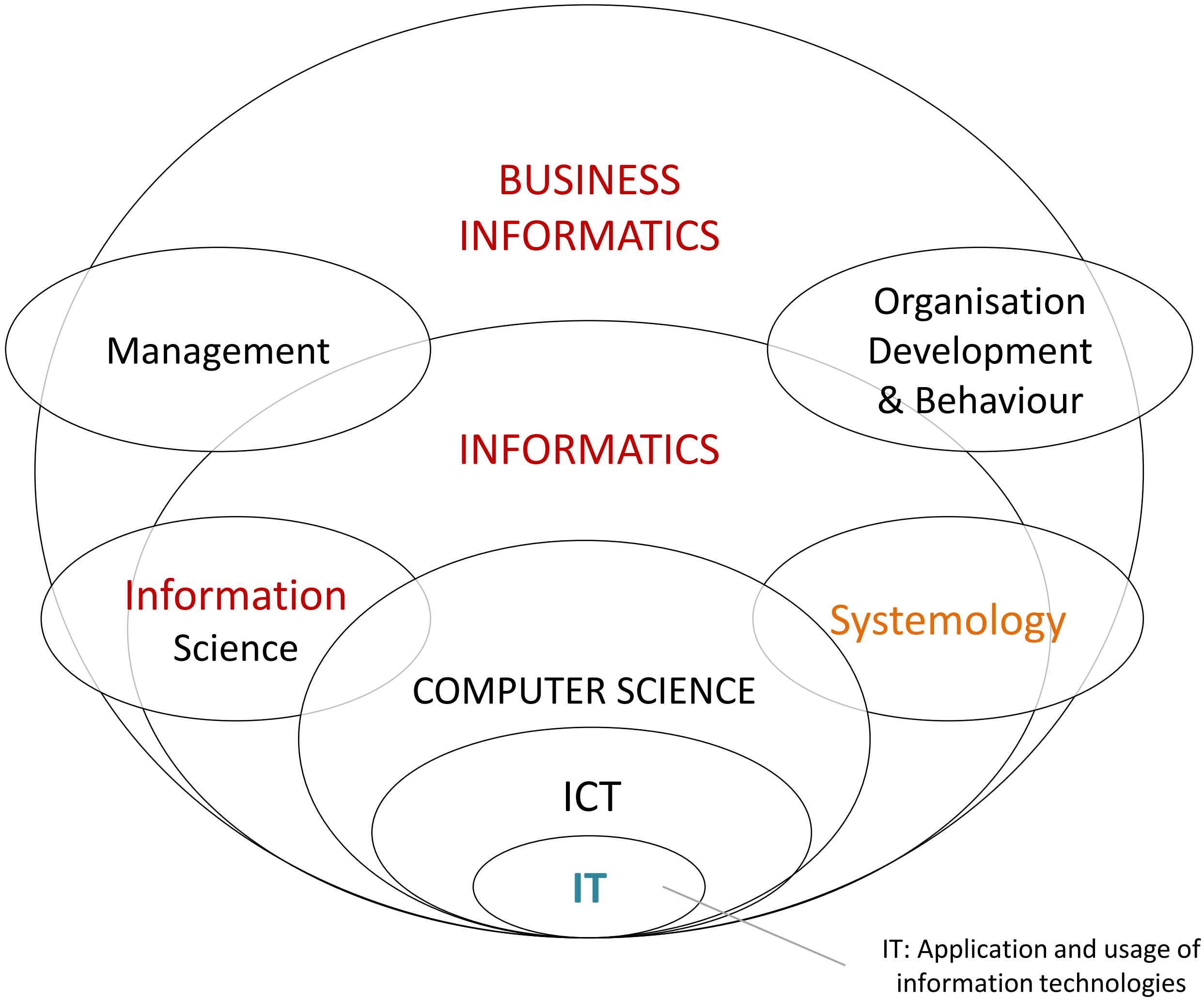
The objective of Informatics applied in organisations is to improve the organisation and its functioning and to contribute to the value creation for its clients with the common and implicit, but not obligatory, intention of automation (IT).

Advanced level: a scientific field that focuses on different informational phenomena, such as cognition, thought, language, communication, and computation. It is an interdisciplinary and integrative scientific field involving computer, communication, cognitive, and social sciences.

It is commonly practised in multidisciplinary initiatives.

Informatics

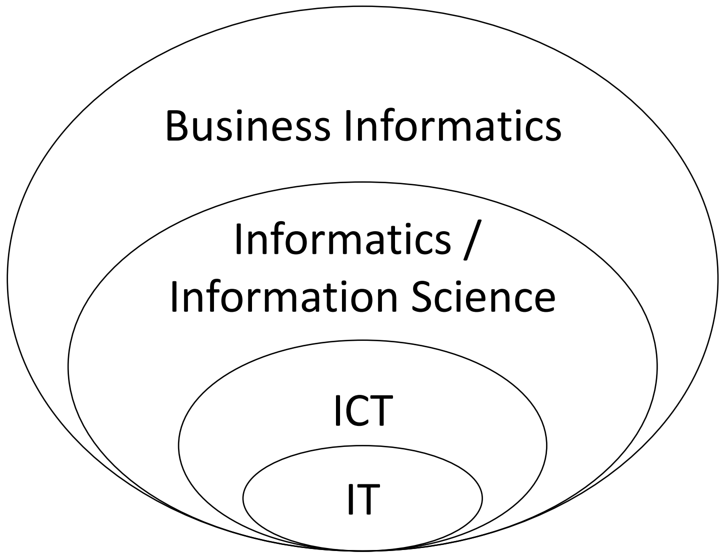
Informatics is an interdisciplinary science



Informatics contains 3 of the 4 Critical Knowledge Spheres, and more.

- Core Notion: organisation, transformation, communication, interactions and usage of information by organisms or machines in natural and engineered systems and their environment.
- Information Science, Information Engineering
- Information Systems Engineering, Information Processing
- Computer Science, ICT / IT
- Links with Mathematics, Statistics, Electronics, Biology, Linguistics, Psychology, …
- computational, cognitive and social aspects

IT vs Informatics



IT ≠ Informatics

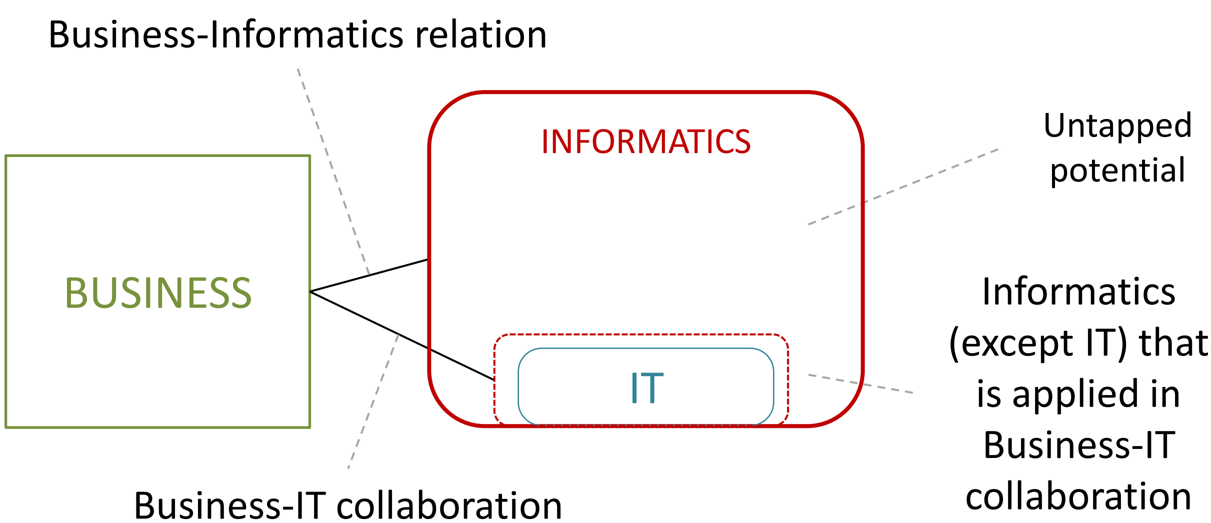
"Business – IT" Model ≠ "Business – Informatics" Model

IT Department ≠ Informatics Department

Untapped Potential in IT and Informatics

IT as
sub-discipline of
Informatics

The Informatics (the non-IT part)
defines
what IT implementations should do



Informatics offer possibilities to create value,
the Business community is not aware about.

That's where all the power is !!

That's what can make the difference !!

Product of the Informatics Dept.

INFORMATICS DEPARTMENT

PRODUCES

INFORMATION COMPONENT — *implements* — INFORMATION CAPABILITES

- Information Competencies
- Information Innovation
- Information Product and Services
- Information Systems — Software Systems
  - Software Applications
- Information Processes
- Information Flows
- Information Management
- Information Practices & Usage
- Information “Warehouse” (Ensemble of Information Storage)
- Information / Communication Tools
- Technological Architecture & Infrastructure

Informatics Dept. Needs :

- Capability of Engineering, Developing and Managing the Information Component
- Meta Information about Information Component

Notes:

Informatics Department is an alternative name indicating that the department plays a more important role and does way more than just “IT”. Another alternative name could be the “Information Department” (similar to the “Finance Department”)

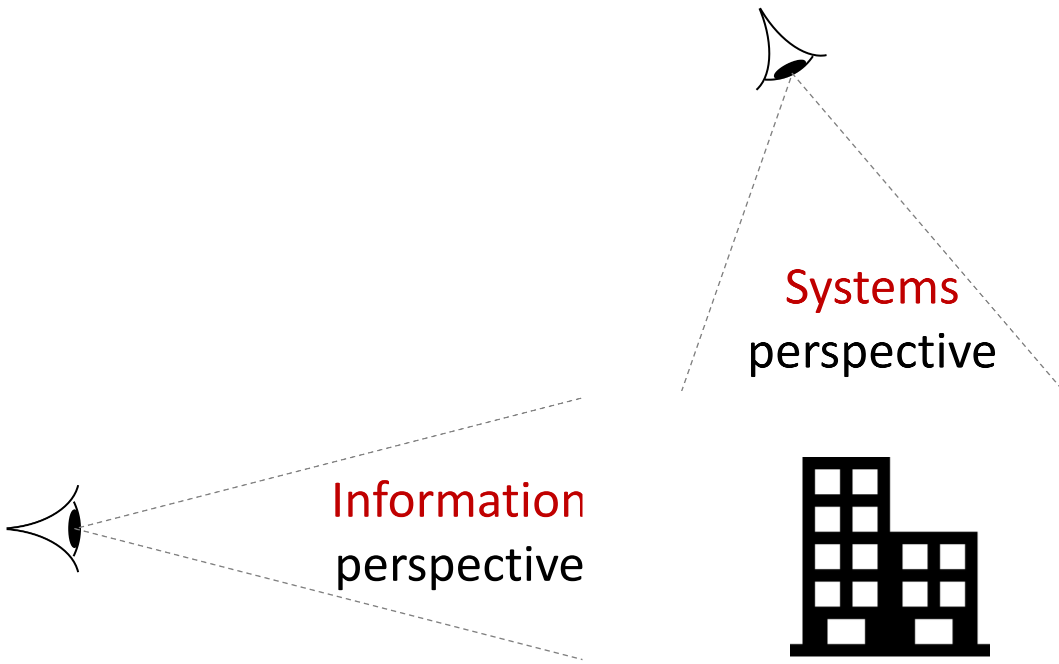
FOCUS of INFORMATICS Department

1. INFORMATION AS RESOURCE
2. INFORMATION QUALITY & VALUE
3. INFORMATION CAPABILITIES
4. INFORMATION EXPLOITATION
5. INFORMATION COMPETENCIES
6. INNOVATION THROUGH INFORMATION
7. INFORMATION AS PRODUCT OR SERVICE
8. INFORMATION NEEDS
9. INFORMATION PRACTICES & USAGE
10. INFORMATION RISKS
11. INFORMATION SYSTEMS
12. INFORMATION PROCESSES
13. INFORMATION FLOWS, SHARING AND REUSE
14. INFORMATION CONCEPTS
15. ORGANISATION OF INFORMATION
16. INFORMATION WAREHOUSE
17. INFORMATION MANAGEMENT
18. AUTOMATION / AUTOMATED SYSTEMS
19. INFORMATION AND COMMUNICATION TECHNOLOGIES, TOOLS AND INFRASTRUCTURE
20. TRAINING / INFORMATION SKILLS DEVELOPMENT

Two Important Perspectives

SYSTEMIC PERSPECTIVE

How can we conceive, strengthen, improve and expand the systems, structures and processes dealing with information of the enterprise?



INFORMATION EXPLOITATION

How can we maximise the capability of the company or enterprise to exploit information resource? How can we increase the value of the information and use it to the benefit of the company and its customers.

Informatics in Business Environments

Business

Business Thinking

How do we organise and conduct business? What products and what services can we provide to the market? What materials do we need? Who can supply us? How to distribute the products and services? At what price can they be sold ? …

Information is required to make this work. So, we have to ask the question of information.

Information

Information and Systems Thinking

How can information support or execute business activities ?
How does information has to flow?
How can we organise information?
How can information be exploited to improve business?
How can information drive and innovate business? What systems are needed ? …

Now raises the question of who will execute it. It should preferably be automated (software and computers) and how to translate this into software system.

IT – Application of Technologies

Implementation, Building & Technological Thinking

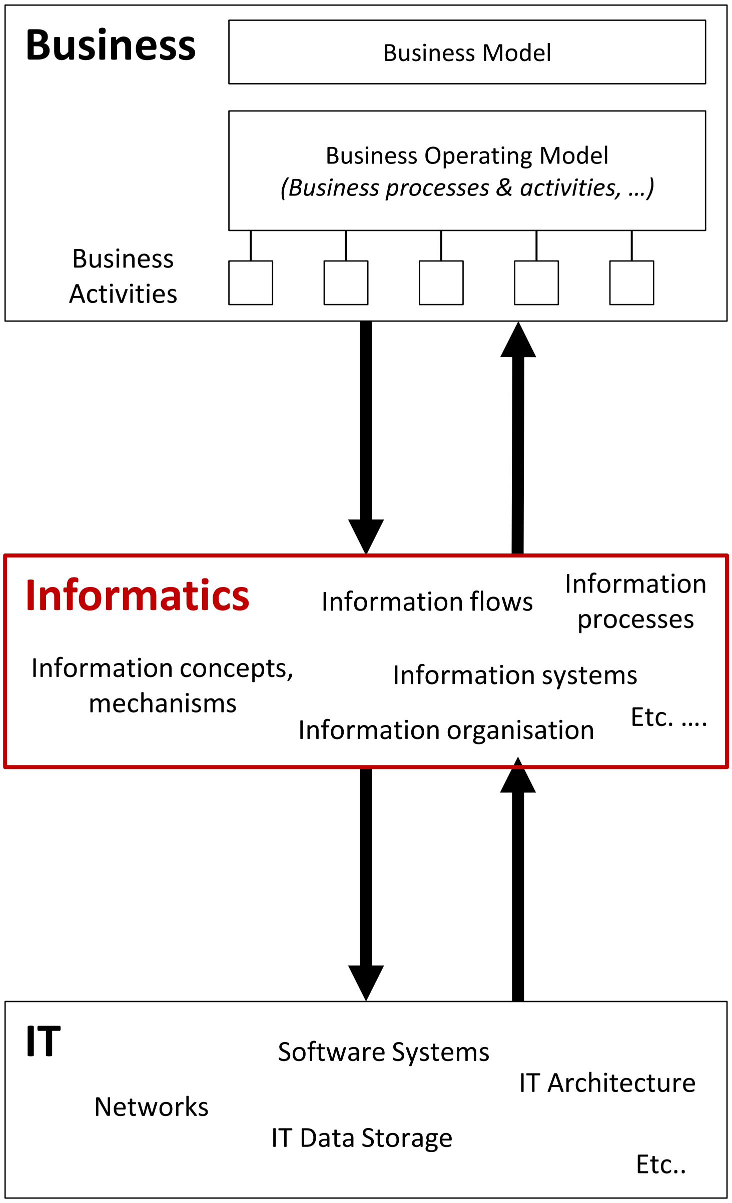
What technologies should be used ?
How to use technologies ?

Technological vocabulary and skills; solves technological issues

This is a "LAYERED PROBLEM"

(see chapter Problem Solving)

New Business – INFORMATICS Model



Business Thinking

Defining Products and Services;
Determining the business models, strategies, tactics, policies, rules and operations;
Solving business problem;
Executing and managing business activities

Information and Systems Thinking

Determining what information to collect, to capture or to create
Determining how to maximise the quality and value of information
Determining how to maximise the exploitation of information to benefit in business activities
Determining information solutions supporting the business activities
How to organise this information, how to keep it clean, store it, etc…
…

Implementation, Building & Technological Thinking

Determining how to structure the solution
Determining what technologies should/can be used and how they will relate to each other (technological architecture)
Determining how technologies will implement the information solution
…

<u>Notes:</u>

It is not that Informatics is absent. It is watered down and undervalued. It is practised by business people and IT people. IT people have some more knowledge in informatics, but it is not really their focus or objective.

The flaw is somewhat mitigated by Analysts and Architects.

IT is a sub-discipline of Informatics. We consider here the part of Informatics that is not IT.

Informatics in Business Environments

Necessary SKILLS

Business

Solving the "Business Question"

Business Subjects,
Business Knowledge,
Business Expertise,
Business Skills,
Business Techniques,
Business Vocabulary,
Management, …

Information

Solving the "Information Question" and "System Question"

Requiring Information Science,
Systemology, Systems Thinking,
Problem Solving,
Analytical Thinking,
Informatics vocabulary,
Informatics Techniques, …

IT – Application of Technologies

Solving the "Technological Question"

Technological skills,
Programming skills, Ability to build systems by using technologies,
…

Different Purposes or Goals

Different Intentions and Perspectives

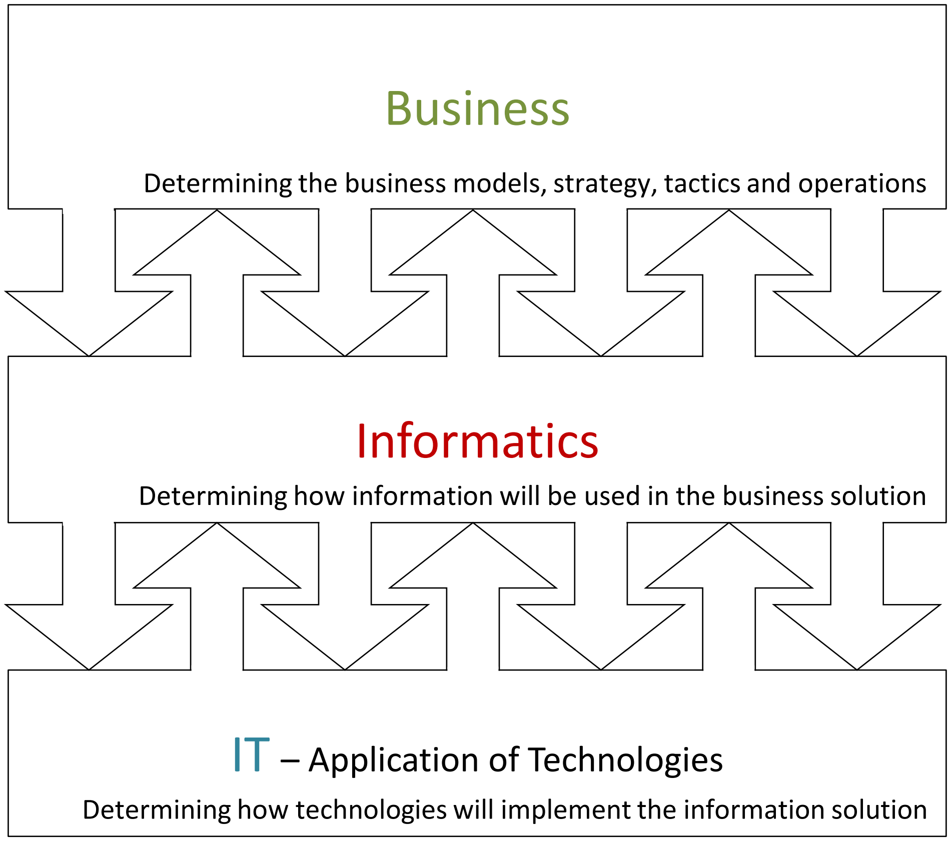
Different Problem to be solved

Different Matter to be processed

Different Way of Thinking

Different SKILLS

Informatics in Business Environments



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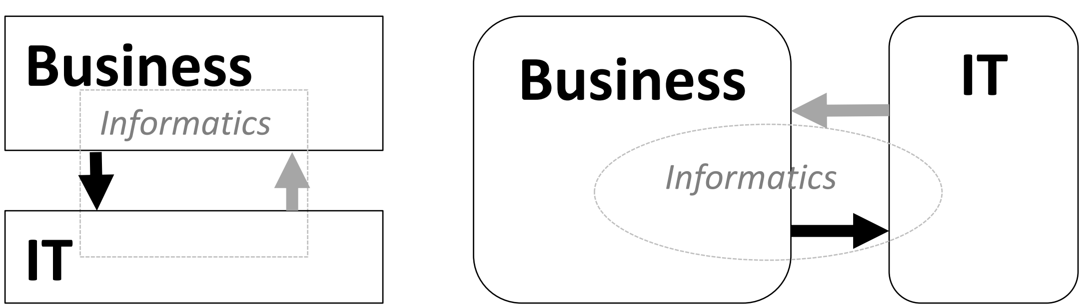
Traditional and present 2-layered Business – IT Model



Informatics, the non-IT part of the discipline, is often vague, shallow, and misapplied. And it is often performed by business people and by IT people.

Notes:

NOT BUSINESS TERMS: website, ERP, data warehouse, internet, web, software application, apps, software system, screen, windows, menus, button, entry field, database, tables, records, indexes, information model, information entity, attributes, relations, state transition diagram, data model, object model, Java, Python, HTML, etc..

A PERSPECTIVE ON CORPORATE IT's MAIN QUESTIONS

	INFORMATION NEEDS	EXPLOITATION	INNOVATION
	How to satisfy information needs and allow the organisation to function?	How to maximally exploit the information?	How to create value through innovation? How to innovate with information?
Information VALUE — How to preserve and maximally increase the value of the information pool? (at least avoid destruction of value)			
Information RISKS — What are the information risks and how to limit them?			
	Minimal Survival Short term Risk: Weakening	Strengthening Improving Long term Prosperity	Long term Prosperity Driving activities Creating activities

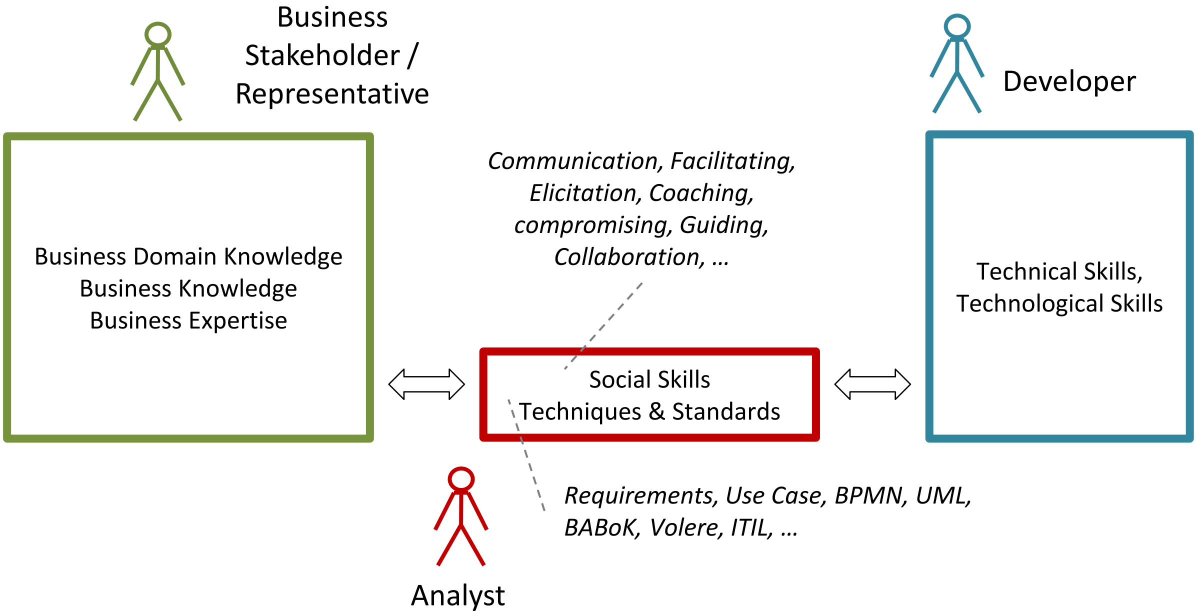
The ANALYST should keep these questions always in mind

Two other key-questions, regardless of needs or demands are:

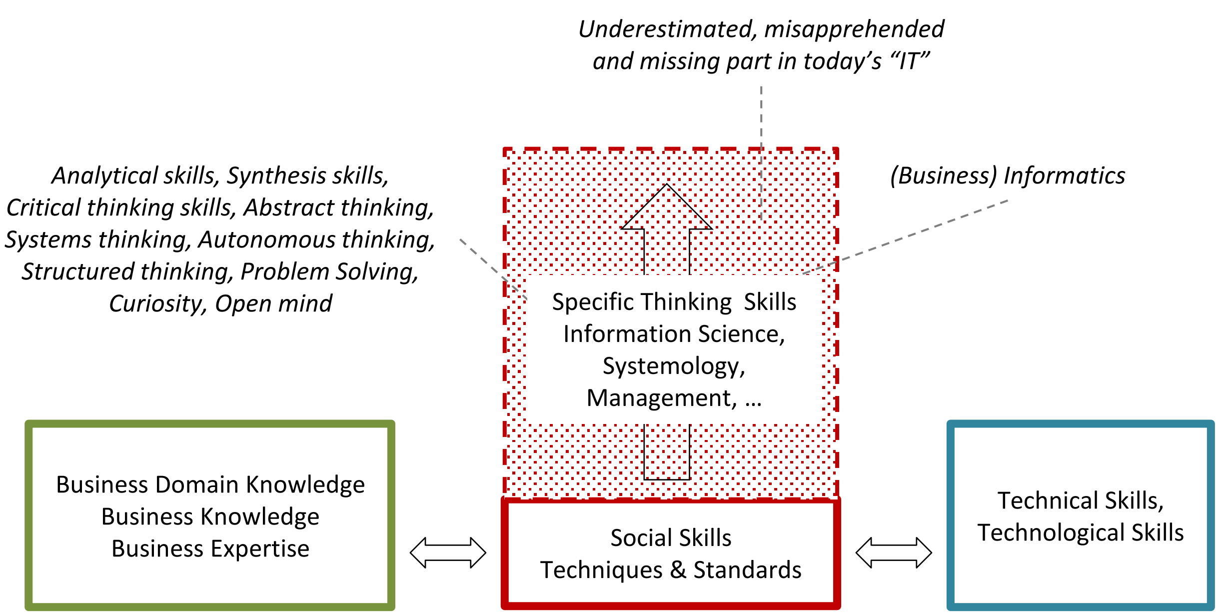
- How to preserve and maximise the value of information?
- What information risks are or will be faced and how to avoid or to limit them?

Strengthening the Role of the Analyst

Presently



Exploitation of the full potential of the discipline and increasing the added value requires the expansion and consolidation of the role of the Analyst.



The Analyst

~~Anyone who performs Analysis activities~~

Undermines and destroys the profession of Analyst

Anyone
who **MASTERS**
the Systems Analysis discipline,
or any of its variants or sub-sets,
and the capabilities to apply it

One does not become
professional Analyst
overnight.

"What got you here won't get you there“ (Marshall Goldsmith)

Notes:

- Every person can fight, but not everybody can fight like a black belt martial art practitioner.
- Assuming that performing analysis activities turns someone into an Analyst or that anyone can become Analyst in a short period of time is a immense underestimation of the discipline and of the true importance of the role.

Professionalisation

Perception of Systems Analysis

as **"Activities"** that anyone can do	as a **"Professional Discipline"** to be mastered by professionals
ACTIVITY	DISCIPLINE
ROLE	PROFESSION
KNOWING	UNDERSTANDING
(how-to-Knowledge)	(WHY-Knowledge)
FOLLOWING	DECIDING
APPLYING	ADAPTING
RESPONDING & EXECUTING	LEADING, DEFINING, GUIDING
DOING IT	THINKING INFORMATION

fundamentally different
in level, skills, role, beliefs, attitude, recruitment, managing, training, collaboration, …

Inferior Results
Higher Risks

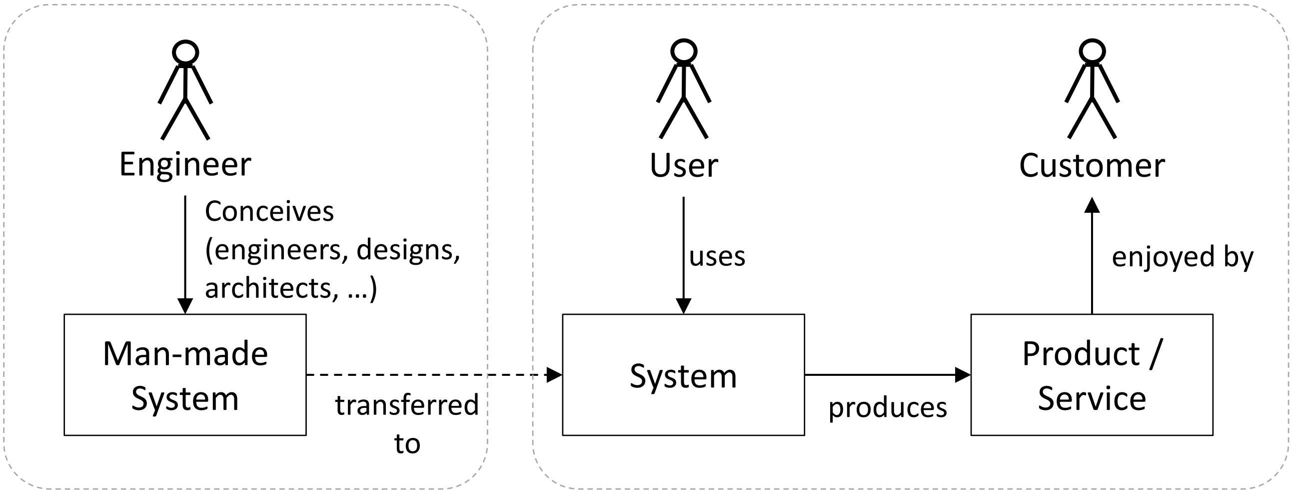
PATH TO
EXCELLENCE

from → *to*

Notes:

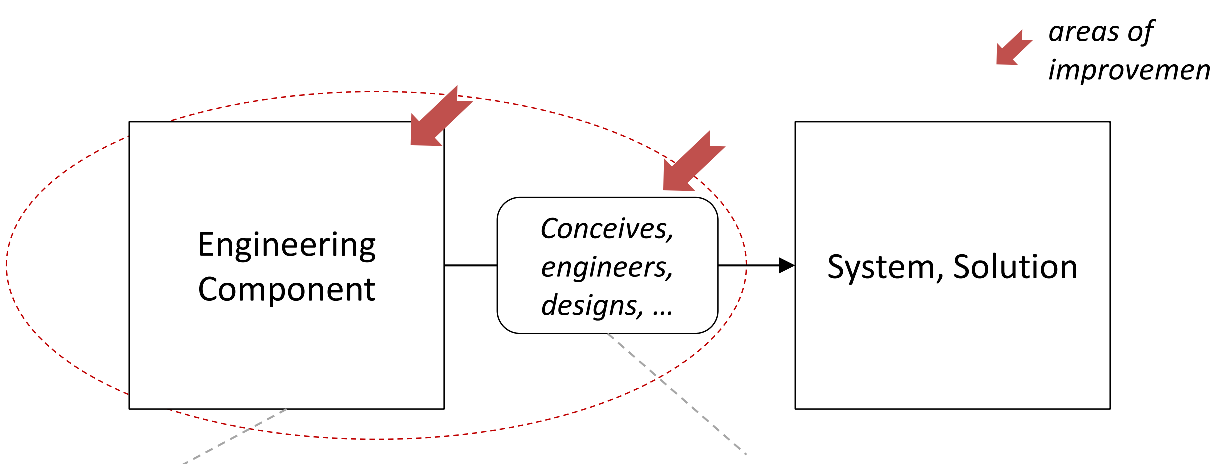
- Considering '*Analysis*' as a set of activities, assuming anyone can be an analyst, assigning the role to an employee, learning and applying techniques and following standards, responding to demands, seeking to satisfy others, being lead, copying, perpetuating (bad) habits, … → key to disasters
- Developing oneself to an expert, learning to master the discipline, thinking independently, determining and organising own work → professional

Improving the Engineering



Improving this enhances the ability to improve this.
(= PROFESSIONALISATION)

Improving the Engineering Component and its initiatives leads to better systems and solutions.



- Knowledge
- Skills
- Methodologies
- Frameworks
- Approaches
- Tools
- …

- Organisation (of activities, of initiatives (projects, ..))
- Framework, approach, process, methodology (applied)
- Work environment
- Plans
- Collaboration
- Interactions (information input, decision making, …)
- Resources
- …

Pursuing Higher Goals and Professionalisation

- Better tools
- Better collaboration and social interaction
- Better methods and techniques
- More **knowledge**
- Better **insight**
- Understanding ineffective **approaches** and **habits**
- Clarify and eliminate **assumptions**
- **Beliefs**

TARB

Our overall view, our perception, our belief system
and how we perceive our role,
determine
the results we can produce
and thus the value we can create.

It can limit it or it can increase it remarkably!

PROFESSIONALISATION

Professionalisation is not a luxury. It's a must.

First things learned by a junior

Mastery of disciplines:

- Vocabulary – Major terms
- Positioning of the tool, technique, methodology, concept, …
- Knowledge of the process(es), method(s), tool(s)
- Understanding the general idea behind the process(es), method(s), tool(s)
- Ability to use the tool or to apply the method/technique/process as prescribed
- Understanding the expected result
- Develop the own skills
- Understanding the meaning, purpose and value
- Understanding preconditions, applicability, key aspects, importances, priorities, options, alternatives, strengths and weaknesses, constraints, the limits, risks, the evolution, forces, influencing factors and tendencies
- Understanding the why and effects of every step or aspect
- Able to adapt the technique, method or usage of the tool to the context and circumstances. Understanding what can be done and what can't be done.
- Understanding variances; ability to tune
- Able to take a broader range of the aspects into account
- Understanding the underlying purposes, mechanisms, laws and principles
- Ability to see and understand the true nature of things
- Ability to put everything in broader perspective
- Limiting the unwanted effects
- Understanding effects, consequences and implications of decisions and choices
- Identification of opportunities to apply the technique or to use the tool
- Optimal exploitation of the approach, method, technique, tool
- Able to further develop the discipline
- Attitude: open-minded, ability to learn, curiosity, critical thinking, ability to identifying and understanding what is imperfect or problematic, seeking to do right, methodical, sharing knowledge, ready to go the extra mile, pursuing higher goals or harder challenges, using higher norms, autonomous thinking, truth-seeker, …

Goals and Drivers

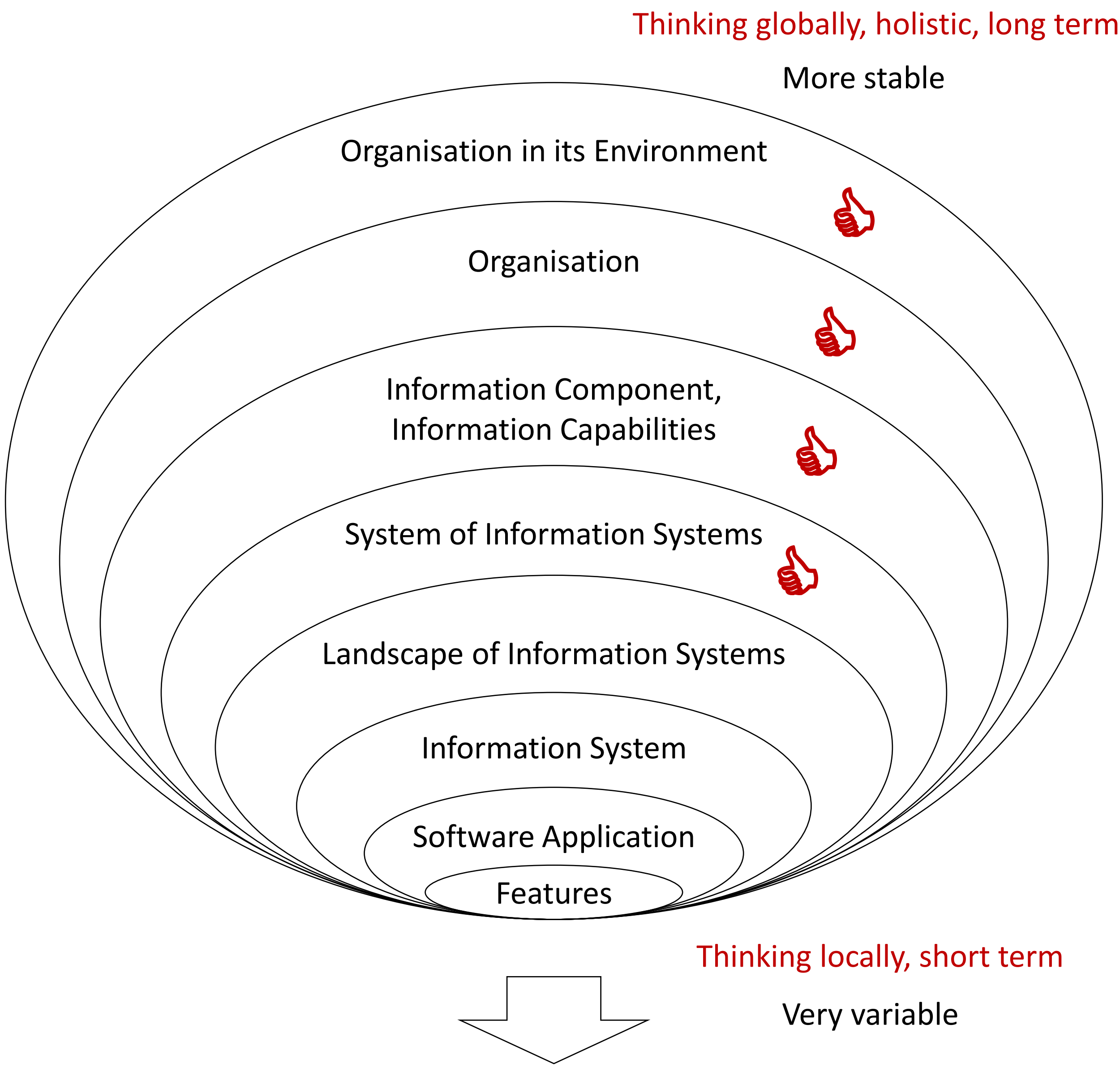
To find out if lower or more higher goals are pursued:

- What goals drive the thinking, decisions, actions and initiatives?
- What defines our priorities? What do we consider as 'valuable' ? …

Notes:

- Companies continue to computerise. More and more work is executed by software. Some systems are of strategic importance (example: supply chains). But the Analyst can't contribute at the strategic level if the mind still is driven by the idea of "developing demanded software features to satisfy the user".
- Being driven by the higher level goals requires a more holistic approach, different goals, different competencies, different relation with the business, different responsibilities, …
- Working at a higher level is harder, but much greater value can be created.
- Trying to satisfy a lower goal, being driven by the lower motives, does NOT automatically imply a positive contribution to the higher plans and goals. Even the opposite can be true (example: sub-optimisation; creation of obstacles, limitations and incoherence; tendency to fragmentation and chaos; …)

Levels of Thinking



*Each level has a different type of **goals**, **scopes**, **environments** and leads to different types of **products** and **results**. It requires different **approaches** and **methodologies**, different **responsibilities** and **authorities**, different **methods** and **techniques** and requires different **competencies !!!***

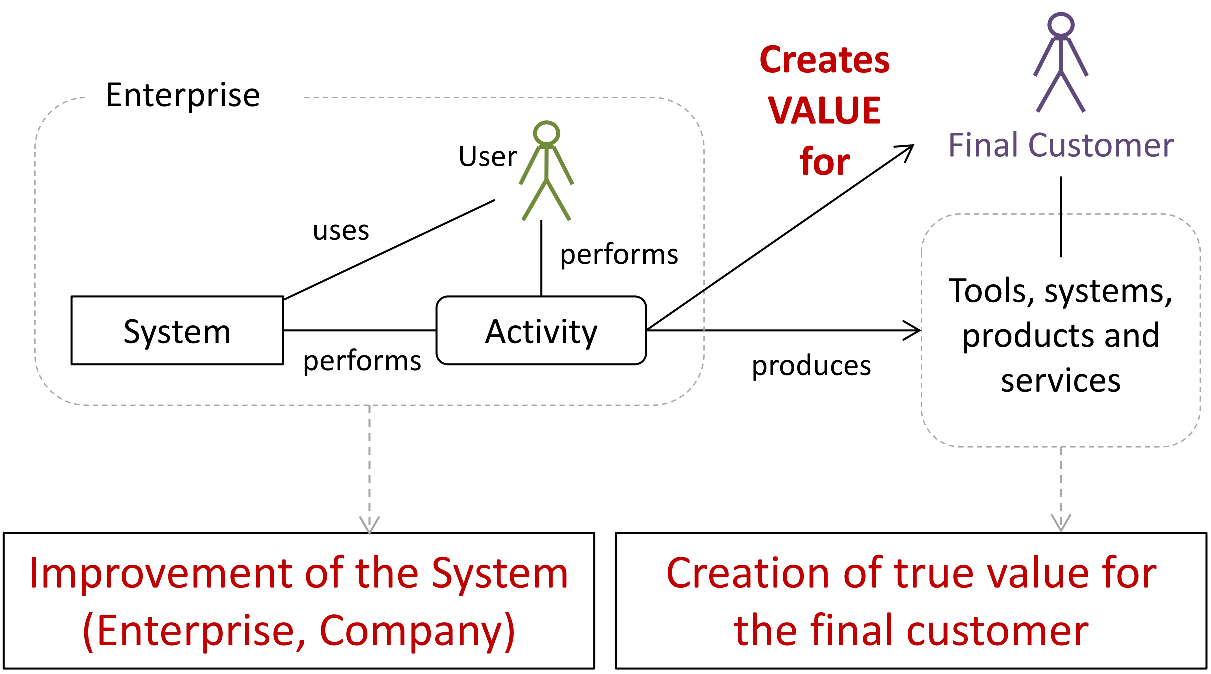
The thinking of the lower level is inappropriate to conceive solutions for the higher level.

Creating Value Through Engineering

How do we, as Analyst/Engineer/Architect, create value?

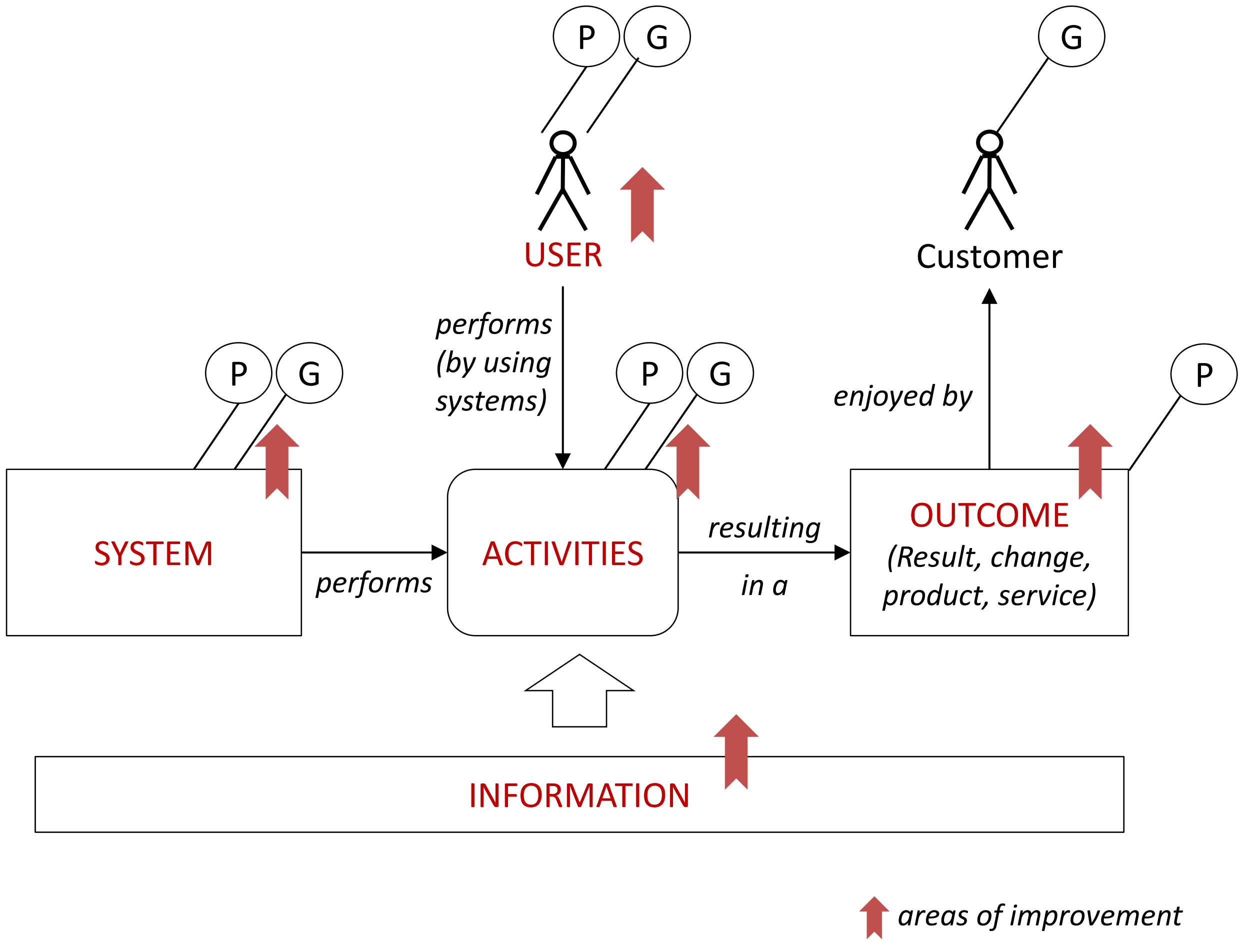
A system creates value by its functioning and by its usage. This value is for the final customer.

Example: A car creates value by functioning and by the usage the driver does with the car.



This can and has to be further detailed.

Creating Value Through Engineering



1. Improving and developing the SYSTEM
2. Improving and developing ACTIVITIES
3. Improving and developing PRODUCTS and SERVICES
4. Increasing the AMOUNT and VALUE of the INFORMATION
5. Improving and increasing the EXPLOITATION and USAGE of INFORMATION (User's knowledge, skills, behaviour & actions)

In line with PURPOSES, NEEDS and GOALS

Value Creation

Higher outcomes are the trigger, the goal and the motivation of the Analyst

Improve and renewing the supra-system (company)	Driving and renewing the Business (Final Customer)

How?

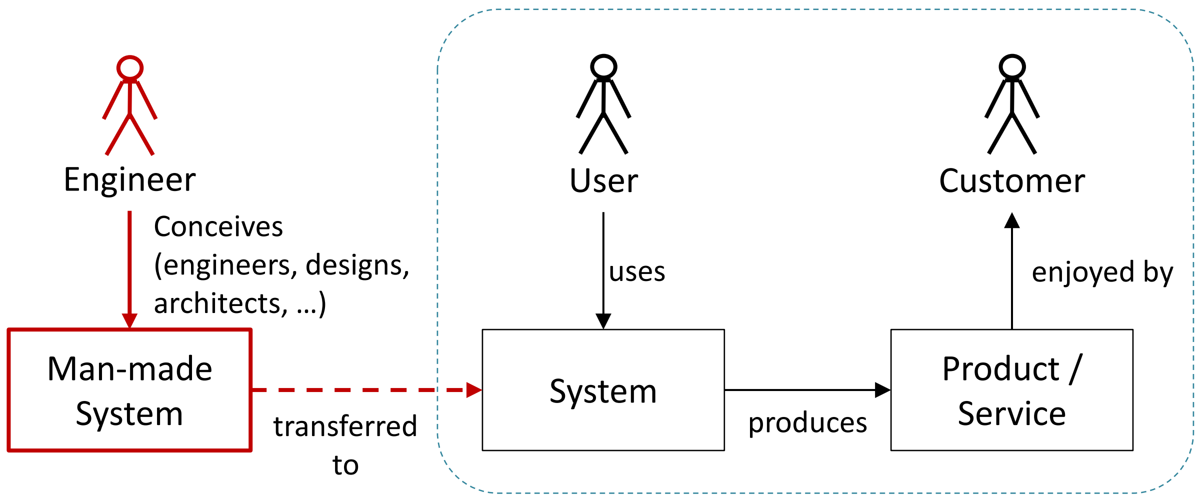
	System	Activities - Processes	Outcome, Products, Services
Reduce required material			
Reduce waste			
Reduce risks			
Creating opportunities			
Improve capabilities			
Improve characteristics			
Innovation			

Main constraints:

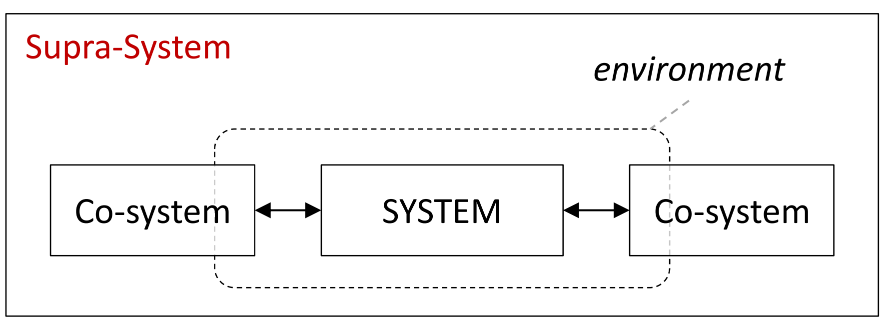
- Not degrading or endangering the supra-system (enterprise), its environment or the resources
- Aligned with strategy and plans

Creating Value Through Engineering

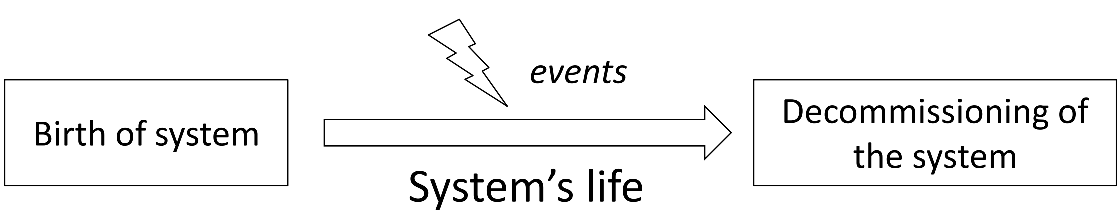
1) Functioning, Usability and Value Creation



2) Integration and interactions with other systems and environment



3) Capability to maintain its qualities during the whole system's lifespan (includes capability to evolve)



The ANALYST

is the

INFORMATION &

INFORMATION SYSTEMS

“DOCTOR”

The Company & Business Activities

are

the patients

even if they are impatient

Engineering Systems

Systems		Activity
Army	→	War
Body	→	Running a marathon
Car	→	Taxi activities
Company	→	Deploying business activities

Design based on purpose, system's life, environment and operational conditions → Then, adapted to the specific activities

Also true for company? For information systems?

Principles

- Simple and cheap tools or features can be designed for purpose and usage.
- Complex, expensive and lasting systems must be designed primarily based on their purpose, their future life and their environment (operational conditions).

Notes:

- What if we declare war, without building or strengthening the army first?
- What if we run a marathon, but ignore the capabilities of the body and its signals?
- What if we are able to run one marathon, but finishing exhausted. What if we have to run continuously marathons one after the other? (sustainability)
- Or, can we do a sprint, after sprint, after sprint (running)?
- What if a car can transport people only for a too short period of time or if it can't operate when it's raining, when it's freezing or when it's too hot?

Some Major Engineering Approaches

Analytical, Methodical, Logical, Structured, Critical → Systems Analysis, Systems Thinking, …

Creative, Explorative, Experience → Design Thinking, Brainstorming, Trial & Error, …

Plan-driven, holistic, top-down, long-term based, shaping the future, …

Opportunistic, local, ad hoc, problem or need driven, Bottom-up, Explorative

Continuous Analysis

Continuously study of objectives, plans, changes, systems leading to projects

Mission-driven

Initiative-driven

local, ad hoc, free or authorised (sudden idea, local need, problem or opportunity)

Notes

- Some approaches can be combined in one.
- A company may need to have or allow different types of approaches. It’s not about choosing one single approach for the whole company. Usually, one main approach can make sense.

Two Major Engineering Approaches

BALANCE

70% (+ or - 15%)

- Value-driven
- Plan-driven & plan-based
- Holistic
- Learning by analysing & thinking
- Top-down
- Collaborative
- Adaptive

Defining overall objectives, long term, main lines, overall architecture, …

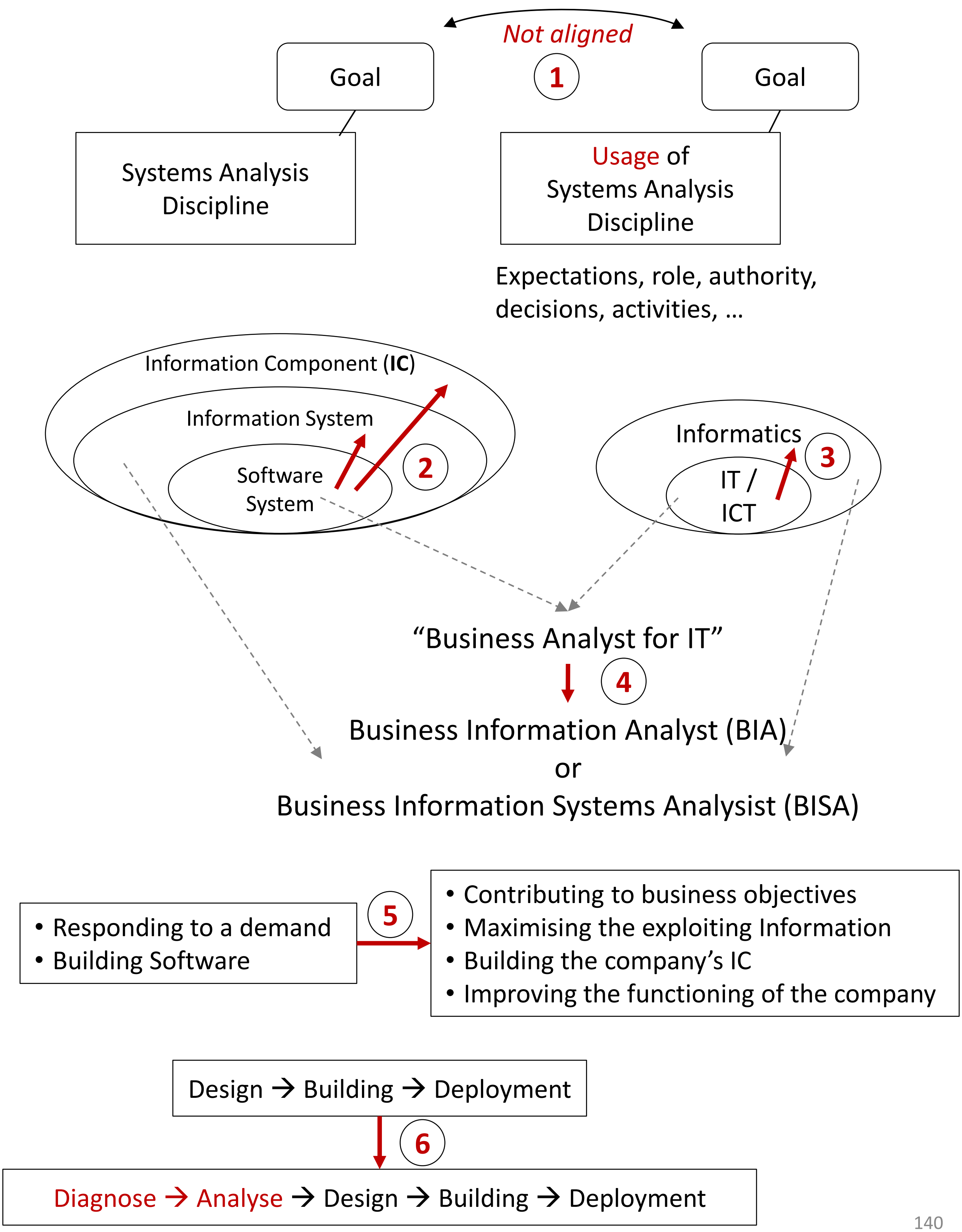
30% (+ or - 15%)

- Opportunity-, demand-, problem, need-driven
- Local
- Do and Learn
- Bottom-up
- Exploration

Adjust, fine tune, adapt, improve, seize local opportunities, …

Notes
This depends largely on the industry, on the type of system (core vs peripheral) and on the customer (example: operations vs marketing)

Some Important Shifts



PARADIGM SHIFT

Goal

Facilitating the activities of the business community by putting in place technologies and by implementing software systems

Driving the company's business (activities) by

1. Improving the functioning of the company by using S.A. methods and by working on the information domain
2. Maximally exploitation of the available or obtainable information
3. Developing information capabilities
4. Implementing an Information component
5. Innovation through information

Product

Implementing **software** systems, software applications, software features and IT infrastructure

Delivering …

1. Optimised and streamlined company **processes**
2. Enhanced information **capabilities**
3. Optimised, streamlined, manageable and flexible **information component** aligned with other company's sub-systems and integrated into the company's body
4. Organised, flexible and manageable **information** of increased value
5. Conception of new **information products** and **information services**

Value

Value comes from the implementation and usage of **technologies**.

Huge focus on technologies: How can we use technologies to the company's advantage?

Value comes from **information**

Focus on information.

- How can information benefit to the company?
- How can we better exploit information?

The technology-question is still present, but it is subordinate to this.

PARADIGM SHIFT

Trigger / Input

Responding to **demand**
Delivering what is **wanted, liked or preferred**
with assuming to create value and to satisfy customers

⇨

Mainly driven by **goals**, **plans**, **context** and **constraints**
Based on what is **diagnosis** and **necessary**
Requires the understanding of the real situation
Also through ***Continuous Analysis***

Approach

Reactive, short-term, local:

Problem-driven,
Opportunity-driven,
Need-driven,
Demand-driven.

⇨

Global system design should be (mainly)

- Vision-based
- Long-term oriented
- Inspired by Leadership
- Pro-active
- Creating the future
- Holistic, integrative, multidisciplinary

Problems, needs, opportunities and demand will continue to be dealt with, in particular when it is aligned within the global approach.

Client

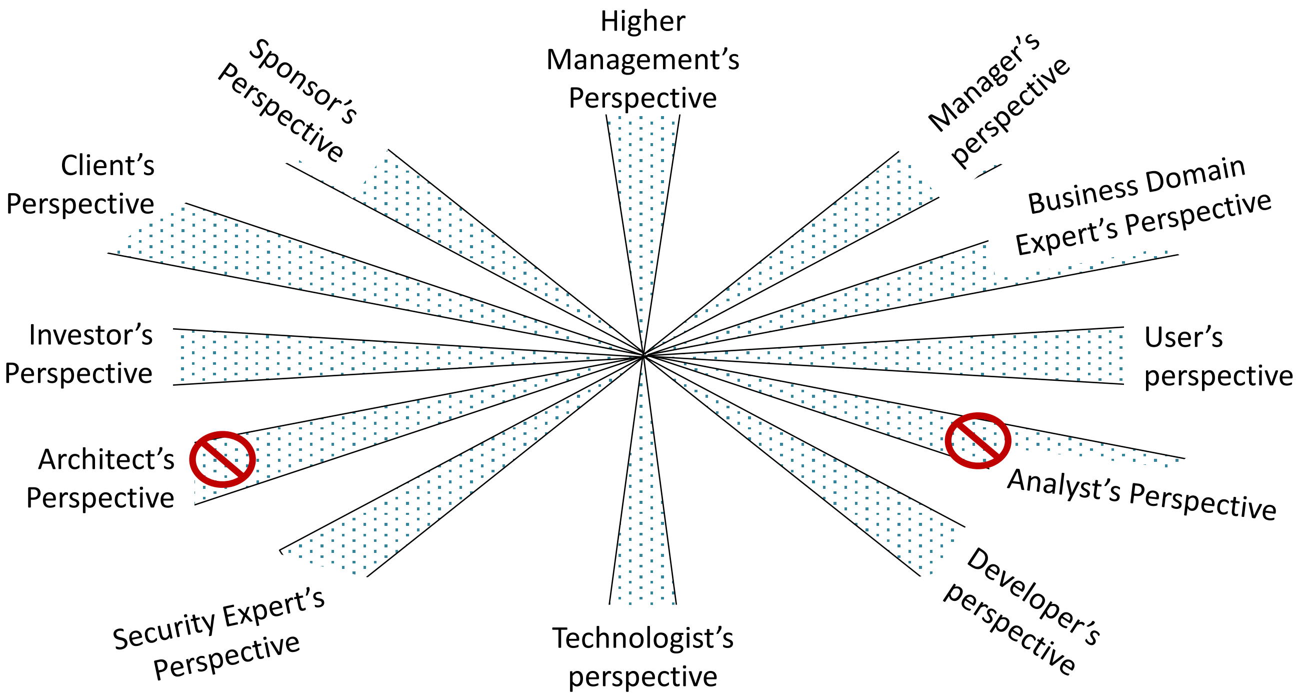
Serving
1. the business stakeholders
2. the end-users

⇨

Satisfying the needs of

1. the company and its clients
2. the business community and the IT/informatics department
3. direct business stakeholders
4. end-users

Analyst Being Part of the Problem



Examples:

Top Management's perspective:

Can we implement our vision and strategy? What will be the position of the company and its results? Can the company grow? Can the company have a stronger market position?

Management's perspective:

Can we achieve our objectives?

Sponsor's perspective:

Priority? Cost? What results will it yield?

User's perspective:

Will I be able to do my work? Will I reach my criteria? What will I have to learn ? Will my work become easier and more interesting?

Analyst's Perspective:

What do customer and users want? What solution will they find acceptable? What are the business requirements? What will I give to the developers?

Developer's perspective:

What do I have to develop? What technologies will I be able and allowed to use? What will the user like and use ?

Very Ineffective: If architects and analysts work from their own perspective, then they are PART OF THE PROBLEM.

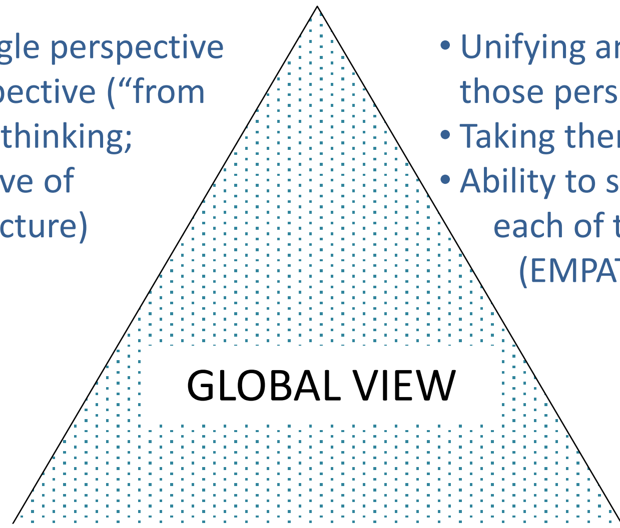
Architects & Analysts Above the Frey

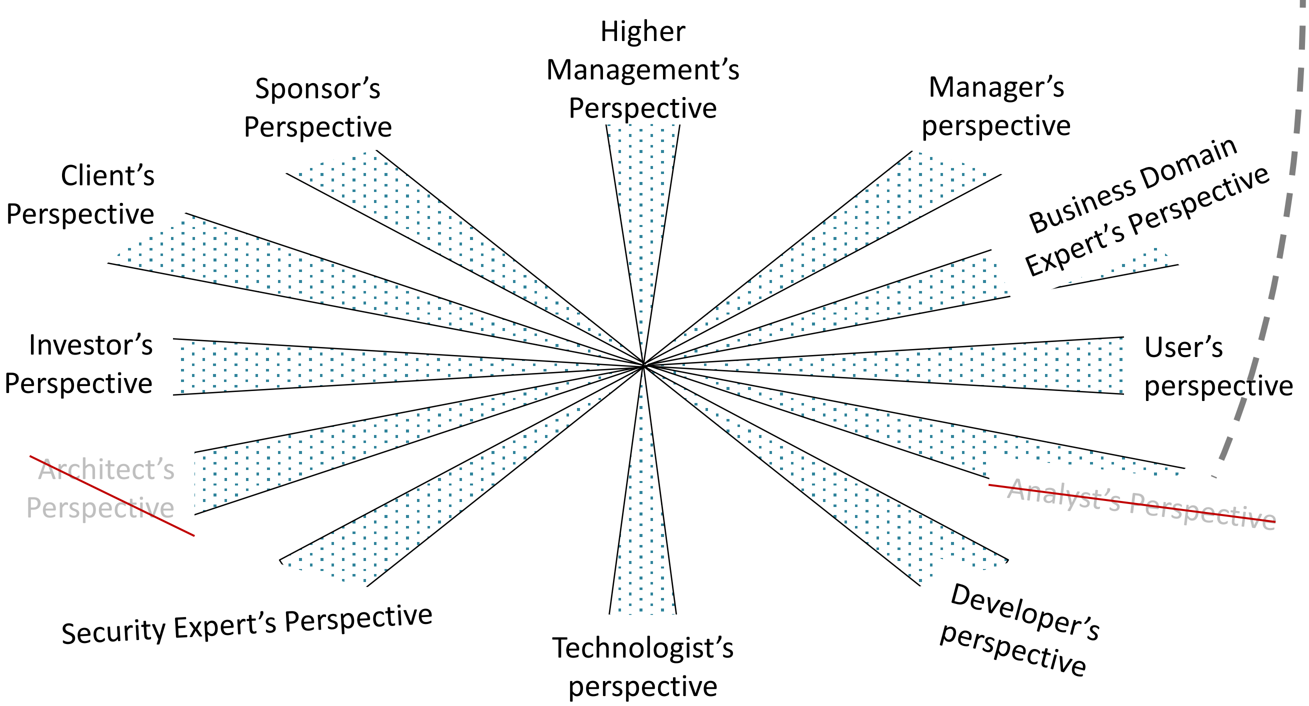
10/01/2020

Architect's & Analyst's Perspective

- Not adopting a single perspective as one's own perspective ("from my perspective ..”-thinking; from the perspective of Analysis or Architecture)
- Being detached

- Unifying and aligning all those perspectives
- Taking them all into account
- Ability to see and think from each of these perspectives (EMPATHY)





A Problem Solver a Solution Creator can not do his/her job if she is part of the problem. (S)He has to position himself/herself outside and above.

FUNDAMENTAL TOPICS

---

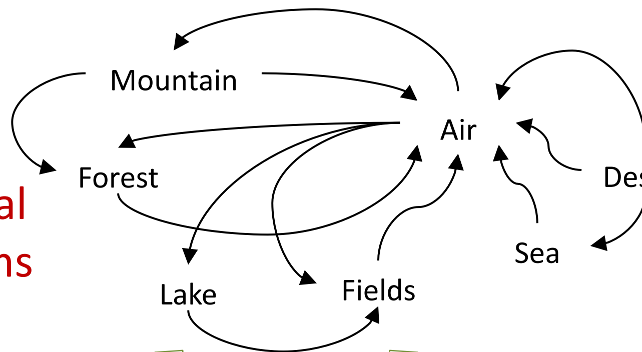
1. SYSTEM
2. COMPANY
3. INFORMATION
4. PROCESS
5. PROBLEM SOLVING

- SYSTEMS -

How Important are Systems

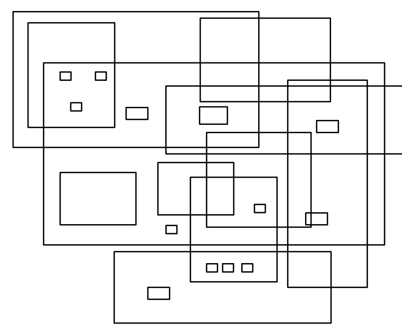
WORLD

Natural Systems



Co-exist & interact

Society



Persons

interact
are served by
use
are part of
influence
are influenced by
…

Artificial Systems

- Governments
- Armies
- Traffic systems
- Waste Water Systems
- Companies
- Software systems
- World Wide Web
- Smartphone
- Pair of scissors
- …

Systems are imposed to us.
And we can't live without.

Definition:

A system is a set of interrelated or interacting entities that form a unified whole.

Notes:

All living creates are systems as well. And the society is in itself a system and is organised in systems.

Understanding Systems

A more profound understanding of systems is required to

- conceive systems
- use systems
- manage systems
- deal with systems in general

Notes:

A lack of understanding in how a system works, its constraints, prerequisites, right handlings, limits, risks and anything that may harm the system may damage the system and even destroy it.

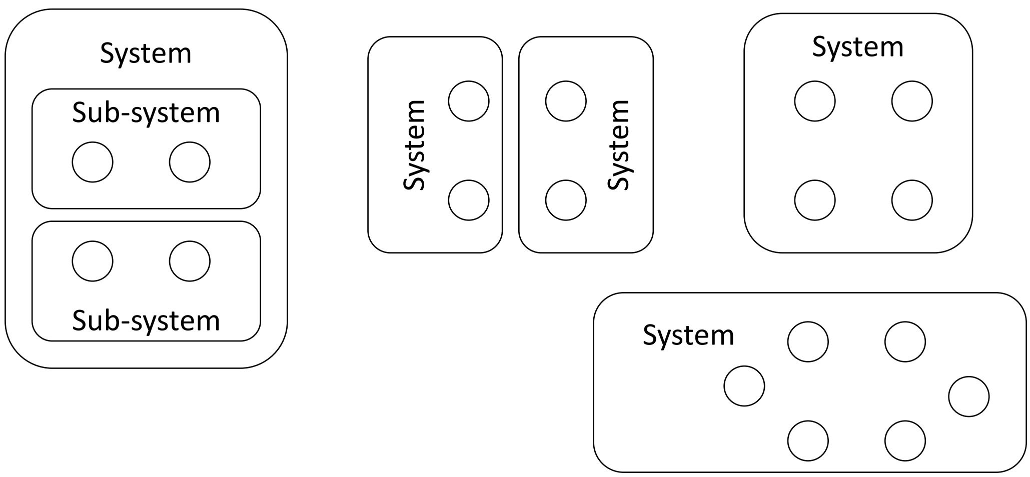
Modifying a system, ignoring or not understanding the effects on other systems downstream, may create problems in these systems (domino effect).

In software development, this risk is increased if information is shared (several systems accessing the same databases).

Identifying a System

The concept of “system” is a method to structure and organise the world to help the human mind to understand this world.

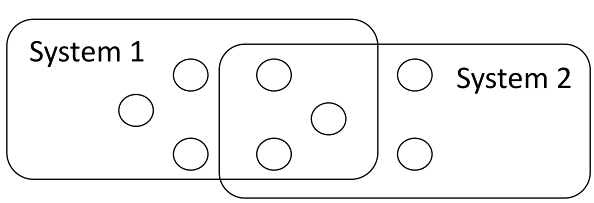
A system can be determined by selecting sub-systems and grouping the parts in many different ways.



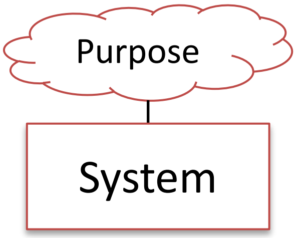
The purpose, the goal, the collaboration, the cohesion, the logical domain, the spatial and natural ‘boundaries’ and how it is best to be managed are good criteria to define a system and its boundaries.

What is true for a system, is also true for supra-systems, sub-systems and co-systems.

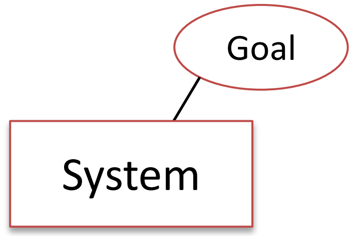
Overlapping Systems



Systems

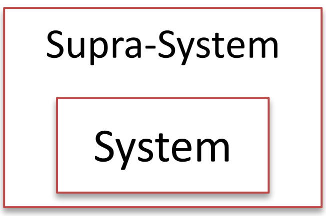


has a purpose, a role

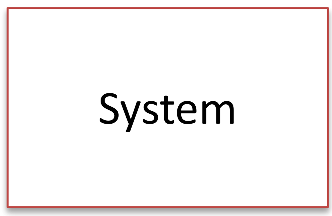


has a goal

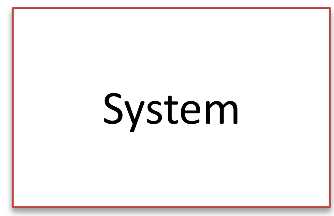
has a boundary



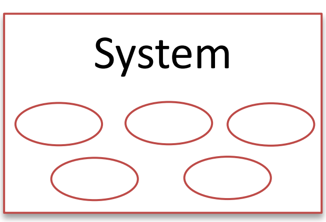
can be part of a supra-system



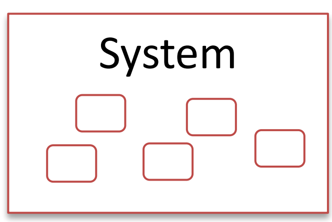
has characteristics



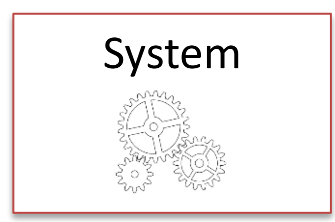
has limits, weaknesses, critical parts, …



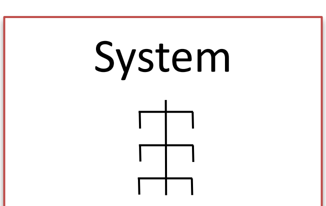
has capabilities



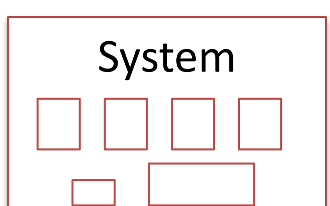
has functions



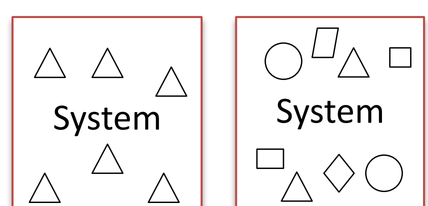
has a behaviour, mechanisms



has internal structure, organisation, architecture

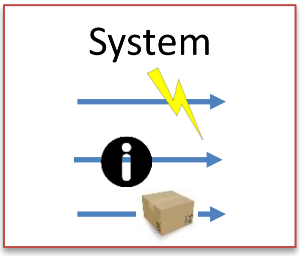


has sub-systems and components + interactions among them
Note: Sub-systems are systems (co-systems)

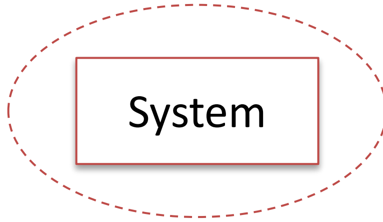


can be homogeneous – heterogeneous (components of different nature)

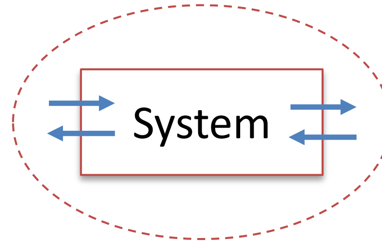
Systems



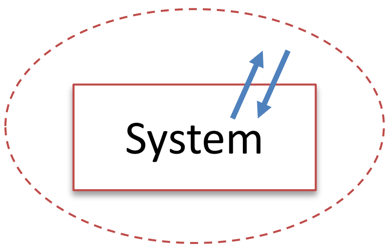
flows of matter, energy and information



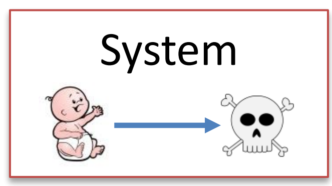
exists in an environment



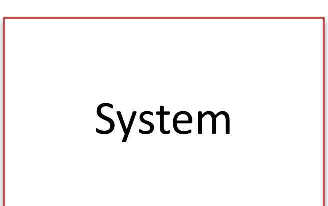
exchanges and uses information, energy and (often also) matter



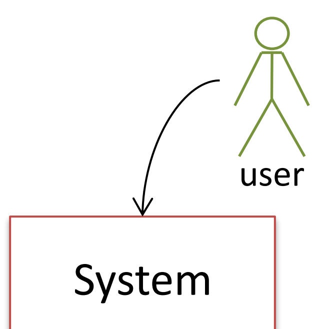
Influences, forces, exchanges and interactions with environment. Even its existence, the fact of being present, has an influence on the environment.



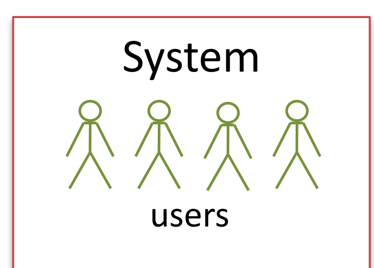
is temporary, has a life (full of events), has a lifecycle (even if the end is not foreseen)



can be autonomous

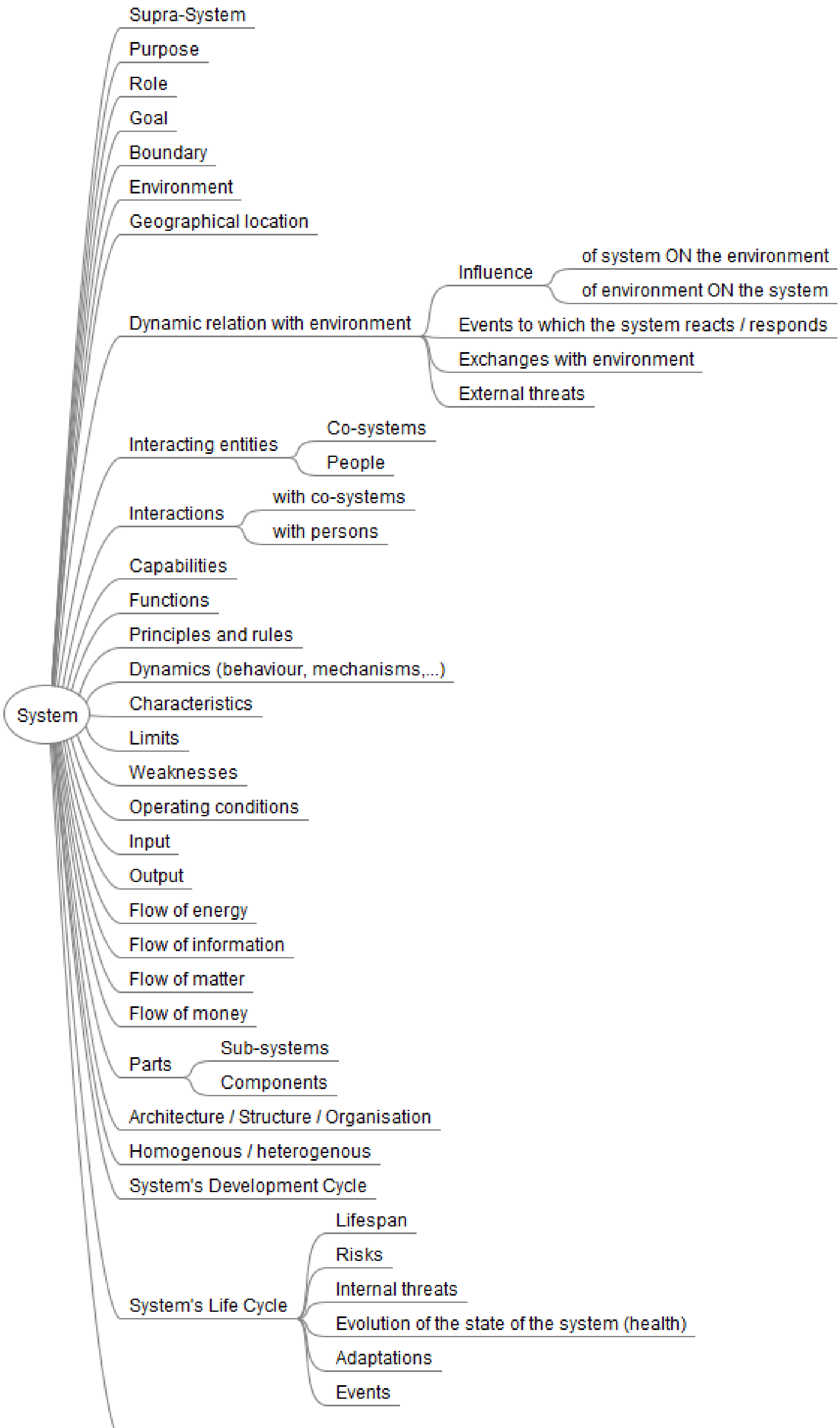


can be used (by 1 or more users or users groups)

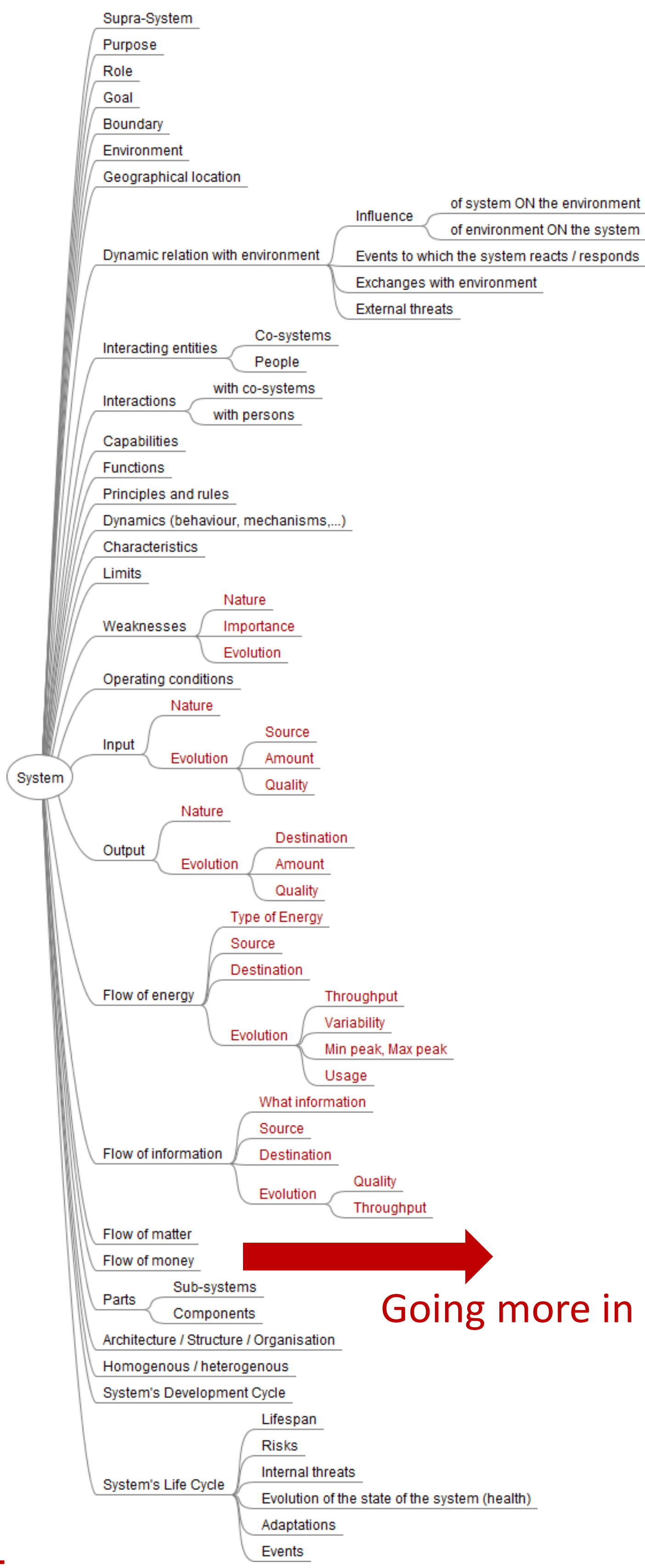


may contain users

System’s Characteristics

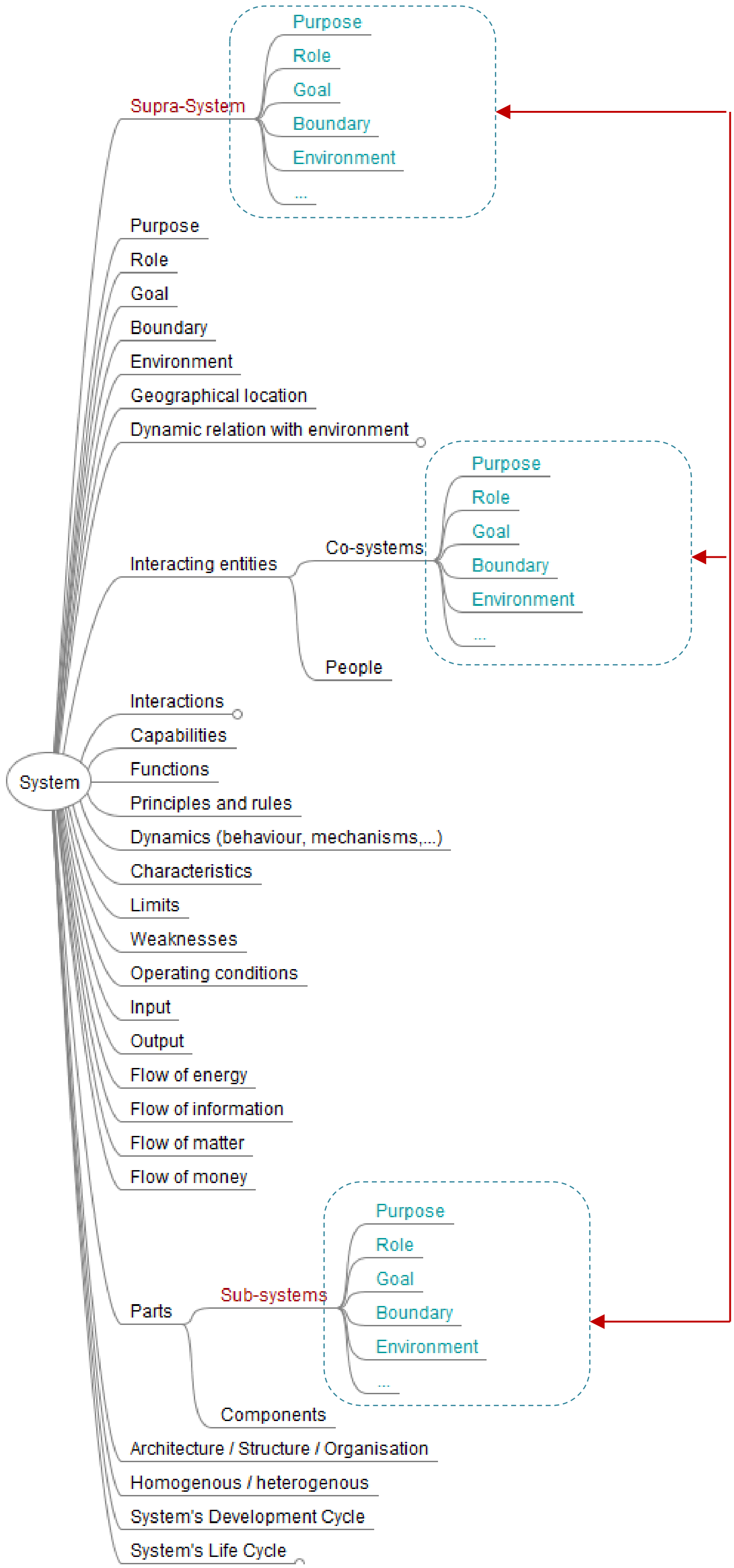


System's Characteristics



Going more in depth

System's Characteristics



NESTED
Different components are similar.
Groups of characteristics may be repeated.

Classification of Systems

Natural Systems	Designed Systems
Open Systems	Closed Systems
Physical Systems	Abstract Systems
Static Systems	Dynamic Systems
Homogeneous Systems	Heterogeneous Systems

Man-made, engineered, artificial

Simple Systems	Complicated Systems	Complex Systems	Chaotic Systems

Other possible classifications:

a) Linear, non-linear systems
b) Time variant, time invariant systems
c) Stable, unstable systems
d) Causal, non causal systems
e) Continuous time, discrete time systems
f) Invertible and noninvertible systems
g) Fixed, mobile systems
h) Predictable and unpredictable systems
i) Manual and automated systems
Social systems
…

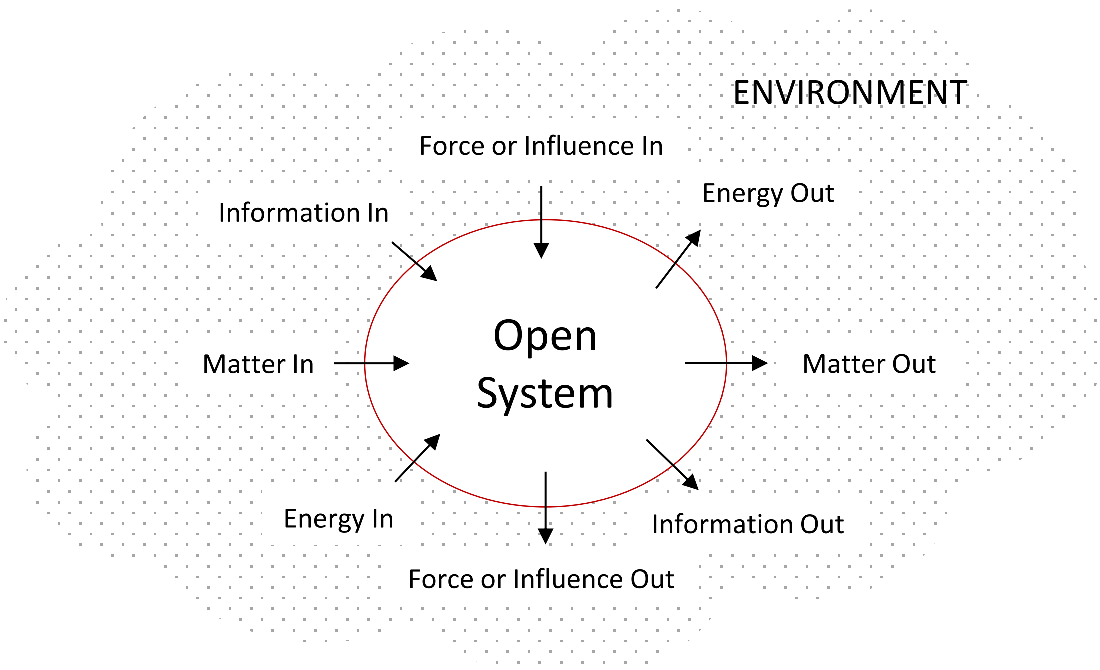
Note:

Not all man-made systems are engineered. Just like we can't call any creation "art", not all system creation can be called "engineering".

Sometimes, gradation (not always black or white): Is a forest created by people a natural system or a designed system ?

Any system's characteristic can be used to classify systems

Open Systems



An Open System is a system that interacts with its environment.

Not all ‘in’ or ‘out’ have to be present.

Matter and Energy are not created out of nothing.

Living Systems

A LIVING SYSTEM SEEKS TO EXIST INFINITELY AND TO PROSPER

Hierarchy of living systems

Supranational system

Society

Community

Organisation

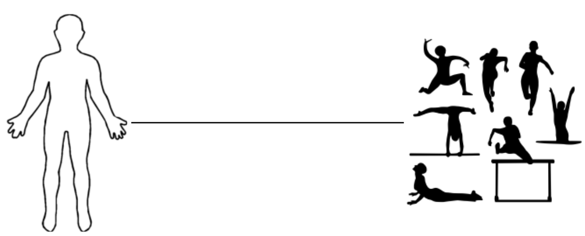
Group

Organism → Body + Conscious Mind

Levels of company to individual

appearance of the

Cell → Natural evolution



Body	Activities
↓	↓
Formed by **natural evolution** (but equipped with conscious mind)	Execution is guided by **conscious mind** (implies decision making) (and unconscious mind)

Notes:

Decisions (intellect, mental, conscious mind) and activities may shape the body somewhat. But basically, it's a product of natural evolution.

A company is a living system. However, this does not mean that all its sub-systems and parts are living systems as well.

Scale of Systems

… ?
Laniakea
Milky Way
Solar system
Earth system
Ecosystem
Industry
Country
Political system
City
Club, Household, company
Department
Car, Plane, Ship
Person
Cell phone
Human Body
Organs
Parts of machinery
Cell
Atom
…

Natural Systems	Designed Systems

We are interested and focus on designed open dynamical systems (artificial, engineered, man-made).

We can learn from natural systems

BUT

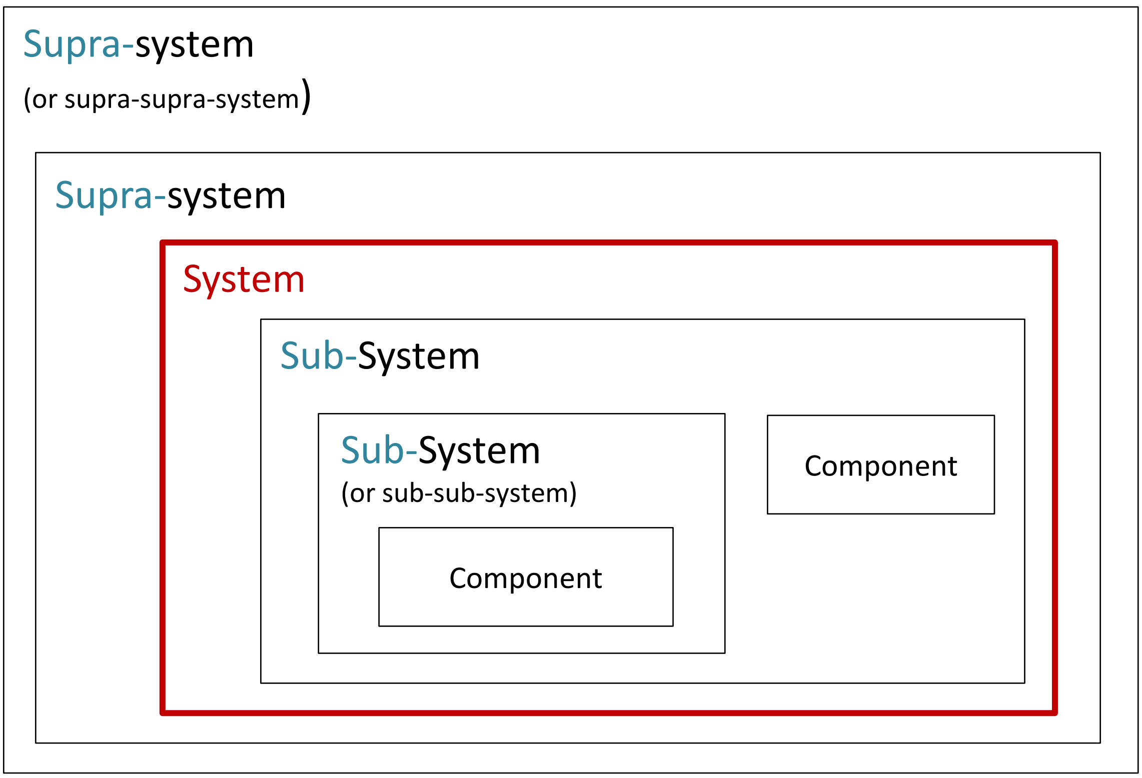
Natural systems and artificial system are different.

Therefore, not all principles, concepts and methods are applied on both.

Hierarchy of Systems

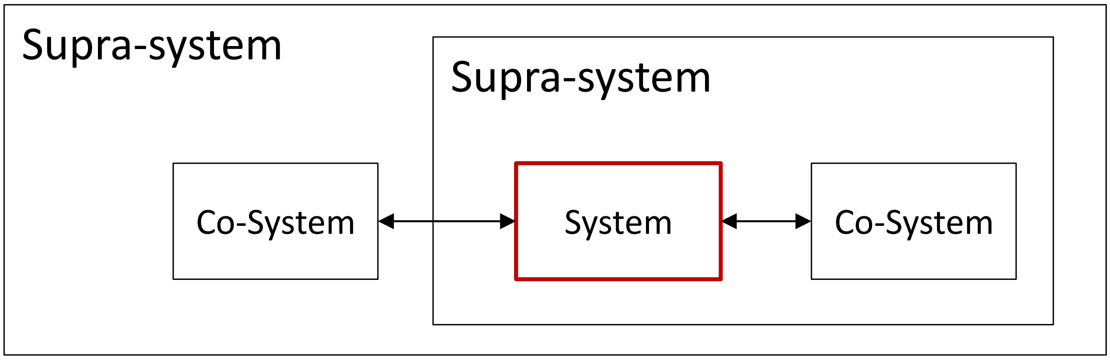
Supra-Systems and sub-systems are all systems.

The “System” indicates the level in the hierarchy of systems under consideration.

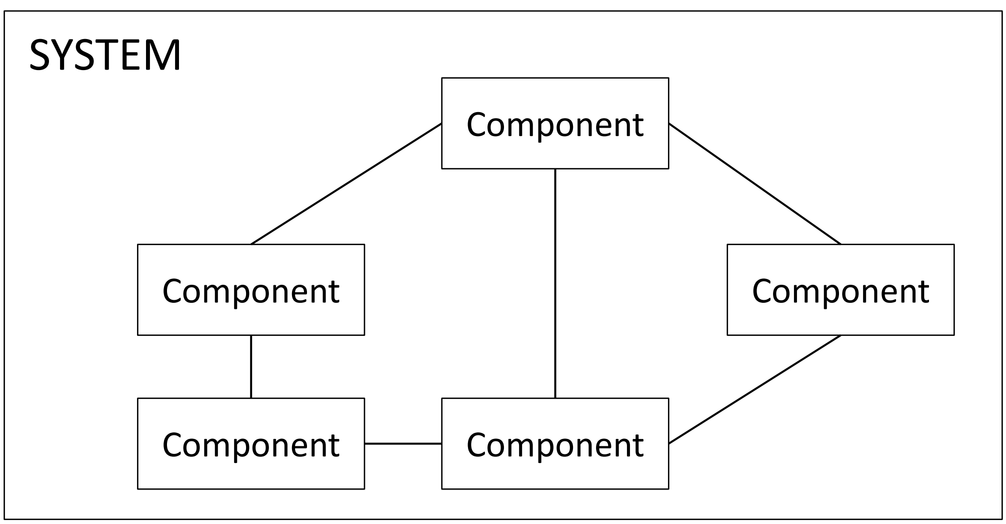


1. Sub-systems and components are within the system’s boundaries and contribute to the system’s goals.
2. A sub-system can be the system. A supra-system can be the system. It depends of the system under consideration.
3. The hierarchy can have as many levels of supra-systems and sub-systems as needed.

Hierarchy of Systems



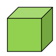
A co-system is a system at the same level as the system under consideration. Often there is an interaction, an exchange, a relation among them. They are often part of the same supra-system

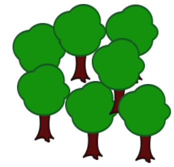


Components and sub-systems are connected forming the architecture. They interact and collaborate. They collaborate towards a common goal. Together, they implement the system's capabilities and qualities.

Hierarchy of Systems


a heap of blocks


a single block


a forest


a tree


a group of people


a person


a city


a house or building

At glance: a group is formed. There is a one-to-many relation

Forest

A forest is more than trees. It’s an ecological environment. It’s a whole dynamical environment.

Group of People

A group of people is more than a number of people placed together. Communication & group dynamics.

City

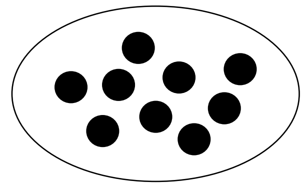
A city has road infrastructure, emergency services, communication network, energy supply, …

The cluster, the grouping, the aggregation of the individual similar systems may (also) form a new supra-system

A block is not a system. A heap of blocks doesn’t form a new system.
We may easily fail to perceive or to consider that a group of systems is more than a group. We may not be aware that they form a supra-system because our focus remains on the more visible and obvious individual systems.

Hierarchy of Systems

Individual system



Group, collection, ensemble, cluster, aggregation of similar individual systems forming a supra-system

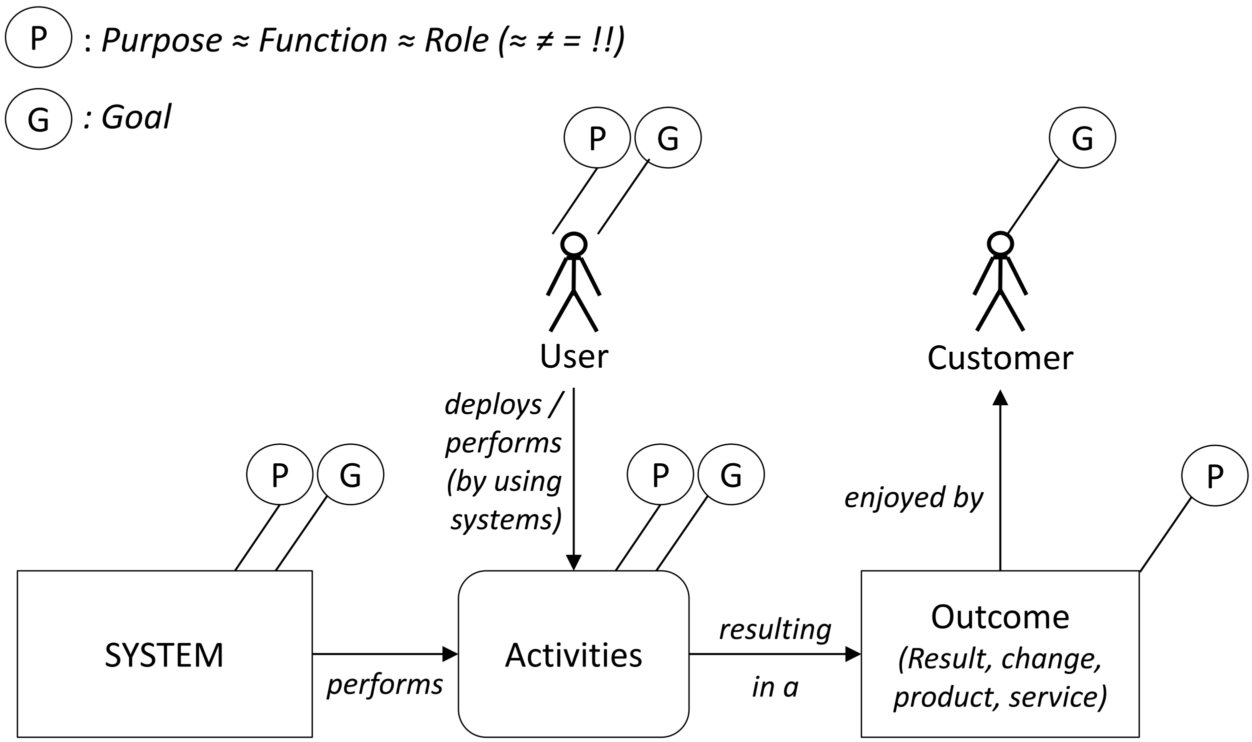
A Supra-System is formed:

- has its own purpose
- is of different nature than the constituting individual systems (tree, person, house).
- has relations among the individual systems. They interact with each other.
- has its own characteristics.
- Obeys to its own principles, rules or laws
- Has its own dynamics (mechanisms, forces, evolution, behaviour)
- contains components or systems other than the individual system.
- has its own issues that doesn't exist at the level of the individual system

Limits of Scalabilities in Approaches and Methodologies

We can not solve problems of a higher level with a thinking (and approaches) of a lover level. The level of thinking (or maturity) used to design a philosophy, an approach, a methodology, … determines the limit of its scalability.

Designed Systems



- A customer has goals (and/or Needs)
- The product has a purpose.
- Activities have a purpose (meaning) and their goal is to produce or to contribute to the production of a certain outcome.
- A user has a goal. The user, as part of a system, has also a role (a purpose).
- A system has a purpose. It has also some goals.

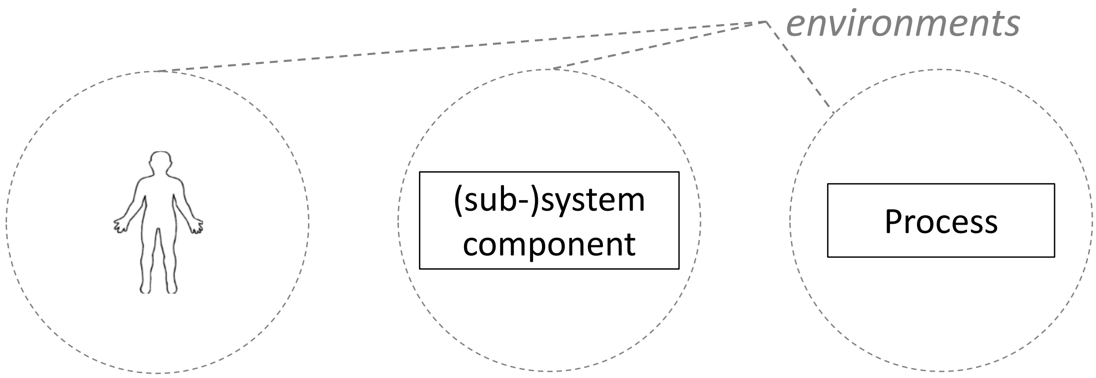
Purposes (,roles) and goals have to be aligned.

Absence of alignment → Problematic

Notes:

User and customer are roles. They may point to a group of people. A single person can have different roles.

System - Environment



A person, a group, a team, a project, a community, a society, a component, a (sub-)system, a process exist in an environment.

- They are influenced by the environment.
- They influence the environment.
- They depend of the environment.

Their existence, their thriving and survival depends of their environment: how well they are adapted to it; how well they are accepted by it and/or how well they serve it.

We can't function, decide, solve, conceive, heal, restore, guide, build, grow, … while ignoring the environment(s).

We can't do without understanding the environment.

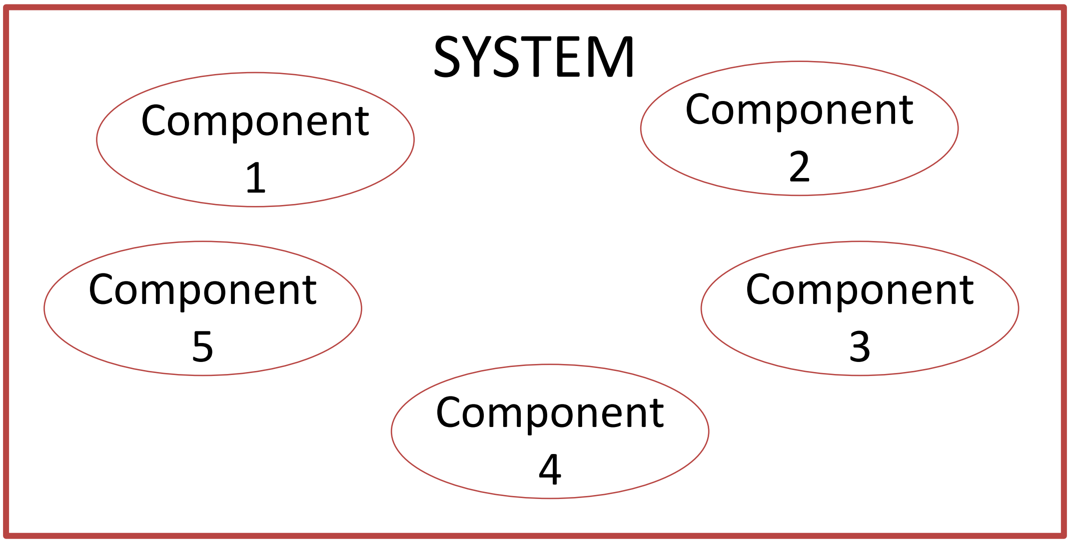
See, consider, focus also on the environment…

SEE the ENTIRE picture

We can build the nicest and most advanced submarine. But it will be completely useless if it is in the desert. And building it with little knowledge of the ocean (the environment is a recipe for failure.

Systemic Harmony

Achieving a well-functioning system



What is HARMONY?

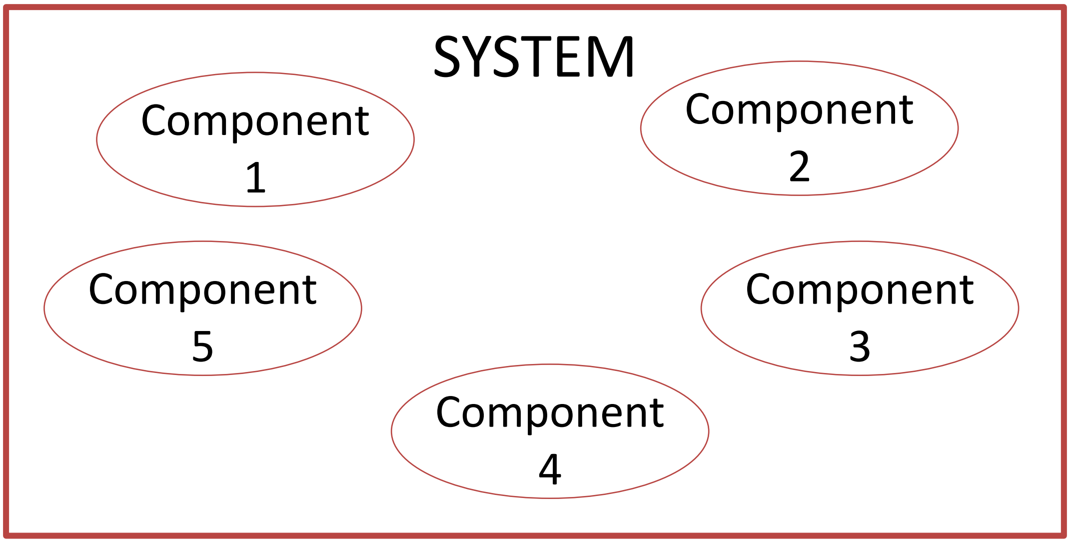
- Components form together a larger unified whole
- Optimised contribution of every part to the whole's interests
- Environmental fit
- Functional alignment
- Alignment of capabilities
- Optimal coordination
- Coherent logic
- Balance in behaviour, capabilities and in physical qualities
- Efficient and effective collaboration
- Internal logical, ordered and balanced structure
- Systemic Integration
- Mutual accommodation of the components
- Optimal use of resources (*including information*)

How to achieve harmony in a heterogeneous system of systems (organisation) ?

This quality of systemic unity is a **crucial** aspect of any stably perduring whole.

Systemic Harmony

Achieving a well-functioning system



Systemic harmony is achieved when different parts of a system form a harmonious whole and work seamlessly together. This unity is crucial for the long term stability and existence of the whole.

⇩ *requires*

COLLABORATION among engineers

The organisation must structurally facilitate the collaboration among the engineers & company must be structurally integrated.

Note:

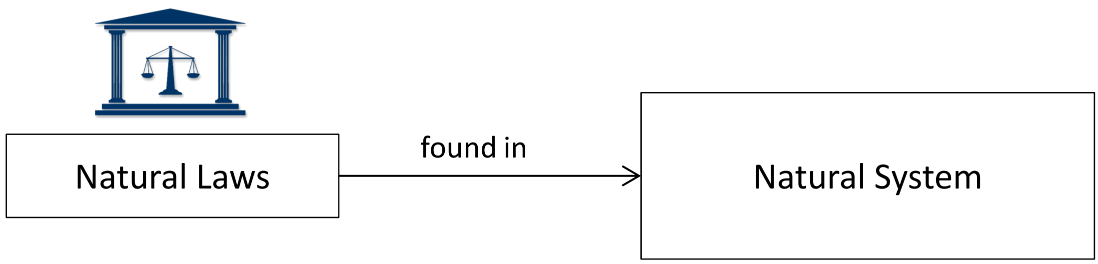
No or difficult collaboration → no well-functioning system → problems

The collaboration is not restricted to a collaboration between the engineers only.

Natural Laws and Natural Systems

Natural Laws

- Laws of physics
- Laws of biology
- …



Nature obeys only to its own laws.

A natural system always acts and reacts

- accordingly to the natural laws
- and accordingly to its own nature, its logic, its mechanisms, its capabilities, its characteristics, …

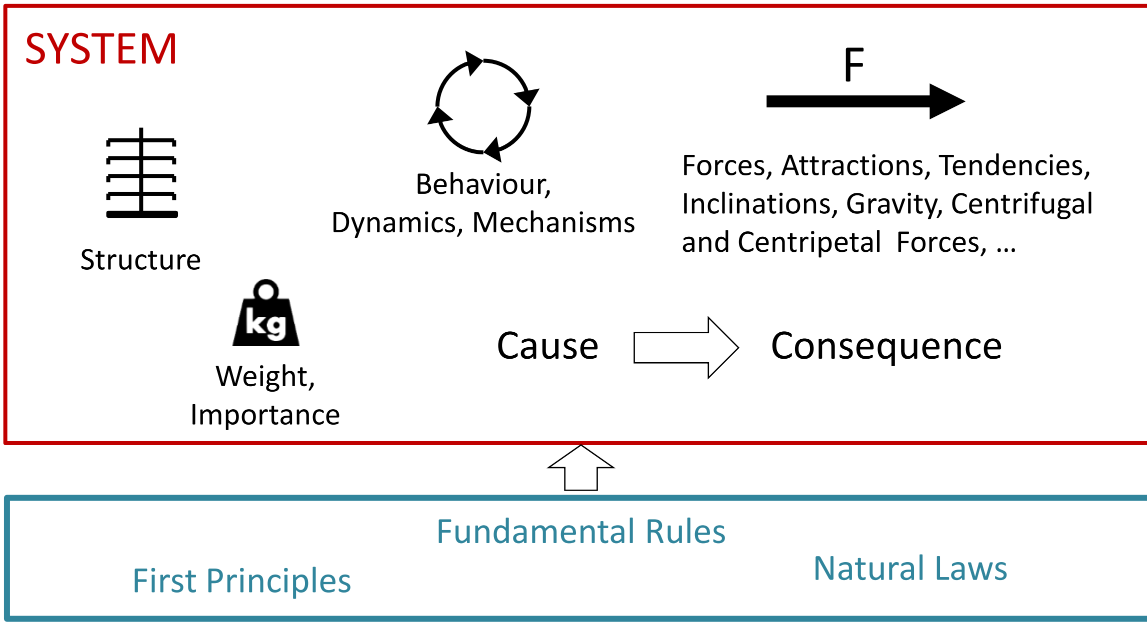
Breaking natural laws and disrespecting natural systems beyond the point of resilience, inevitably leads to consequences or at least to increased risks.

Nature is an excellent, but intransigent, teacher.

It lets you fail until you learn and respect its laws.

Systems kill us if these laws are violated

Equilibria in Systems (1)



The respect of these principles, laws and rules is critical for achieving equilibrium

Where do these principles, laws, rules come from?

1) Find the elements that makes up the future solution and its environment
2) Identify the disciplines related to these elements
3) Or study the nature of the elements

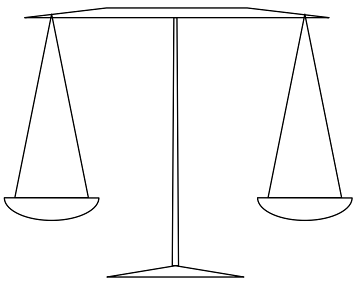
Element	Laws / Discipline
People	Psychology, organisational behaviour, …
Computers	Computer science
Money	Financial management, Economics
Electricity	Science of Electricity
Information	Information Science
Metal parts	Materials science
Water	Fluid Mechanics, Hydrology, …
…	

+ Systemology + Engineering + Problem solving + …

Notes:

To be further investigated

Equilibria in Systems (2)



Dynamic Systems, and their components, have a kind of balances. There are parameters of which the value must be within a specific range to achieve a state of equilibrium. These balances belong to and are formed by structures, behaviours, forces, weights and cause-consequences. Since these balances are part of the same system, they might be connected and influence each other.

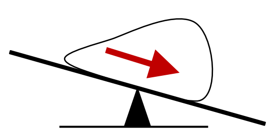
THIS IS ABOUT THE WELL-BEING OF THE SYSTEM

A value may change, but as long as it remains in the acceptable range, the state of equilibrium is achieved. Some values must stay above or below a certain limit. Or, values have to exceed a certain threshold. There are trigger points or a critical mass setting the system, or a part of it, in motion.

Example:

- Speed must be kept in a range. It may not exceed a limit. Sometimes it must be zero.
- An energy supply must be kept within a range. And it must be continuous.
- The mass (weight, or volume) has to be spread across the system.
- A bearing structure has to be able to support a certain weight.
- A bearing structure has to be stable and to mitigate bumps, shakings and other lateral forces.

A disequilibrium may hinder a system from functioning properly, or even causing its collapse. A system can also become unstable or go in an uncontrolled or abnormal state of hyperactivity. It may react in many unforeseen ways.



Many states of equilibrium and states of well-being of the system have to be identified, understood, managed and the necessary protections need to be built in. It is the task of the engineer to detect them in existing systems as well as in the systems being designed. This is not an easy task for engineers and, a fortiori, for end-users (in existing systems).

Criticality

Critical – Important – Useful – Optional

gradation

System's Perspective

Structures, principles, mechanisms, components, capabilities, capacities or resources important for the **survival**, well-being and thriving of the system

User's Perspective

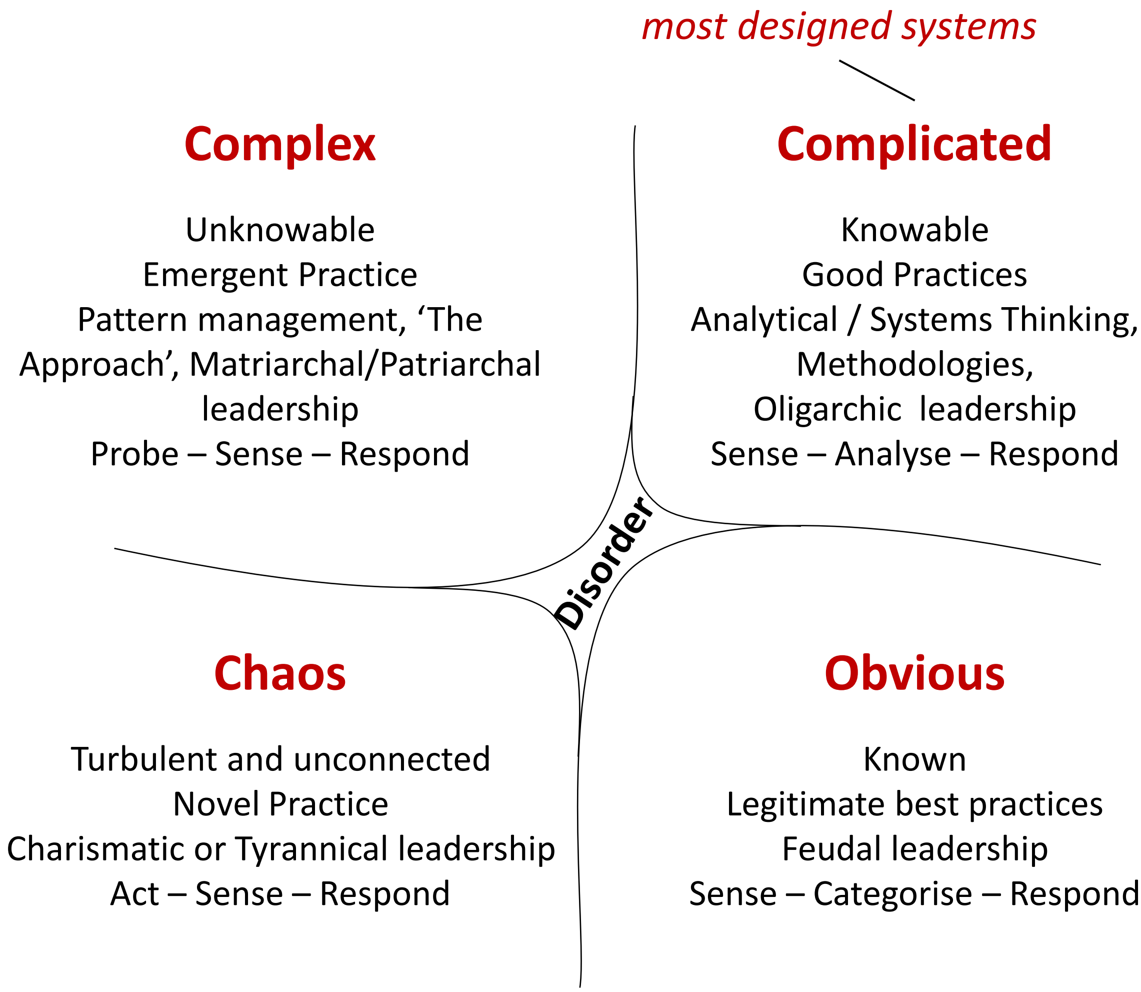
Capabilities, features, capacities, outputs important for the **usage** of the system

Notes

Example: A system may be useable, but without internal controls and maintenance, over time, the system will degrade.

The more important the item or aspect, the more attention of engineers it deserves.

Cynefin Framework (“KUN-iv-in”)



Inventor: Dave Snowden

<u>TRAP:</u>
It is too easy to qualify a system as a complex adaptive system (CAS) based on the personal inability to learn, to analyse and to understand it or in order to avoid the effort of acquiring the understanding it.

Systems Analysis has been developed in order to understand more complicated systems.

Functions of Information Systems and Software Systems

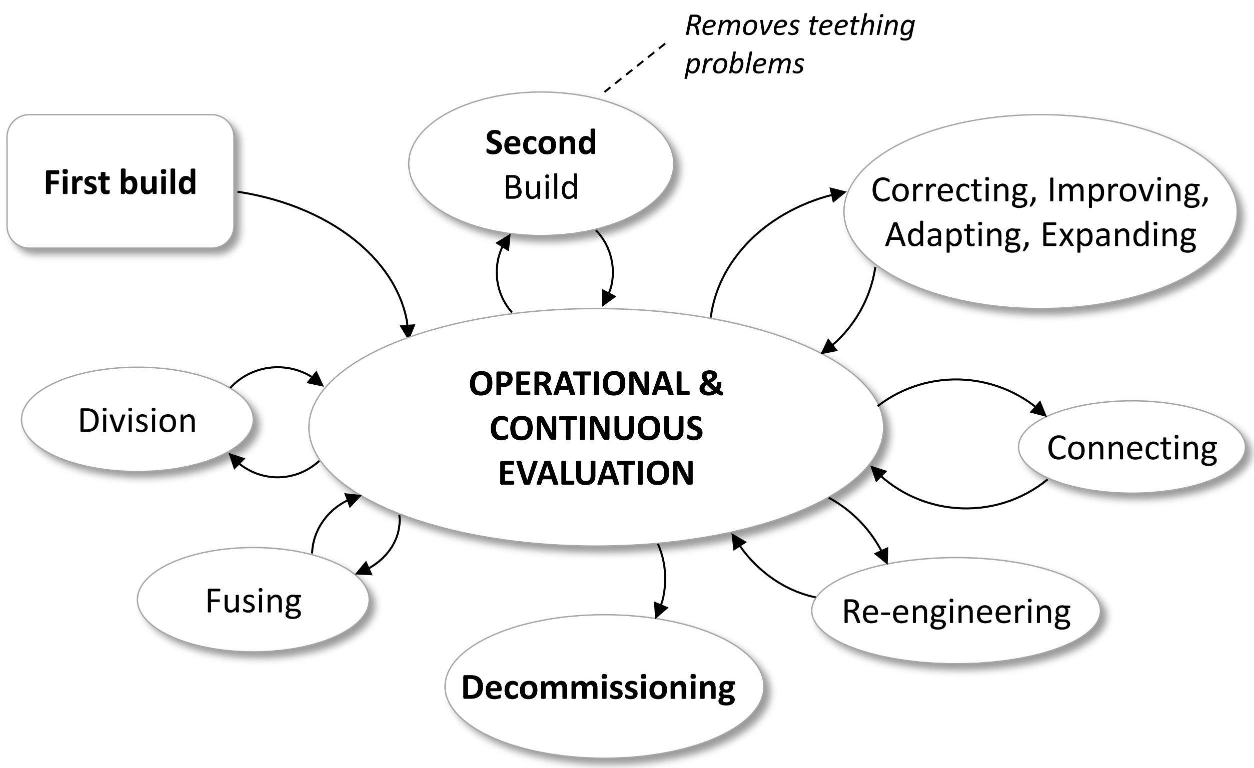
Source of Inspiration for New Services and Innovation

Capturing, controlling, processing, storing, securing, transporting and providing Information

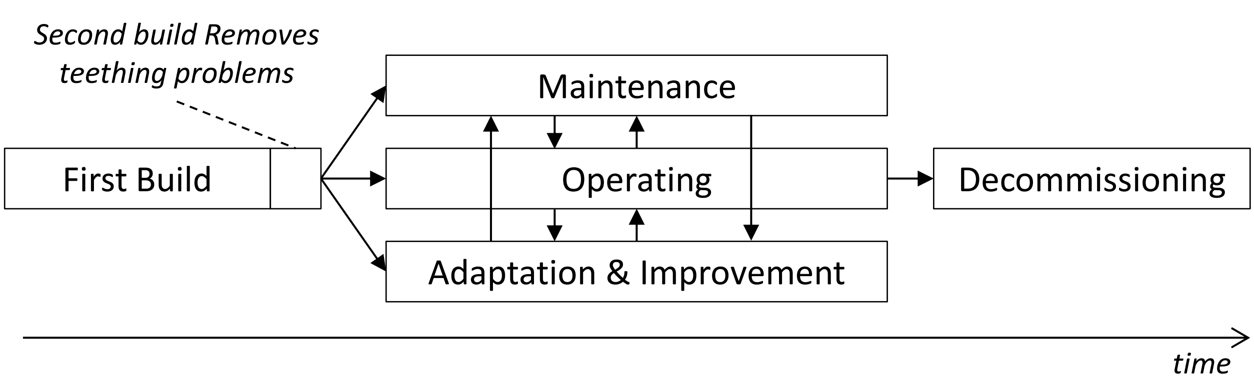
- Performing tasks of people (related to information) in a much faster, unvarying and reliable way.
- Amplifying Human Capabilities (good and bad)
- Relieving people by performing its activities
- Controlling people
- Guiding people
- Preventing people from making mistakes
- Informing people

entertaining ppl, influence ppl, drawing the attention, interest ppl, attract ppl, assist them in taking decisions, providing choice, teaching ppl, assisting in thinking, …

Engineered System's Lifecycle



Systems have to be able to cope with events happening during their future life. They have to be engineered for it.



Huge changes, such as re-engineering, may also happen.
This is can be considered as a first build of a new similar system.

Natural Design - Intelligent Design

Evolution by Natural Design

~ DESIGN DARWINISM

- Purposeless
- Foresightless
- Randomness, directionless
- Slow
- Unpredictable (unsure ‘if’, ‘when’, ‘what’, ‘value’, ‘meaning’, …)
- Extremely costly (Waste on the <u>many failed trials</u>)
- Produces organism suitable to the environment
- but in the end … it is brilliant
- Happens by many clueless minds in a very huge amount cycles (iterations)

Intelligent Design (Artificial Systems)

- Purposely (goal oriented)
- Mainly top-down
- More foresighted
- Directed search
- Relatively fast
- Governed by cost considerations
- Beautiful designs is done by great minds

<u>Notes:</u>

Today, we can simulate evolution in computers (huge amounts of iterations are possible; genetic algorithms, deep learning)

Intelligent design matches better the world of the company. In specific cases, natural design can be applied, or as a combination of both.

Additionally, we can use natural evolution by getting inspiration from nature (biomimetics or biomimicry). It all still requires insight and intelligence.

Pieces and the Whole

The whole is greater than the pieces.

Why?

- Having a common goal
- The implementation of an overall concept
- Implementing the system's capabilities and characteristics
- Forming the architecture (structure and order)
- Interdependency among the parts
- Alignment among the parts
- Interaction: communication, exchanges, transfers among the parts
- Collaboration and support among the parts
- Components may share same elements
- Shared environment (influencing the environment, reacting to same changes in the environment)
- Sometimes built on same foundation or container
- Sharing the same infrastructure
- Common principles, policies, rules, standards …
- A limit or risk of one component is a limit or risk for the whole
- Sharing resources

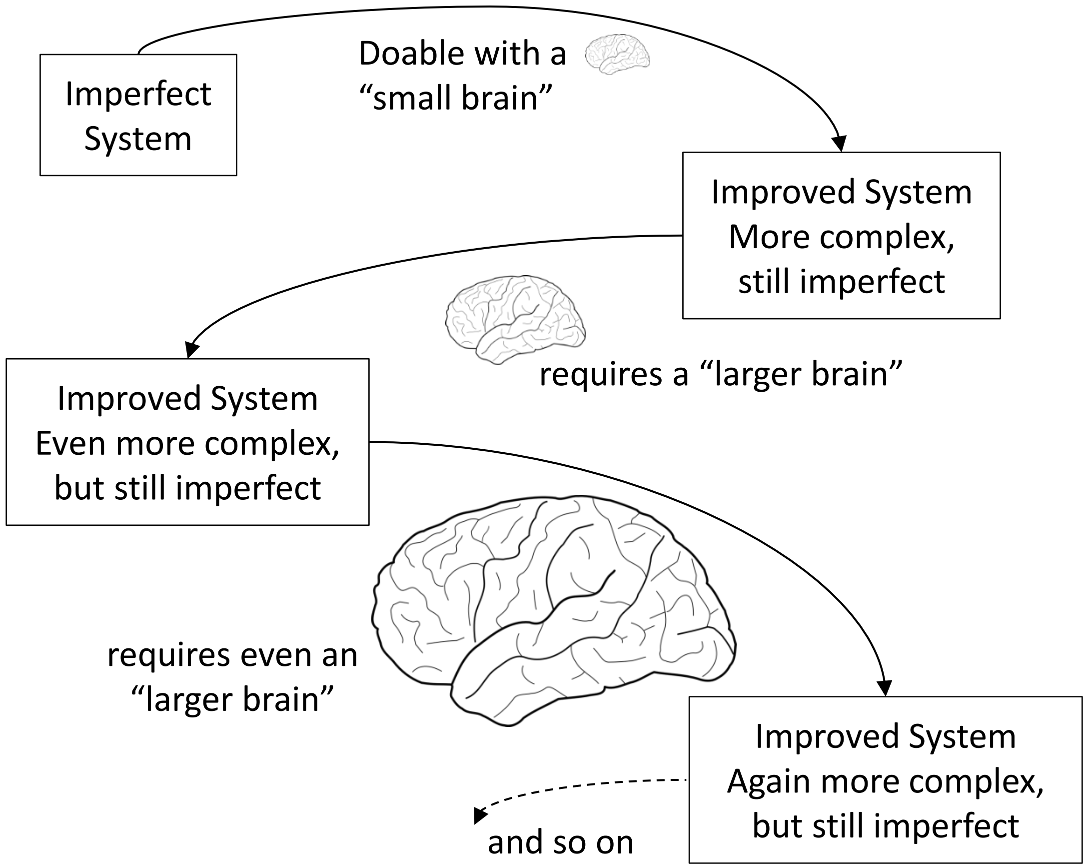
Implications:

Building pieces and assembling them (bottom-up) without overall design, is likely to lead to a lower quality of the whole.

Over time, by repeating this many times, it leads to a chaotic result.

Important for integration

Intensifying Complexity



If a bigger brain is required, it may imply a maturation step (change of perspective, improved belief system, paradigm shift, …)

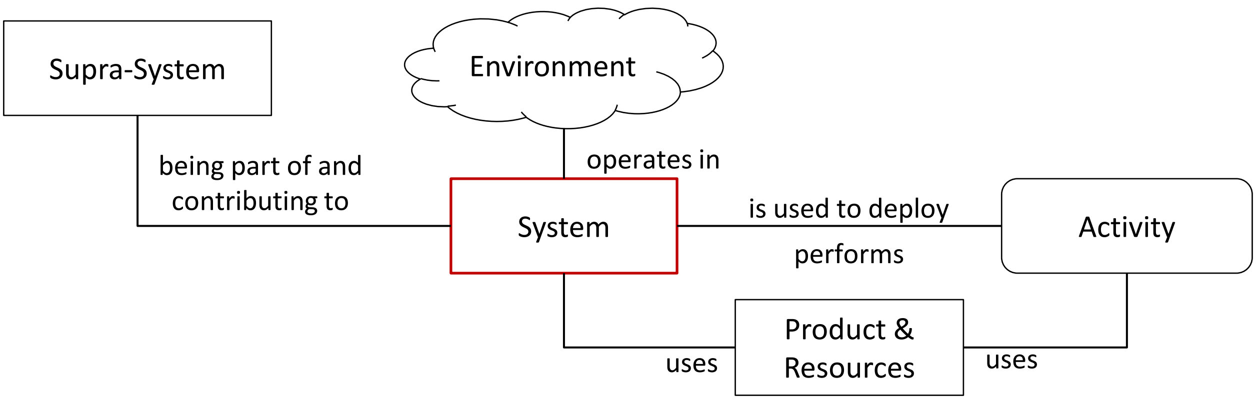
How to combat this tendency?

- Don't repetitively add layers, cases, exceptions, rules, criteria, differentiations, … → this adds complexity
- Get back to the fundamentals, first principles
- Clean-up, re-engineer, re-simplify

Neglecting this will increase the effect of the tendency of complexification

Sources for Design Input

Five major sources determining the capabilities and characteristics



Environment

Structure, capabilities, mechanisms and characteristics
- adapted to the environment,
- able to deal with the environment,
- allowing proper interactions with the environment
- fitting in the environment

System

Structure, capabilities, mechanisms and characteristics
- supporting effectively the purpose and goals of the system
- able to protect the system (verifications, monitoring)
- able to maintain harmony (monitoring, measuring, controls, management, avoiding misuses and abuses, …)
- allowing the system to survive during its lifecycle (lifetime) (adaptability, scalability, ability to deal with unforeseen events, …)
- able to maximally exploit the resources
- able to maximally create value for the environment and/or for the supra-system

Supra - System

The Supra-system combines the three others (environment, system and activities). The Supra-System also provides a context of needs and requirements.

Activity

Structure, capabilities, mechanisms and characteristics
- able to perform the necessary activities in line with their overall purpose and goals

Product, Resources, Raw Materials

Structure, capabilities, mechanisms and characteristics
- able to produce the intended product
- able to optimally process and exploit the resources, the raw materials

Defining the System's Environment

System's survival depends (also) of their environment.

Therefore, the definition and the understanding of the system's environment is critical to design meaningful systems that can survive in it.

The environment is defined by the elements and the space between these elements

- with which the system interacts
- able to influence the system
- of which the system's survival depends
- impacted by the, present or future, system

one way or another, in the present or future: input, output, constraints, obligations, forces, opportunities, exchanges and interactions, impacts, …

The more perspectives (holistic) are taken into account, the more meaningful the defined environment is. The environment is not static and may evolve over time.

The objective is not to identify the perfect exact environment, but to identify what is meaningful in order to be able to study it and to take it into account.

A good starting point is to identify the elements with what the system interacts and elements that are shared. The study should go much further.

The "boundaries" can be solid, impenetrable, penetrable to different degrees, clear or fuzzy. It may vary in time.

The better the insight of a person is, the better (s)he will be able to define the environment. The better the environment is defined, the more valuable insight can be acquired. It's 'definition doesn't need to be formal and can be adjusted.

The Environment should not be confused, let alone limited to a "Context Diagram".

The understanding of the environment and the relation and all interactions between the environment and the present or future system is crucial.

Design a system that is valuable and that can survive in an environment is impossible without understanding that environment.

Minimum Viable System

The **Minimum Viable System** (MVS) is the version of the system with the minimal set of features, qualities and capabilities which is still able to create value by performing a business activity or, for non-business systems, to fulfil a minimal meaningful role.

The MVS is equipped with ALL the **critical capabilities** (**critical features** and **essential qualities and capacity**) and is suitable for a basic usage.

An MVS can not work with partial logic, partial processes or incomplete set of features. Removing one single feature, capability or reduce a characteristic will render the system unable to function, unusable, unable to produce any business value and unable to play its role. It would make the system worthless. The MVS is thus the minimum that has to be delivered. All critical logic and features MUST be implemented and delivered. Anything less can not be operational.

Examples:

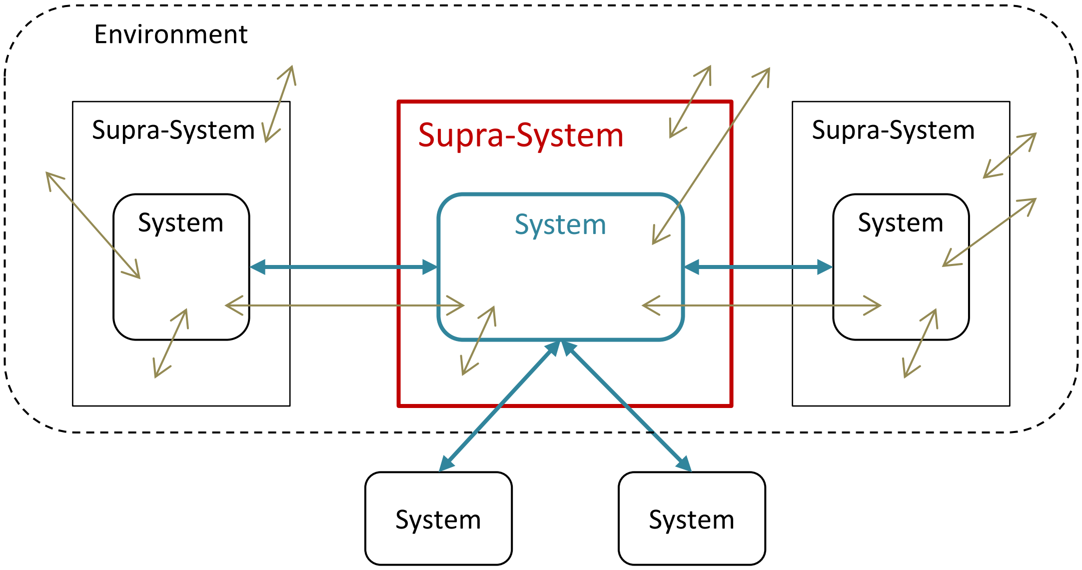
- A car with an engine but without steering wheel.
- An airplane with take-off and flying capabilities, but which isn't equipped to land.
- A software system capable of accepting client data but which can't accept the products data or orders.

The MVS leads to projects with (relatively) fixed-scope !!

Possible Criteria for Determining an MVS

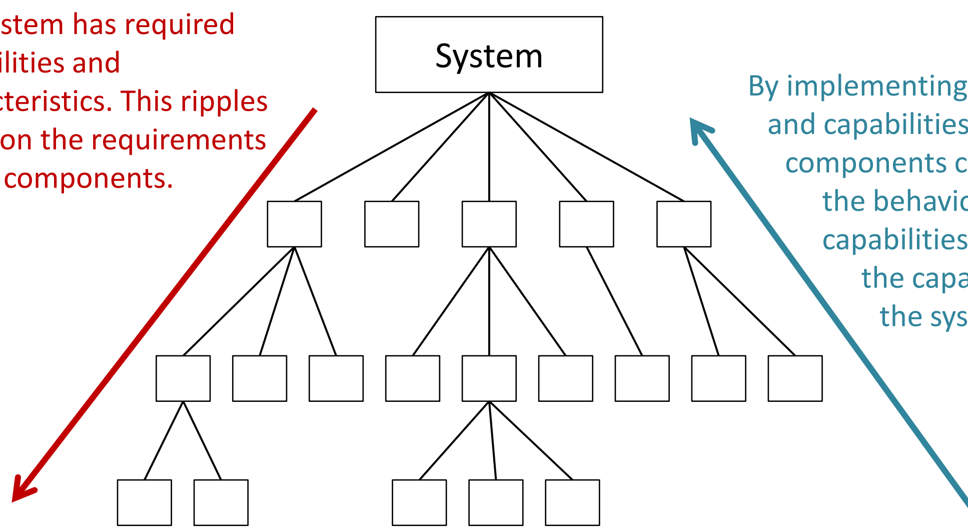
- Ability to perform a business function, to perform its role.
- Ability to perform an end-to-end process
- Ability to provide a service or to produce and deliver a product
- Ability to serve the supra-system or external customer

Implementing Characteristics



Systems and companies are/have:
- Connected
- Permeable boundaries
- Influences, interactions and exchanges among systems and between systems and environments and between companies and systems
- Consider that each system has its own environment (sub-environment of the company's environment or supra-environment). The environment not always / rarely a clear border. It is up to the practitioner to define its limits.

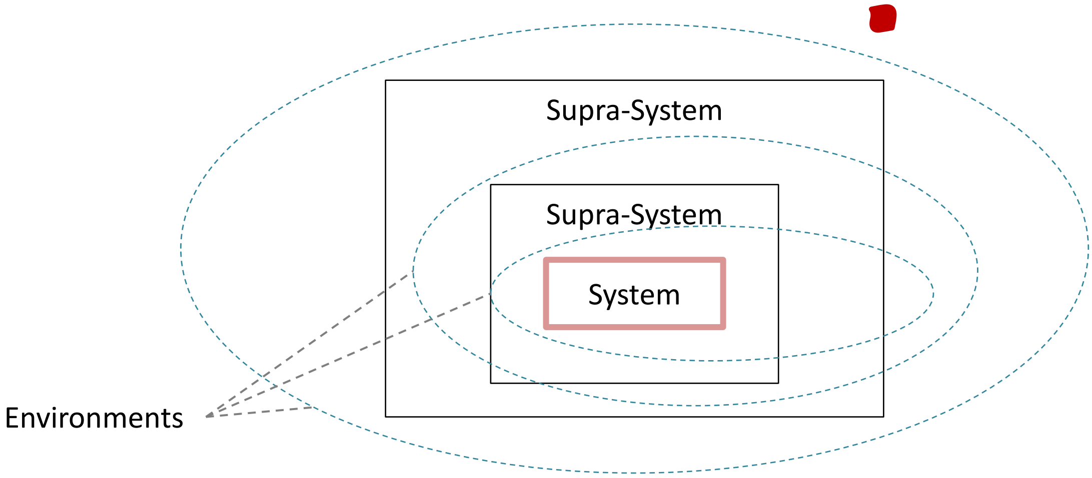
The system has required capabilities and characteristics. This ripples down on the requirements of the components.



By implementing qualities and capabilities, the components create the behaviour, the capabilities and the capacity of the system.

Besides this model, connexions need to be included in this model.

5 KEY INSIGHTS



1. System

- Purpose, structure, mechanisms, strengths, weaknesses, risks, prerequisites and limits. (This is valid for anything: process, methodology, system, …)
- Every part of a (clean) system has a purpose, a function, reasons, …

Important to understand this !!

2. Supra-system

- Including the supra-supra-system, the supra-supra-supra-system, …
- A system needs to be fully part of its supra-system (structural/systemic integration = integration by design).

3. Environment(s)

- must be determined properly (must contain everything influencing, even indirectly, in a meaningful way, the system), including those of the supra-systems
- the relations, interactions and influences between the environment(s) and the system(s).

4. Nature of the resources

- Resources and materials inputted, outputted and/or changed by the system

5. Internals weakening or that may weaken the system

- Internals: structures, mechanisms, dynamics and tendencies
- Among others, mechanism creating disequilibria endanger the system !!

For studying, analysing, engineering and managing systems
(like software systems, IS, IC, company, …)

Analysis Approaches have to include this !!

CRITICAL PRINCIPLES in SYSTEMS DESIGN (1)

Applicable to many types systems: political systems, governmental systems, economical systems, banking systems, organisational systems, rewards systems, system of (business) services, business models, information systems, …

1. Systems amplify the human capabilities. Some systems are stronger than individuals.

- A system amplifies human strengths and qualities.
- Systems also amplify the effect of human flaws (weaknesses, negative & destructive qualities) !! (*beware when designing*)
- A system can help avoiding people to make mistakes (information, control & preventive barriers)
- A system can be misused and abused.

2. System’s design must reflect reality

- System’s design must respect nature, natural principles, first principles, …
- through its structure, principles, relations, abstract concepts, mechanisms, …

3. A system must fit in its environment

- The environment interacts with the system.
- The environment as an influence on the design.
- The survival of a system depends of its environment. An environment can ‘decide’ and/or reject or terminate a system.
- The environment can’t be ignored
- If a system doesn’t respect the environment then it will be an enemy of that environment. Normally, the environment is stronger than the system.

CRITICAL PRINCIPLES in SYSTEMS DESIGN (2)

4. A system has to implement ALL the functions necessary to be viable.
    - These are more than the functions dedicated to the purpose or to end-users. Examples: control functions, protective functions, management functions, …

5. The system's lifecycle has to allow the system to deal with events happening during its lifecycle.
    - It deals with it or facilitates dealing with it, for example, by minimising the required adaptation.

6. A system has to respect key qualities and key capabilities.

7. The system has to respect spiritual values, universal values, moral values.

8. A system has to implement stabilising mechanisms, protective measures, safety measures, …

Key Design Principles for Man-Made Systems

Control and Protection

A system without control and protection mechanisms is at risk. Input, behaviour, performances, resource usage and outputs must be controlled.

Balance

Examples of balances are capabilities able to process approximately same amounts, win-win-situation, equity, and so on.

Modularity - Component-based

Modularity is achieved by having components that are loosely coupled (separation of concern) and high cohesion. Components can then easily be adapted and replaced. They create order. Components are also easier to support reuse.

Reuse

Developing for reuse can save a lot of time and effort. However, reuse requires a broader understanding and good anticipation skills. Components containing more general logic are usually potential candidates for reuse.

Internal Order

Internal order is, at glance of no concern of the business stakeholders. However, it reduces the time required to search for the concerned source code. It facilitates debugging, maintenance and adaptations. It decreases the learning curve. Order reduces complexity and complexity related risks.

Natural laws, Science, Rational Logic

Some laws, rules and principles may simply never been broken or the system won't work or it will lead to its decline. It is important to be aware and to understand these laws, rules and principles and where and how they apply.

Foundation

A system has to be based on a solid, well-organised foundation. The foundation can be organised in layers.

Knowledge – Insight – Truth

In large and complex systems or environments, it might be a challenge to acquire the required knowledge and insight. Often the truth may not be what we expect, want to hear or are ready to hear. But designing a system or solution with insufficient knowledge or a distorted mental image leads to problematic results

7 Main Survival Rules

A MAN-MADE SYSTEM has to

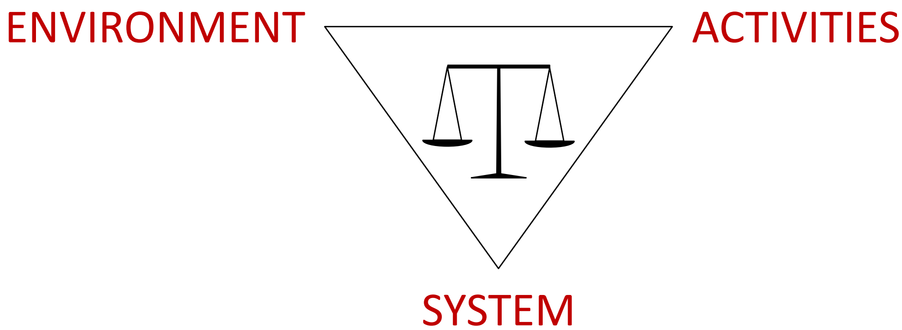
1) have a worthwhile purpose, to function accordingly and to use available resources for it
2) be useful, produce (real) value
3) fit in its environment and be accepted (acceptability: like moral, respectful, …)
4) fit into its supra-system and serve it by contributing to its purpose
5) have internal harmony: maintaining balance, reflecting real world, respecting natural laws, absence of conflicting logic, no mechanisms undermining the system itself, sound internal structure, …
6) be able to cope with events it will or is likely to meet during its lifetime
7) be better than competing systems or alternatives

during its whole lifetime (thus being able to evolve).

And …

- Each of these rules has many implications for the internals (the design).
- A broken rule can shorten the system's lifespan.

SURVIVAL



BALANCE AMONG THESE THREE ELEMENTS IS OF VITAL IMPORTANCE

System

A system that is neglected will deteriorate. As a result it won't be able to perform activities.

Activities

If the system doesn't fit with its intended usage or if it is not used (no activities are performed), then the system is useless. Some systems may 'rust' or die.

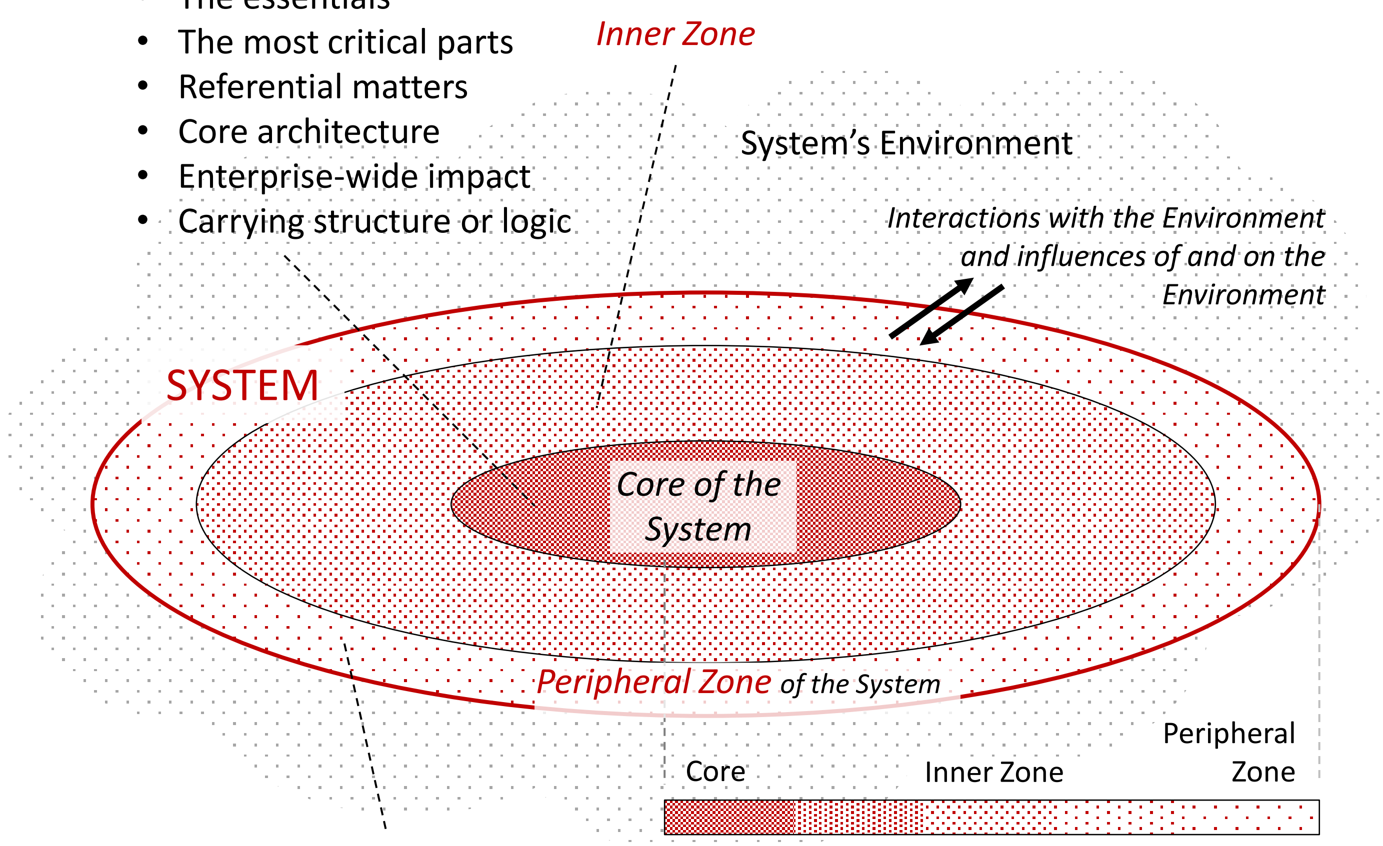
Environment

Each system exists in an environment. This environment is as important as the system itself. If the system is not aligned with the environment, if the system does not respect the rules of the environment, if the environment is not respected, then either the environment may kill, boycott or expel the system (like by stopping feeding the system) or the environment itself may deteriorate leading to the death of the system as well.

System's Layers

Core / Fundament of the System

- Core Logic
- The essentials
- The most critical parts
- Referential matters
- Core architecture
- Enterprise-wide impact
- Carrying structure or logic



- Non-critical functions
- Functions built "on top"
- Functions with local purpose and importance
- Features with temporary value
- Extensions
- Whistles and bells

Harder to change

Requires more stability
Is more likely to be stable

Easier to change

More likely to change

Notes:

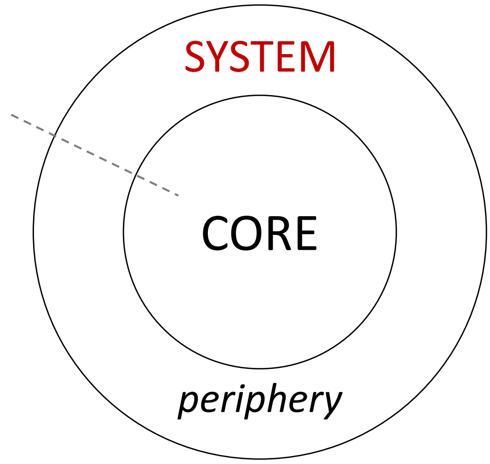
The number ad names of 'zones' don't matter. The concept does.

There are no real clear criteria or discrete boundaries between the zoned. It's all a gradual scale and it's up to the judgment of people how to deal with it.

The Core of a System

30/10/2018

Everything that shapes systems, affecting the Structural Design and Core Mechanisms, usually strongly related to the system's purpose



CORE CONTENT

- Core Processes
- Core Mechanisms
- Core logic of key processes
- Key persons
- Role, functions, capabilities of components
- Architectural Structure
- Architectural qualities (integration, fragmentation, separation, duplication, scalability, interoperability, …)
- Organisation of key resources (energy, matter, information, money)
- Components and Mechanisms required for survival and thriving

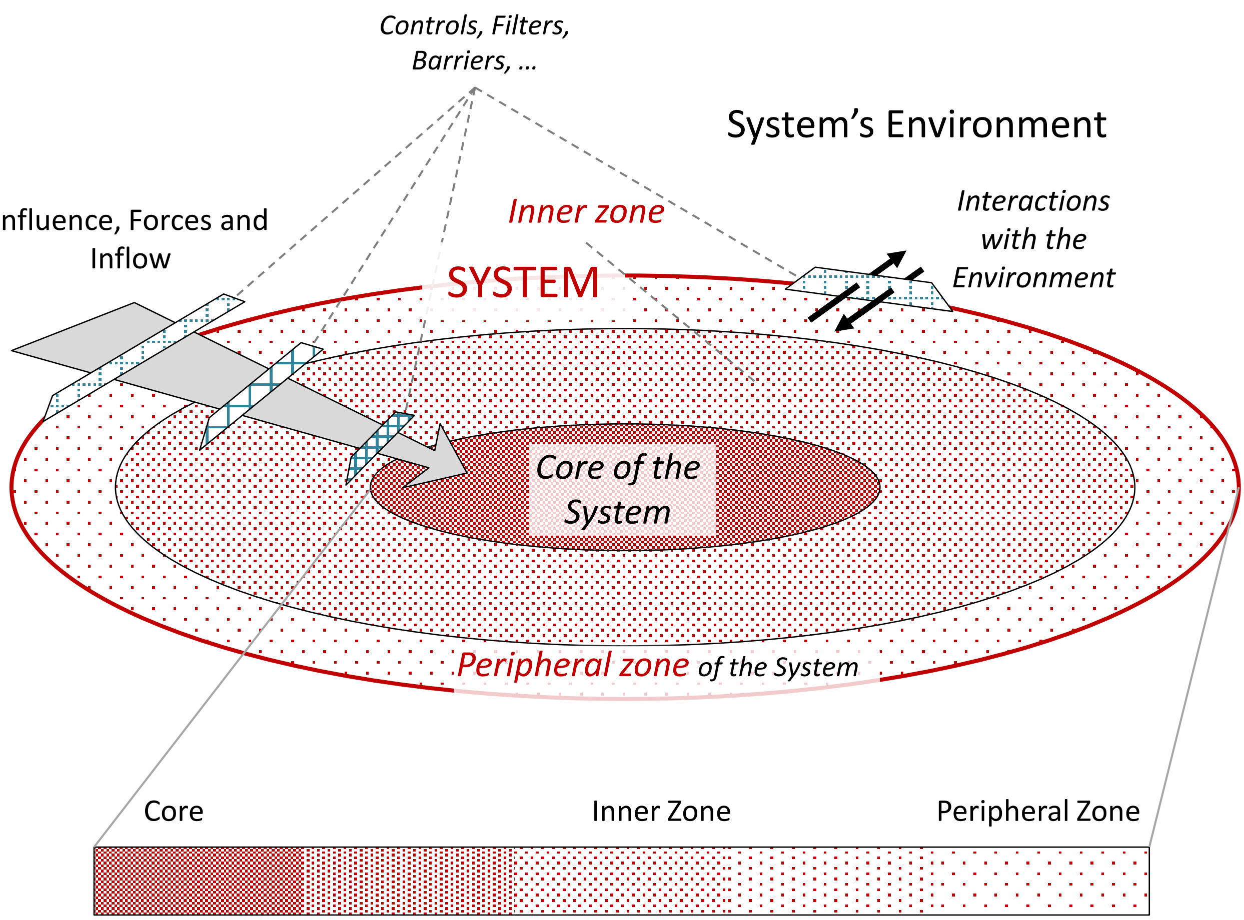
Adapting the Core requires huge changes, possibly structural changes. It is a lot of rethinking and reengineering. Often, it influences other areas across the system. The core should be well-thought and as stable as possible. *(How to increase the stability of the core?)*. A system can be organised with inner-core, outer-core, foundation, … These are just additional layers of the onion.

Periphery: (In software systems): features, user-interface, local logic, loosely coupled information, … Changes in the periphery may affect other aspects of the periphery, but won't affect the core and are often simpler, local and easier to implement. More layers are possible (like an onion).

Not an end-user or stakeholder's issue: Something might be important or even vital for end-users and can be located in the periphery !! Or inversely, something can be of no importance to the end-users but be part of the core layer.

System's Controls (Tests)

Inflows constitute a potential menace for the system.
Hence, they have to be verified.



- More protected
- Verifications aimed to verify good functioning

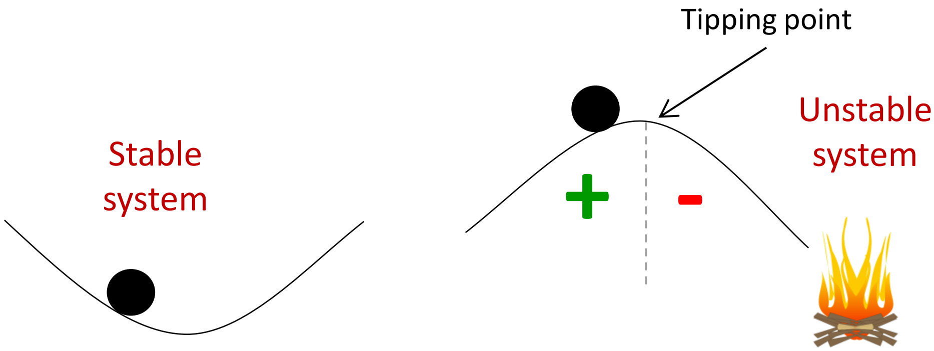
- Protects the system from its environment
- Deals with the interaction between system and environment
- Verifications aim to protect
- Contains a lot of tests of input and output, but particularly of inputs
- Contain sensors monitoring the environment

<u>Notes:</u>

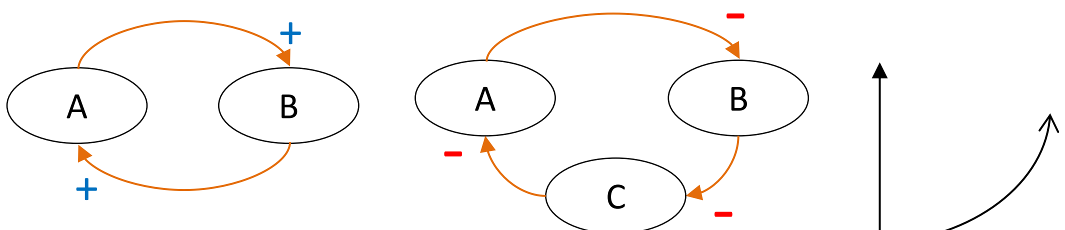
Verifications, security, quality, as well as other characteristics my be dependent of the role and place of the part in the system. The organisation of controls and other systemic functions has to be defined per system.

Mechanisms

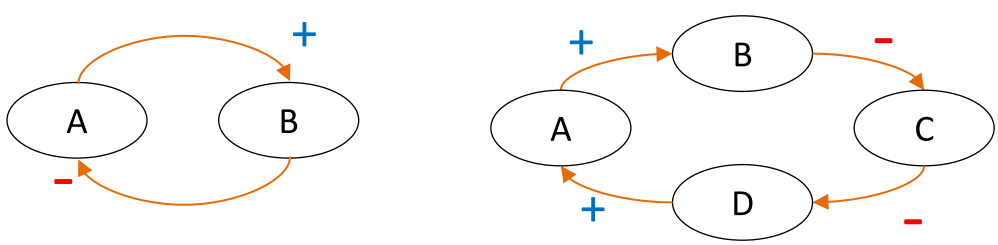
Stable and Unstable Systems - Tipping Point



Positive Feedback Loop – Reinforcing Loop



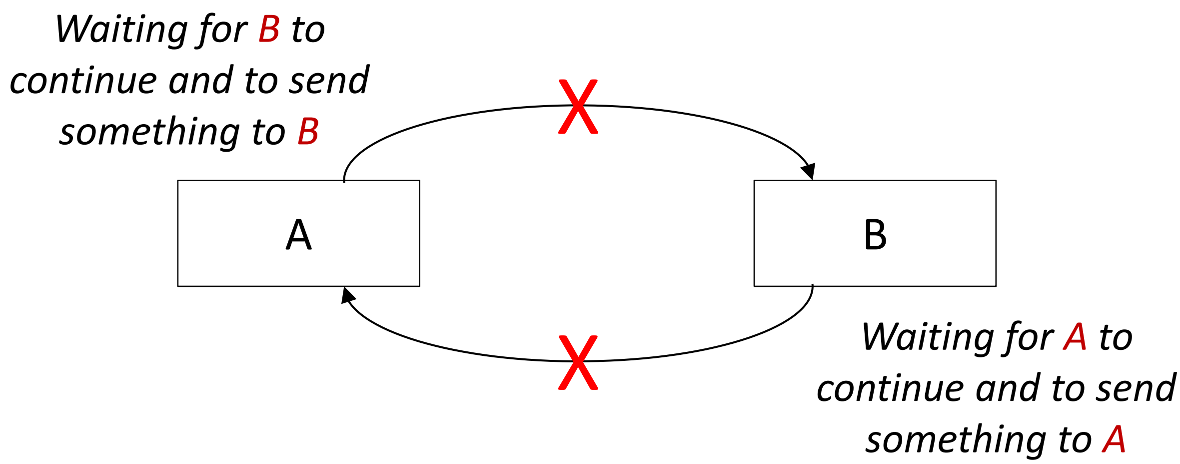
Negative Feedback Loop - Balancing Feedback



Positive and negative effects can be mixed in same dynamic model. The ensemble of these relations, their strength and the reaction of the components provides the final result.

Mechanisms

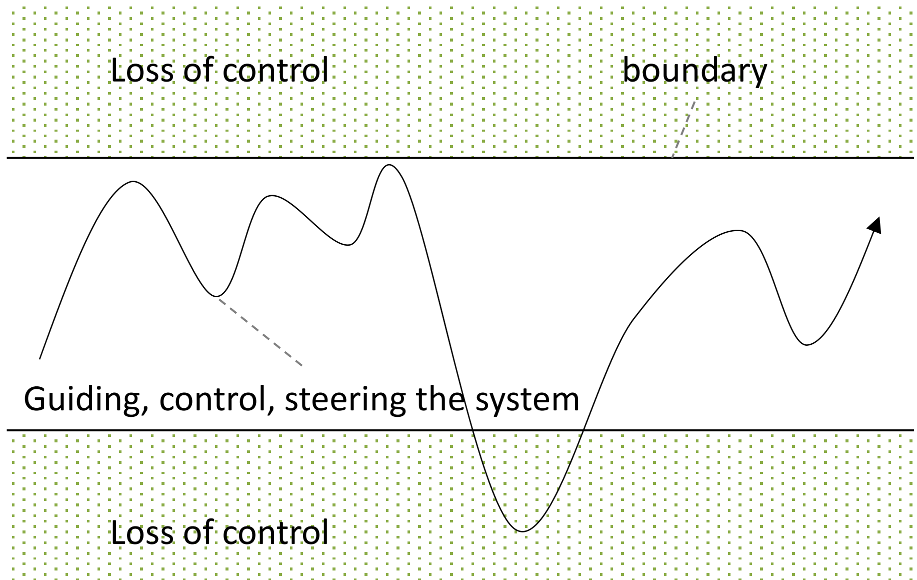
Dead Lock



Critical Mass

Critical mass is the minimal amount of something required to bring about an unstoppable dynamic, one that is hard to stop or one that creates an acceleration

Controlling Systems



- Individuals are allowed to control a system within some boundaries. As long as the steering individual stays within these boundaries, he remains in control. If the individual crosses a boundary, (s)he some or all loses control.
- Control is a continuous dimension.
- A system has many boundaries (limits, thresholds, breaking points, …).
- A boundary is not necessarily a precise line. It can be vague and broad.
- Crossing several boundaries may enlarge the effect. Crossing a boundary has not necessarily a linear effect on the system.
- Crossing the boundaries does not necessarily mean a loss of all control.
- These boundaries are not “fixed”. They are determined by the environment and by the system (thus defined by the designers and builders).
- Systems have to be respected. It is unwise for an individual to do whatever it wants with a system, unless it seeks to create havoc.

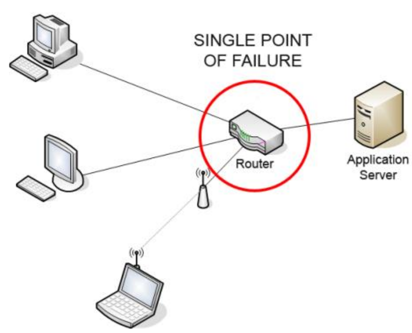
Notes:

Examples: human body, companies, information systems, climate system, financial systems, ..

System Failure

Weakest Link

Single Point of Failure

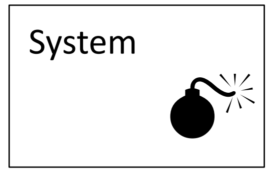


Definition: A single point of failure (SPOF) is a part of a system that, if it fails, will stop the entire system from working. (Wikipedia)

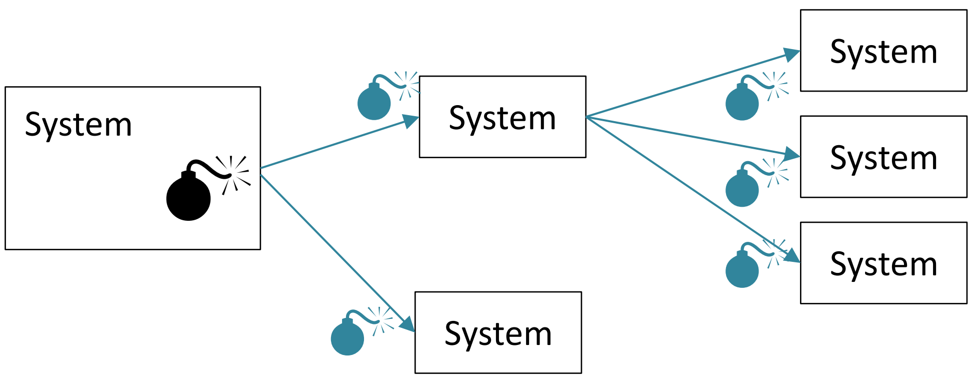
Applicable to any component, including users, interfaces, connections, services, external devices or tools, ... Components, tools and systems in other systems and organisations.

Domino Effect

Single System Failure



Multiple Connected Systems Failure (or SoS Failure)



Domino-effect

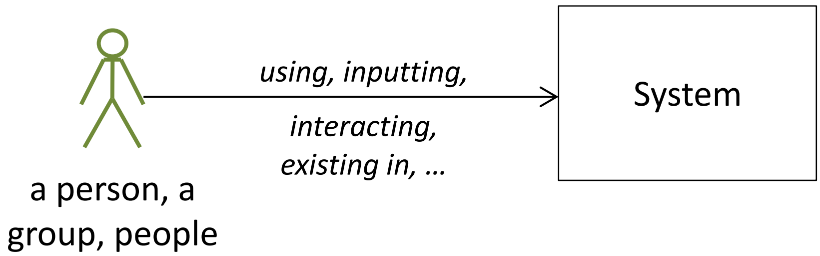
- A company is a set of inter-connected systems.
- These systems might be connected to external systems in other organisations.

How to conceive systems resistant to the domino effect?

Note:

Domino-effect is commonly considered as repercussions on other systems leading to their collapse. This is an extreme form. One problematic issue on a system may influence the functioning of other systems. Or, they may contaminate them. This influence is not necessarily direct, immediate and obvious. Sometimes, it may even be immaterial, like a loss of reputation and trust.

Interacting with Systems



A system

- ○ responds to this input, usage, force, influence, ..
- ○ accordingly to its own
    - Nature
    - Characteristics
    - Rules, Laws, Principles
    - Mechanism, dynamics
    - Capabilities
    - Limits
    - Constraints
    - …

Notes:

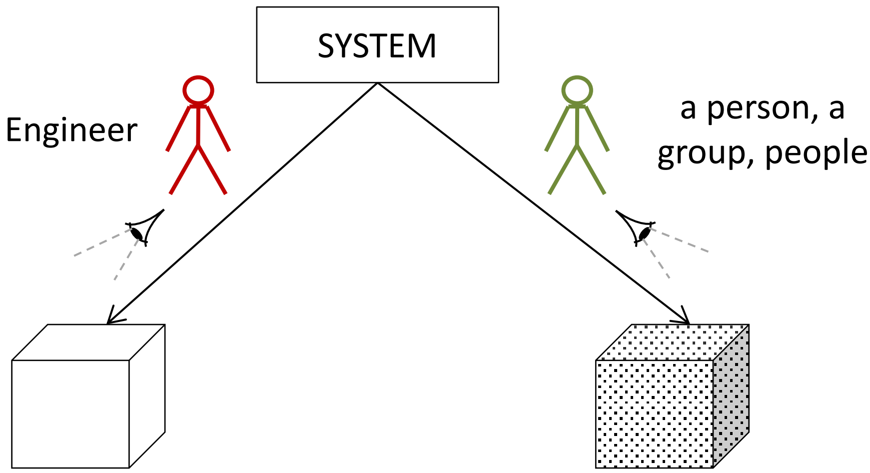
- A system receives a trigger, a signal, a kind of input, forces an influence or its operational environment changes and it reacts to it accordingly to its own nature and to its inherent logic regardless of what people want.

  Example: A car behaves well and follows the orders of the driver as long as crucial parameters remain within a certain range. If one or more exceed a limit, the car will act in a way not meant and not desired by the driver.

- The person (or the people) has to create the conditions, provide the right input and activate the right behaviour of the system. This will produce the desired output or result.

- Using or adapting a system that is only partially understood is very risky. One never know what new problems it introduces and how the system will react.

Managing Systems



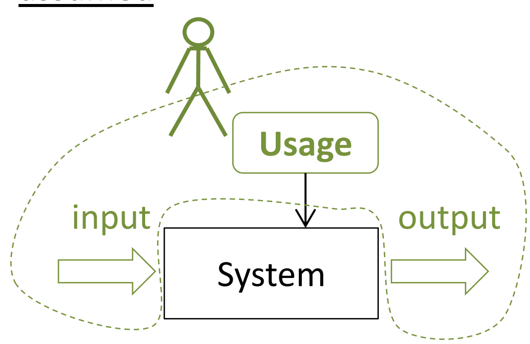
White Box

- Understands and has access to the system's internals

Black Box

<u>Limited understanding</u>

- Understands the system through its inputs and outputs
- Understands the usage
- Some internal functioning can be understood <u>or this insight can be assumed</u>



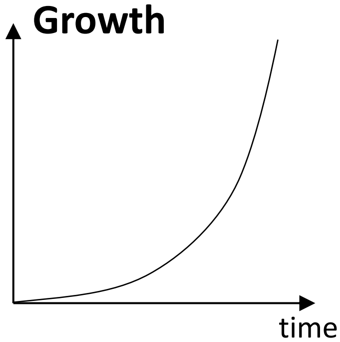
Real insight in the system's internals and having access to them, makes it possible to manage the system. It greatly reduces the risks.

Managing the usage, input, output, but also the environment can be achieved with black box insight. Managing may be very risky depending of the system.

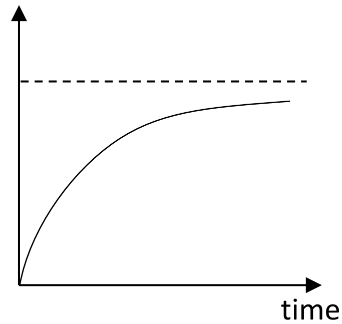
We can only manage what we understand.

Exploitation and Growth of Systems

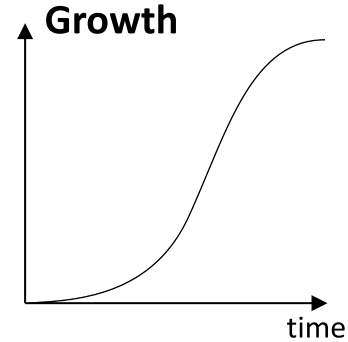
Exponential Growth



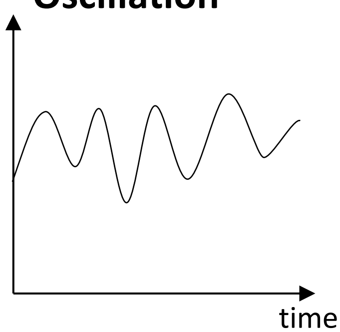
Goal Seeking



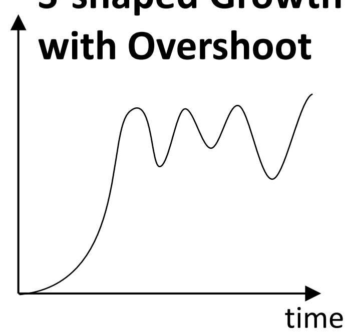
S-Shaped Limited Growth



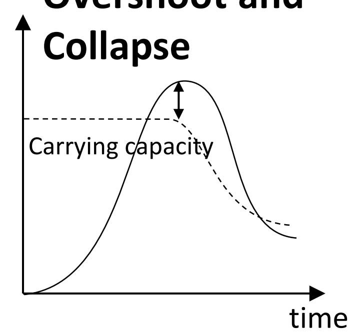
Oscillation



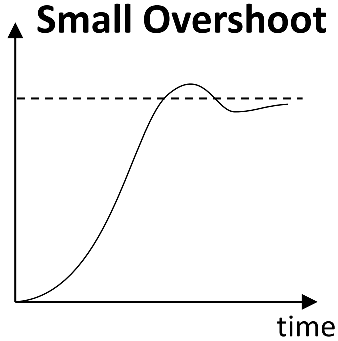
S-shaped Growth with Overshoot



Overshoot and Collapse



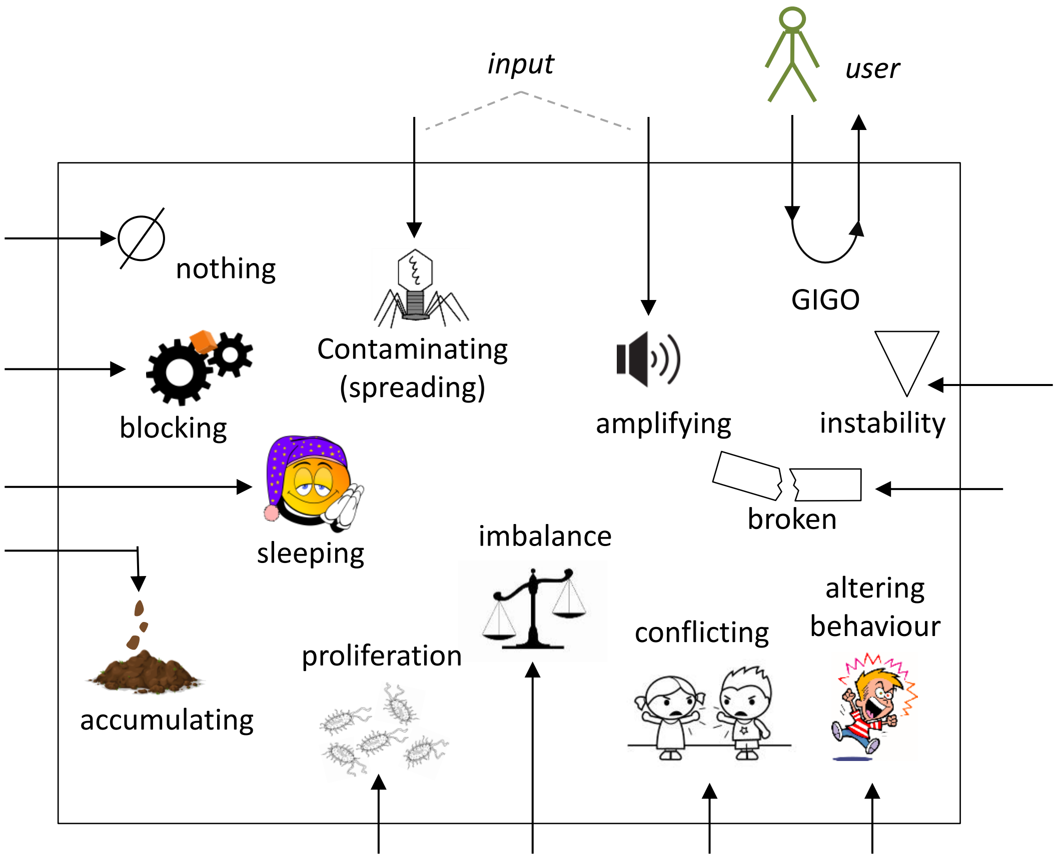
S-growth and Small Overshoot



Sustainability: Remain under the carrying capacity of the system.

Practical: Interesting to take decisions about capacity and scalability or for the implementation of mechanisms like buffers, triggers, alarms and controls.

Destructive Effects in Systems



Other effects:
increased pressure, wear and tear, frustration, demotivation, learning the wrong lessons, irresponsibility, lower values and norms, various damages, wrong drivers (motivators, reasons for doing something), uncertainty, confusion, increased sensitivity, negative forces (influences, …), aging, degradation of matter, SPOF, domino, destroying, slowing down, speeding up, erratic behaviour, unreliable, wear and tear, …

Note:

- Some issues occur in software systems, other in physical systems and other in human systems.
- Not all of the issues (applicable to software systems) can be detected through the user interface.
- Idea: Make a list of all possible types of problems that may deteriorate a system. Then indicate on what type of systems/matter it may occur (natural system, human system, industrial systems, business system, software system, …)
- Idea: Identify who can identify them and how to identify them (required competencies).

Decay of Systems

TENDENCY TO ENTROPY

OVER TIME

SYSTEMS

TEND TO DETERIORIATE GRADUALLY,

HEADING TOWARDS THEIR COLLAPSE.

MAJOR AREAS

- System's Functions
- Internal Organisation
- Usage / Input
- Resources

ISSUES

- Awkward to use
- Improvisation
- Patch and Pray
- Misuse, abuse
- Too many
- Illogically organised
- Vague
- Unreliable
- Missing
- Duplication
- Different forms and shapes
- Incoherent, inconsistent
- Conflicting
- Confusing, unclear
- Overly complex
- Ballast
- Unsuitable
- Not standardised
- Fragmentation
- Chaotic

Decay of Systems

TENDENCY TO ENTROPY

OVER TIME SYSTEMS

TEND TO DETERIORIATE GRADUALLY,

HEADING TOWARDS A COLLAPSE.

How to prevent this?

- Guiding the Usage
- Clarify Norms
- Barriers against Abuses
- Limiting the Freedom
- Appropriate Control Mechanisms
- Appropriate Monitoring Mechanisms
- Never lose control or give control away
- Foresee corrective mechanisms

Notes:

The more something is critical

- the more crucial it is to understand it fully
- to put the best people on it with the best competencies
- To acquire and strengthen the required competencies

Controlling and Managing a system requires advanced skills.

Dysfunctioning

Wrong Behaviour

Causes

- Structurally
- Logically
- Inappropriate materials, unsuitable application

Blockages, limits

Causes

- wrong interfaces
- inappropriate materials, materials don't fit
- inappropriate logic
- sometimes inappropriate structure

Rotting System

When a system rots, it often rots

- from the inside
- under the surface (unnoticed)
- gradually
- imperceptible

Causes are inappropriate or lacking internal mechanisms.

Frequent causes: Lack of controls, incoherent logic, wrong incentives, wrong control, wrong objectives

Notes:

The main idea is to give important clues to consider when designing systems (not just IT systems or software systems, but also all kinds of organisational systems).

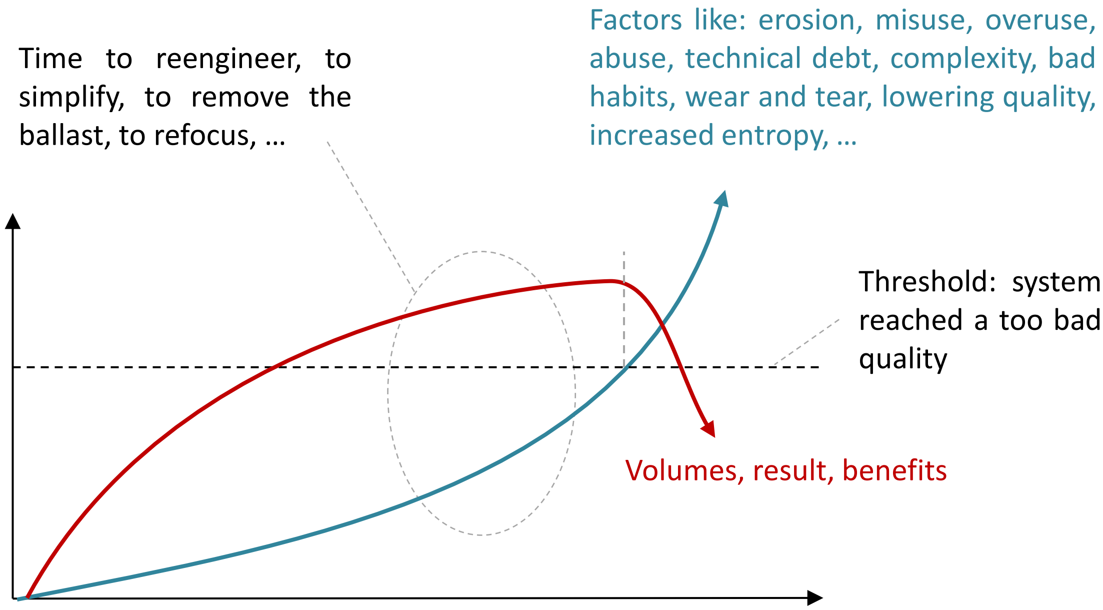
Therefore, the listed factors here may not be exhaustive.

Main Cases of Dysfunctioning Systems

- Not the right objective
- Not inline with the purpose
- Not taking the environment into account
  (insufficiently, underestimations, …)
- Not driven by the right forces (wrong incentives)
- Lack of controls and other protections
- Lack of manageability
- Overly adding complexity or oversimplifications
- Lack of integration
  (purpose, role, functional, logical, standardisation, …)
- Lack of training
- Abuses of systems

Can be prevented
by DESIGN

System's Gradual Decay



Gradually the system will decline. Erosion and other similar tendencies may undermine the system. Probably, this will first affects its performance and its results by a decline.

At a certain point, the cost/benefit (effort/result) ratio may become uninteresting. But an undermined system may also block or collapse. The decline may be sudden or gradually and predictable or unpredictable.

Beware: System's decay often happen internally, inside the system, under the surface. It can evolve for a long time under the radar. It takes some time before signs are perceptible and before the signs create awareness. Measures and analysis may bring these tendencies earlier to the light.

Note:

The lines do not represent the course of real evolution. They are only drawn for the sake of clarity, to explain the concept.

Self-Destructive Designs of Systems

A design of a system may embed its own destruction

Self-sabotaging system

A System that is in the way of its own intent or own goals.

Unsustainable systems

A system may behave, by design, in a way that it is unsustainable.

Self-destructive

The design may implement mechanisms destroying the system itself.

Systems Failures in Time

Short Term

- Inappropriate
- Missing capabilities or functions
- Incoherent Logic
- Defective
- Missing parts
- Integration issues
- Access issues
- Interaction issues with supra-system or environment (inputs and outputs)

Usually tested

"Does it work and is it usable ?"

CAN BE ROOTED IN BAD CONCEPTION !!

Long Term - Survivability

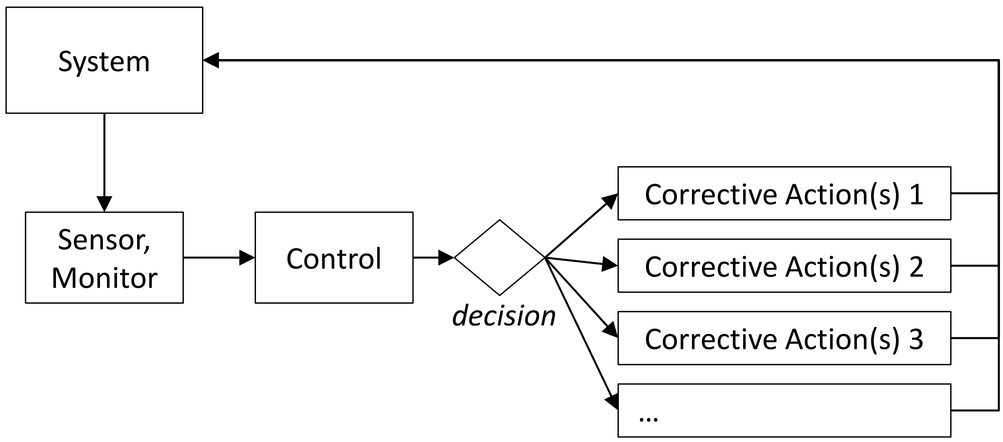
- Gradual internal decline

  example: quality of information declines
- Possibilities for misuses and abuses
- Flexibility & Evolvability

  Adaptability, connectability, interoperability, extendibility, scalability
- Unsustainable input and output
- Evolution of behaviour
  - Internal behaviour
    - Creating internal imbalances and disharmony
    - Encouraging undesired behaviours
  - External behaviour

    Behaviour unacceptable and unaccepted by the system or by the environment

CONTROLS



Controls are vital mechanisms for any system. Their aim is to ensure the right behaviour of a system, improving its efficiency, indicating when to adjust or adapt.

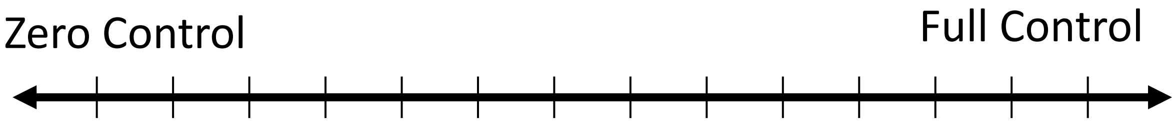
Controls are a matter of survival of the system

A system without controls or lacking of appropriate controls, and lacking of appropriate corrective mechanisms coupled to these controls, is prone to deterioration, abuse, fraud or any other form of decline.

Note:

- A team, an organisation, a company and even a society are also systems.
- Corrective actions can be, among others, adapting the system's behaviour, adapting the system, adding limitations, sending an alarm signal, changing a status, replacing parts, etc. A corrective action can be taken ad hoc.
- It is possible to control the controls. Questioning the efficiency of controls often happen only after a disaster struck. The question is then raised why the controls didn't function or how to improve the controls.

Controlling a System

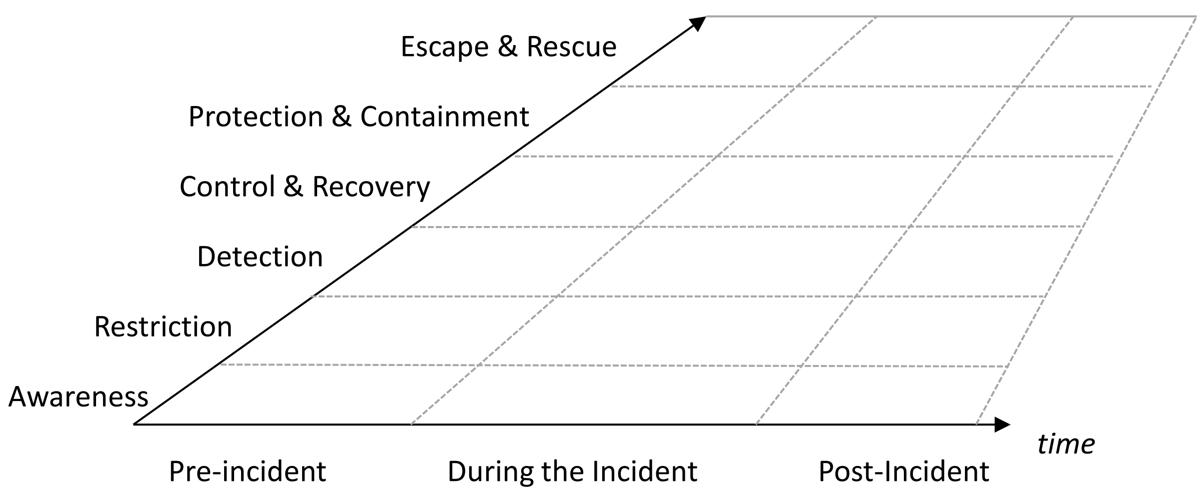


1. Ability to monitor the system
2. Understanding the interface
3. Possibility to adjust the behaviour and output of the system
4. Possession of the necessary competencies to adjust the behaviour of the system
5. Understanding the internals of the system
6. Possibility to adapt the internals of the system and access to these internals.
7. Possession of the necessary competencies to adapt the system

These aspects are not binary questions (yes/no). Their answer has to be expressed as a degree.

Barrier Functions in a System

Prevention	Awareness	Deeper understanding of the matter; Insight and understanding of how system works, of risks and hazards.
Prevention	Restriction	Limitations of actions or imposing to establish necessary pre-conditions before an action or processing.
Prevention /Resolution	Detection	Verification/detection and warning mechanisms
Mitigation	Protection & Containment	Limiting further damage or losses being inflicted; Avoiding spread of damage, such as contamination
Resolution	Control & Recovery	Managing the incident, taking measures Recovering with minimal harm or loss



Control mechanisms, recovery systems, back-ups, emergency procedures, and so on have to be elaborated before an incident happen to be used either during or after the incident.

During an incident new restrictions can be imposed, such as access limitations.
Awareness of the incident and of what and why actions can be taken is different from the awareness necessary for normal operating conditions.

See pages "Incident Investigation"

Some key notes about Systems for Engineers

1. Man-made systems are engineered or can be engineered (majorly, not necessarily for 100%).
2. Characteristics are engineered into man-made systems. They do not always materialise as intended and some appear spontaneously. Some characteristics are necessary or desired, while others are not. It is desirable that the creation of capabilities and characteristics happened in a methodical, intentional and controlled way. This belongs to the essence of engineering. Systems Engineers seek to determine what characteristics and capabilities are required and to engineer them into the system.
3. Systems have capabilities, capacity, prerequisites, minimal and ideal operating conditions, constraints, tipping points, breaking points, limits, weaknesses, bottle-necks, deadlocks, SPOF's, … .
4. A system reacts to input, to forces and to changes in the environment in which it operates.
5. A combination of specific factors or exceptional circumstances may trigger a complete change in the system's behaviour. The change of behaviour can be (partially) unexpected due to lack of insight in the system, the circumstances and its environment.
6. A system reacts and behaves always accordingly to its own logic and characteristics. It follows always its own program. Piloting (or using) a system is in fact providing an input to the system. This input triggers a reaction and a behaviour of the system which will create an output or outcome. The pilot (user) loses control when the system exhibits a behaviour that was not intended or when the output is unexpected. Unsuitable circumstances in the environment or inside in the system or an incorrect input won't lead to the intended result.
7. Misuses of systems is more important when the user doesn't know how to use the system or when the freedom of the user is not under control.
8. When a system's purpose is changed by design, or when a system is used for another purpose than the one intended by its design; the system is usually either lesser efficient and effective. This usage may even weaken or deteriorate the system.
9. A system may implement principles, concepts and mechanisms which may undermine itself from within. It may exhibit self-destructive behaviours and tendencies.
10. Flexibility and freedom increase the complexity and risks of misuse and abuse. Freedom should go together with responsibility, competencies and wisdom.
11. A system is equipped with internal controls to protect itself from misuse, abuses, other external influences, inappropriate circumstances and input.
12. Having as goal meeting the criteria of "a working system" leads to mediocre systems. This represents only a single perspective. Meeting more and higher norms is imperative.

Some key notes about Systems for Engineers

13. Some consequences of a problem are visible. Some are undesirable effects that are experienced. The shortest and cheapest way to eliminate these annoyances is to mask or solve them, or sometimes by dealing with their direct causes. This is why consequences, symptoms, are often solved and not the real problem. We label them too easily as cause (cause of annoyance). We neglect to look to their cause, and then to consider this cause as a consequence and to look further upstream until we find the root cause.
14. Solving consequences allows the underlying problems to continue to exist.
15. Solving symptoms makes systems more complex. We don't solve problems, we add solutions, layers, exceptions and by doing so we create chaos.
16. A system forms a whole. Changing something may impact the whole system or may impact it on a different place, area or aspect as the one where the change occurred. This is why it is advisable, and sometimes even imperative, to understand the whole system before changing it or seeking to change the system through influencing it.
17. In mechanical systems the interactions are much easier to understand. Therefore, the causes and consequences are easier to detect. In more abstract or complex systems; like organisations, software systems or natural systems; the logic and the interactions are much lesser obvious.
18. Understanding the environment and the interactions, tendencies, forces, opportunities, threats, events and other influences between the system and its environment is essential to engineer suitable systems.
19. It is wise to get first the foundation, the carrier structure and core part, right when engineering a system.
20. An approach based on systematically accumulating parts and changing logic is more prone to result in a overly complex, disorganised, confusing, incoherent, ineffective, inefficient system. A system is more than the sum of some elements. Structure, internal organisation, order, coherence, interactions, alignments of parts are key to systems.

For man-made systems,

"Good" is "NOT Good Enough"

- COMPANY –

2 PERSPECTIVES

COMPANY as SYSTEM

COMPANY as ENVIRONMENT

Looking Outwards

Looking Inwards

Link Company – Information System

Why discussing the company in Information Systems Engineering ?

- The company forms the <u>environment</u> of the Information System. The IS has <u>to fit</u> into the company and must be able <u>to operate</u> in it.
- Information Systems are parts of the company. They have <u>to be aligned</u> with the company, its business model, its strategy, its culture, operating model, ….
- All information systems have <u>to contribute</u> to the company's objectives. The company is their supra-system.
- Information systems <u>influence the company</u>. They implement and influence its functions, capabilities and characteristics.
- Company and its environment <u>influence aspects of the IS design</u> and its functioning. They both play a critical role in the determination of objectives, role, purpose, functionalities, capabilities, characteristics, behaviour and constraints of the IS. They also determine or influence the logic and architecture.
- Information systems and information may <u>drive the business</u> and are a source of <u>innovation</u>.

⇩

The conception of the IS must respect the nature of the company.

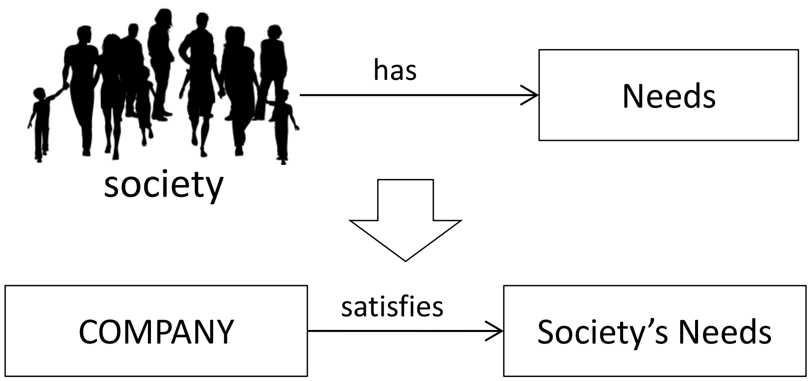
⇩

The IS Engineer must understand what companies are,
as well as the specific company and its environment,
and take them into account.

<u>Notes:</u>

- If the company requires to be flexible, can the IS be rigid?
- If the company requires to be manageable, can an IS be an unmanageable black box?
- If a company is a guided system, can ISE then be a directionless process?

What is a Company?



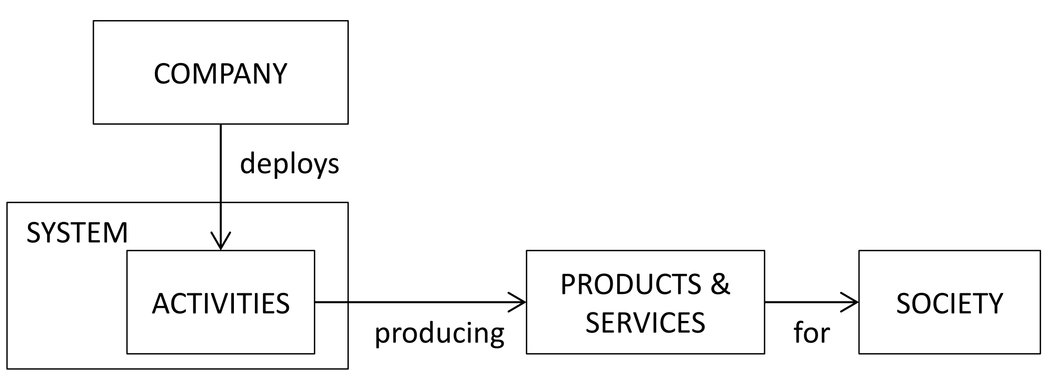
Company's Purpose

- Providing value to the society
  - Society: people, living beings, environment
  - How? Through its products and services
- Making society to progress

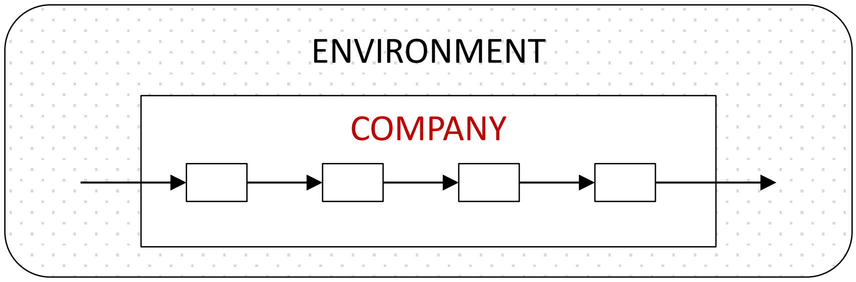
But, it is also

- a formalised entity consisting of people working together to a common goal
- a way for people to contribute to society and to make a living
- a way for personal growth

Achieving the Company's Purpose



Company Is a System



A company is a system that produces products and/or services and sell them in order to prosper.

A company is a man-made open dynamic purposeful evolving socio-technical managed living system

Man-made	→	understandable, manageable, …
Open	→	interaction with environment
Dynamic	→	has a behaviour
Purposeful	→	has a specific role, intend, objective, …
Evolving	→	changes, adapts
Socio	→	containing people
Technical	→	containing machines, computers, tools
Managed	→	controlled, managed and guided
Living	→	**complex system seeking to exist and to prosper**

These are goals, capabilities and characteristics that approaches, methodologies, methods, architecture and sub-systems have to take into account, to respect, to implement, or to contribute to.

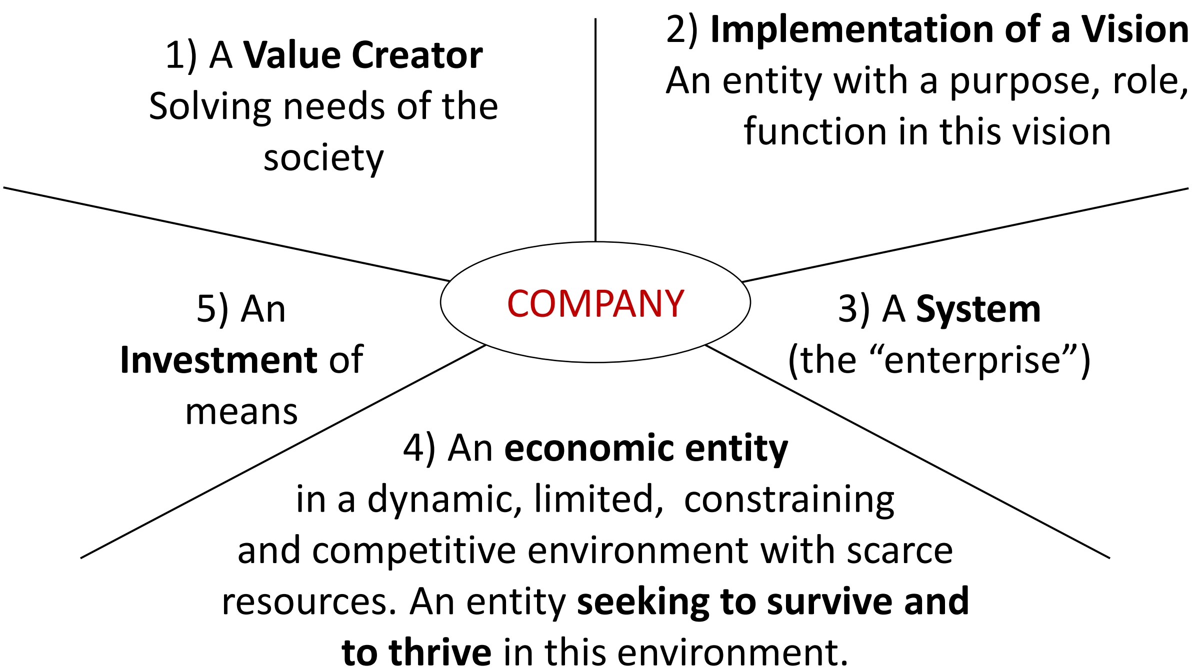
What is a Company

See also the few pages in section

"FOUNDATION – Core Ideas"

What is a Company ?

5 Perspectives



Complex, man-made, dynamic, open, heterogeneous, managed, guided, economical, socio-technical system

- A perspective is only a limited view on a company.
- The company’s (sub-)systems have to comply and to be aligned with the whole ensemble of these perspectives.
- Each perspective brings its own understanding, priorities and requirements. None of these perspectives can be ignored.
- Each has its own far reaching implications in aspects like the development approach, priorities, design or even organisational and collaborative aspects.

The Analyst has (to understand and) to reconcile these perspectives.

5 Perspectives

Implementation of a Vision

Some companies are truly implemented to realise a vision. Others simply evolved without. They simply deployed activities, took decision and seized opportunities which appeared as the most beneficial at that moment. A vision provides guidance and focus. It helps to concentrate the activities on some type of work, on products and services, on needs and/or markets. The entire company has to build on a coherent whole and direct its effort to a common goal. This is mainly a top-down guidance. It avoids inefficiency due to development of unrelated activities in different directions.

Value Creator

A company that doesn't create value for the society is useless. It's a parasite. Value is created through activities. Competition forces the company to be effective and efficient. The company has to stay ahead by having better products and services. Customer relation and innovation are crucial. Innovation requires a propitious environment and advanced skills.

An Investment

An investment is the allocation of money in the expectation of creating or getting a benefit. Typically, the investor takes the decision to invest based on ideas, plans or studies demonstrating the likelihood of a creation a benefit. The investor seeks to know more about the initiative in advance. These plans have to be implemented and executed.

Economic Entity

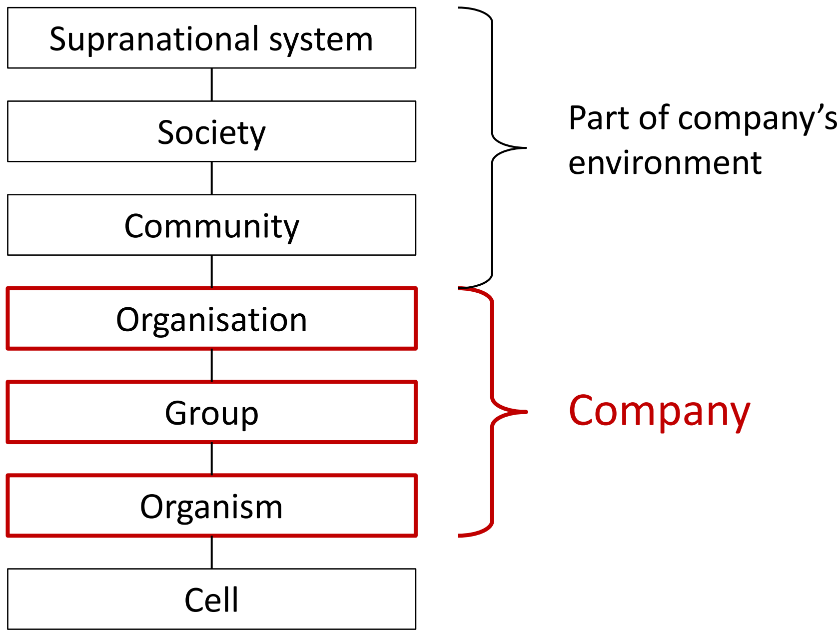
An economic entity is about value creation through the production of goods and services in an effective and efficient way. It seeks to maximise its return on investment. Money is a critical mean for a company to survive, to function and to adapt.

System

A company is a system. Some of its parts function in an undefined (free, ad hoc, erratic, variable, unpredictable) way. These parts don't suit the concept of 'system'. The system-like part of the company must be treated as a system. The company has to evolve, to renew itself. It has to engineer itself. Systems engineering (engineering of systems) is a key discipline.

A Company is a Living System

Living systems are open self-organising living things that interact with their environment. (Wikipedia)



Living systems try to remain alive, to grow and to prosper

Living systems transport:

Matter

Energy

INFORMATION

Organisations (including the architecture, subsystems, capabilities, ...) must be designed with these abilities in mind. What are the implications?

Living systems

- maintain themselves
- organise themselves
- develop themselves
- adapt themselves

A matter of survival

What does the society need? How does the society evolve? How do we envision a future society?

Opportunity to contribute to society ↔ Vision

⇩

What role will our company play in the creation or evolution of this society and by respecting what values ?

Mission | Values

⇩

What main products (or type of products) and (kind of) services will our company produce that will contribute or change the society in line with our vision, mission and values ?

Main Products & Core Services

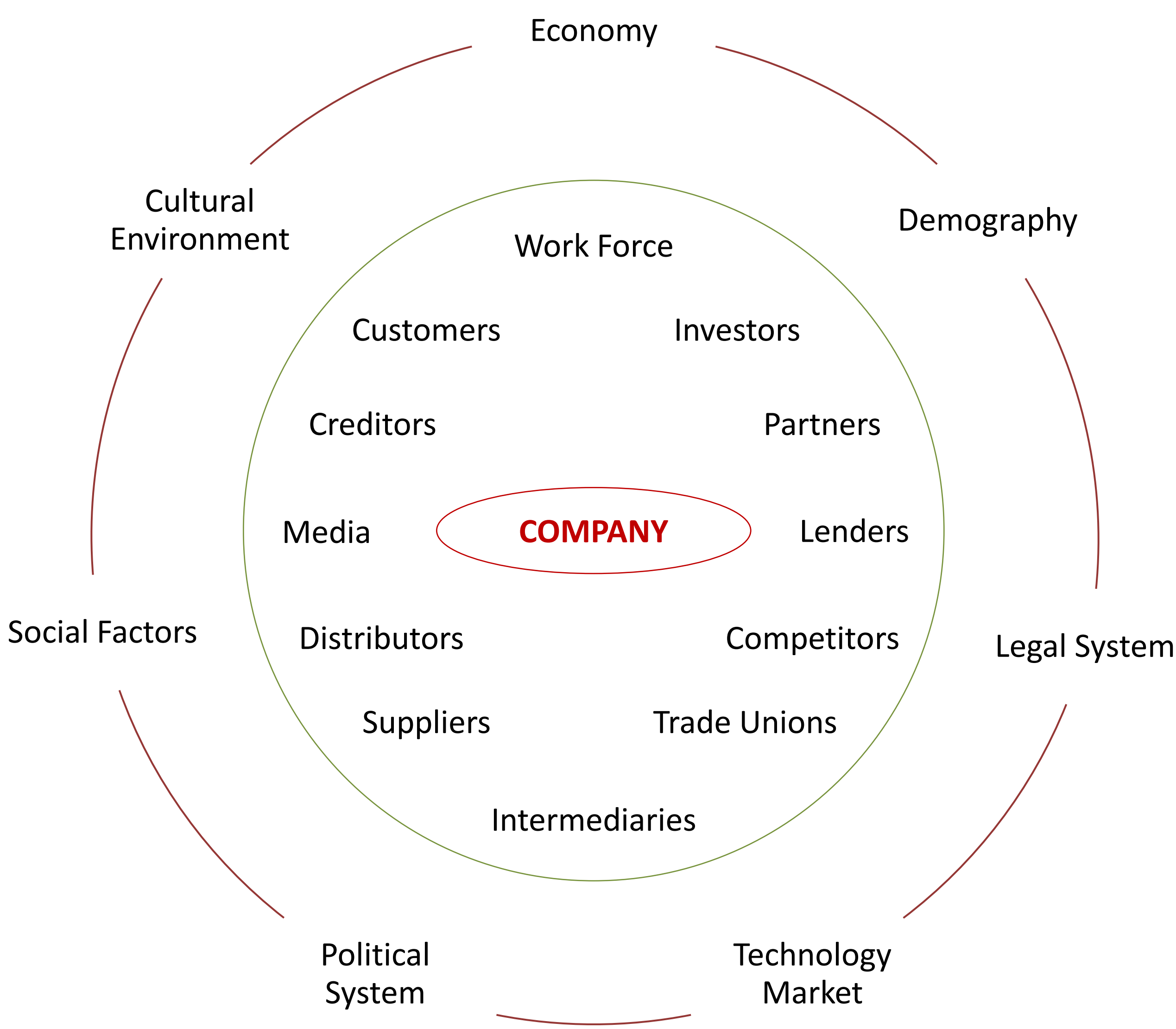
⇩

What high-level system has to be created in order to produce these products and services and this while being inline with the vision, mission and values?

Value Network ↔ Business Model ↔ Strategy

Notes

Company's Environment



A entity that can only exists if its environment allows it

Notes

A company operates in an environment. This environment provides opportunities and threats. The company's internals are influenced by this broader environment. The company has to fit in its environment. → Understand the environment and take it into account when conceiving solutions.

See also

- Pesteli-Framework
- Michael Porter's Five Forces Model

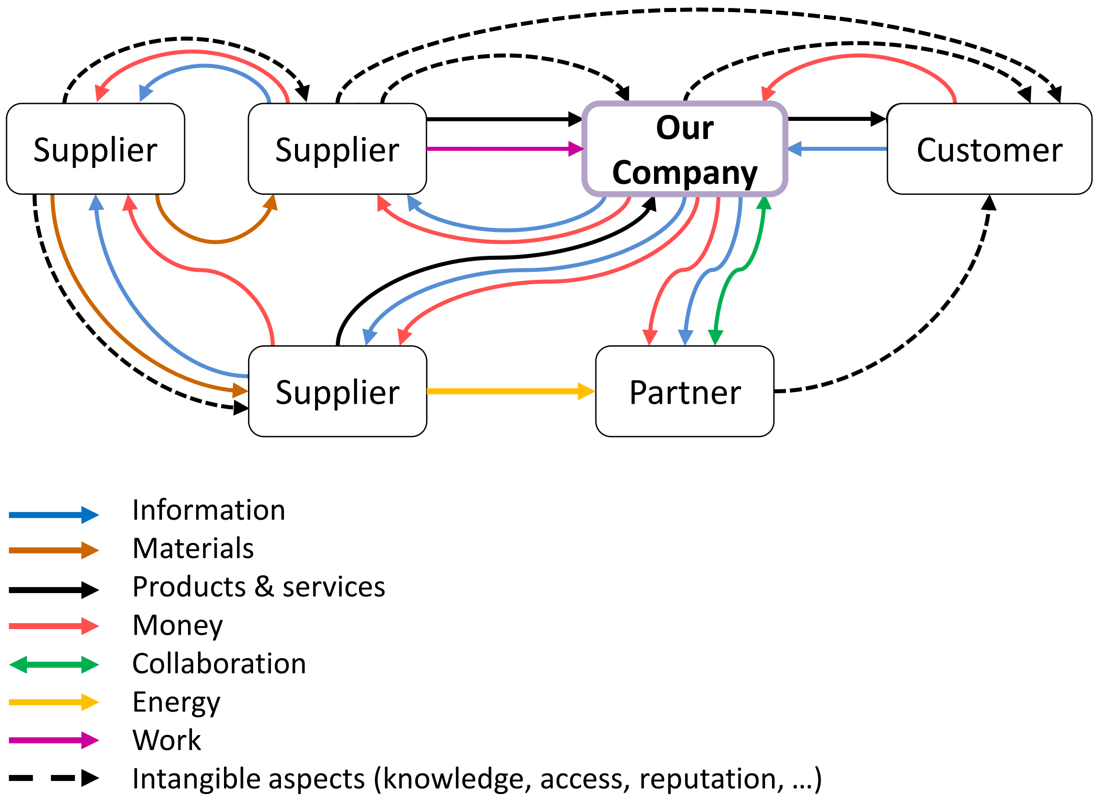
Company’s Environment

- Society
- Community
- Country organisation
- Governments
- Political system
- Politics
- Law makers
- Legal bodies
- Economical system
- Healthcare system
- Financial system
- Recreation
- Ecology
- Technology
- Natural environment
- Climate
- Partners
- Suppliers
- …

- Competitors
- Suppliers and partners of competitors
- Clients
- Prospects
- Work force
- Trade unions
- Academic Institutions
- Research centres
- Media
- Transport infrastructure
- Communication infrastructure
- Energy infrastructure – Energy supply
- Water infrastructure
- Service providers
- Raw materials
- Resources
- Waste disposal infrastructure
- Social Security

Company's Supra-System

VALUE NETWORK



Notes:

- Represents
  - What party creates what value
  - Exchanges: Flows set up between different parties involved in the creation of value (final product) and for the deployment of business activities.
- Flows can be enriched with descriptions and other data (value, capacity, delays, …)
- Suppliers, transporters and distributors are part of this system.
- Model can be enriched with plenty of information: amounts, problems, critical/optional flow indicator, positive/negative exchange, and so on… Own symbols can be used.
- We don't just set up a company. We create a much broader system beyond the company's borders with clients, suppliers, partners, … An analyst has to look even beyond the company's borders.
- Example: Supply Chains, Distribution Networks

The Business Model

The **Business Model** describes the global business idea.
It answers the question: “How do you (plan to) make money?”

It provides an overall framework for developing a coherent and streamlined and focussed set of activities to create value.

More detailed questions:

- What value is created?
- Who are your target customers?
- What customer’s problems or needs will be solved?
- What are the products and/or services?
- Who are the customers ready to pay for them?
- How do you reach, acquire and keep customers?
- How do you differ from the competitors?
- How do you produce the products and services (from a business perspective, not from a technical perspective)? And how do you get them to the clients?
- What is the turnover?
- What is the cost structure?
- What is the profit margin?
- *And so on..*

Note:

The “Business Model Canvas” is a template for developing a new or documenting an existing business model.

Business Model ≠ UML model

Business Modelling ≠ Business Process Modelling (!!!)

A business model is a response to an opportunity and has to suit the company, be appropriate for the product and market and fit into the company’s environment.

Business Model Canvas

<table>
<tr><td colspan="2" rowspan="2">Key Partners</td><td colspan="2">Key Activities</td><td colspan="2" rowspan="2">Value Proposition</td><td colspan="2">Customer Relationship</td><td colspan="2" rowspan="2">Customer Segments</td></tr>
<tr><td colspan="2">Key Resources</td><td colspan="2">Channels</td></tr>
<tr><td colspan="5">Cost Structure</td><td colspan="5">Revenue Streams</td></tr>
</table>

Business Models

LIST OF TYPES OF BUSINESS MODELS

Add-ons/In-app purchases
Advertisement (Ad-based) model
Affiliate/Referral fee
Aikido
Auction model
Bait and Hook model
Barter or Swapping for products
Barter or Swapping for services
Brokerage model
Cash Machine
Commission-based model
Cross Selling
Crowdfunding
Crowdsourcing
Customer Loyalty
Data model
Digitalisation
Direct Sales model / Direct Selling
E-Commerce
Early Exit strategy
Experience Selling
Flat-rate
Fractionalised Ownership
Franchise model
Freemium model
From-Push-to-Pull
Get-one-give-one model (G1G1)
Guaranteed Availability
Hidden Revenue
Ingredient Branding
Integrator
Internet Bubble model
Layer Player
Leverage Customer Data
License fees
Lock-In
Long Tail
Low-Cost model
Make More Of It
Manufacturing model
Mass customisation
Merchant model
No frills model (discount or budget model)
Open Business model
Open Source model
Orchestrator
Pay-as-you-go model (PAYG)
Pay-per-use model
Pay-what-you-want (PWYW)
Peer-to-Peer
Performance Based Contracting
Premium model
Razor and Blade model
Recurring Revenue model (subscription model)
Rent Instead of Buy model
Revenue Sharing
Reverse Engineering
Reverse Innovation
Robin Hood
Self-Service
Shop-in-Shop
Single purchase model
Solution Provider
Subscription model
Supermarket
Target the Poor
Tip jar/donation
Trash-to-Can
Two-Sided Market
Ultimate Luxury
User Designed
White Label

Note:

Not an exhaustive list

These business models are like templates. The chosen model is a starting point and has to be adapted and further developed to suit the company's specific situation.

Strategy

A STRATEGY is a long term plan, 5 years of longer, for a company (organisation) to realise a vision or to achieve a goal.

A strategy is (often) meant to change the position of the company in the market.

A STRATEGY is

a PLANNED PROCESS of TRANSFORMATION of the company

- the Business Model
- the company's Value Network and partnerships (partners, collaboration, suppliers, sources, …)
- its activities
- the company's location
- the company's capabilities
- the company as system
- its products or services
- its policies, rules, principles, …

A strategy "predicts" the internal changes.

To **increase the chance of a successful execution** of a strategy

- The strategy has to be communicate to all the company's employees
- The enterprise (the system) has to be changed in time
- Information is required to understand the company and its activities and to understand how the strategy works out.

Notes:

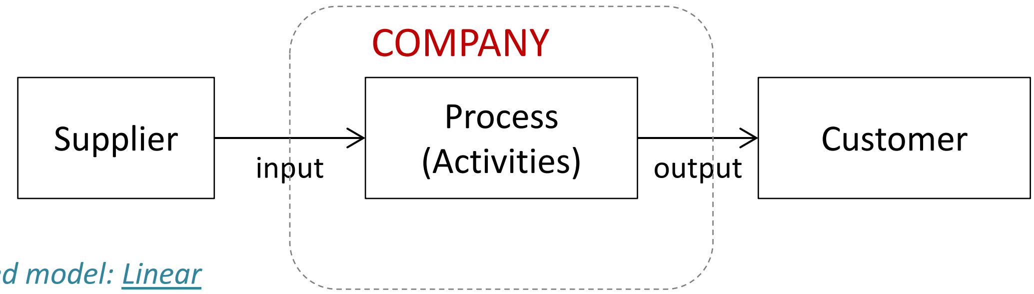
This is the main idea of a strategy. A strategy may also be related to priorities, timing, policies, resources, leadership, company culture, competencies, internal organisation, and so on.

The timespan of a strategy concerns, by nature, years (like 3 to 10 years).

"strategic" is often confused with terms like 'important', 'critical', 'key', 'fundamental', …

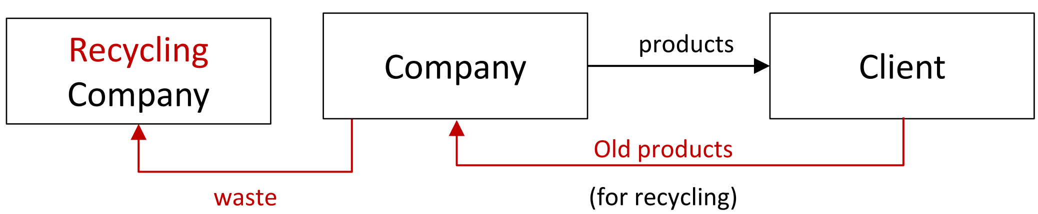
Basic Business Models

SIPOC – Model

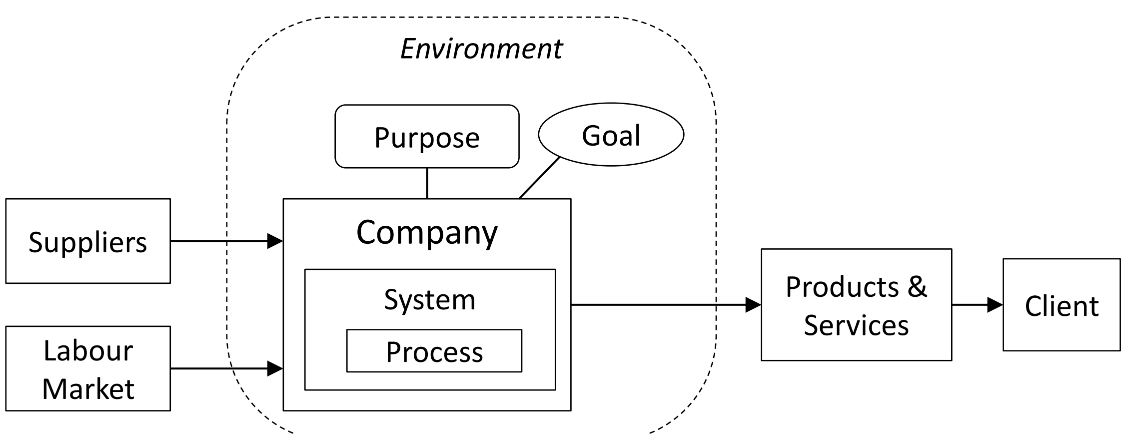


Limited model: Linear model. Not holistic.

Cyclic Model

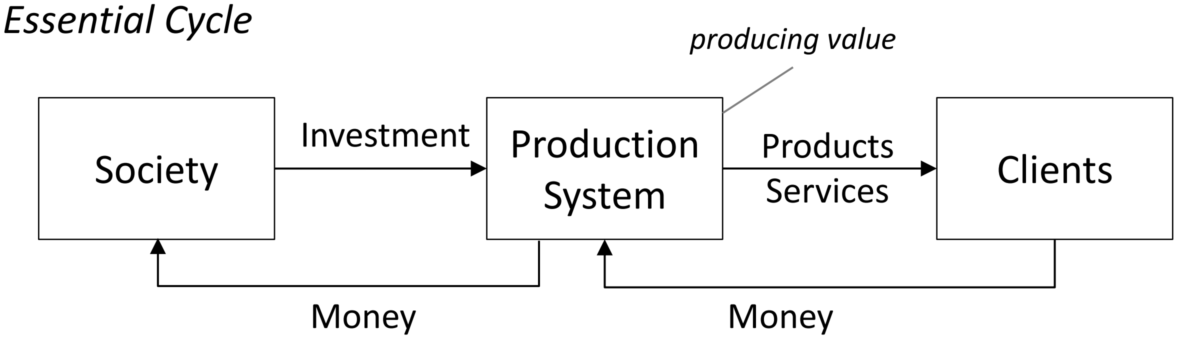


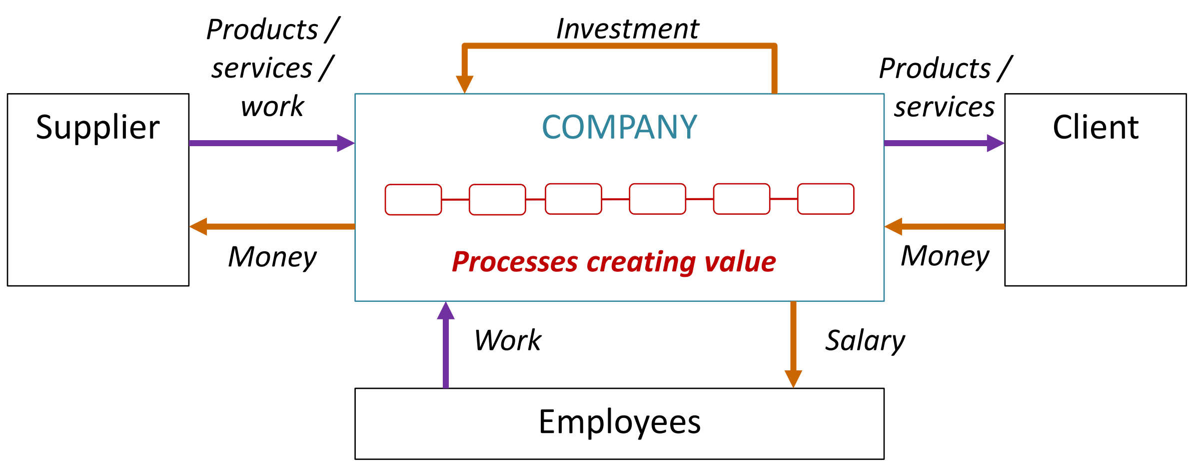
Remark: This is an example. Different cyclic models are possible.

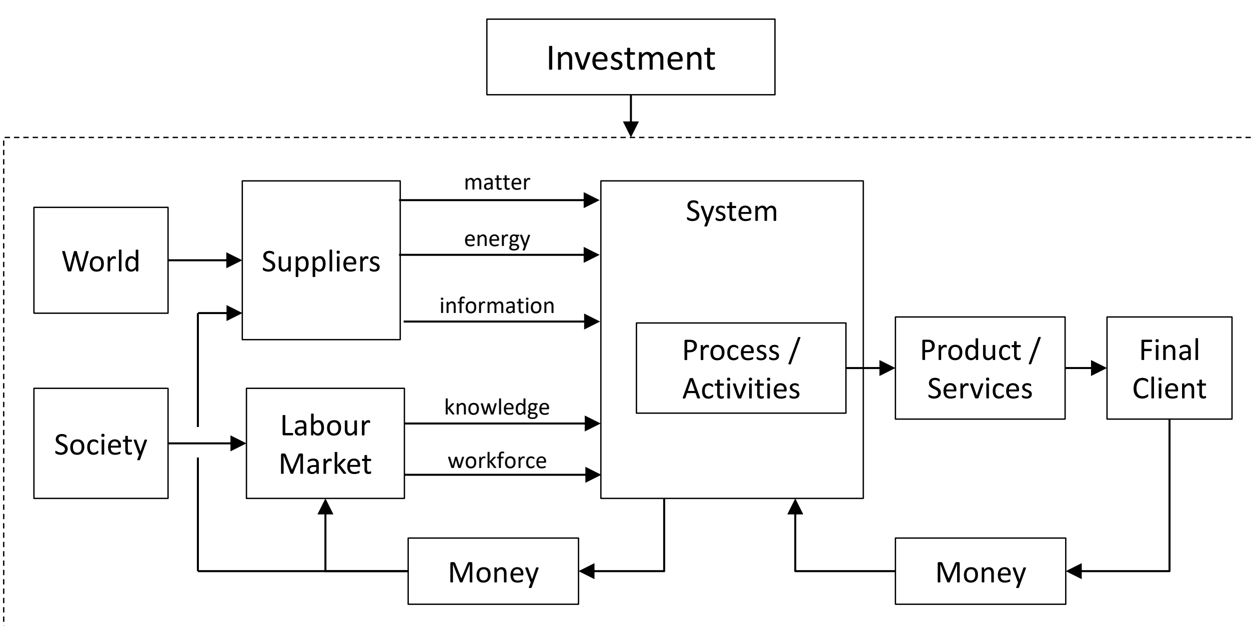


Basic Business Models

Essential Cycle

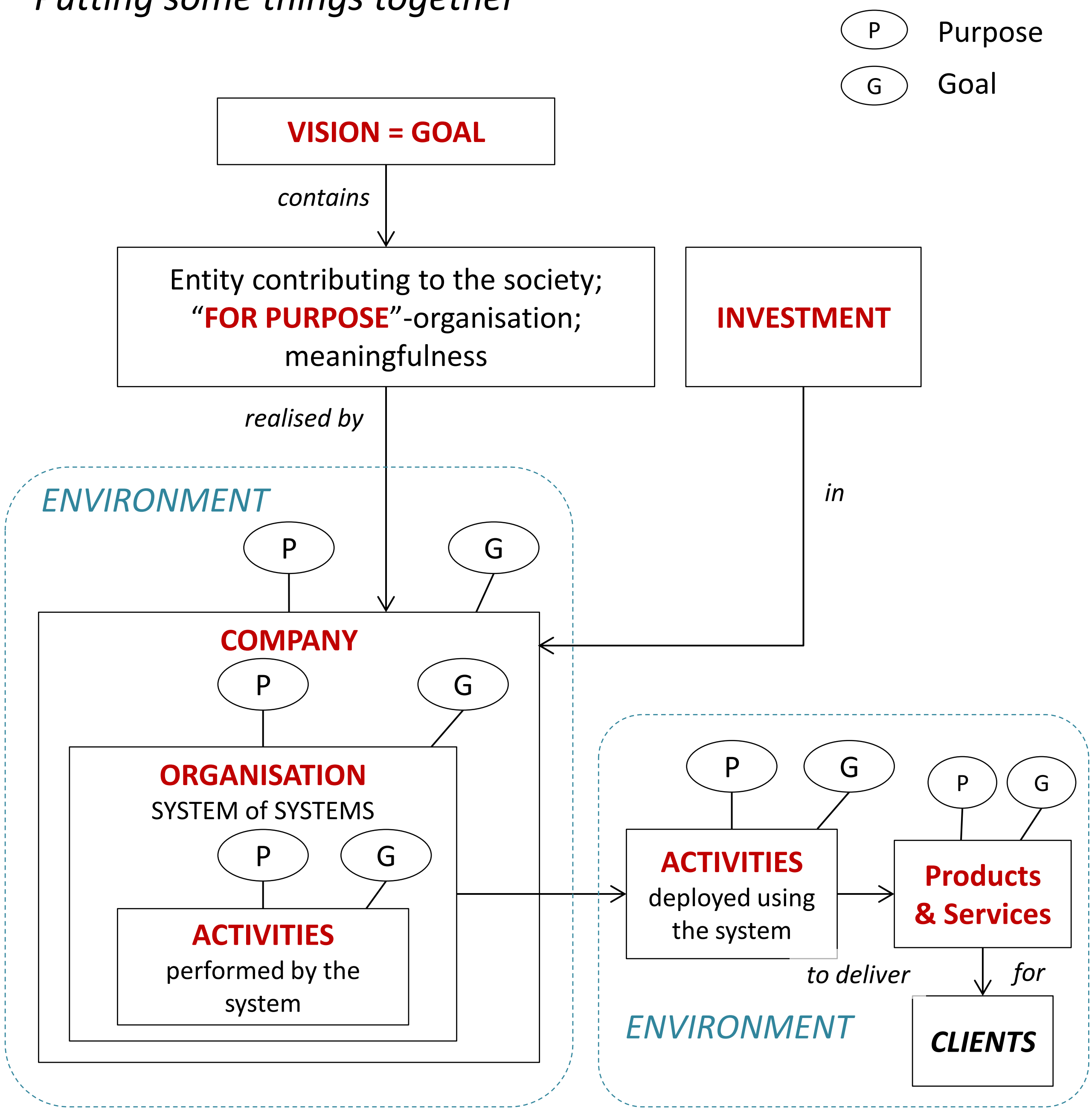






Overall View

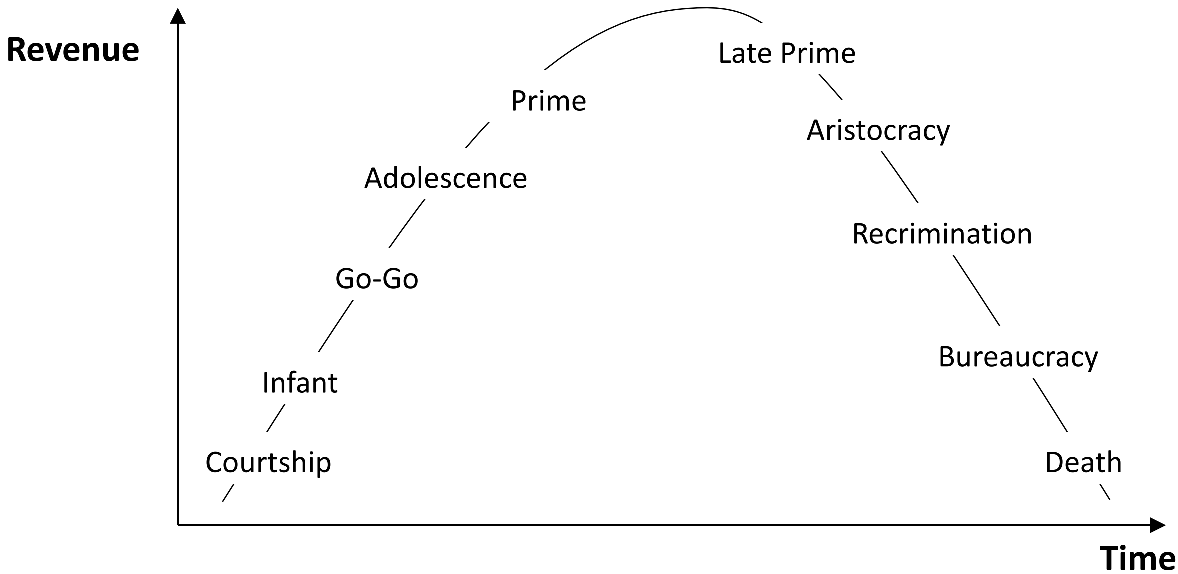
Putting some things together



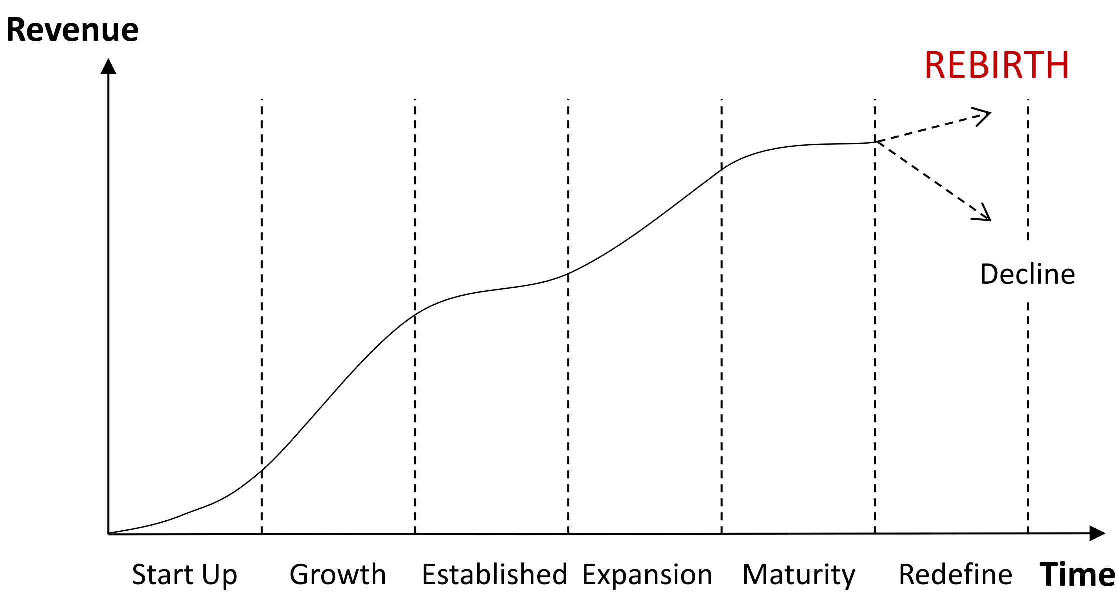
Notes:

Everything has or should have a purpose and a goal (target, intention, reason, …). Knowing it is important to understand what and why we do things, why they are necessary (or not), …

Company's Life Cycle



A more optimistic model …



Notes:

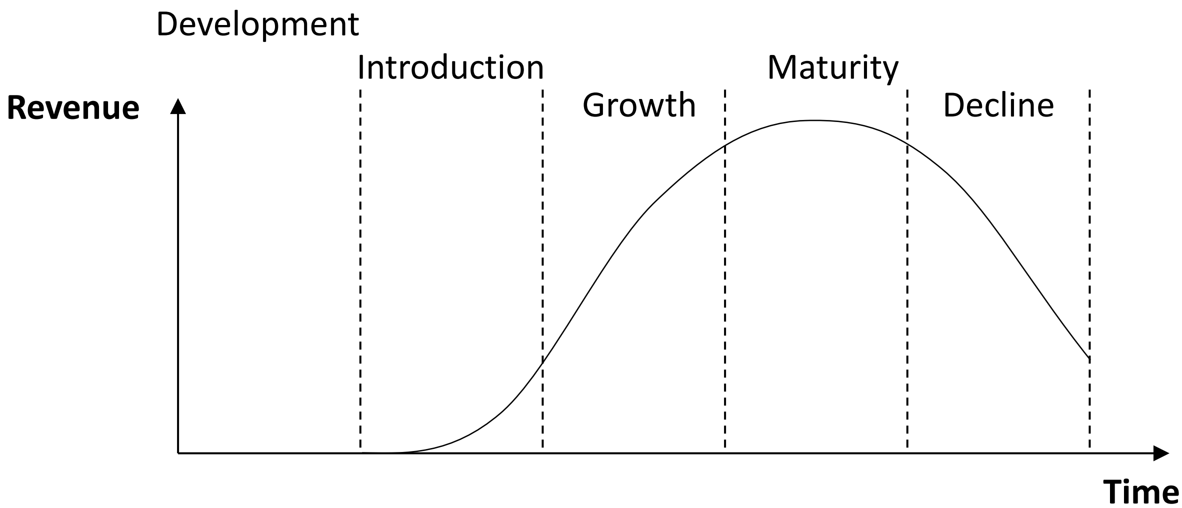
Model may represent the maturity of a set of competing products on a market.

Cost of development, sales, sales revenue, profit, …may be added to the graphic.

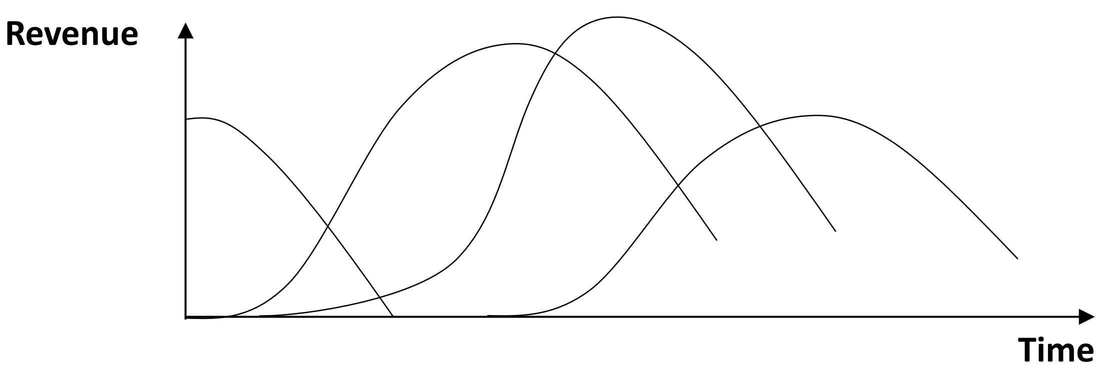
Why do companies end? To avoid at all cost. Sub-systems have to help to prevent this.

Simple linear model. Why? Can it be different? Why?

Product Life Cycle



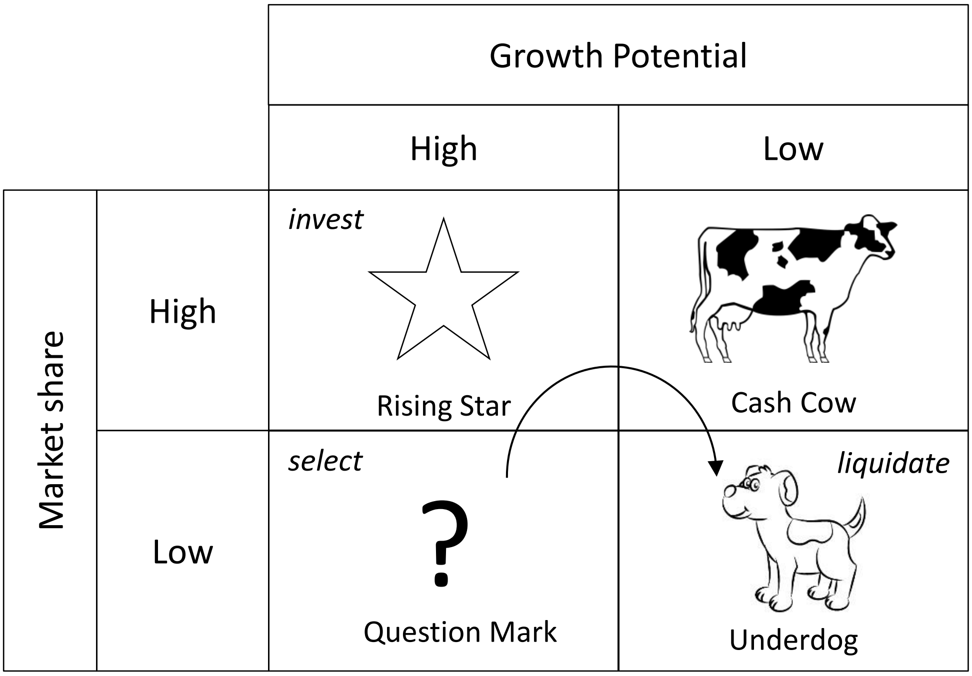
Company's product portfolio



Impacts projects and systems.

A company strives to have always one or a set of growing to mature products to ensure permanent stream of income.

Product: BCG - Matrix



Notes:

Question marks: Uncertain products, services, activities, opportunities

Rising stars: Selected good opportunities

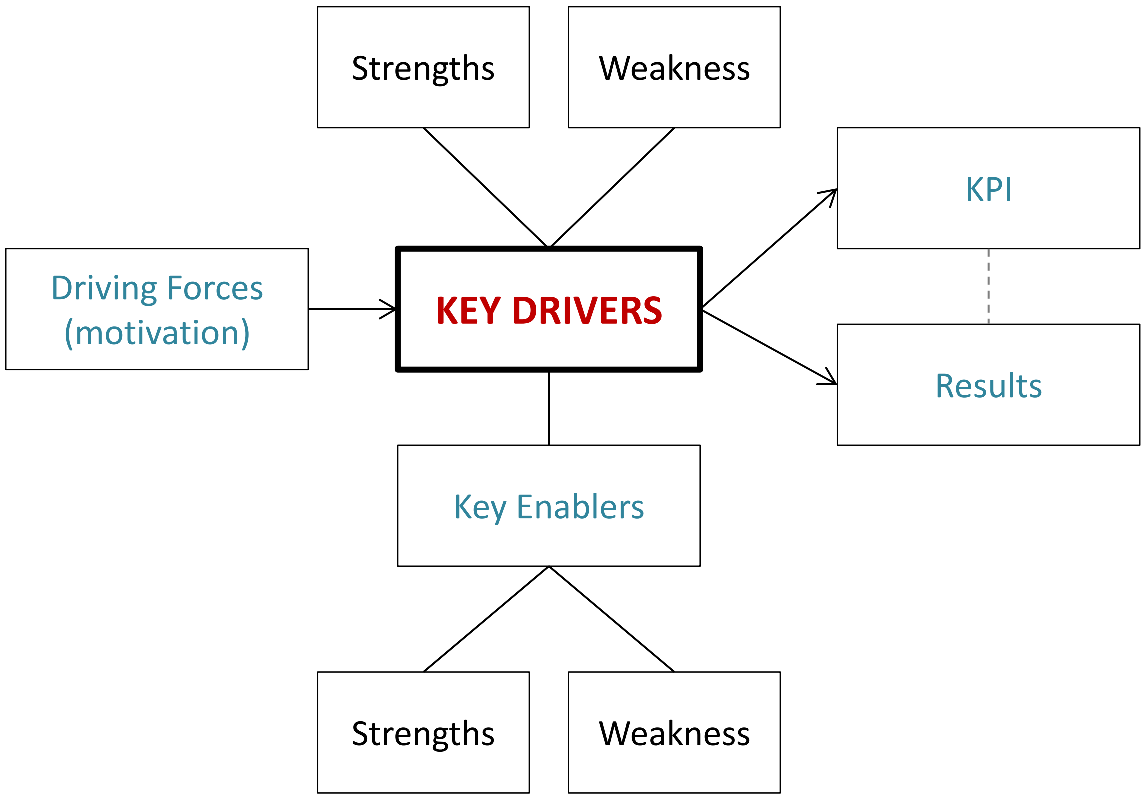
Cash cow : provide business volume, benefits, …

Underdog: old products and services in decline. Revival (innovation) or disinvest?

The BCG-matrix must be considered in the light of the strategy and business priorities.

A company needs to have cash cows and rising starts that, later, will become cash cows. Therefore it needs to invent new products that will evolve into new rising stars.

BUSINESS KEY DRIVERS



Understanding quickly the essence of business and where to look for improvements

Notes:

Identify the few key drivers generating most of the business results.

Identify their main enablers allowing the drivers to function

Understand the driving forces (motivation, reasons, intentions, ...) driving the drivers?

Results are expressed as measurements of the KPI's (there are also PI's (Performance Indicators))

Know the strengths and weaknesses (+ risks) of the drivers and enablers.

The key drivers must be considered in the light of the BCG-matrix, the strategy and business priorities

Still need to understand the environment and the relation between this core aspect of the business and the environment.

Company's Evolution Drivers

	Top-Down (mainly)	Bottom-Up (mainly)
External drivers for change		
• Markets ………………………………….	Y	
• Legal …………………………………….	Y	
• Clients ………………………………….	Y	Y
• Competitors ………………………….	Y	
Internal drivers for change		
• Strategy, tactics, plans, priorities	Y	
• New activities ………………………….	Y	
• Improvements …………………………	Y	Y
• Innovation ………………………………	Y	Y

Analysis like SWOT, PESTELI (or PESTLE), Michael Porter's Five Forces Model and others may identify external changes.

Implication: The question is not whether a top-down or bottom-up should be followed (dualistic thinking). Main directions are mainly coming from the top. Top-down is clearly the major approach. However, bottom-up approach should be use as well and should be integrated in the approach.

Events in the Company's Life

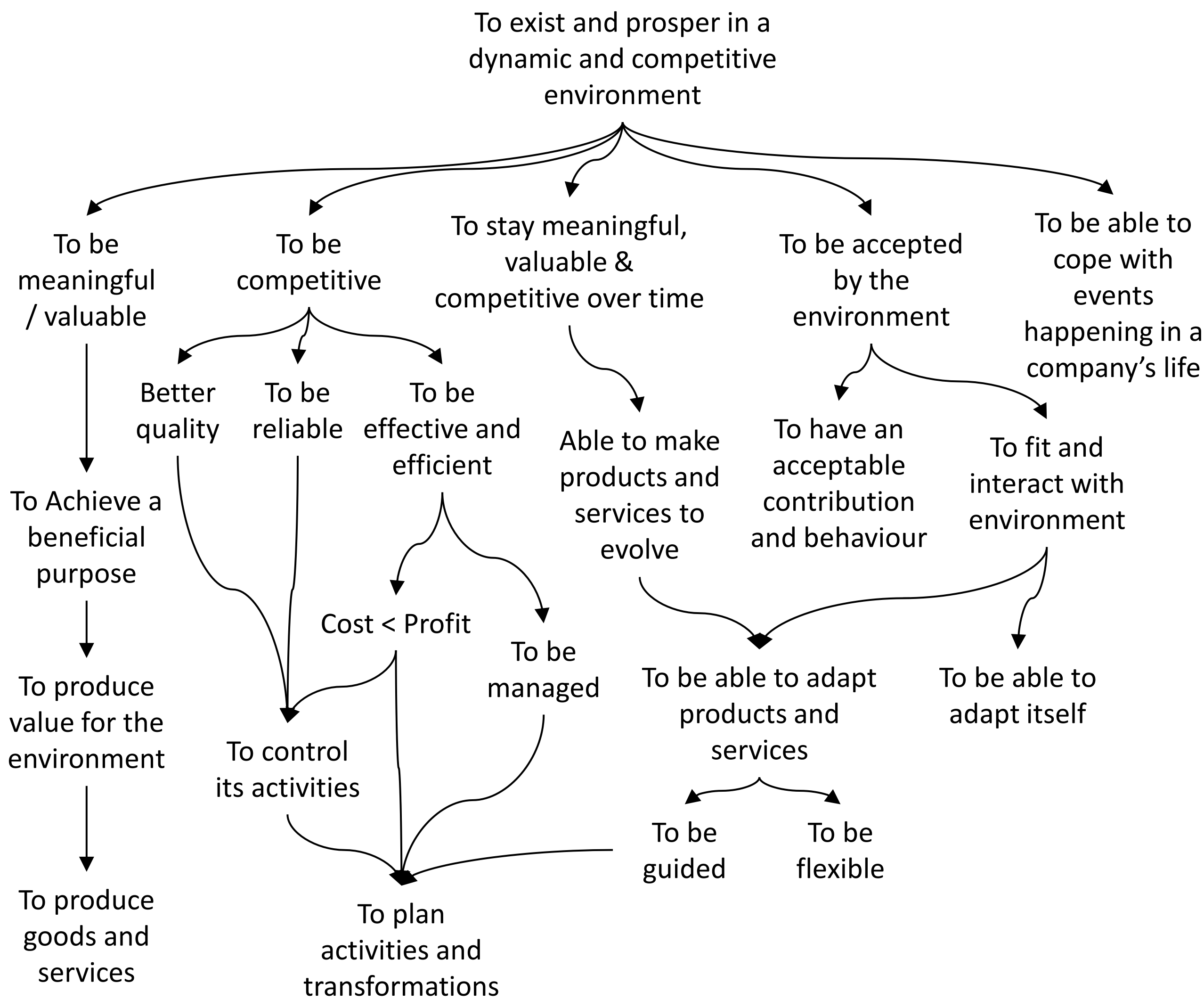
Events the company may have to deal with during its lifetime (not exhaustive):

- Adapting the company culture
- Changing the business model
- Changes in strategies, policies, tactics or priorities
- Organic growth
- Maturing organisation (optimisation, formalisation, …)
- Restructuring, rightsizing, downsizing
- Acquisition
- Merging
- Relocation of activities (like offshoring)
- Externalisation of activities (like outsourcing, privatisation, …)
- Disinvestment
- Diversification
- Consolidation
- Takeover
- Bankruptcy
- Relocation of HQ or plants
- Changes in product portfolio or in service portfolio
- Changes in customer base
- Change of geographical market location
- Changes in investment and sources of revenue and profit
- Changes in distribution and transportation network
- Changes in partnerships and inter-organisational collaborations
- Changes in work philosophy, approach, methods …
- Technological evolution
- Evolution in automation and computerisation
- Digitization
- …

Notes:

How well can the architecture and systems cope with such events? Does the implemented system hinder these events? How to prepare for them? How well can the engineers deal with such an event?

Essential Requirements for a Company



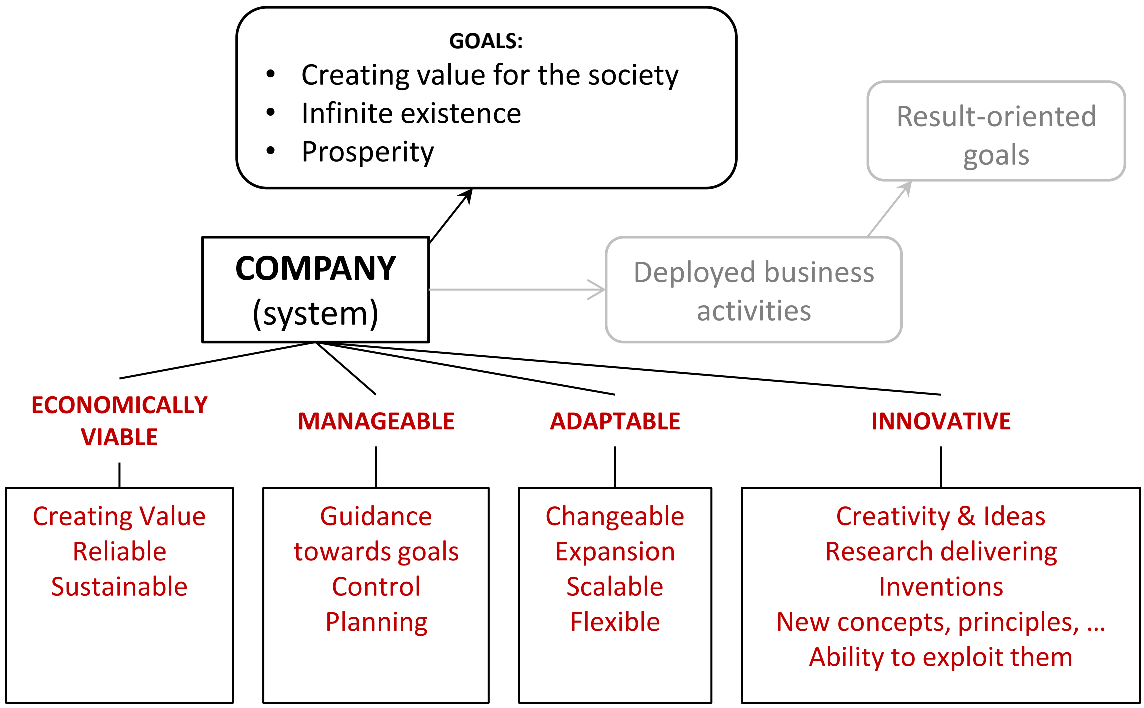
Notes

This reasoning can be further detailed.

Since a company is also an investment → goal, guidance, predictability, control.

Control, predictability and planning are required, as well as flexibility and adaptability. A balance must be achieved. Sometimes this will lead to a trade-off. Sometimes these are not conflicting and both can be achieved.

Company's Critical Characteristics



The sub-systems and components have to respect these requirements.

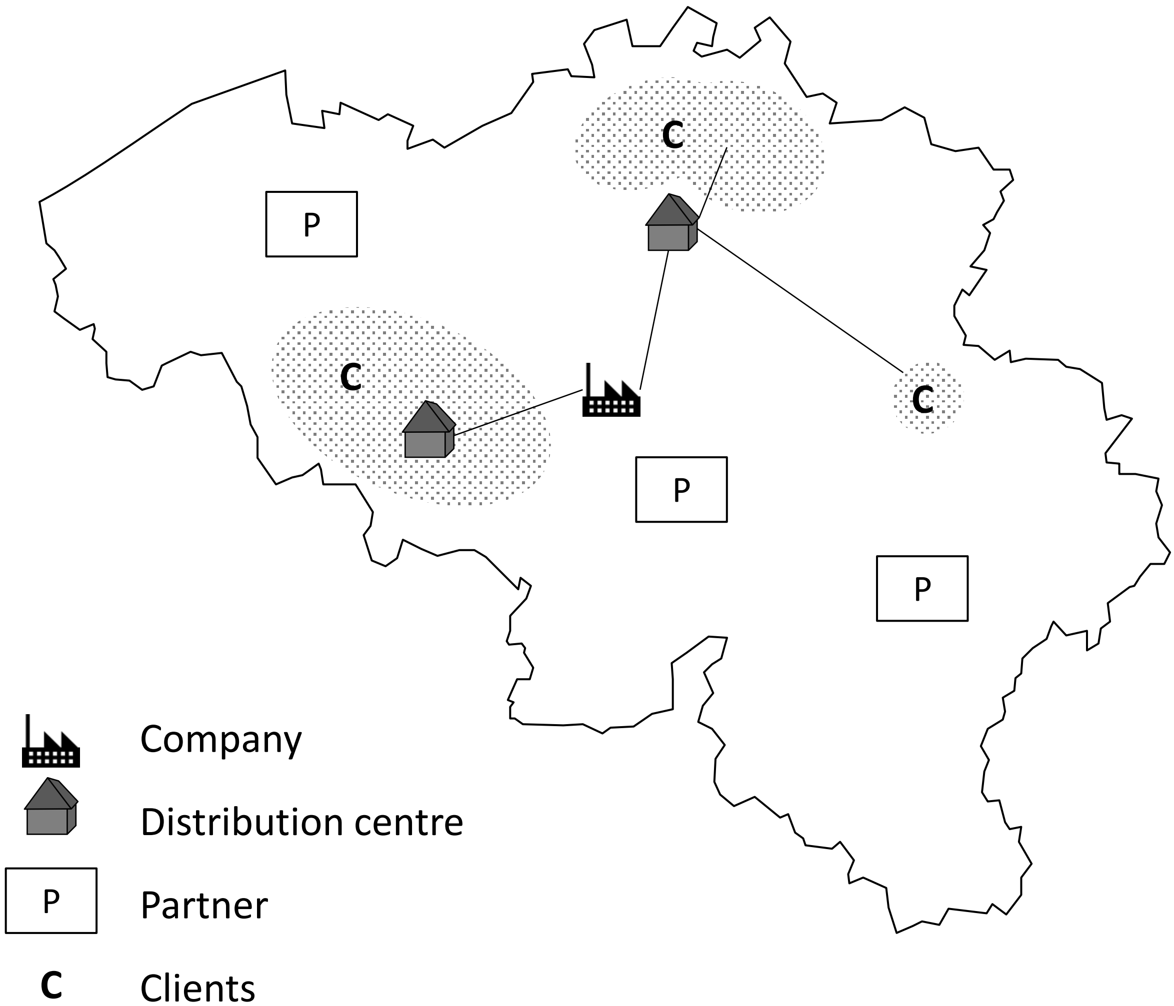
These required qualities have to be engineered in the enterprise. They can be found in the principles, capabilities, structures, concepts, features, mechanisms and characteristics.

They influence the systems design, the engineering philosophy and methods, the development processes, the transformation initiatives, … but also roles and competencies of people (authority, responsibilities, activities, interpersonal relations & collaboration).

Notes:

- The listed characteristics are critical for the company "as a system" (for the engineers). From a broader perspective, other characteristics like leadership and culture are critical as well.
- These characteristics don't appear by themselves in the enterprise and its systems. They have to be engineered in it.
- Each characteristic can be further detailed:
    - Sustainable: effective, efficient, legal, ethical, planet-friendly, socially respectful, …
    - Flexible: elegant architecture, modular design
- None of these characteristics or deduced characteristics can be ignored or neglected, at any level of engineering.

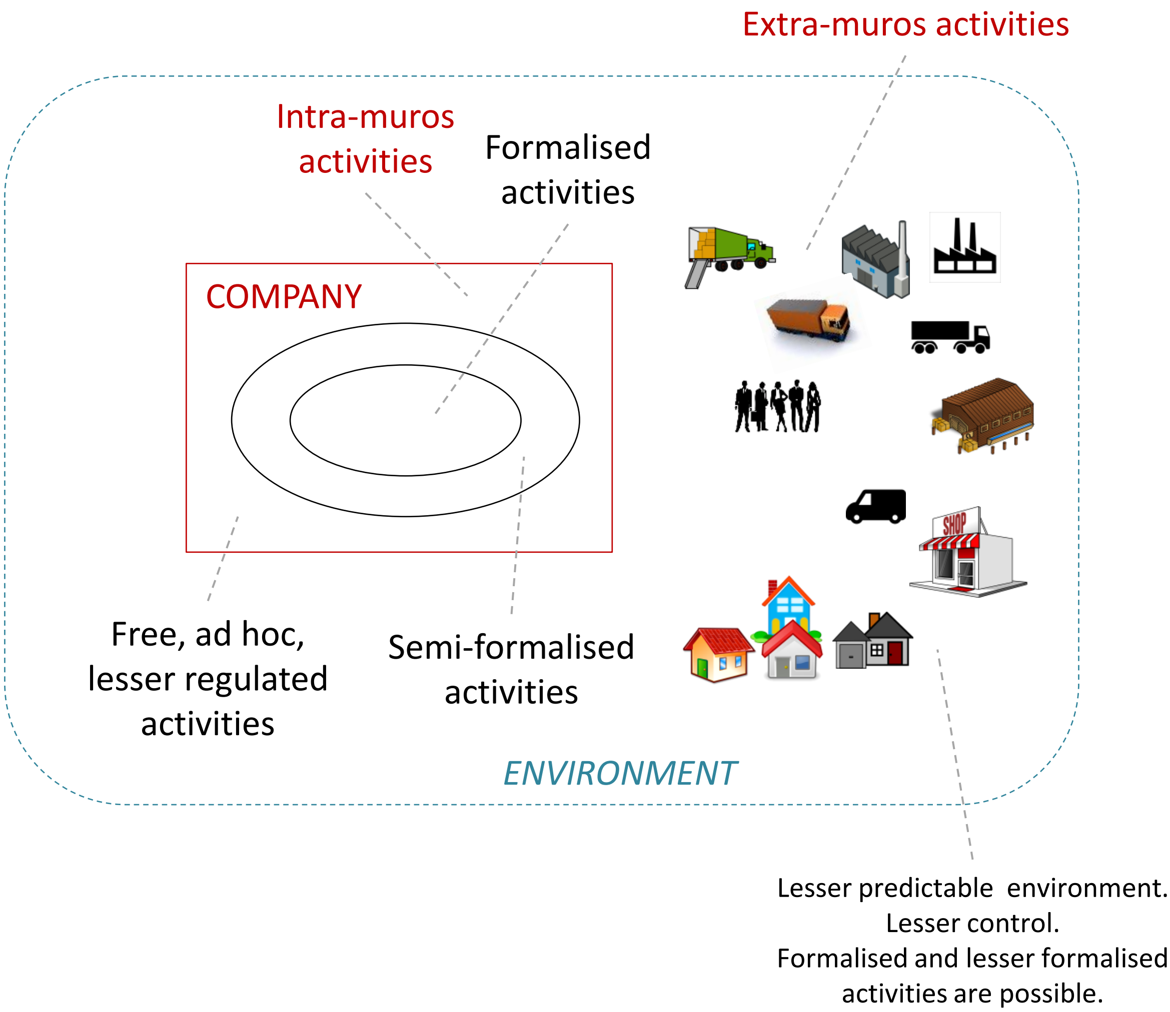
Geographic Organisation



Notes:

The geographical situation often plays a role in the organisation of the company and in the architecture of processes and systems.

Activities



Notes:

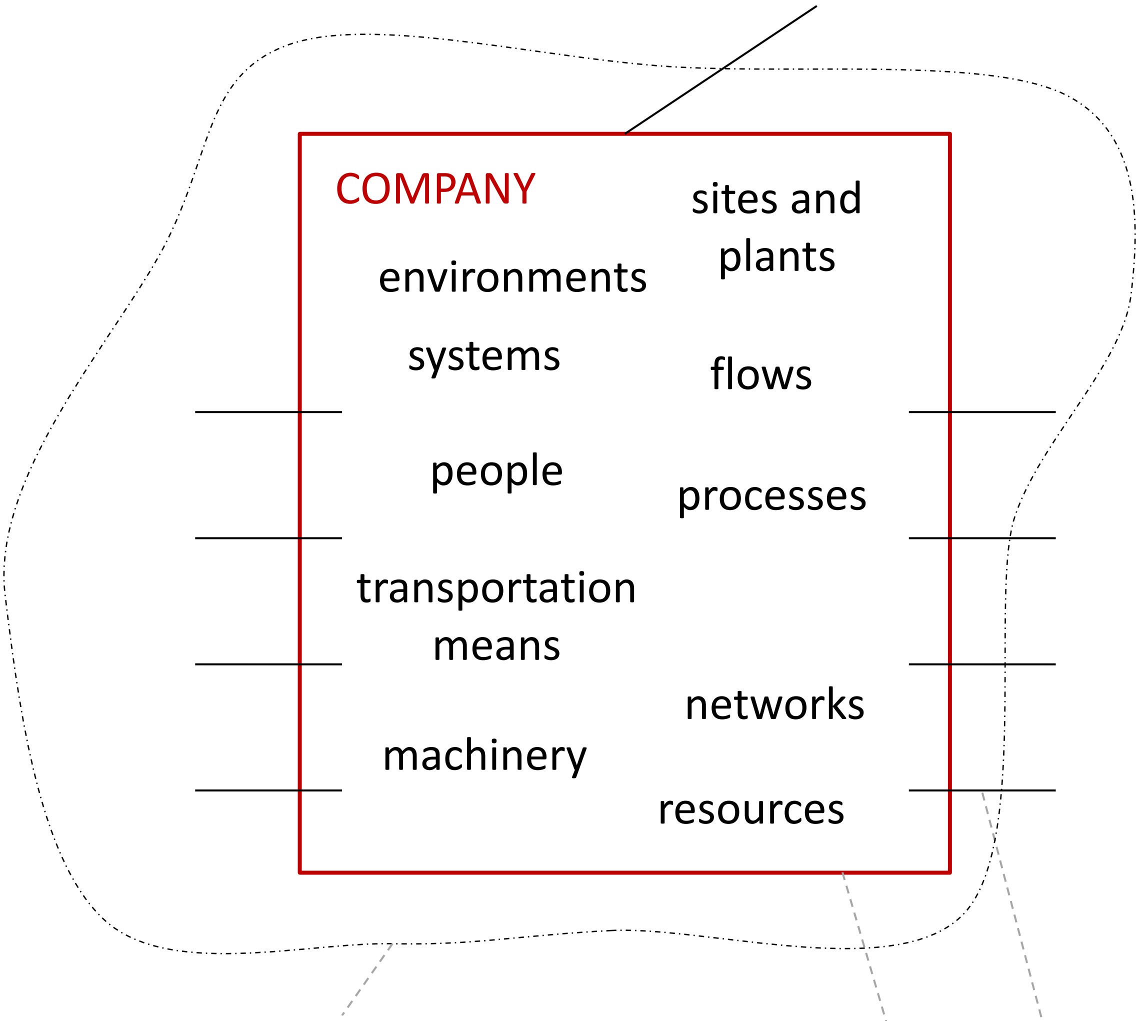
Inside a company a system can be more cohesive, more tight. Outside the company the systems tend to be more tentacular and lesser bound to a location (web applications, Apps, …).

Inter-organisational information systems, like supply chains, are somewhere in between.

Unfortunately, often the term Interorganisational Systems (IOS) is used. This term is too vague and should specify that the system has to be an information system. A energy distribution network, a transport network between organisations, a close collaboration between two or more companies are all systems between organisations.

The Company – “Intra Muros”

harmonious and managed system, seamless collaboration



Area <u>outside</u> the company’s wall in which the company deploys its activities. (example: sales man visiting prospects)
Environment is not under the company’s control (no ownership)

Interfaces with outside world

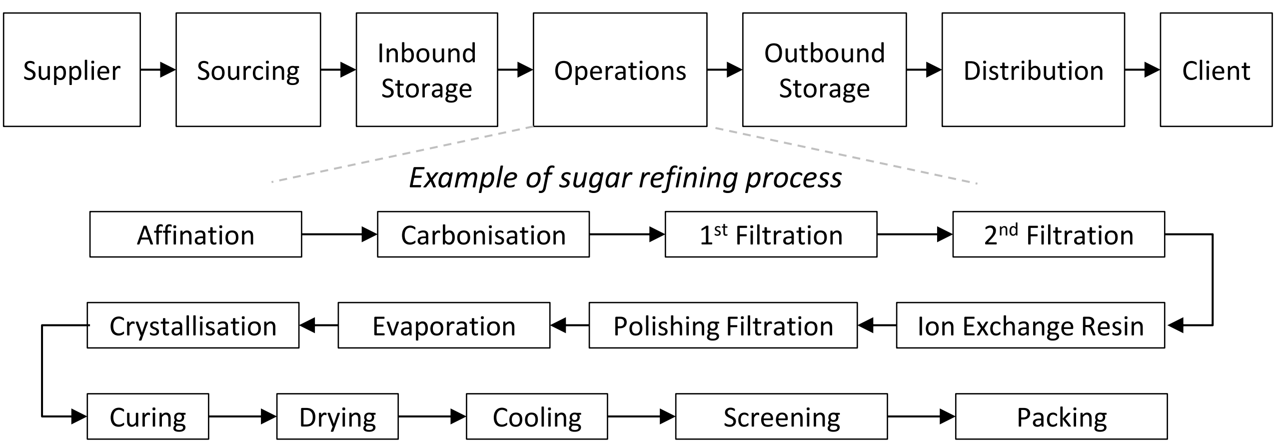
Engineered, controlled, managed and guided environment / system (because of ownership)

Internal Operations Model

Business Model & Value Network
(value creation and value exchange models)

SIPOC

Value Stream: *level above the Business Processes*



Methods: Value Chain Model, Value Stream Model, Rich Pictures, …

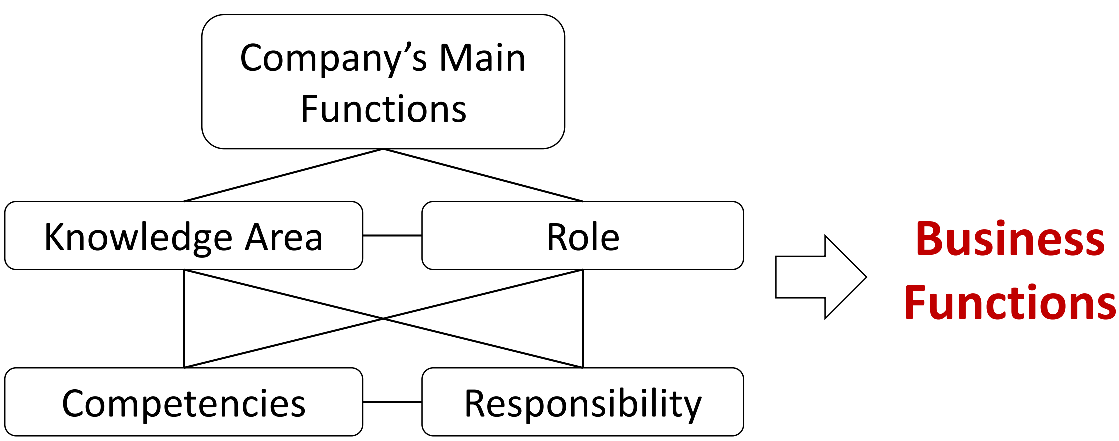
Business Functions

SIPOC

Value Chain Model / Value Stream Model

Business Functions Model

Model organising the company's main functions

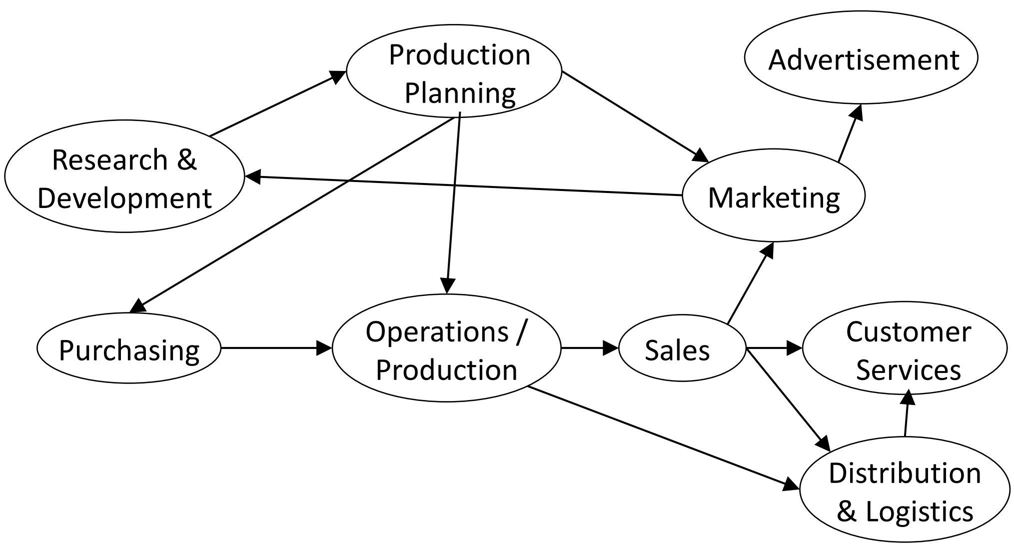


Business Functions
≠
Organisational Units

Organisational Units

Business Functions

Research and Development	Finance	Market Research
Purchasing	Marketing	Public Relations
Technical Maintenance	Production Planning	Sales
Facility Management	Production	Distribution / Logistics
HR / Personnel	Accountancy	IT



Notes:

- Organisation of activities.
- Organised per business knowledge area and main expertise, per purpose, per goal, per responsibility and authority,
- Types (production, selling, support; internal, external) can be indicated.
- Can be enriched with main relations or flows among business functions.
- Business functions often coincide with divisions and/or departments. However, business functions ≠ department or other organisational units.

Business Capability

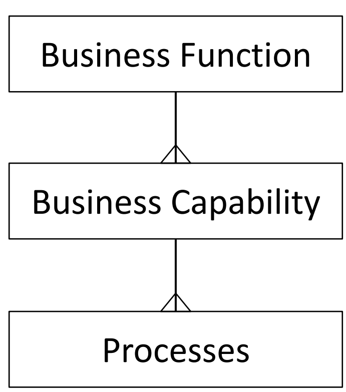
A Business Capability is the organisation's ability to perform a unique function or unit of business activity. This ability is the result of the intentional implementation of a defined set of necessary means.

In management: allows to manage functional strengths.

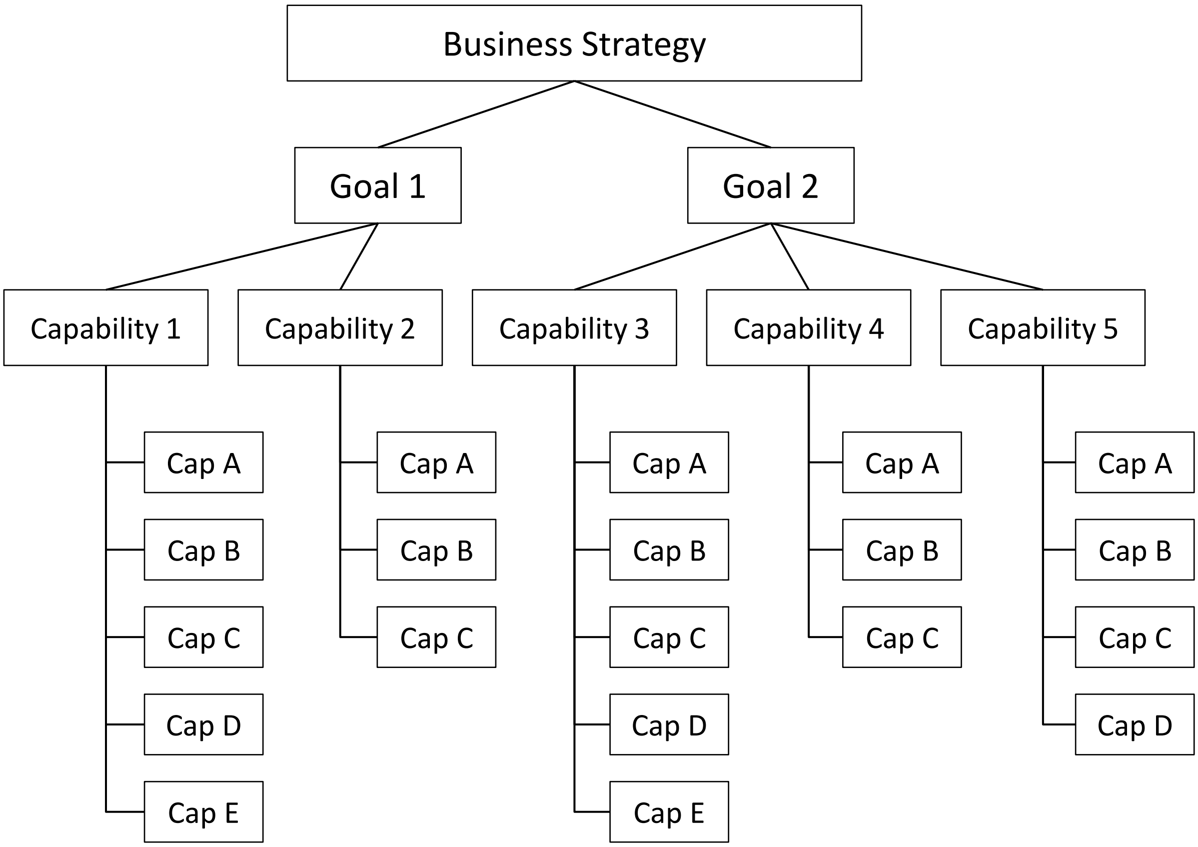
In enterprise architecture: a building block to define the business architecture and to translate it into the enterprise architecture.

Business Function - Business Capability

Business Capabilities can be grouped under a Business Function. A Business Capability is a sub-function of a Business Function. A Business Function is rather an abstract grouping used in models. A Business Capability is, when implemented, more concrete since it links between means and ability.



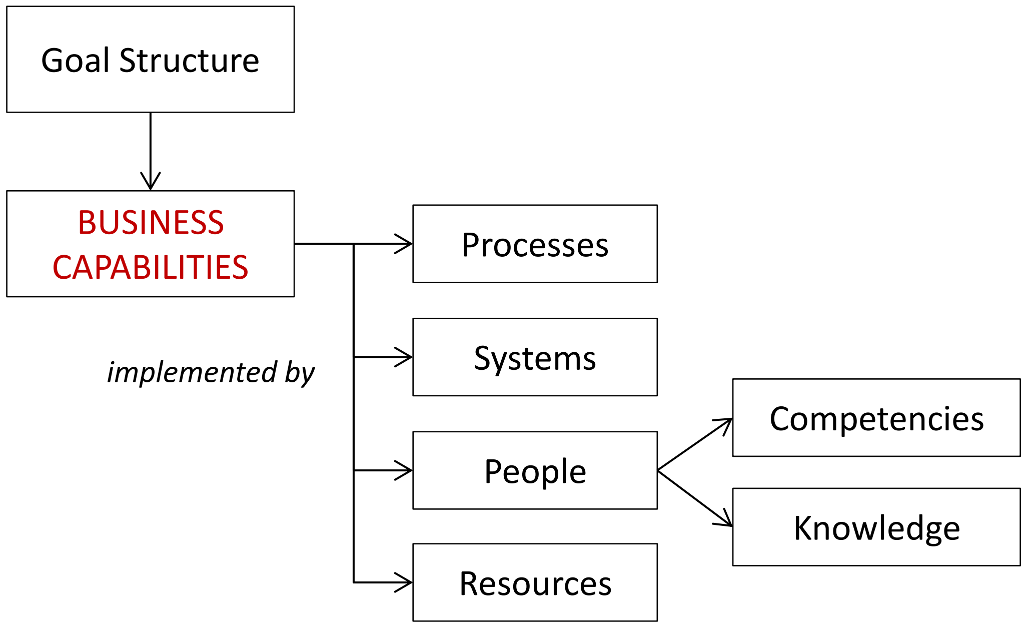
Business Capability



Related:

- Business Capability Map
- Capability Management

Business Capabilities



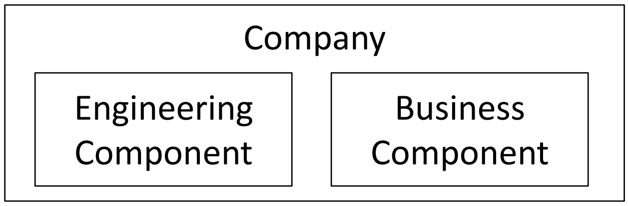
As example, an approach can be deduced:

- Definition of goal structure (for example, deduced from the strategy)
- Definition of the required business capabilities necessary to reach the goals
- Define the hierarchy of capabilities (key indicators and targets)
- Link the business capabilities to the business functions. Are they present in the business functions? To what is their strength? Is there a gap?
- Determine the required/involved processes
- Determine whether the processes are aligned with the required capability.
- Determine the required/involved systems.
- Determine whether each system is aligned / implement its part of the capability.
- Same for organisation (people), competencies and resources.

Notes:

- The process can be adapted for listing the available capabilities, for verifying if a plan or forecast is feasible, to identify a gap, weaknesses, …
- This model can be enriched with risks, limitations, links to on-going projects, …

Business Capability



BUSINESS CAPABILITIES

Core Capabilities

Essential capabilities required to fulfil the company's purpose. These capabilities should be strong, solidly embedded and optimised. They should be better than those of competitors. Innovating here is certainly useful.

Strategic Capabilities

Critical capabilities especially developed to enabling the execution the strategy and which are developed. They are developed to execute the strategy. Innovation in these capabilities is very important. Over time, they may become a core capabilities.

Common (Business) Capabilities

These are usual capabilities.

Supporting Capabilities

These capabilities provide support to all the three other capabilities. Examples are HR and warehouse management capabilities.

ENGINEERING CAPABILITES

To be developed: like Engineering Capabilities (R&D, Industrial Engineering, Product Engineering, Service Engineering, ISE, …), Common Capabilities, Supporting Capabilities

Activities

- Managing
  - Guiding
  - Planning
  - Organising
  - Controlling
- Executing

- Counselling
- Coaching
- Negotiating
- Learning
- Researching
- Communicating
- Social processes
- Conducting
- ….

- Intra-muros
- *both*
- Extra-muros

- Pre-production
- Production
- Post-production

- Core processes
- Supporting processes

- Critical
- Other degrees of criticality

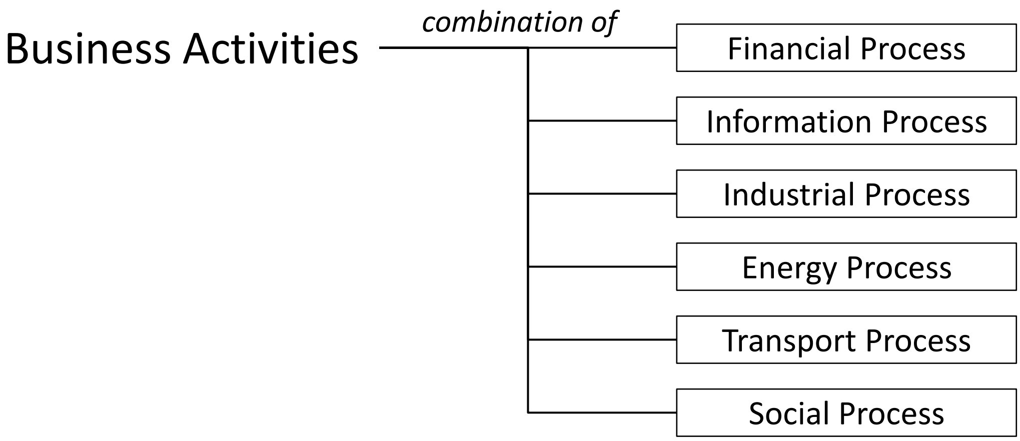
- Industrial process
- People process
  - Intellectual process
  - Manual process
  - Mixed process
- Computer process

- Predictable, Structured, Repetitive
- Partially predictable, Partially structured, Repetitive to some degree (cases)
- Spontaneous, Ad hoc, Unstructured

Main discipline applied in a process

- Business discipline (ex. insurance)
- Other discipline(s) (ex. statistics)
- No specific discipline

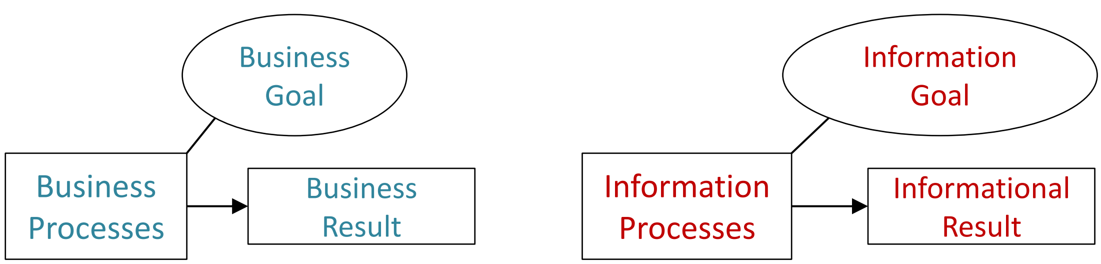
Business Processes



Business Processes	Financial Processes	Information Processes	Industrial Processes	Transport Processes	Energy Processes	Social Processes
Information Processes						

Some information processes may <u>support</u> other processes.
And, all process types <u>contain</u> some information processes.

Business Process vs Information Process



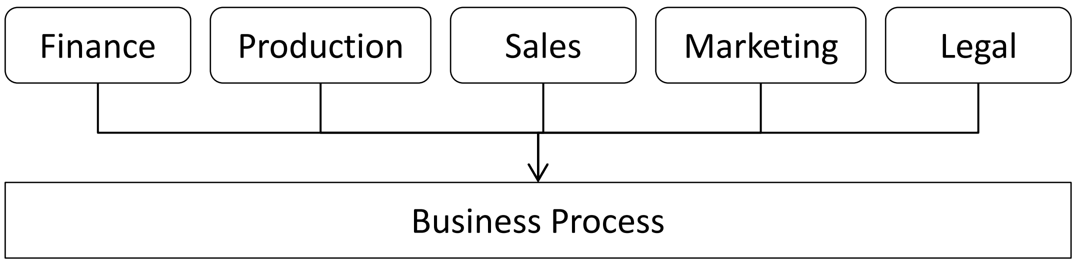
Business process structures the process. It may process matters, money, information, .. It may include transport or social processes. Business processes implement always some information logic.

Processes only information. Information processes implement business logic.

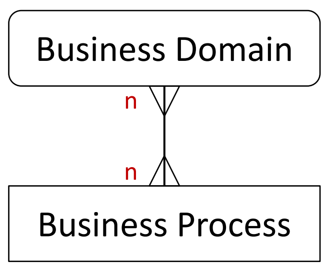
Not all processes executed by the business community are Business Processes. A Business Process can be decomposed into more detailed processes. These more detailed processes are not Business Processes. Some other detailed processes exist which aren't Business Processes either.
We can't simply label every software feature or software process as '*Business Process*'.

Business Departments, Domains and Business Processes

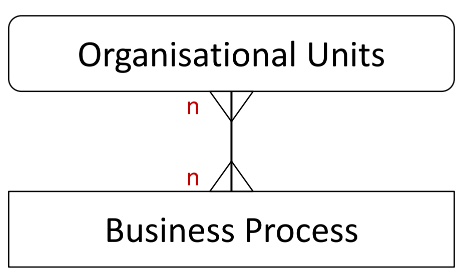
Business Processes & Organisational Units



One business process may implement logic of different business domains



Business Processes & Organisational Units



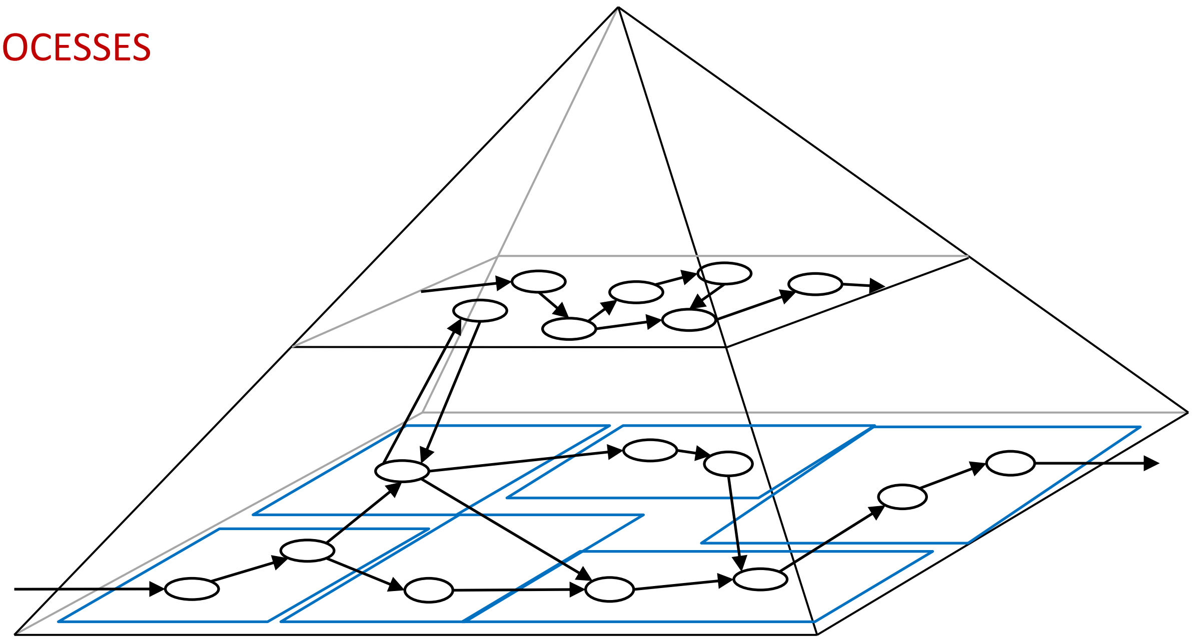
Each organisational unit has its own goals, priorities, plans, needs, intentions, rules, …

Notes:

Business processes are (often) a collaboration between business domains and between organisational units (like departments, services, …). Analysing or designing a business process may require consulting different experts and taking into account the variety of goals, contexts, priorities, …

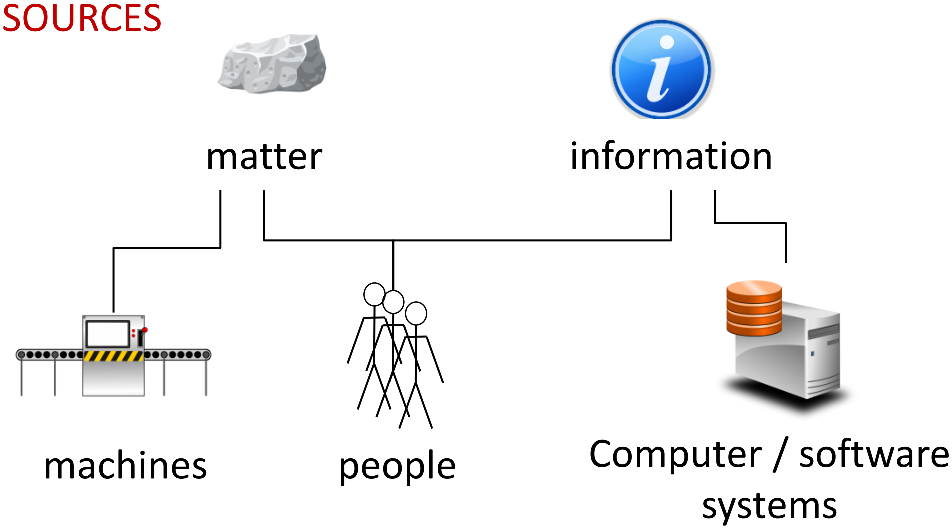
Processes

PROCESSES



PROCESSED RESOURCES

EXECUTORS



FLOWS inside the company

matter | energy | information | Knowledge (information) | Money (mostly information)

Main Elements in the Company

System / Company

- Structure
- Mechanisms
- Channels
- Storage

Flows of

- Information
- *Money*
- Matter
- Energy

- People
- Machines
- Computers

Robots (Computers+Machines)

- Infrastructure / Networks

- Buildings, Terrains

A Company as Heterogeneous System of Systems

System of Systems

- People organisation
- Industrial systems
- Accounting system
- Cost system
- Communication systems
- Transport system
- Software systems
- …

Heterogeneous

Systems are of different nature
Example:

- people organisation ≠ software system
- financial system ≠ industrial system

Question:

- Have to fit, to collaborate and to function harmoniously.
- Requires different domain expertises and engineering skills and methods

Difficulty!
How to solve this?

System of systems ≠ collection of systems

DIFFERENCE BETWEEN COMPONENTS

	COMPANY		
Executor	INDUSTRIAL COMPONENT	HUMAN ORGANISATION	**INFORMATION COMPONENT**
Way of execution	Automated	Manual	Automated
Processing	Material, Energy	Material & Information	Information
Nature of processes / processing	Pre-defined processes	Interpretation, variable logic, ad hoc decisions, explicit and implicit knowledge	Pre-defined processes

1. People are able to deal with higher level logic. They have the capability to interpret, to take ad hoc decisions and to adapt. They can deal with high-level more vague instructions, with non-formalised logic, variable process execution and with intuitive knowledge. Not everything is or need to be pre-defined, formalised, …

2. The Industrial and Information component contain pre-defined, hardwired (even if configurable) logic. Faster and more reliable process execution.

People organisation and automated components are very different.
May lead to misunderstandings, conflicts, …

Notes

These are the three most common main "executing" components in a company.

We can also have an "energy component", "transport component" (doesn't matter).

Automation is done either by moving work to the industrial component, or by moving work to the information component (reduction of the people organisation?)

COMPANY: People

People can learn. Able to acquire new skills.

People can deal with fuzzy situations.

The mind activities and products of the mind are partial, distorted, subjective and fuzzy. These are lines of thoughts, ideas, visions, beliefs, motivations, intentions and expectations.

Difference between the talk, thinking and actions.

Intellectual activities are not linear. Their pace is highly variable.

People are creative.

People can inform themselves, investigate, research, ask, interpret, evaluate, take decisions and adapt their actions accordingly.

People's mind is variable. The understanding changes over time. Ideas may pop up. Preferences may change. Different decisions can be taken.

People tend to create a set of beliefs and an understanding that makes sense to them and which is coherent.

People have social relations which are dynamic, temporary and of different intensity and quality. This impacts collaboration.

People influence each other for the best or for the worst.

People tend to copy each other.

People like simplicity and dislike complexity and problems.

People are bad problem solvers.

A person can get tired or sick.

Many factors influence the speed, efficiency and quality of activities of people.

People need to relax, take a break and have some rest, days off and vacation.

People are different, have different qualities and require different work environments.

People may use freedom well or abuse of it. With freedom comes responsibility.

People react on fear, uncertainty, lack of information, threats, and so on.

And so on… !!

The strengths, weaknesses, limitations and other characteristics of people have to be taken into account when designing IS's, but also when working in projects or elaborating methodologies.

COMPANY: Software Systems - Machines

SOFTWARE SYSTEMS

- Designed to deal with information
- Implements information capabilities
- Implements information processes
- Solves (or help solving) **information problems and information needs**
- Man-made
- Have purpose
- Process information <u>incredibly faster</u> and way more precise than people and can deal with huge amounts of information
- Information is stored more reliably (lesser volatile than people's memory)
- Work defined by predetermined logic (with AI, things can change)
- Fully formalised systems
- User interface is only a very limited and superficial view on the software
- Expresses high-level logic as well as extremely detailed logic
- (Pure) Business logic is only a part of the implemented logic
- Weaknesses: interpretation, improvisation, ad hoc decision making and thus ad hoc adaptation (because of prior detailed definition of the logic (slow and tedious))

MACHINES

- Man-made
- Have specific purpose
- Transform or transport materials, usually faster, more precise and at lower cost than people
- May reduces risks for people
- Machines produce repetitive work with similar results (good or bad)
- Work is predefined
- May need information; may contain software (robots)

5 Key Architectures

The company consists mainly of people, processes, industrial systems (not in administrative companies), information systems and information. They are organised in architectures. These architectures need to be aligned. They are inter-dependent.

People Organisation

Best known. More on next pages.

Industrial Component

Only applicable for industrial companies. Out of scope in this paper.

Process Organisation

- Structure of the execution of the processes
- Structure of the logic of the processes

Information processes are executed by people, information systems
Processes dealing with matters are executed by industrial systems

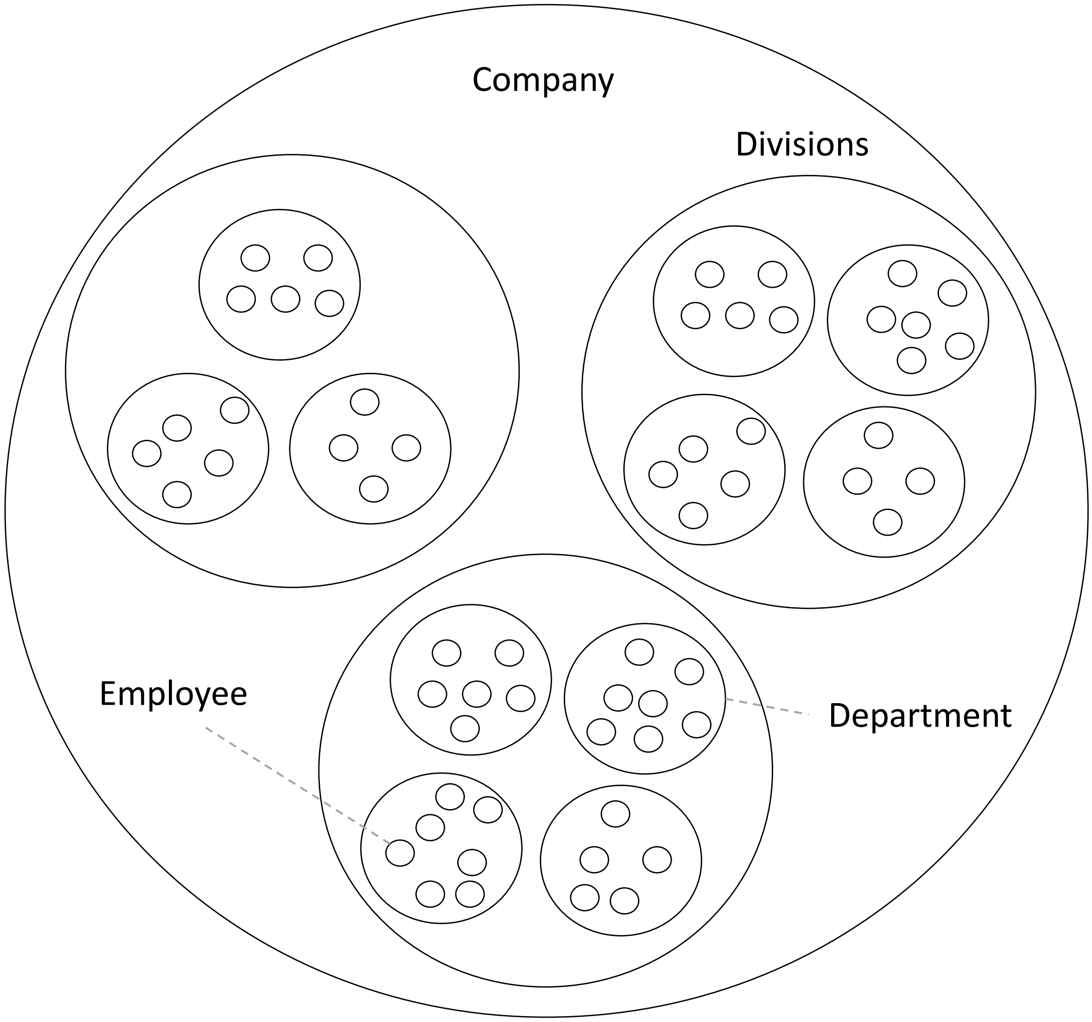
Information Architecture

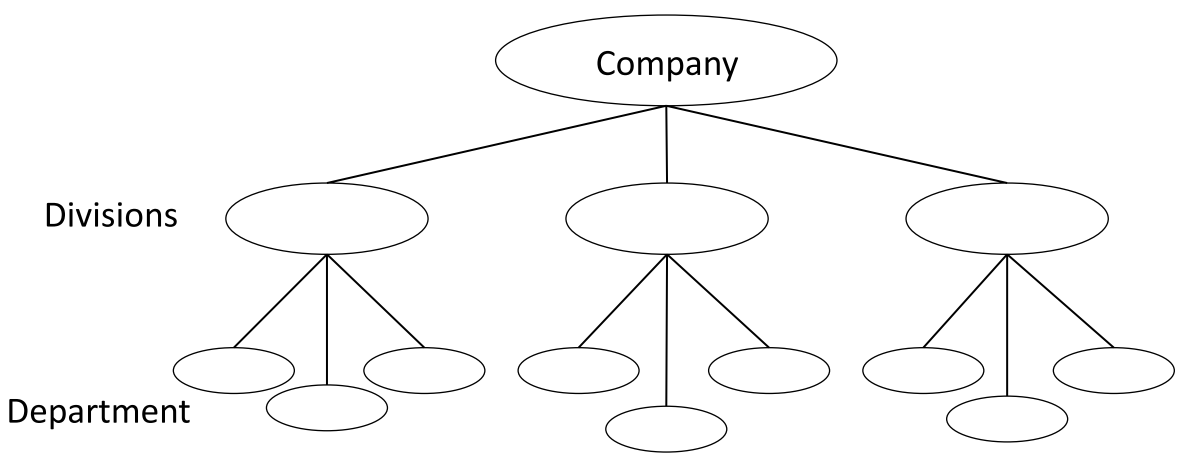
The information in a company is not a collection of databases. It should be organised around a global high-level information model.

Information and Software Systems Architecture

Organising information systems and software systems around an architecture is likely to be more effective and more cost-efficient than having simply a collection of systems.

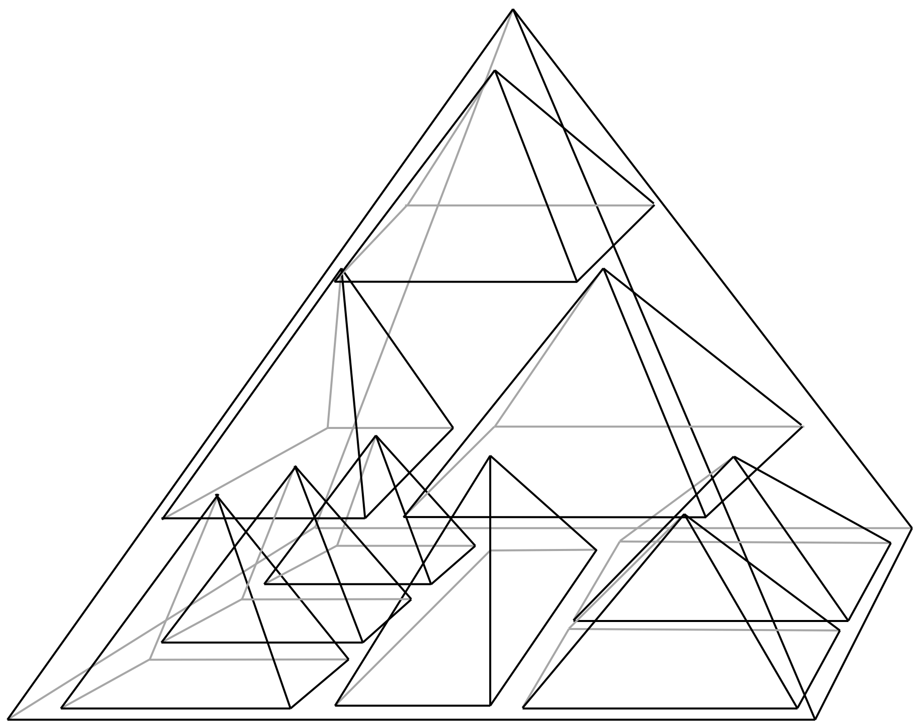
Organisational Units





These models show, as example, a common basic idea of dividing a company into organisational units. Other organisational structures and names are possible.

Organisational Units



The company can be seen as a pyramid of pyramids. Flat organisations contain lesser layers of pyramids, while larger more hierarchical organisations are based upon more superposing layers of pyramids.

A “pyramid” can be temporary (like for a project initiative).

Organisations executing a lot of project may chose for a matrix organisation.

Organisational Structure

Notes:

Organisational units often receive the names of business functions. The relation between both is often very strong.

Traditional and common way to represent a company

Represents:

- units, departments, services
- or management hierarchy (names and roles)
- or both together

Reflection:

Is it beneficial for the company as a whole to allow the departments to define themselves how they work? Why or why not?

A Logical Company Organisation

Management

ENGINEERING

Research and Development

Product development

Service Development

Organisation Development

Informatics

....

BUSINESS COMMUNITY

Finance

Marketing

Sales

Production

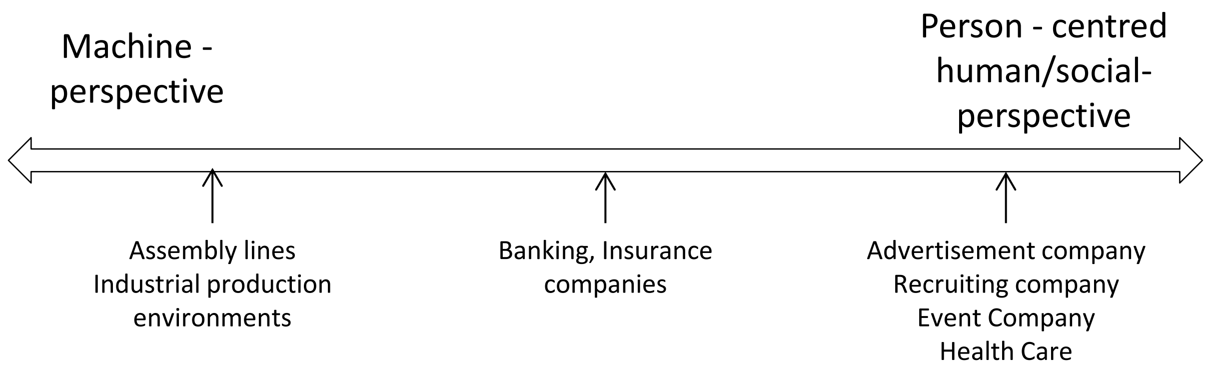
HR

...

Systems builders

Systems users

System - Psychosocial



All organisations are partly …

- organised like a machine (formal structure, procedures, processes, controls, specific skills, cost structure, …)
- a human and social aspect

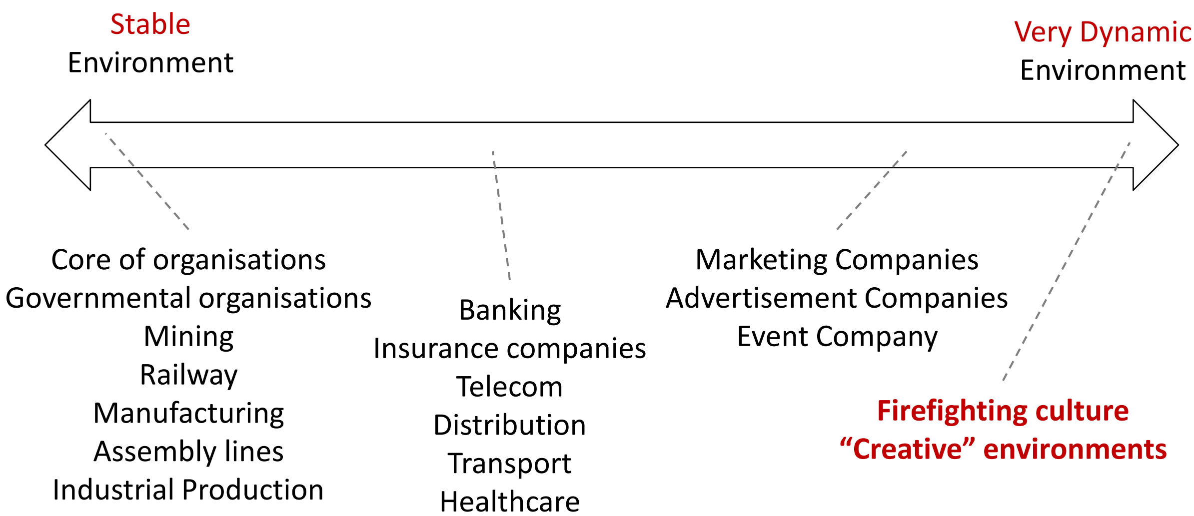
These aspects are present to different degrees depending on their economical activity but also depending of the part of the organisation (product development, customer service department vs industrial production line)

Notes:

Engineering IS, or larger parts of the organisations, has to take both perspectives into account.
The weight and priorities must match the specific nature of the organisation.

Dynamic Environments

30/10/2018



Essence:

Some industries, some parts of a company are rather stable environments. Other industries or departments are very dynamic.

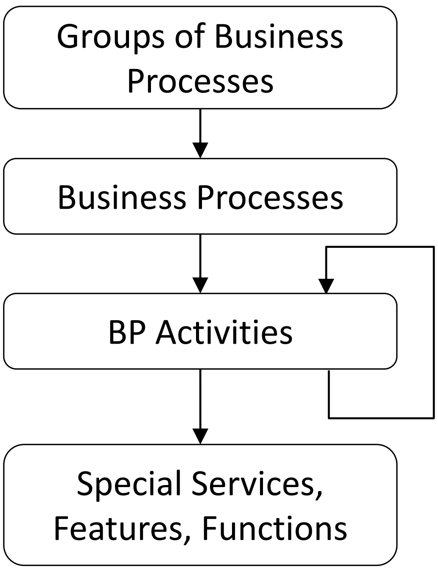
Equipping **dynamic** environments with a solid Information Component is much more challenging

Remarks:

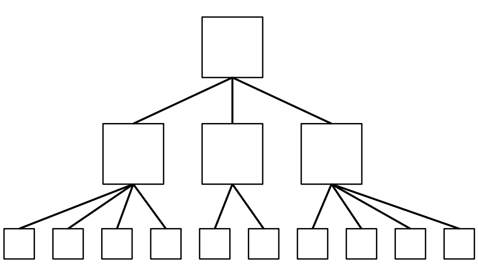
- Only rough estimations (can be inaccurate, subjective, …)
- Depends on the department
- Depends of the company culture
- Every company is different
- Know your environment

Process Architecture

Process Architecture (Execution Perspective)



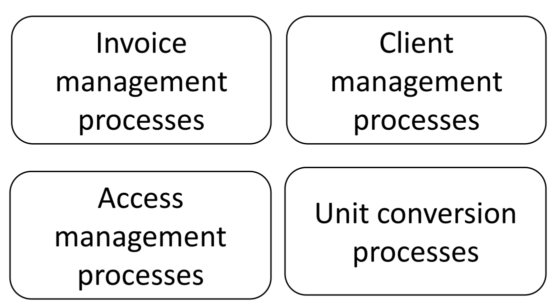
Decomposition of the processes as it appears when executed.
Function and services are called and executed as needed.



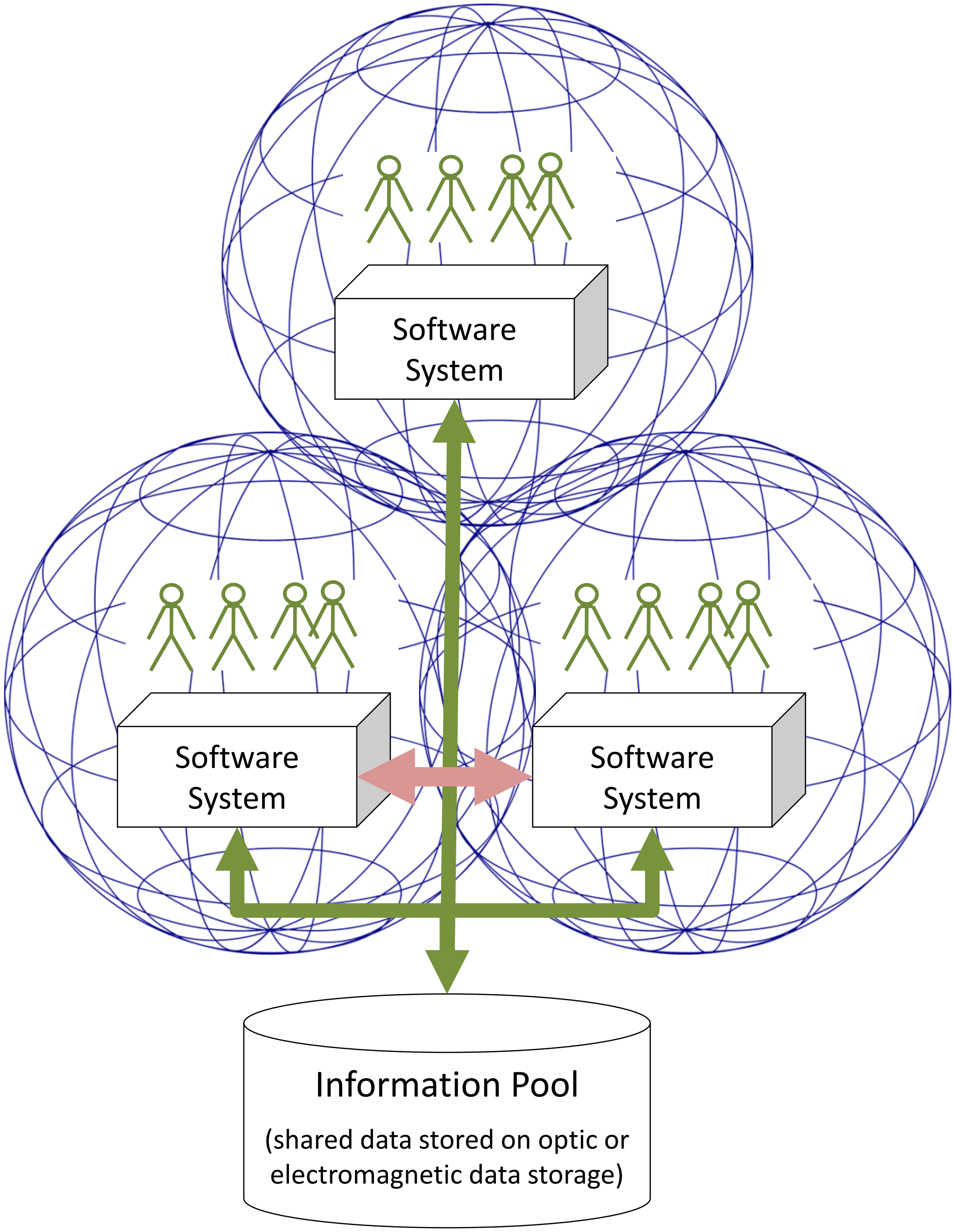
Process Logic Architecture

Organised in systems, libraries, components, modules, service software agents, …

This architecture organises the process logic, like the source code. They are usually grouped by purpose or by information domain to be accessed.



Information Systems



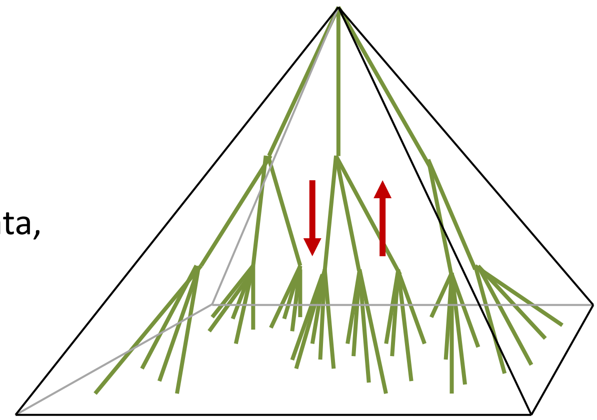
Notes

- IS's share information
- IS's communicate with each other. IS spheres overlap.

FLOWS

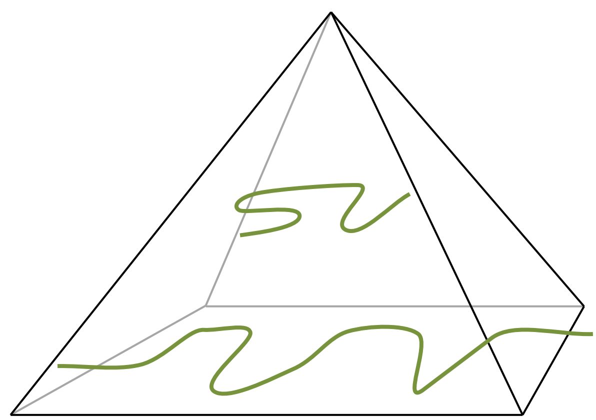
VERTICAL FLOWS

These flows concern mainly budgets, information for guidance and management, like plans, guidelines, policies, authorisations, performance data, results, ideas, …
These flows move up and down through the organisation.
It often concerns selected, filtered, aggregated, global data, or in the other direction, a refinement occurs as the flows goes downwards.



HORIZONTAL FLOWS

Horizontal flows are often embedded in business processes or concern sharing and collaboration.
Information, material, 'work' and knowledge tend to flow horizontal.
Horizontal flows happen at different levels (in layers). Detail of information across the flow remain the same.



Flows happen not only inside systems, but also between systems. A flow represents a dependency between systems. Flows help to achieve final outcomes. Today, no system can work in isolation anymore.

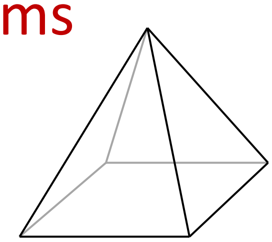
Flows are critical and should be engineered

We tend to engineer architecture and systems, but we tend to forget the flows.

Electricity, water, gas, computer networks, telecom networks reach to all corners of the company.

Systems

Very important internal global systems



Goal Hierarchy System

System for analysing, decomposing, deducing, aligning and spreading goals across the company

Planning System

Elaboration and alignment of the various strategies, tactics and plans across the company

Communication System – Communication Channels

Established communication channels or processes across the company

Decision Making System

How decisions are being made and spread

Incentive System

Gathering and aligning all the incentive policies or mechanisms across the company

Creativity System

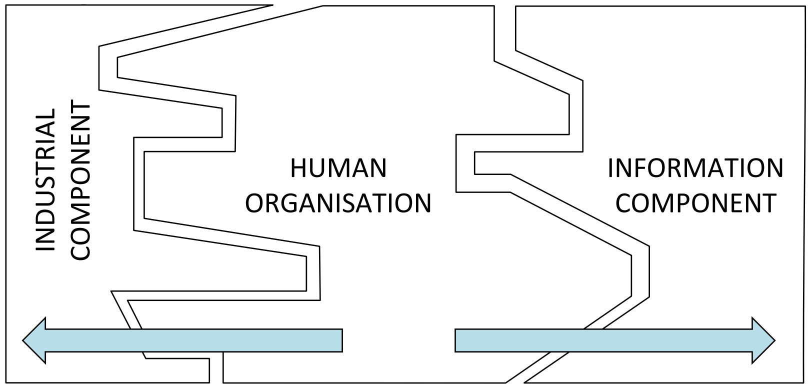
System to capture ideas across the company, evaluate them, and so on.

Other interesting/potential systems: knowledge system, collaboration system, network system (people), investment-profit system, priorities.

Notes:

- The key here is to establish first about the mechanism, the logic of the system. Thinking about software comes later as a way to implement the solution. (‘system’ ≠ ‘software system’)
- Each or most system should include evaluation, control and feedback mechanisms.
- These systems are not independent: goal, decision making, planning and incentive systems.

Automating the Three Components



Automation of processing of matter

Automation of information processing

Three Executors

- have to fit into each other
- are intermingled
- have to collaborate seamlessly to achieve a same goals

AUTOMATION

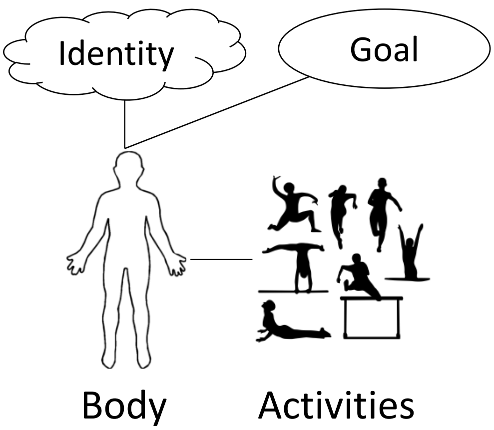
Work performed by the company

	Prescribed, Structured, Predictable	Semi-structured	Ad hoc
Matter	Automation	Partly automated	Human activity
Matter & Information	Robotisation		
Information	Computerisation	Supported by software systems	*Supported with OAS, AI?*

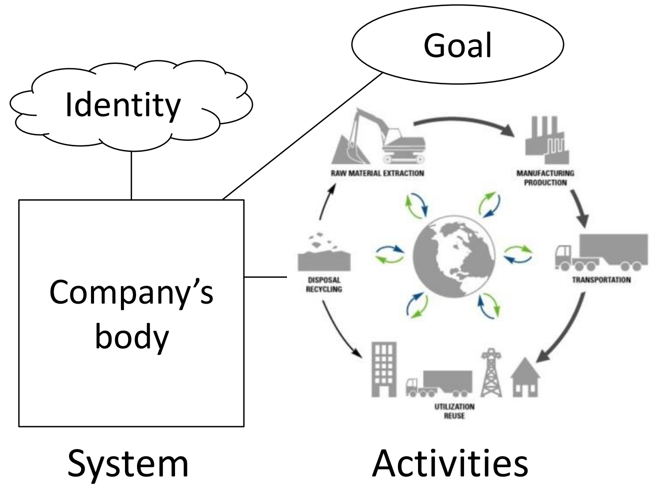
Ideally, forming a coherent single set of activities working towards some common goals.

Person ←→ Company (1)

PERSON



COMPANY



- Seeks to remain alive, well and happy;
- Personal development and self-realisation;
- to achieve the full potential and dreams;

Seeks to remain in existence;
to flourish and to prosper
(too often: to be profitable now)

Person ←→ Company (2)

PERSON	COMPANY
Name, Identity	Name, identity, brand names
Personality, personal values, culture, belief system, thinking patterns, mental strength, norms, habits, autopilot, maturity	Company culture, values, leadership, CSR (Corporate Social Responsibility) , world view, belief system, way of thinking, habits and common practices, automatic responses, maturity, market position, …
Relationships, social network	Relationships, collaborations, partnerships, network
Reputation	Reputation
Activities	Business activities, production
Skills, capabilities, limits	Skills, capabilities, limits
Body	Company as a system
Skin, guts	Boundaries: walls, gates, entries, firewalls, …
Skeleton	Structural elements, like human organisations, organisation in business units, business functions, …
Brain, guts	Management, guidance of operations
Nervous system	Information network
Blood vessels system	Matter and energy transportation network
Digestive system	Pre-processing of matter
Senses: vision, audition, taste, smell, touch (environment, input, …)	Input, monitoring
Liver, kidneys, lungs	QC, Filters, cleaning mechanisms
Lungs, lymphatic system, sweat glands, excreta	Waste disposal system
Liver, Fat	Storage
Immune system	Recruitment (selection), Security
Healing mechanism	R&D, Engineering, Change Management
Pain, symptoms	Alarm systems, control agents, …

Person ←→ Company (3)

- A person has a private and public life.
- Organs perform each a function for the body (specialisation).
- Organs are placed inside a structure.
- Vital organs are better protected.
- Organs collaborate with each other.
- Organs are semi-autonomous. The conscious mind can focus on what matters.
- The body is hyper-efficient and has survival strategies built-in.
- The body and brain learn. We learn (also) from mistakes.
- The body and brain can be trained to acquire skills and capabilities. Not training and learning keeps the body weak.
- The body has the ability to heal itself.
- The body needs rest and sleep to restore.
- Prolonged period of heavy activity or stress is bad.
- If one organ fails, another organ may take over its role, be it partly or temporarily.
- Not treating a body and mind properly and abusing them leads to problems (over time).

Notes

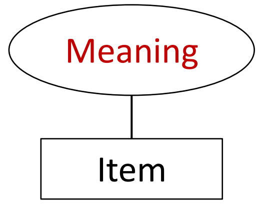
This comparison provides lessons useful for designing systems.

Probably, other similarities can be found.

- INFORMATION -

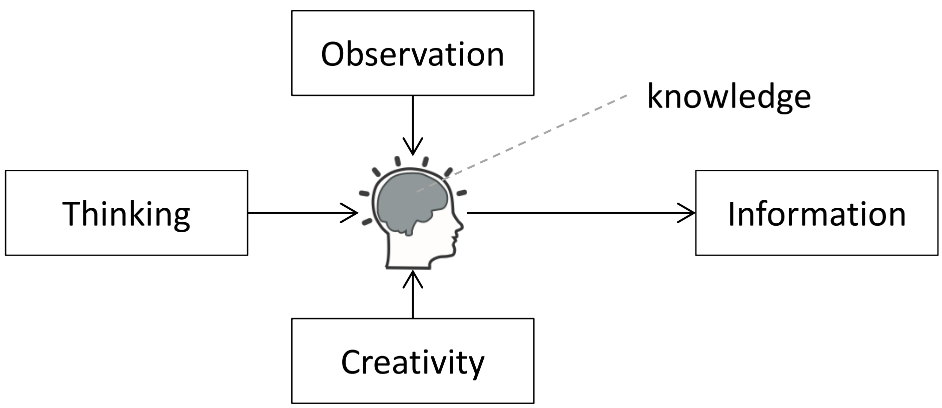
Information

Information is the meaning (or knowledge) attached to something produced by humans.

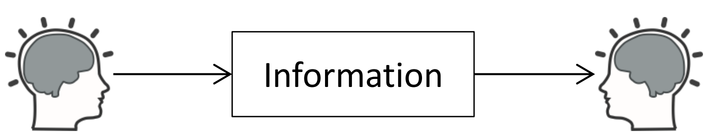


Example: A letter: Nor the letter, nor the words or letters (symbols) are the information. Information is the meaning attached to the letters and words.

Information is the expression of a knowledge.



Message producing a change of a knowledge.

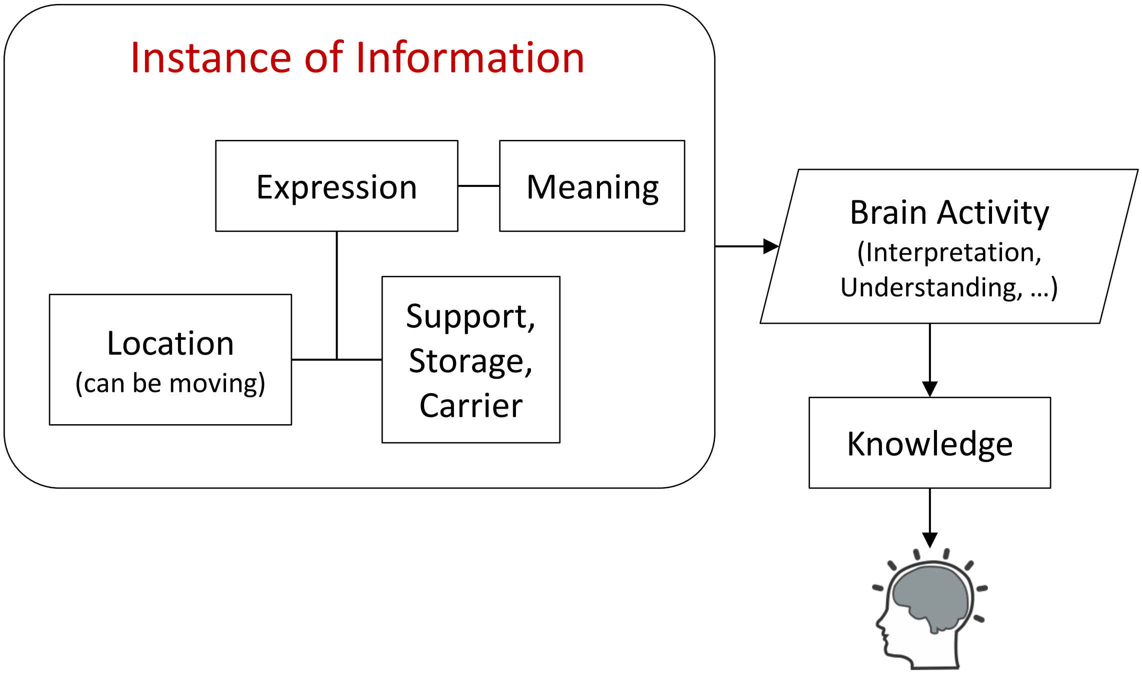


communication

Captured information produces a change (can be very small) in the knowledge

- Information can be “produced” by man-made systems.
- The information doesn’t need to be picked up to be present (books, traffic signs, bottle with a message thrown in the sea, sign in the desert, …)

Information



Information IS the meaning. However, information can not exist without its expression.

Metaphor: A person is not simply the human body. But a person can not exist without the body.

Information Element

An “Information Element” is a piece of information with an atomic meaning.

Examples: 1984, grey, Roger, cloud, …

An information element is NOT a field. A field is a Software concept designed to contain an information element. An information element can be stored in a field.

Remark: For now, the term “information” is used for somewhat broader concepts also like an idea, a concept, a situation, …

Fields, records, files, documents, messages, data files, databases are all concepts related to logical data storage.

Bits, nibble, bytes, words, blocks and pages are concepts representing units in the coding and the electromagnetic storage of this coded information.

Levels

Data

Symbols describing characteristics of objects or events. (raw data, facts)

Information

Is data having value for someone. Answers questions of Who? What? When? How? Where? How many? How long?

Knowledge

The memorised information. Knowledge also often answers “How-to”-questions.

Understanding

Explains “Why”, the reason, the causes, the mechanisms, the forces, the dynamics, …

Wisdom

Ability to consider an issue holistically and objectively, to understand the various degrees of importance and the ability to relativize allowing to see the consequences of (potential) decisions and actions and based on this taking sound decisions.

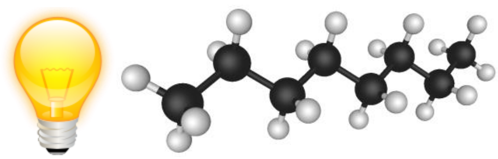
Information

Information is:

- the meaning assigned to and conveyed by symbols or sets of symbols.
- anything that provides an answer to a question.

Real World
(ranging from factual and objective information to subjective views)

Abstract Concepts, Ideas



INFORMATION

Fiction Reality

Past Present Future

→ INFORMATION (study)

INFORMATION (abstract concepts, ideas, …) → Creation of reality (Product, Solution, System, …)

Information

1. Brown fox

2. The colour of the fox is brown.

3. La couleur du renard est brun.

4. Fox — Brown

5. 

5x same "information", but expressed in different forms

Capture expressed information → Interpretation of what has been captured → Extracted "Information"

Information is about 'meaning'. It is immaterial. It has no specific form. Information is an abstract resource describing from the real world to the most abstract and the most intangible, from truth to fiction.

Information is not a tangible, palpable, concrete, physical matter made of atoms. It is not even visible. Only an expression of the information is visible or perceptible.

Information

1. OMNIPRESENT

Information is everywhere in the company.

2. CRITICAL

What would happen if suddenly ALL information of the company disappeared or was inaccessible?

3. INTANGIBLE / AMORPHOUS / INVISIBLE

Information is an abstract concept. Different expressions of information may reveal the same information, a very slightly difference or even the opposite. Information itself is invisible. Only its expression is visible. We can see books and servers or hard disks, but we may not see the letters and the bits and bytes. Even they are nothing more than the expression of information. Even what is NOT said or a silence can be information. Information is similar to knowledge.

4. MULTIMORPHIC

A same information can appear, can be expressed in many different forms and formats

5. MULTIPLE OCCURRENCES/INSTANCES

6. MULTILOCATION

Since multiple occurrences (of the expression) is possible, the information has to be present at different places at the same time.

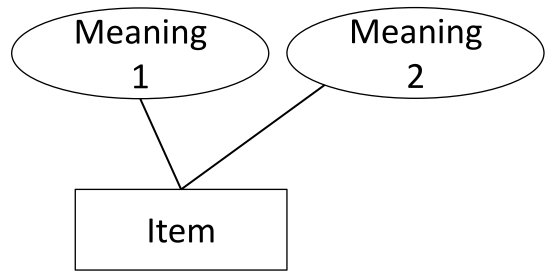
7. INTERPRETATION

Information has to be interpreted by the brain. People may interpret or turn a same piece of information (meaning) into different ‘knowledges’. The value will be different.

Information

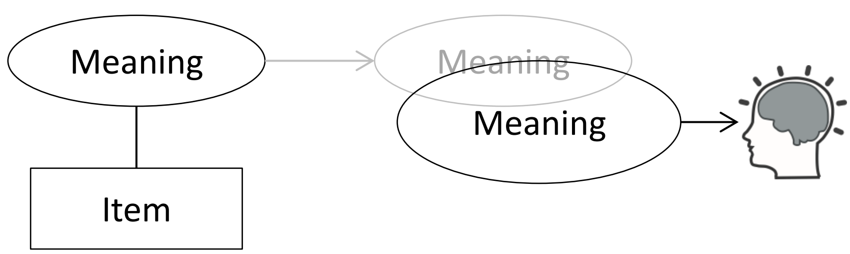
Decreasing information value

Ambiguity

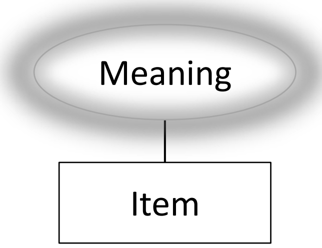


Example: term 'key': 1) piece of metal used to open or close a lock, 2) piece of keyboard 3) Code 4) Crucial

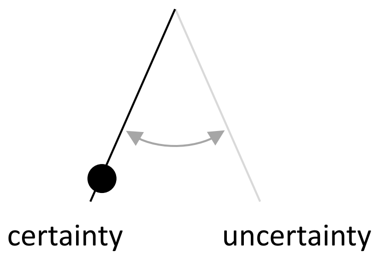
Interpretation



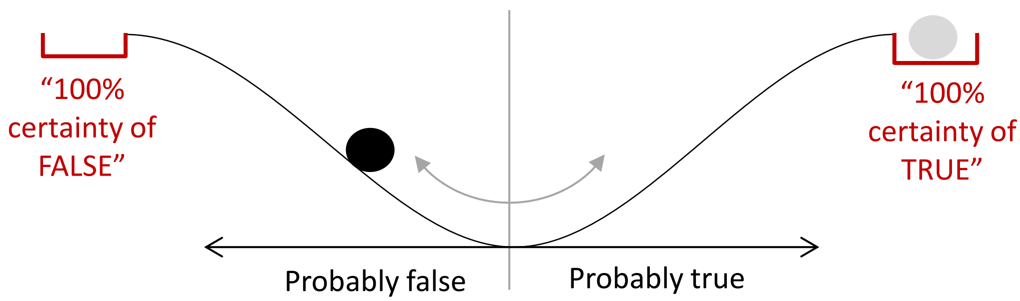
Vagueness



Probability - Uncertainty

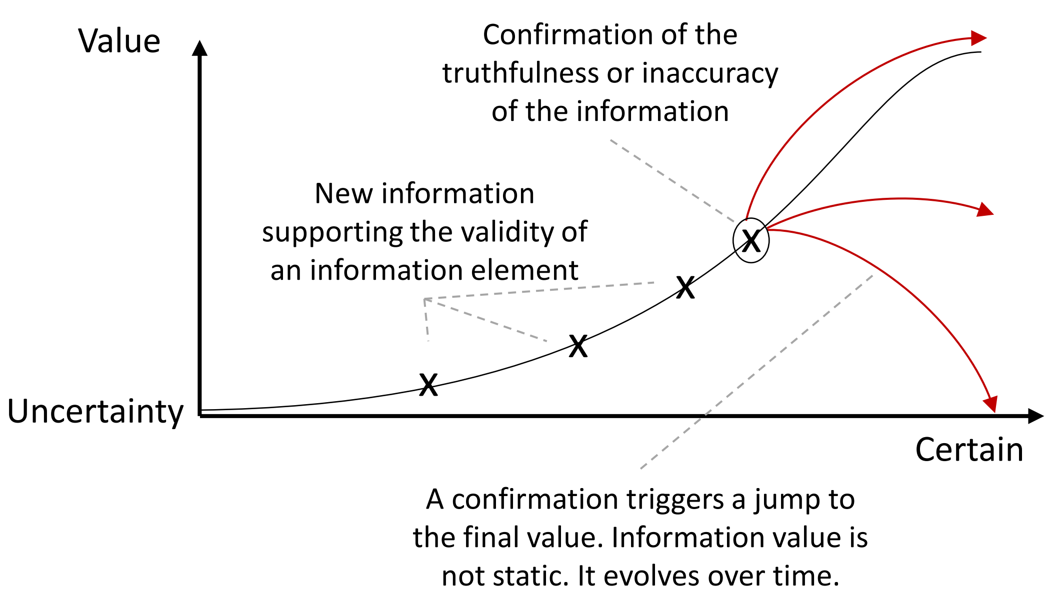


Information balances between uncertainty and certainty. As other information comes in, this movement may gradually move in one direction or it may oscillate until a 100% sure information confirms its truthfulness or falsehood.



Uncertain information is useable, but it is important to take the probability of being either true or false into account and to keep it in mind as long as the information is true.

An information element is (in)validated by other (ex. new) information elements.
The "confirmation" itself is an information element.



Human’s Preferences

0101	5
Yellow	
“B4x3C”	“Yellow”
Brown	Brown
Beach of an island in a purple sea. An orange sunset and in the upper right corner 5 birds flying.	
Picture	Video

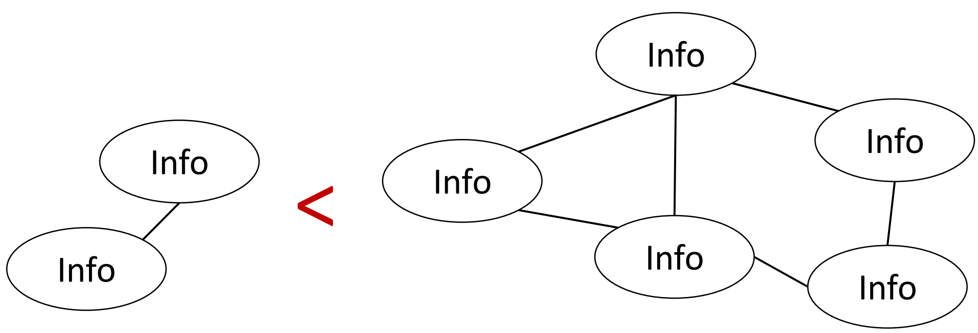
Visual, richer and easier to process by our brain

Exploitation of Information

Value

Importance is subjective

- Personal interest
- Usefulness (practical usage)
- Already known or not



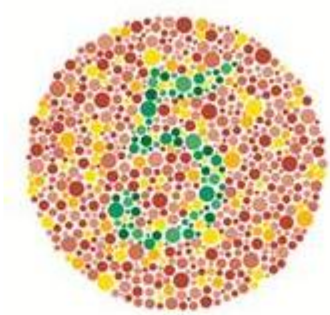
- Connecting information increases the value,
  insofar the information is true and not conflicting.
- Links are information in themselves.
- Linked information provide a richer picture.
- Linking information allows to verify information ant to detect conflicting information.

Data + Context $\longrightarrow$ Information

What is context? Context is the set if data linked to considered data element.

Context increases the meaning and the value to data.

Information Processing

5	Number (integer)	EASY to process
5,0	Floating number	
“5”	Text string	
“Five”	Text	
	Graphic	
	Graphics to be interpreted	
		HARD to process

Information - Definitions

An “Information Entity” is a set of naturally related information elements describing a same concept, object, aspect, ...

- PROCESS -

What is a Process

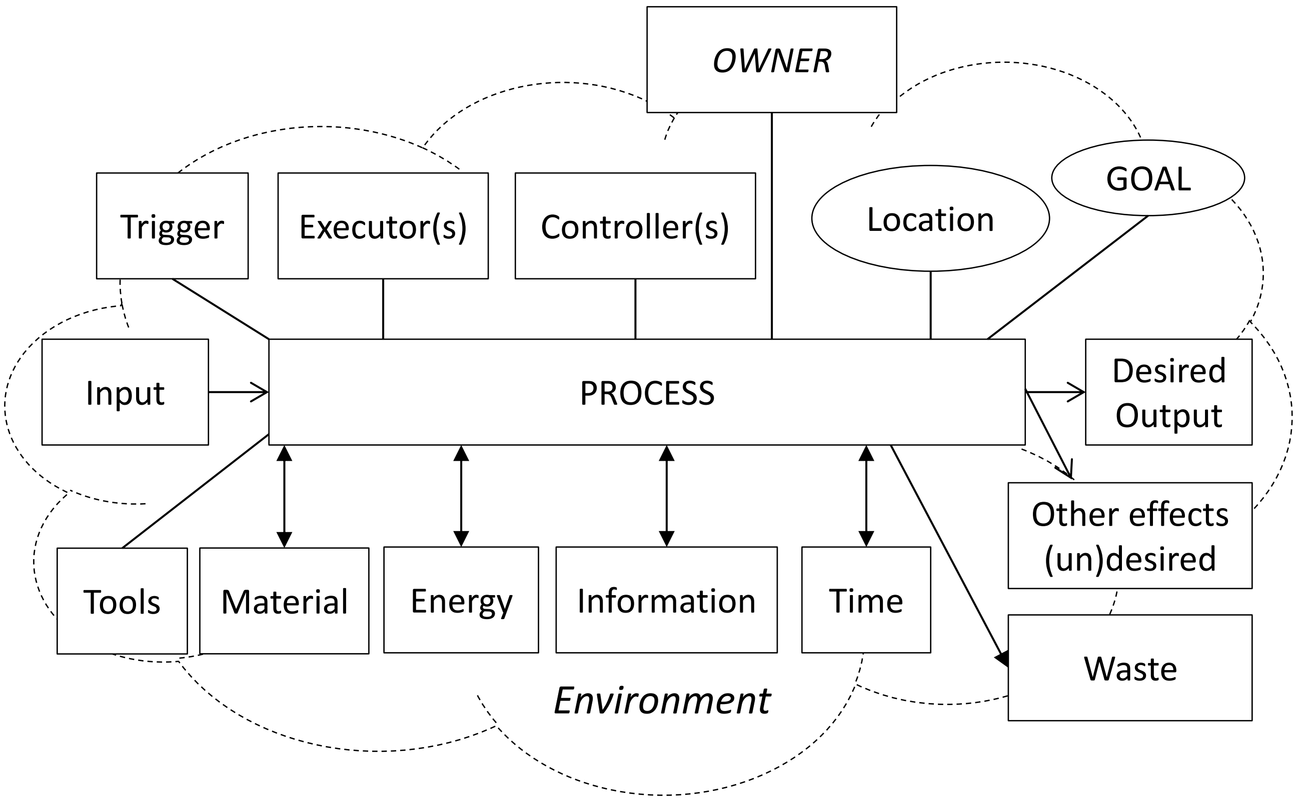
Examples of Processes

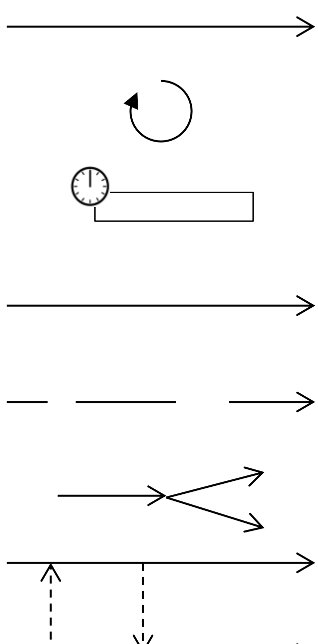
- Producing a car
- Selling a car
- Driving a car
- Executing a strategy
- Conducting a meeting
- Applying a Methodology
- Correcting a client’s address in a database
- Making coffee
- Learning
- Taking a decision

Artefacts representing processes

- Plans
- Methodologies
- Procedures
- Process models

Process Meta-Model





Linear process

Circular process

Recurrent processes

Continuous processes

Intermittent processes

Fork

Signals between processes

Notes

Not all elements are not always present.

SEE "PROCESS ANALYSIS" for additional key-elements(!) for the Meta--Model

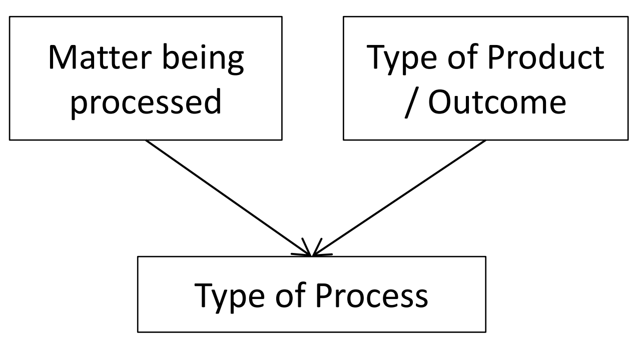
Process Elements

1. Goal
2. Value created
3. Trigger
4. Pre-requisites
5. Input
6. Output / Result
7. Steps
8. Test / Condition
9. Decision
10. Repetition / Loop
11. Discrete, Continuous
12. Linear, Divergent, Convergent
13. Transformation, Assembly
14. Size
15. Complexity
16. Degree of formalisation
17. Degree of structure
18. Phase
19. Gate, stage
20. Used resources
21. Domain of application
22. Required Competencies and Skills
23. Waste
24. Cost
25. Risks
26. Actors
27. Executor, performer
28. Monitors
29. Inspection / Control point
30. Measure point
31. Metrics, Performance, Indicators
32. Capacity
33. Process start
34. Process end
35. Duration of activity
36. Workload per resource
37. Throughput
38. Cycle time
39. Touch time
40. Takt time
41. Work in Progress
42. Work in Queue
43. Critical Path
44. Bottleneck
45. Variability
46. Criticality
47. Supplier
48. Source
49. User(s)

Types of Processes

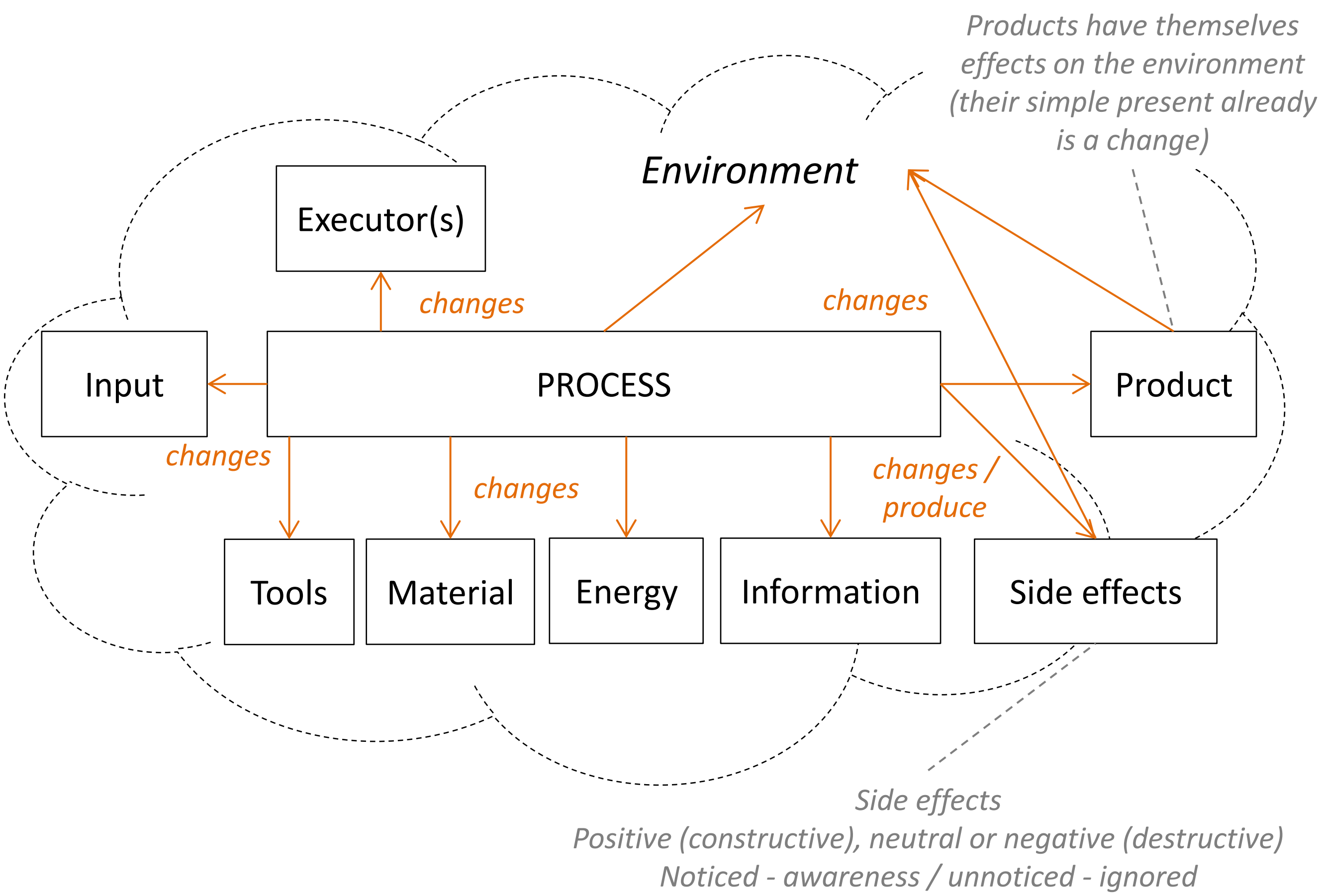
- Industrial process
- Chemical process
- Physical process
- Transport process
- Social process
- Psychological process
- Intellectual process
- Decision making process
- Engineering process
- Management process
- Business process
- Operational process
- Information process
- Financial process
- Communication process

- …



Impact of a Process

What does a process change?



Un- / Semi- / Structured Process

Ad Hoc	(Case Based)	Semi-Structured	Dynamic Structured	Structured

Ad Hoc / Unstructured

- Goal: unknown or may vary a lot
- Phases: None
- Process: No defined process
- Unknowns: A lot of unknowns to be discovered during the process
- Decisions: all decisions are taken during the execution

Case-Based

- See semi-structured
- But case-based can be lesser structured and limited to, for example, an available set of methods.

Semi-Structured

- Goal: Goal or product is known but may vary somewhat
- Phases: Stages and/or phases can be discerned
- Process: Parts (fragments, sections) of the process are defined. These parts can be subject to adaptation. Some steps have to be decided during the execution.
- Unknowns: resolved in order to be able to start next phases
- Decisions: A lot of decisions about the execution and resources are taken during the execution.

Dynamic Structured

- Goal : Goal and product are known, but may still be adapted
- Process: A suitable process based on the knowns can be devised upfront, yet the process is still subject to changes during the execution
- Unknowns: Most unknowns have been resolved. Some are still to be discovered.
- Decisions: Each step is questioned during the execution and appropriate decisions about the course of action are taken.

Structured

- Goal: goal or product are clear an immutable
- Process: Fully defined. It may include alternative paths, paths to deal with exceptions
- Decisions: no change in the prescribed process
- Unknowns: All unknowns defining the process have been resolved upfront.

Predefined processes can be executed as prescribed, without deeper knowledge ("follow the recipe").

All other processes <u>NECESSITATE a real MASTERY.</u>

From Structured to Ad Hoc

STRUCTURED	SEMI-STRUCTURED	AD HOC UNSTRUCTURED
Structured Definable Repeatable Predictable Formal	- Global (HL) structure, but more detailed levels are ad hoc - Partly structured (mix of structured activities and ad hoc activities)	Ad hoc Spontaneous Undefinable Unpredictable
Engineer-able Automatable	CASE-based PROCESSES DEVELOPMENT METHODOLOGIES ENGINEERING PROCESSES PROJECTS RESEARCH	NOT engineer-able, modelable, automatable
Most techniques allow to map, model or engineer this kind of processes	Limited repeatability Limited predictability Hard to determinate in details Most modelling **techniques** are **WEAK** for engineering and modelling these types of processes	
Automate	**Automate** parts; Computers can **support** non –automatable parts	Computers & software can offer **support**

Note:

Not advisable to try to design a case-based process as if it was a structured process. This is ignoring the freedom of decision making of the executor and the freedom to adapt inherent to that type of process.

Process Views

THREE DISTINCT PERSPECTIVES

1. THEORETICAL EXECUTION MODEL

Presents all the steps and decisions and all the possible executions paths.

2. INTERNAL ORGANISATION

Organisation of the process steps and of the logic

- Layers
- Hierarchy
- Libraries
- …

3. EXECUTION

- How the process can, is or has been executed
- Specific instance of the theoretical model

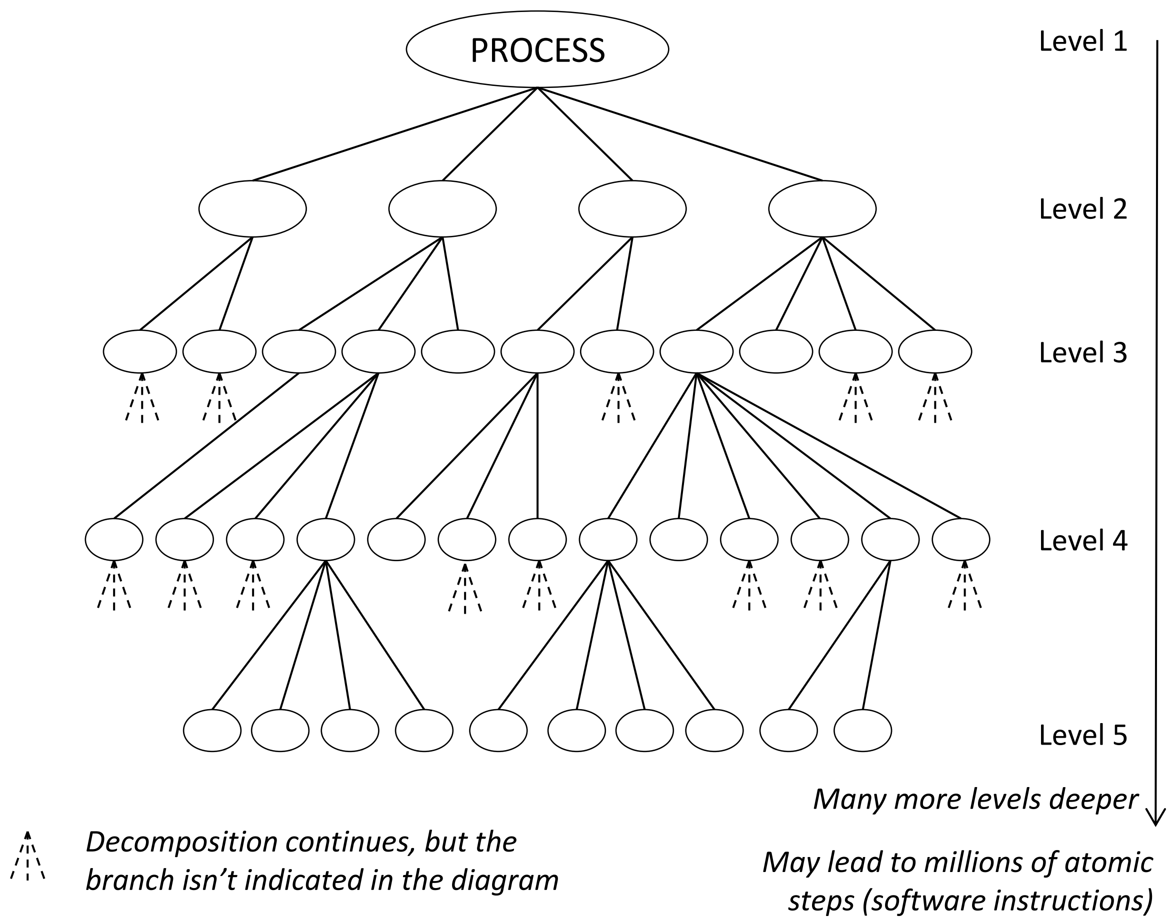
ENGINEERS MUST DETERMINE (MODEL) THESE PERSPECTIVES

Hierarchical Decomposition

VERTICAL VIEW

MAIN IDEA

- *Dividing the process into steps (top-down)*
- *Defining the grouping of the steps*



A sub-process is a process which is being a part of a higher process.

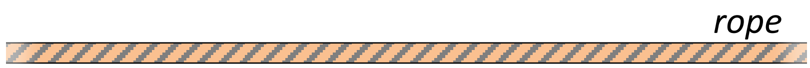
A process can have 0, 1 or more sub-processes.

Notes:

Conditions, repetition can be indicated at the nodes

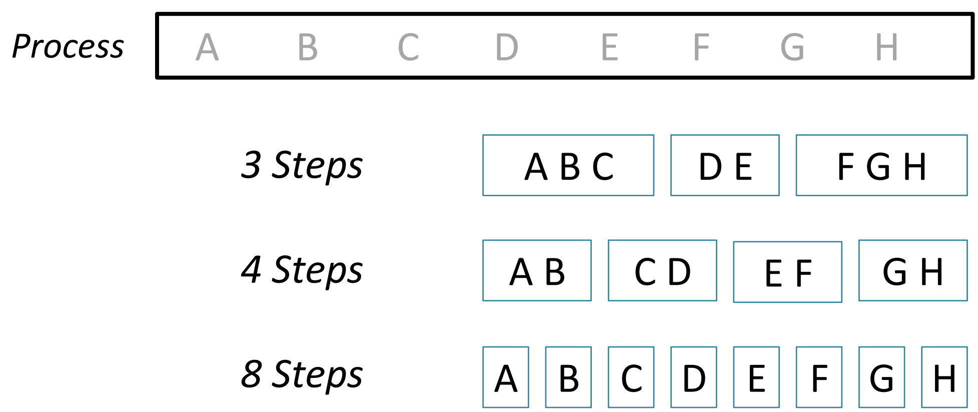
In software applications, a process can be 5, 10, 20, … 50 or more layers deep.

Hierarchical Decomposition

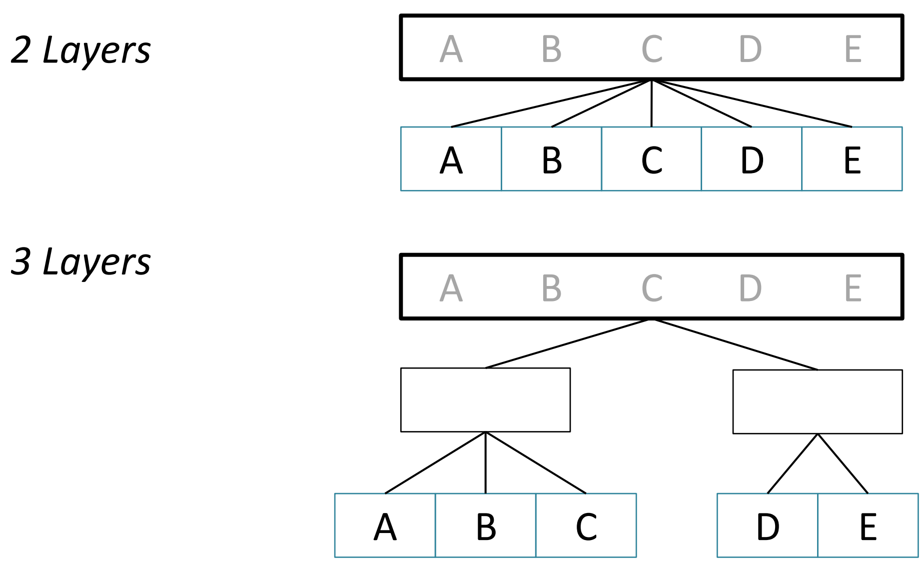


- *In how many ways can you divide the rope (by marking the segments, not by cutting it) ?*
- *Work may differ → different steps. Where exactly stops one step and begins the next one?*
- *Many ways of grouping steps (defining "phases")*

Different ways to divide a same process into steps



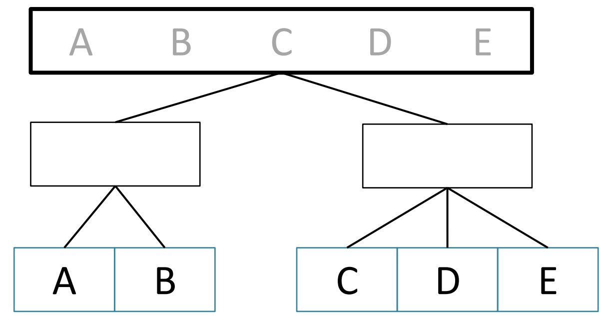
Different organisation of a process in layers



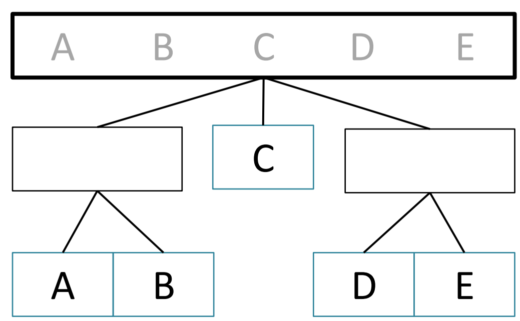
Hierarchical Decomposition

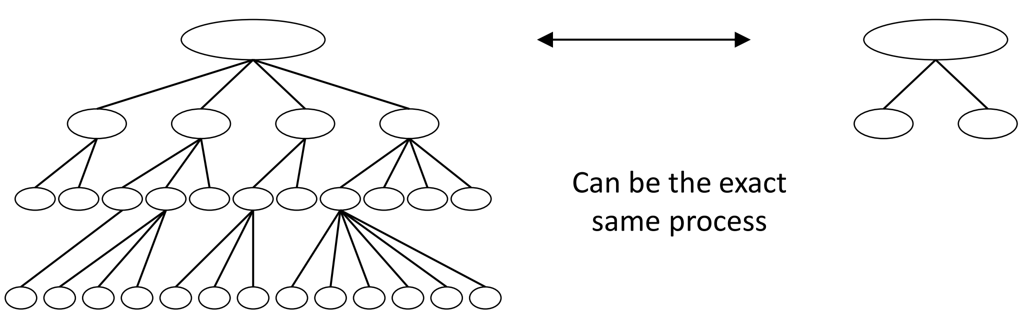
Many different possibilities are possible

Or tasks are grouped differently in the phases.



Or in three phases.





Can be the exact same process

Notes:

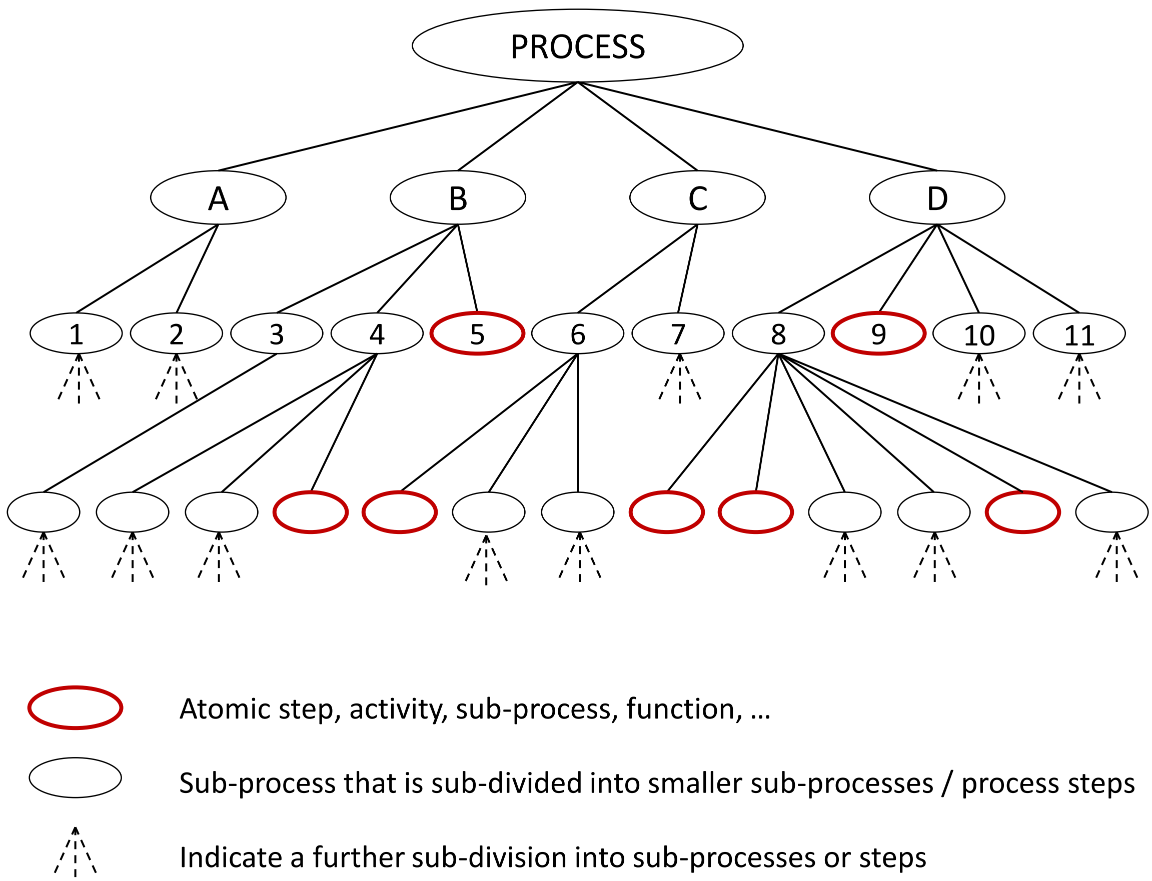
Many ways to represent and organise a same process without changing the execution → affects clarity, maintenance, reuse and flexibility

Need to chose the most logical and practical definition of steps, the grouping of steps and number of layers.

Hierarchical Decomposition

IMPORTANT

This represents a **specific existing or designed** (*) process. All the logic is located in the atomic steps (lowest step of each branch). Atomic steps can be located at different levels (in different layers), and not necessarily all in the lowest layer. The "hierarchy" above is mental construction, normally based on a certain logic defined by a functional grouping combined with a level of detail.



Notes:

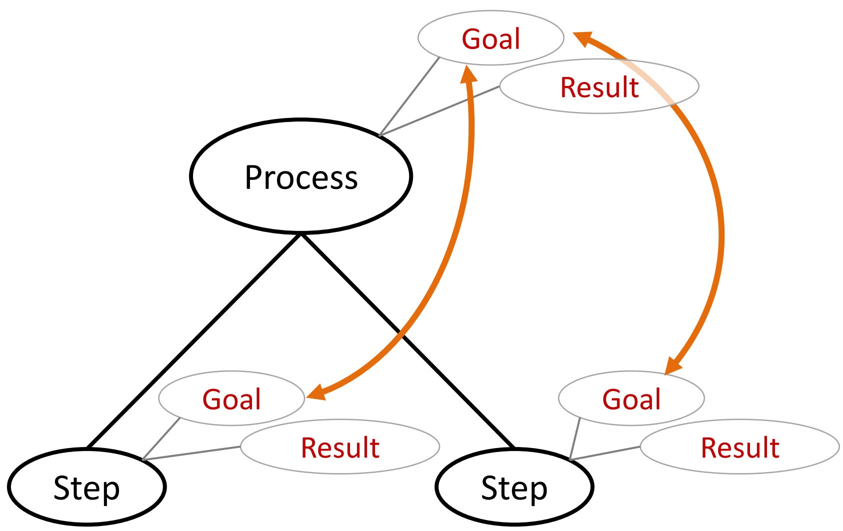
(*) A different case the Analysts face is that of process that is still unknown, inexistent and to be engineered.

The "layers" of bubbles tell the degree of decomposition. They don't represent a level of detail.

Hierarchical Decomposition

PROCESS GOALS

Alignment of the sub-processes and process steps



Goals of sub-process have to contribute, directly or indirectly to the goal (purpose) of the higher process.

The result of the execution of the process should either be useful further in the process or a part of the final result, else it's waste.

<u>Notes</u>

The "goal" is often not just the obvious. It is often not simply the product, problem or business goal. It is actually <u>so much more</u> than what is expressed. Therefore the goal must be identified with the greatest care.

Example:

A marathon: Goal: Winning the marathon

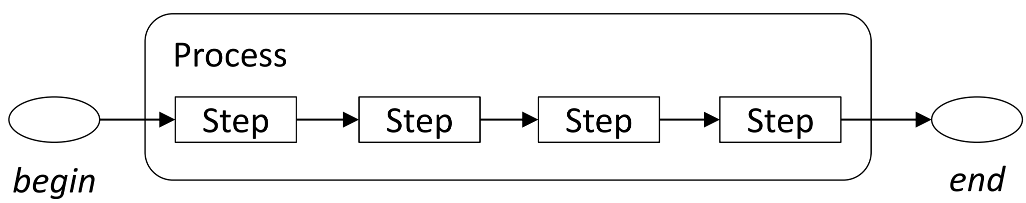
Is the goal reached when winning the marathon and dying after the finish line?

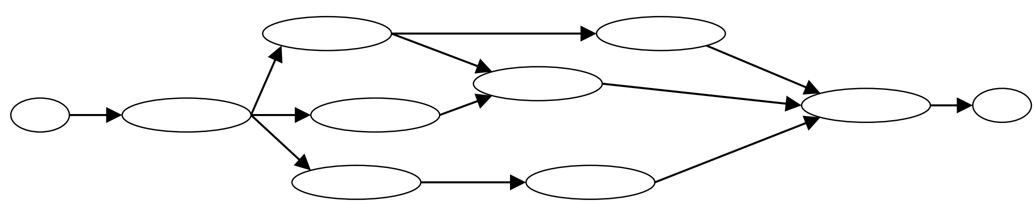
Horizontal View

HORIZONTAL VIEW – Process Flow – Work Flow

MAIN IDEA

Representing the successive steps of (approximately) same level of detail





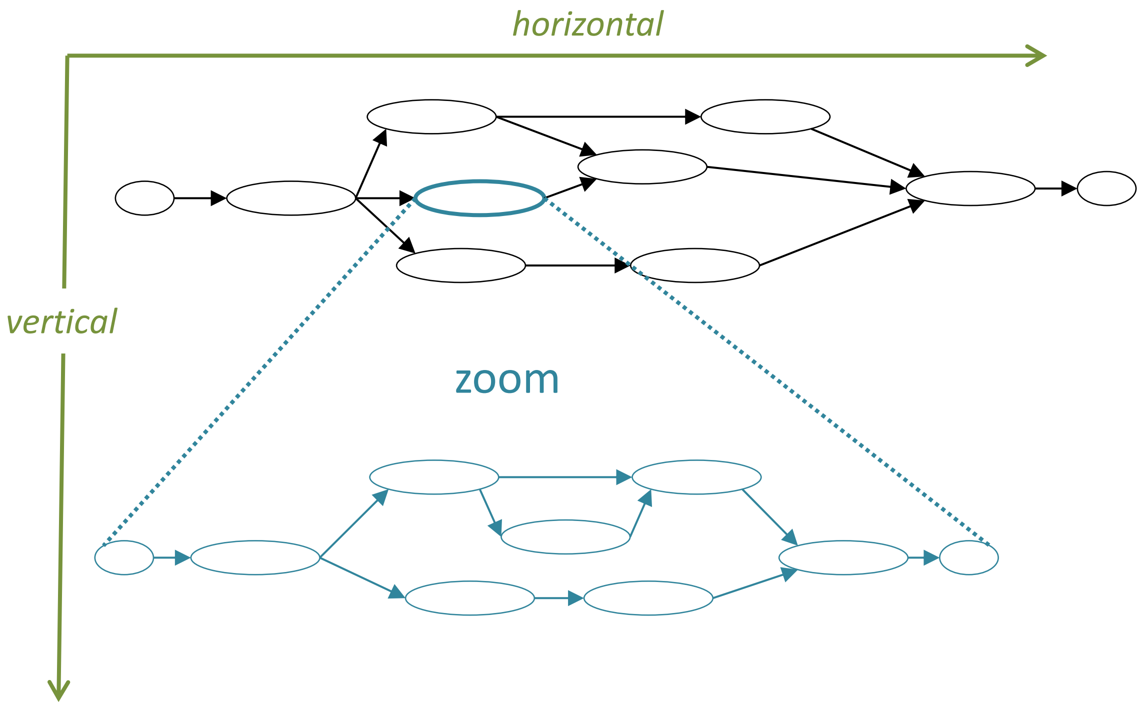
Ideal for representing Business Processes

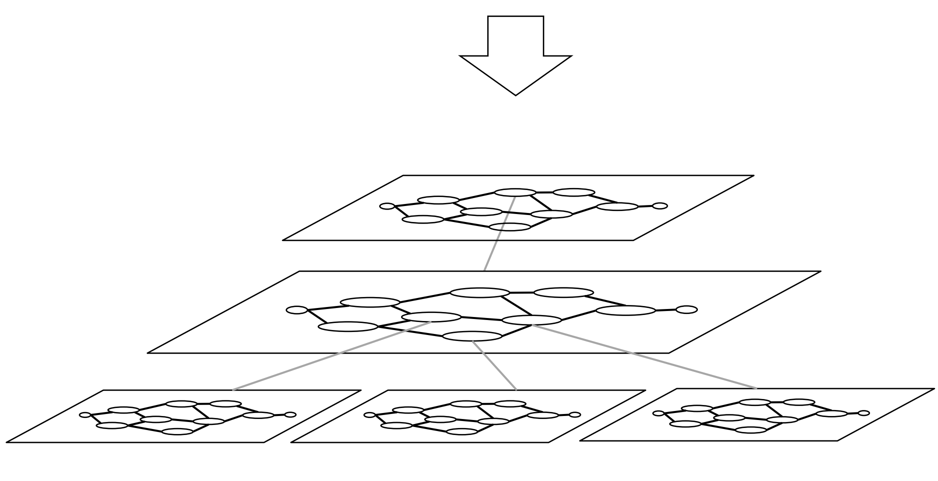
Examples

- Business Model
- SIPOC
- Value Stream Network
- Value Chain
- Data Flows
- Work Flows
- Activity Diagrams
- Swimlanes

Horizontal View - Vertically

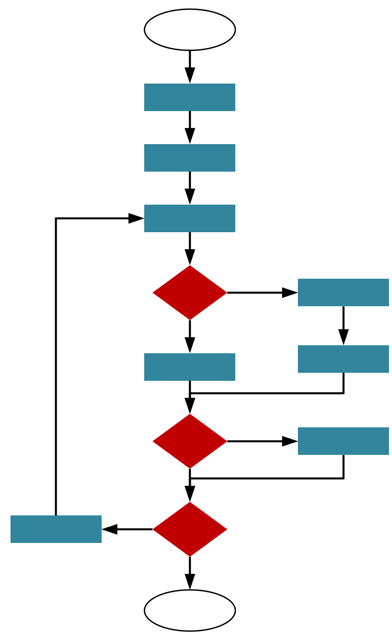
Linking horizontal views with more detailed horizontal views





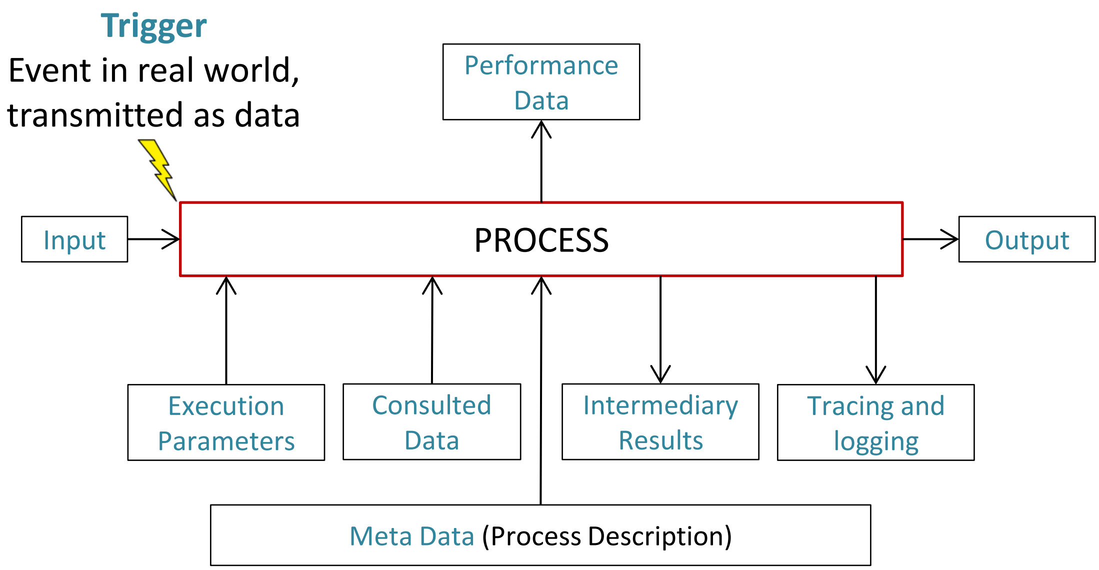
Detailed Process Diagrams

DETAILED VIEW – Flow Chart



- Shows conditions, decisions, repetitions, branches, …
- Shows main stream and exceptions
- Very easy to read and to understand
- Can represent any level of a process
- Ideal for more detailed levels
- Can be combined with swim-lanes to illustrate who executes steps.

Process & Data

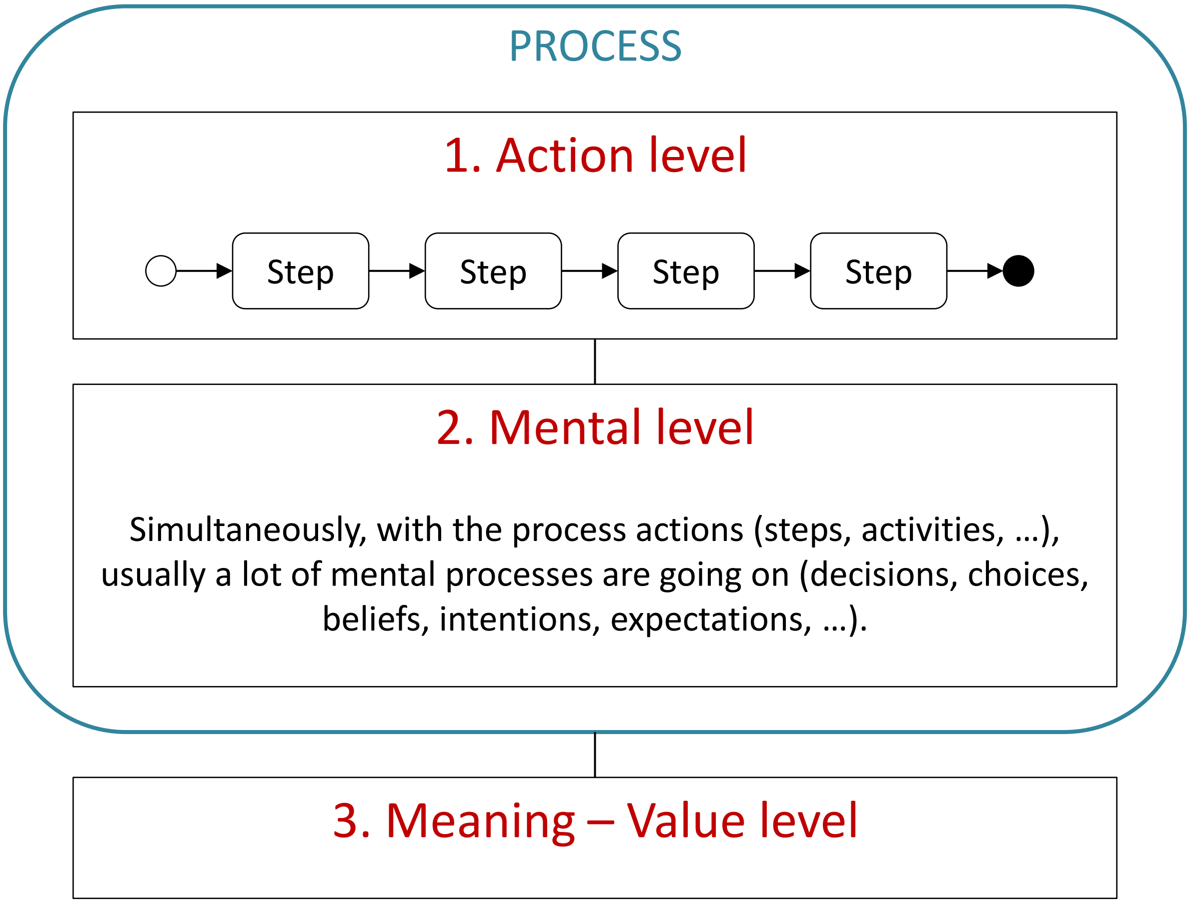


Process Analysis

Identifying existing and required processes

- What outputs need to be created?
- To what events does the company need to react?
- What may happen in the real world ?
- What are the existing processes?
- What are the inputs, resources and prerequisites for these processes? Other processes are required to get these inputs, to create the prerequisites and to obtain the resources. What are these processes?
- What processes are needed or possible to keep the information up-to-date?
- State transitions in information entities also points to events and processes to trigger and perform these transitions.

Process Analysis



<u>EXAMPLE</u>

WAKING-UP process

Action-Level: alarm clock rings, waking up, brush teeth, put clothes on, prepare breakfast, have breakfast, …

Mental level: Why did you or didn't you push the snooze button? Did you take the decision to brush your teeth? How did you choose your clothes? To make the choice, did you think on the activities of today? Why? Did you check the weather outside or the weather forecast? What else were you thinking? How did you choose your breakfast? Did you decide that morning about the order of actions? And so on.

Meaning / Value level: It is important for you to feel good, to look good, to impress and not to be hungry later in the day. And so on.

Process Analysis

30/10/2018

Goal - Result	○ → Goal / Result → Goal / Result → Goal / Result → Goal / Result → ●
Concrete Process Dynamics	○ → Step → Step → Step → Step → ● or activity, loops, the inputs, outputs, timing, messages, … (level of UML, BPMN, Flow charts, …)
Meaning & role of outcome	• **What is the result** of the step or of the whole process? What is it worth? • **Role** of this result / outcome? • **Value** of this result / outcome?
Meaning of the step	• **Meaning**, sense of the step or of the whole process? • **Why** is the step, action, …, process executed? Why executed/designed like this?
Intellectual perspective of the process step	• What **decisions** are made defining the process? • What is the **thinking** driving the process? • What is the **intention** during each step (or whole process)? • What are the **expectations** of the steps (or whole process)?
Beliefs	• What **perspective(s)** is/are at play ? • What is the **belief system**? • What **assumptions** are made?

Depth

Fully understanding of the process

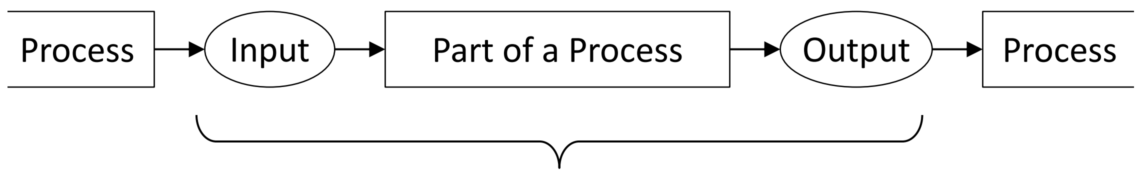
Notes:

'Step' can be a phase, an action, an activity, a process, a function, a feature, … a group or a mix of these.

Models of processes can be drawn by looking only to the actions, the inputs and outputs. But it won't get further than the existing processes or "order taking". A process can't be designed or properly evaluated without a consideration of the deeper levels. The deeper levels bring true and essential and even critical understanding of the deeper sense of the process. A **methodology** is, in essence, also a process which without deeper understanding can't be applied correctly, let alone adapted to suit the project and to create excellent results.

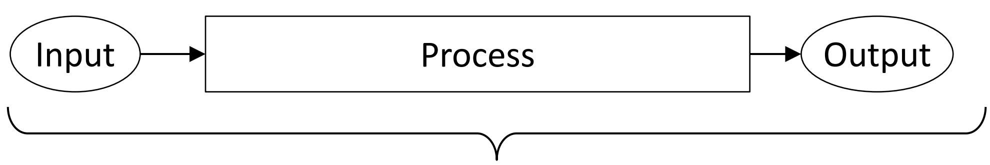
Scope of Analysed Process

Limited Scope



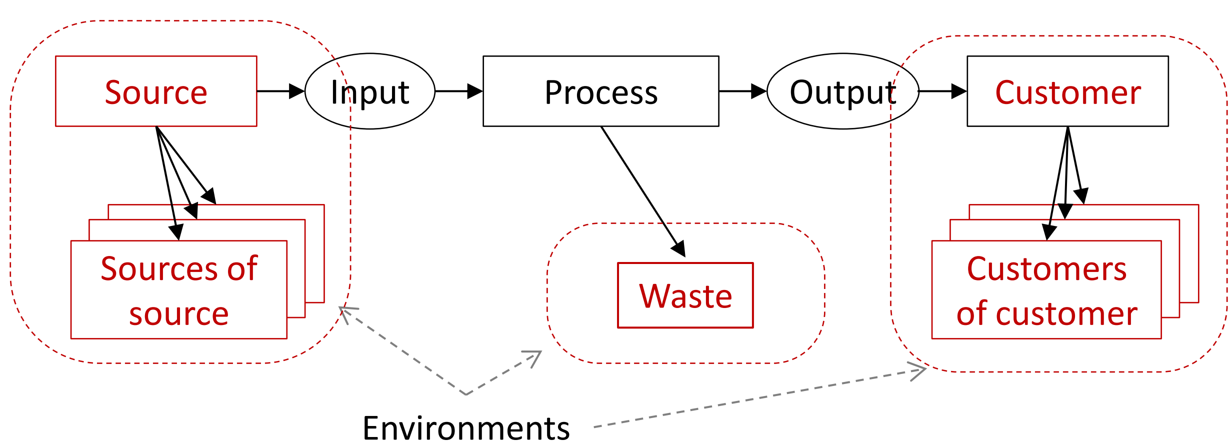
"our part of the process"
(like the 'whole' process within a department, within a system, within our scope)

Whole Scope



whole process within the supra-system
(within the enterprise, the organisation, the company)

Extended Scope



- The sources, the sources of the sources and their sources
- The customers, their customers and their customers
- the waste
- triggers, (hidden) consequences, side effects, …
- and the behaviours, cycles, relations and environments of all these elements

can be analysed as well

Example: SIPOC-model in management

Process Levels

Process Phases

Main steps (activities, functions, …) within a phase

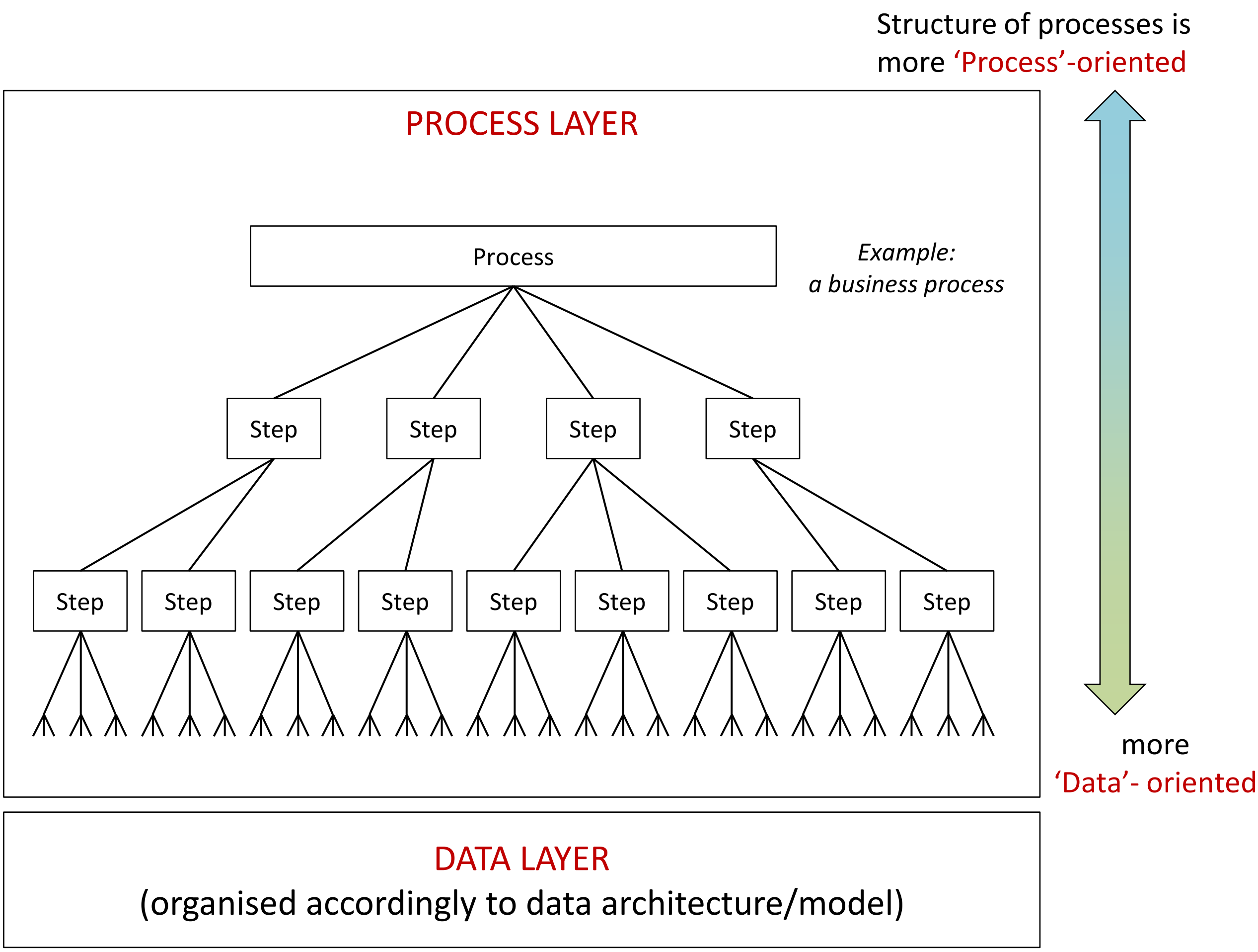
An activity changing multiple composite information entities of different types

Activity changing one or more composite information entities of a same type or changing a set of different atomic information entities (a list)

Changes multiple atomic information entities of same type (technically: set of records in same table)

Changes on an atomic information entity (in technical terms: a *database table*)

Process Design



Notes:

High-level horizontal cross-border processes shows the process in its entirety, often/mainly regardless of the underlying data architecture.

At a deeper layer, we may find process steps dealing with closely related data entities. Even deeper we may find process steps dealing with lists of same data entities and finally steps dealing only with a single data entity.

The lower levels of process steps can be better organised accordingly to the data architecture.

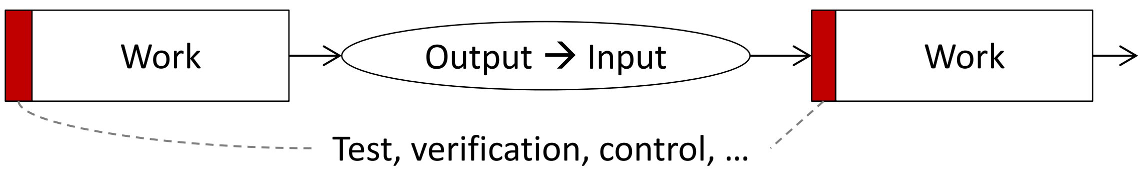
Representation: It presents one view: the decomposition of a process in its sub-processes, steps, sub-steps, …. These steps can be implemented as services, performed by agents or organised in libraries. They can be executed iteratively or form a network structure. These are just other possible views of a process, its execution or its organisation.

PROCESS DESIGN - GIGO

GIGO is not just a phenomenon that happens or caused by bad input. It is a **process design issue**.

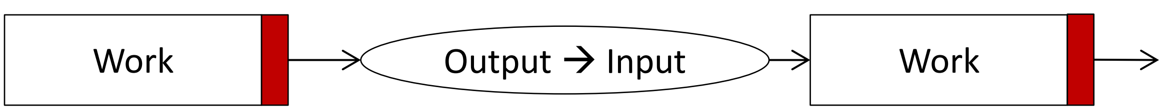
It is caused by processes that don't check their inputs and outputs and are not able to deal with wrong input.

Input Control



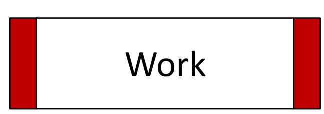
Question: Is the input fine?

Output Control



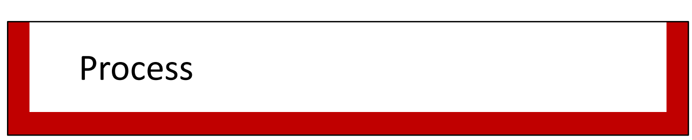
Question: Is the output, the work performed by the process, fine?

I/O Control



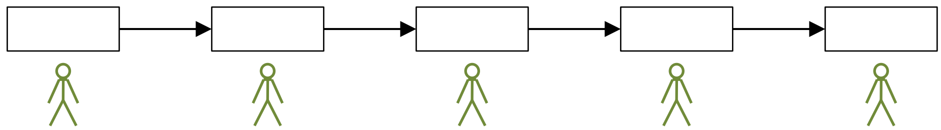
Question: Are the input and output of the process fine?

Continuous integrated testing

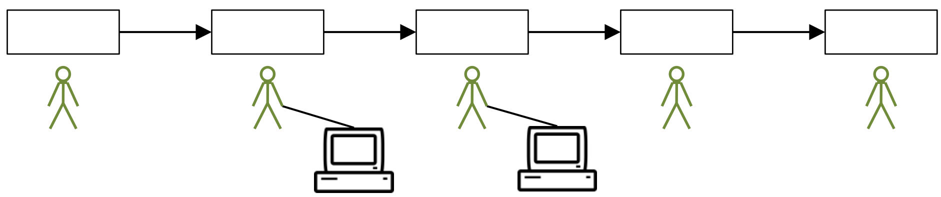


Process Automation

Process executed by people (manual process)

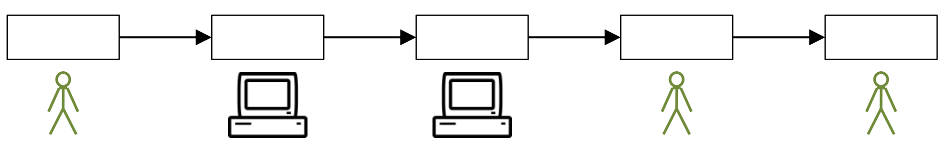


Process executed by people with support of software systems

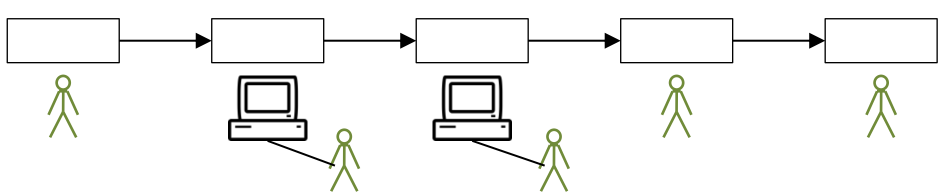


Computers do not execute the process. They are used to increase effectivity and efficiency, like for gathering information to take better decisions.

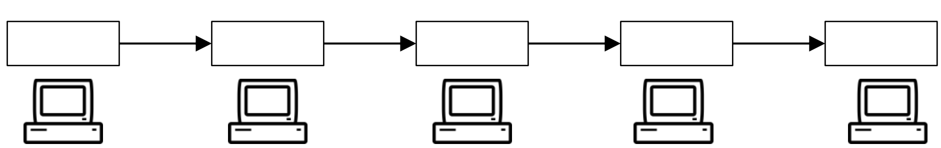
Partly automated process



Partly automated process with support of people on automated parts



Fully automated process



Some Design Tips

- Assigning an owner
  - Processes without owner tend to deteriorate.
  - Owner must understand process engineering, monitor the application of the process and keep the process efficient and effective.
  - Not an honorific title
- Organise processes in a logical and practical manner
- Define processes for reuse (modularity)
- Allow processes to be triggered, put on hold, interrupted, …
- Allow processes to be traced and monitored
- Configurability of processes
- Record process metrics (key performance indicators, and other performance indicators)

- PROBLEM SOLVING -

More about problem solving:
“Problem Solving – Concepts and Approach for Systems and Strategies”
https://goo.gl/IgxPw0

PROBLEM

A PROBLEM is a difficulty to be resolved, an intricate question to be answered, a difficulty to understand or accept. It indicates the existence of a cause, an obstacle or a difficulty.

Why solving problems?

Some problems may:

- Go away by themselves
- Be solved by someone else
- Remain the same
- Amplify
- Change
- Create one or more negative consequences

Solving problems is a way to progress.

Advanced Problem Solving skills help to avoid problems, solve them early and more easily. This limits their negative impact.

The Analyst is first of all
a "Problem Solver"

Problem Solving

?

Problem  (In-)Ability

No Problem	Anything that is OK or that can be solved easily
A Problem	Anything we are confident we can solve. But it will require some dedicated effort.
Big Problem	Anything we don't know yet how to solve. But with a big effort, we believe, we might still be able to solve it.
Very Big Problem	We are unable to solve it.

Each problem tests and trains our ABILITIES

"Problem" = personal & subjective concept

A lesser competent person is more likely to create more problems and to have more problems.

A smart and competent person will have more challenging problems, which may require more effort and time or a higher intelligence to solve them.

Notes:

- A *problem* is a subjective perception linked to our own ability to understand, conceive, build, adapt, change, improve, perform and action, get a result or reach a goal.
- It is also linked to our (im)possibilities, to various barriers and limitations existing in the situation and to the importance and criticality of the problem

SOLUTION

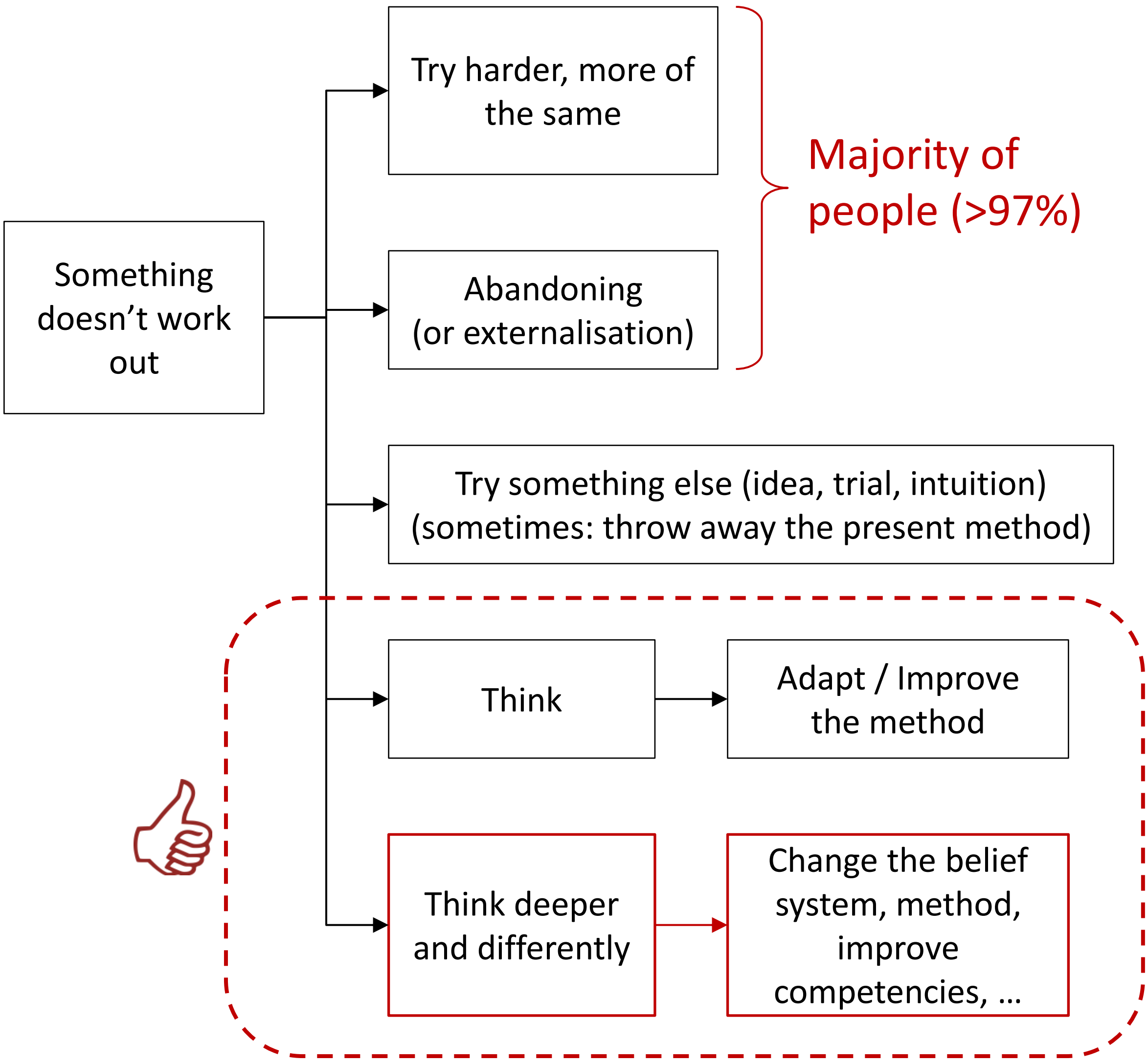
A SOLUTION is only a solution if it solves the problem (the cause, the gap, the difficulty) without creating (too many) new (significant) problems. Anything else is a figment.

- A solution can only exist if a problem exists and has been identified.
- A solution to an unidentified problem is not a solution.
- A ‘solution’ is not a solution if
  - it doesn’t solve the right problem
  - it doesn’t solve a problem in a beneficial way.
- “SOLUTION” is NOT synonym for “PRODUCT”
  - As a product to be bought
  - As the delivered system of a project

Peter Senge’s 1st Law:

> “Today’s problems come from yesterday’s solutions.”

Problem Solving Attitude



Notes:

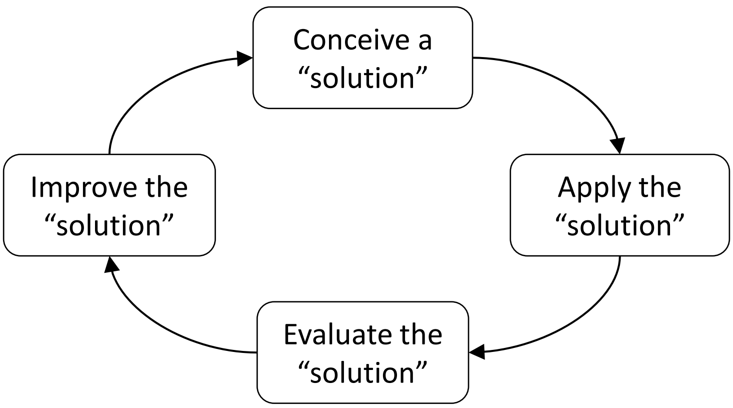
Examples:

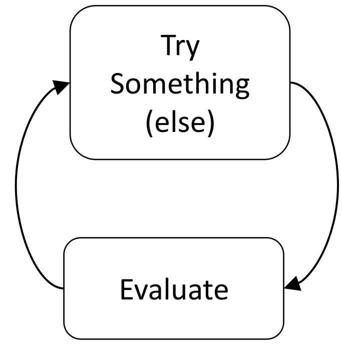
- Delegating, subcontracting, divestiture, closing down a company branch, privatisation
- Quitting instead of improving
    - Plans don't work. Let's stop planning or plan lesser.
    - Requirements are frozen but aren't good. Let's allow them to change freely.
    - Documentation isn't used. Let's document lesser.
    - The 'Waterfall' doesn't work. Let's abandon the Waterfall model.
    - Systems Analysis doesn't lead to good solutions. Let's try hope emergence will bring good solutions.

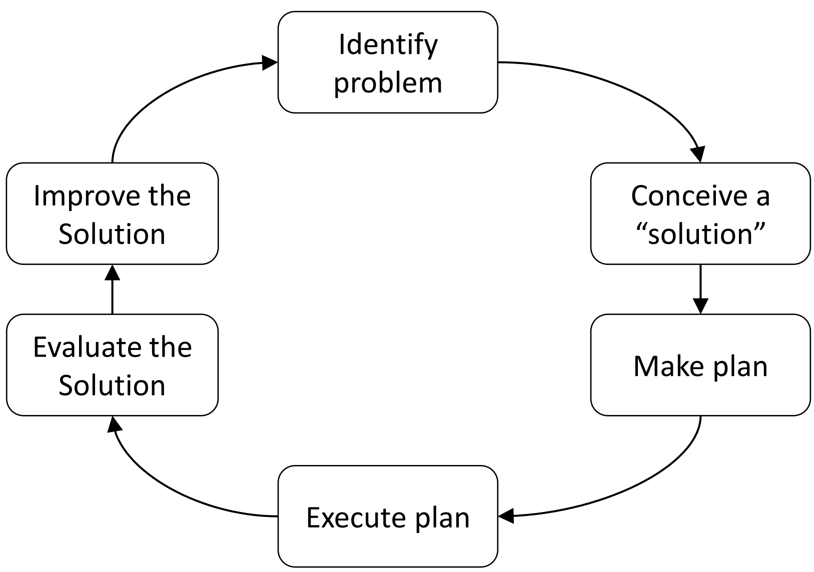
Reality: It's not the tool. It's an incorrect application or lack of skill. Improve and Learn

Traditional Problem Solving Models

TRY UNTIL IT'S OK - MODELS







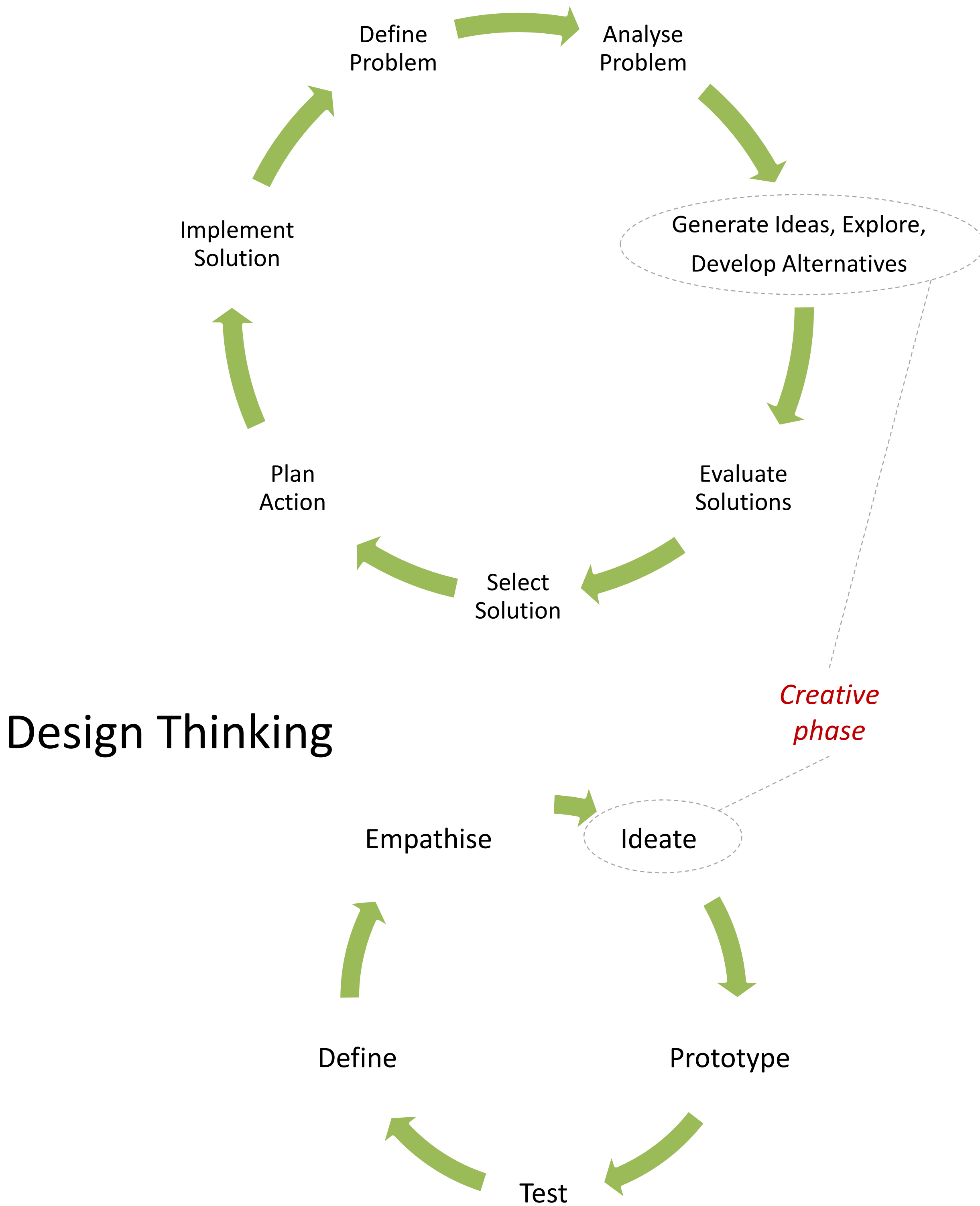
Each iteration:

- Adds time
- Adds resources usage
- Adds rework (more waste)

Unfortunately, these models **don't help** in problem solving. The whole difficulty of problem solving is concentrated in the step “conceive a solution”. The models don't explain how to solve a problem.

There are better approaches than cycling until a solution is obtained.

Creative Problem Solving



Rational vs Creative Approach

Problem: How to augment a restaurants profits?

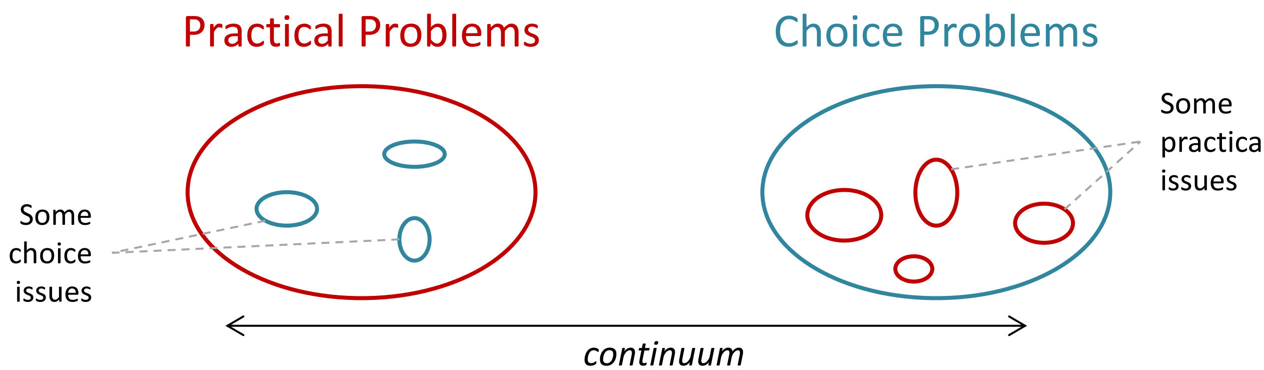
1) Rational, Analytical, Structured Approach

1. Identify the problem
    - Study of the location, visibility, accessibility of the restaurant.
    - Study of the clients (who, do they come back, complaints, …)
    - Analysis of the welcoming process, the restaurant service, waiting times, …)
    - Analysis of the processes in the kitchen
    - Analysis of the restaurant and kitchen collaboration
    - Analysis of the offered plates
    - Analysis of the cooking processes
2. Solve the identified issues
    - Identify the causes
    - What can be changed and what can't
    - …
3. Implement the solutions
4. Evaluate the results

2) Creative Approach

1. Generate ideas by posing the question: "What can be done to make the restaurant profitable?"
    - Introduce a new theme every month (Mexican food, Italian food, sea, hunting, …)
    - Get some more healthy child dishes
    - Offer a little gift to children
    - Install a playground for children
    - Organise now and then an activity or performance for children
    - Offer rare dishes to customers
    - Disguise the waiters and waitresses and decorate the restaurant
    - Install a bar
    - Get more adapted music
    - Get waiters and waitresses better trained
    - …
2. Think of the feasibility, investment, cost, implementability, risks, consequences, …
3. Select and plan the order of the ideas
4. Implement the ideas

Practical versus Choice Problems



Mainly Practical, mechanical, logical

Criteria: Does it work or not ?, …

Focus is more on internal qualities: structure, functioning, strength, capabilities, capacity, …

Respect of laws of nature
Respect of laws of physics
Respect of principles

May contain some choices, preferences, likings, aversions, taste issues, …

Facts, reality, understanding, … are critical

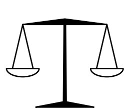
Mainly related to choice, likings, dislikes, emotions, sympathy, opinions, taste, preferences, ..

Criteria: Do we like it or not?, …

Focussed on external qualities: outlook, colour, taste, shape, usage, smell, sensation, sound, …

May have practical implications

Understanding the wants, expectations, taste, opinions, ..
Important: consumer experience, consumer satisfaction, ..



A practical issue has to be solved essentially in a practical way. Choice issues should essentially be solved in a different way.

Notes:

Does it make sense to discuss the colour of internal parts of a pump in an industrial plant? Or discussing the technical characteristics and production process of a romantic dinner you are about to enjoy in a nice restaurant?

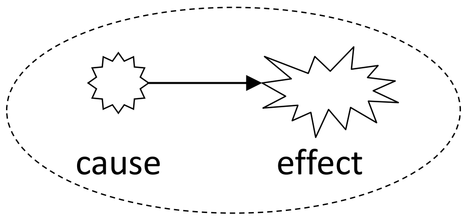
Do information systems in corporate environments solve mainly practical problems or rather choice problems?

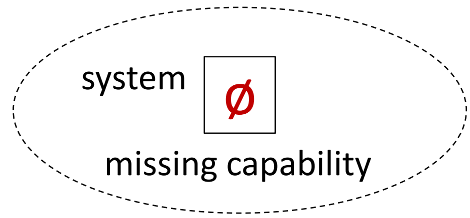
How do you see the balance (practical vs choice) in consumer IT products compared to the balance of information systems? What is the impact on the development approach?

What happens if we try to solve a practical problem with an approach that suits much more choice problems?

Two Types of Problems

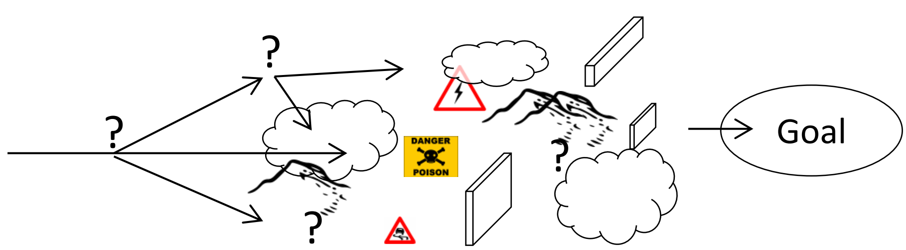
1 Obtaining a tangible result? → Solution: **SYSTEM**





- Production of products or services
- A dysfunctional system, a system that doesn't function as expected or which doesn't produce the expected results
- A system missing abilities or capabilities

2 Obtaining intangible result ? (Reaching a GOAL) → Solution: **STRATEGY**



Goal seems to be unreachable - Path to a goal is unknown.

Obstacles, uncertainties, unknowns, risks, dangers, traps, dead-ends and uncharted territories…

Examples: Winning a battle; winning a medal in a sport; increase the market share, learning strategy, …

Notes:

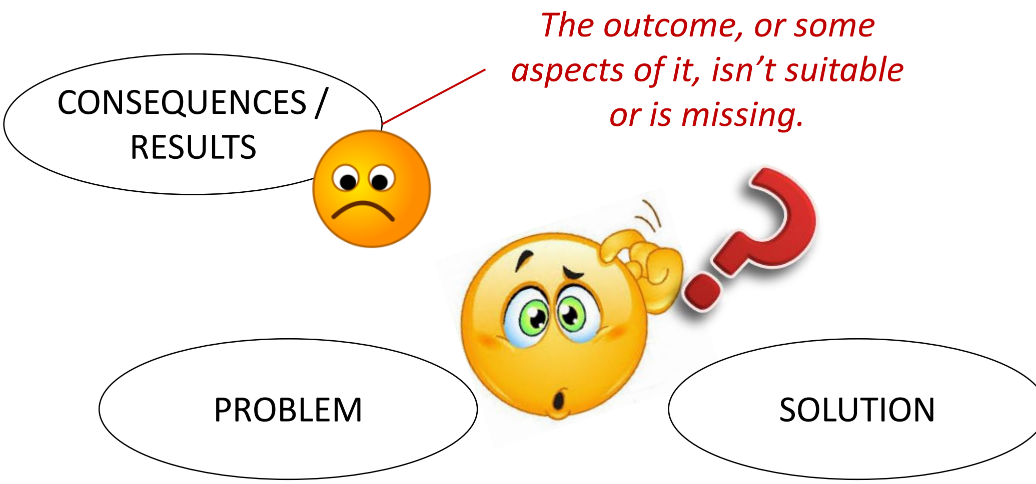
A system executes processes and a system may be part of a solution to reach a goal.

Some problems may require both, a system and a strategy (process) to be solved.

The conception process of systems and strategies differ from each other.

We need a process (strategy, approach, methodology) to build the right system rightly. An inappropriate strategy will hinder the conception.

A Core Aspect in Problem Solving



The main problem in problem solving is (often & mainly)

THE UNKNOWN

- Not knowing what is happening
- Why it is happening
- What the causes are
- What (all) the consequences are
- And not having (not knowing) the solution
- …

The problem solving initiative is (often/mainly) about

***searching and solving the unknowns*.**

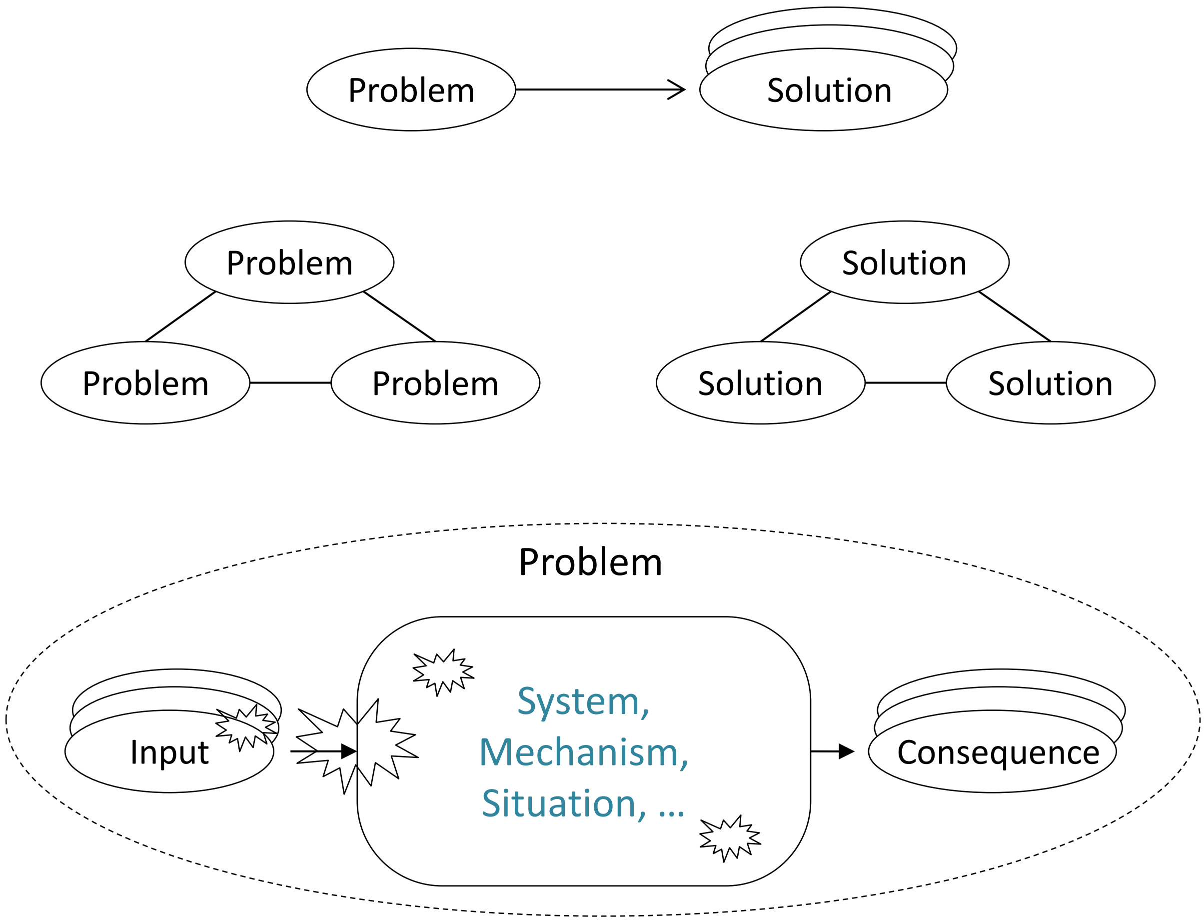
It is about acquiring understanding.

Understanding the anatomy of problems, systems, processes, … helps

(and the dislike of effort that will be required)

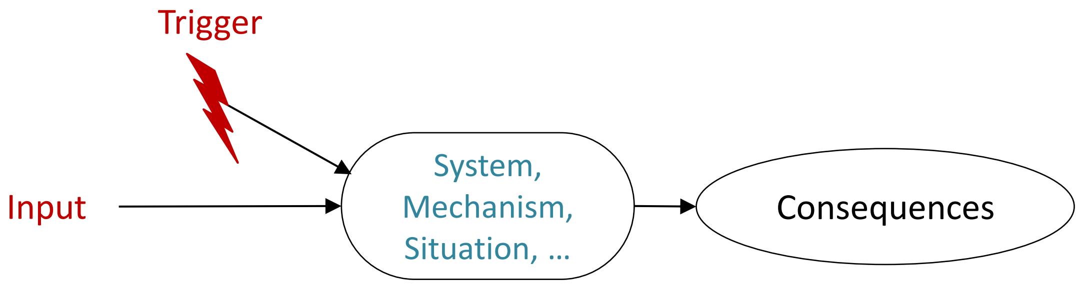
Anatomy of Problem

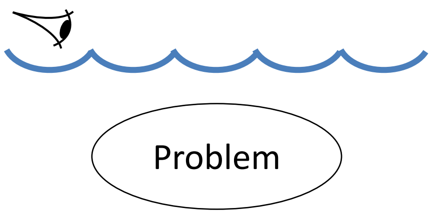
Focus is on 'System'-Problem (not on 'Strategy'-problem)



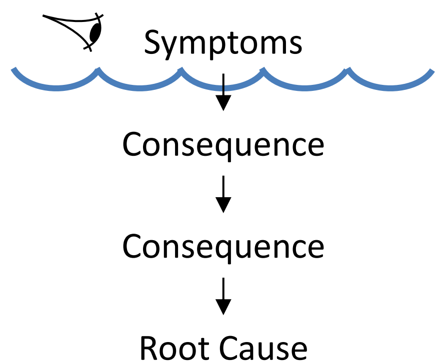
- A problem is solved by a solution. (problem – solution relation)
- One problem may have several solutions.
- Several problems may have a single solution.
- Not all candidate solutions are equal.
- Different problems may be linked. (common deeper cause? Solving together?)
- Different solutions may be linked.
- Several causes ( ) may exist, or several conditions may form a cause.
- A cause can be inside and/or outside the system.
- A problem creates one or more consequences (missing or bad results).

Anatomy of Problem





Hidden problem
(under the surface)



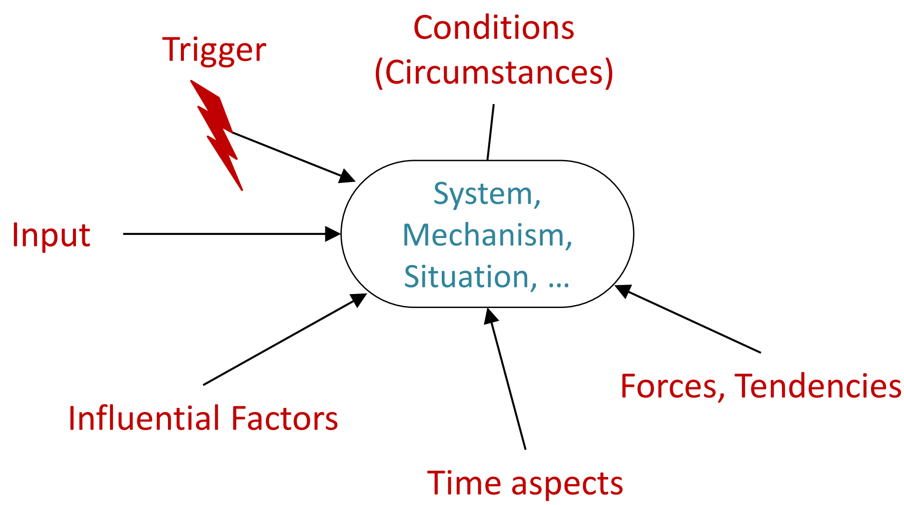
Consequences can be

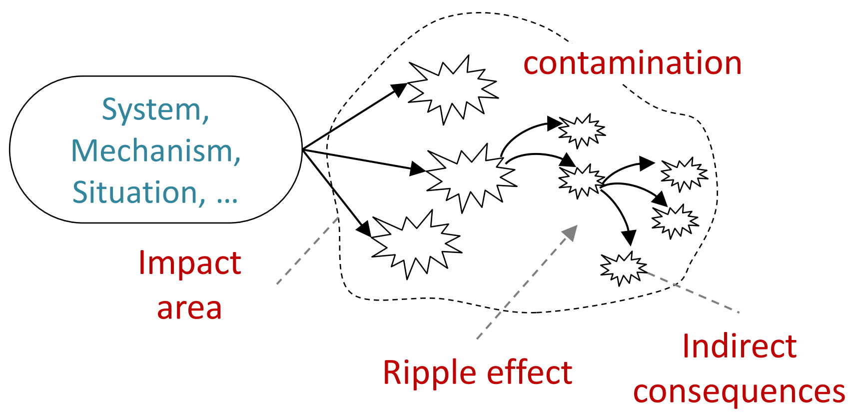
- Missing
- Inappropriate
- Visible / invisible; detected / hidden; known / unknown
- Positive/ negative
- Spread or concentrated
- Specific, generalised
- Irregular, regular or continuous
- Annoying, embarrassing, painful, causing discomfort, irritating, …
- Temporary, permanent
- Reversible, irreversible
- …

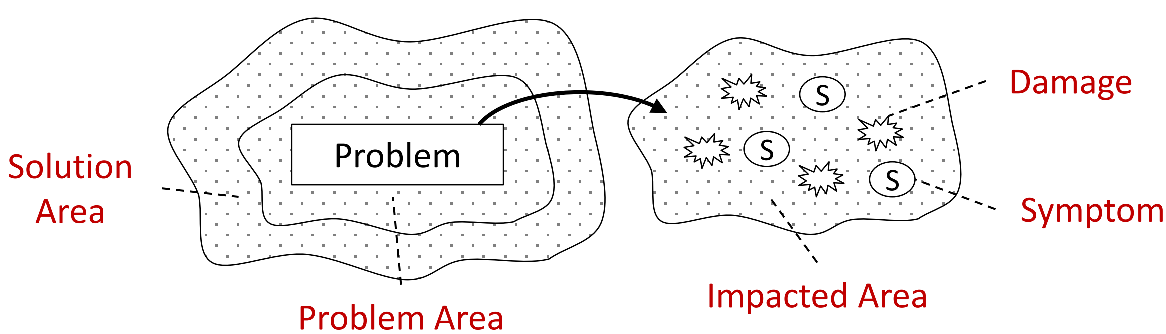
A **symptom** is a noticeable and/or experienced consequence or a side-effect; a sign of an underlying problem

Anatomy of Problem

Behaviour of system can be influenced, hindered, obstructed, …



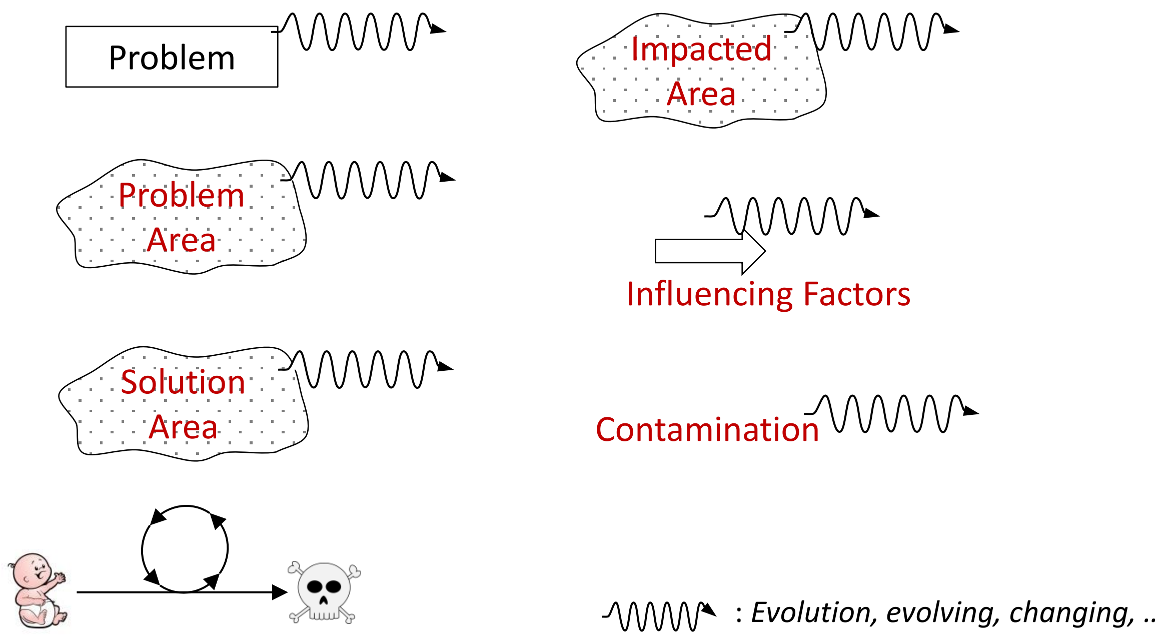




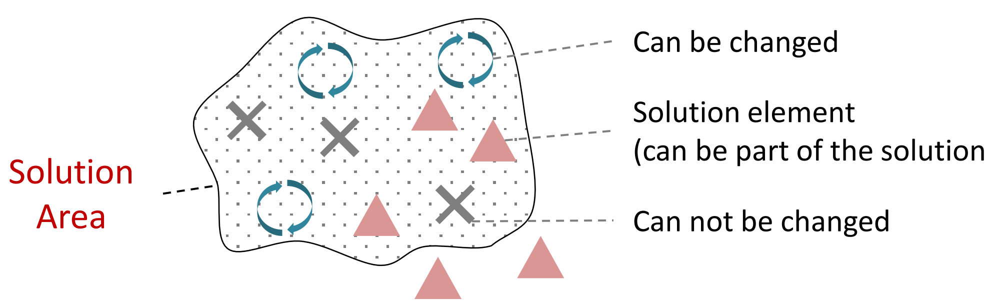
Notes:
The identification of indirect consequences, contamination, impact area, etc. help to correctly diagnose problems, understanding problems, solving them and cleaning up their consequences.

Anatomy of Problem

Problems are (often) dynamic or exist in a dynamic environment



Problem lifecycle



Solution Element

Anything that can be part of a future (candidate) solution

Candidate solution

Any potential solution; the alternative solutions

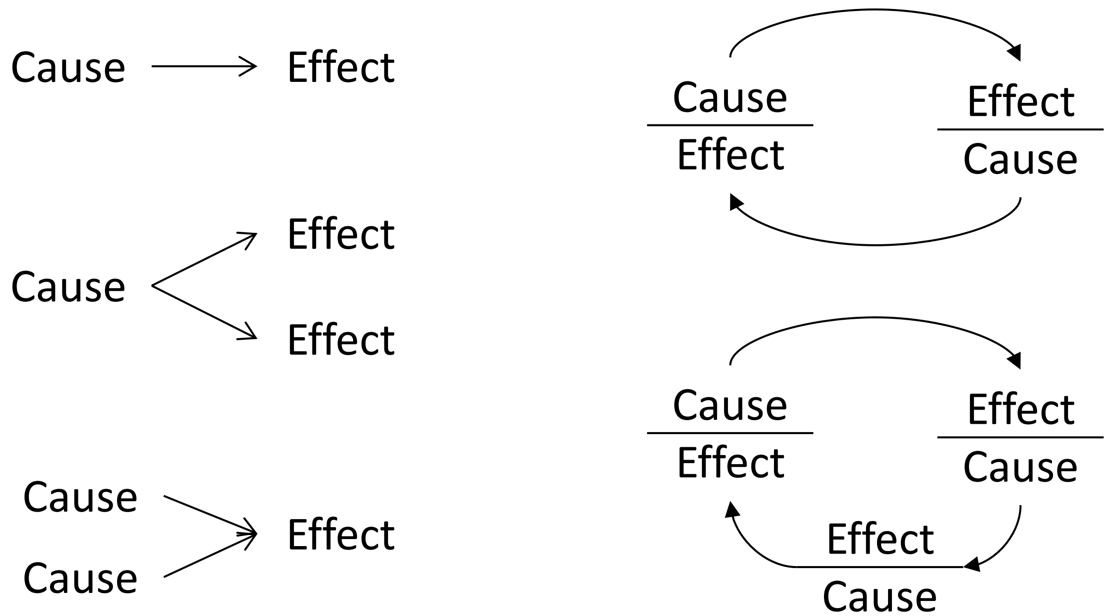
Problem Concepts

Understanding the following concepts helps in analysing and solving the problem

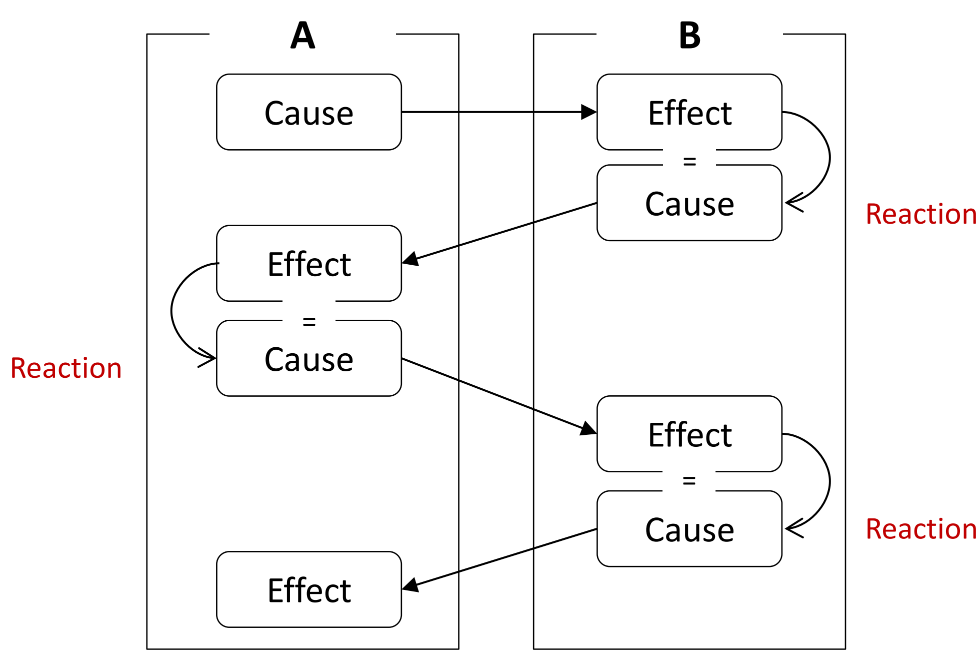
1. Complaint
2. Symptom
3. Impact
4. Consequence
5. Risk
6. Damage, Loss
7. Problem
8. Nature of the problem
9. Perceived (subjective) problem
10. Problem Domain
11. Indirect Effects / Ripple Effect
12. Trigger, Event
13. Input
14. Condition, Circumstance
15. Cause-effect-Relation
16. Dynamic: System, Mechanism, Process
17. Problem's Evolution / Life
18. Forces, Tendencies
19. Problem Area
20. Impact Area(s)
21. Root-Cause Analysis

Note: Concepts related to the solving-part of the process are presented later.

Problem Solving – Cause - Effect Relation

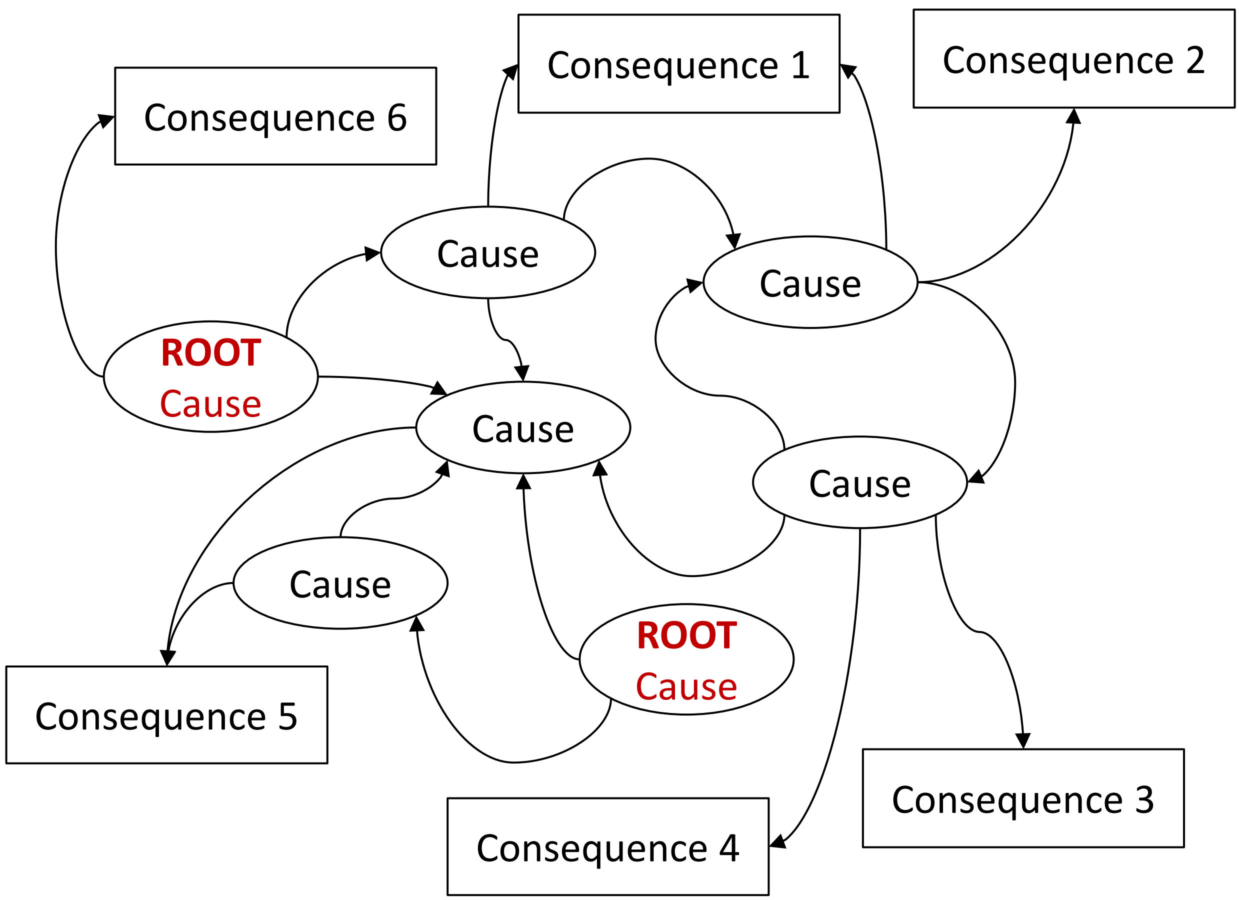


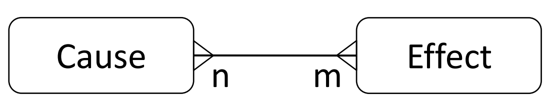
Effect / Cause : *Effect becomes itself a cause of another effect*



- Implies presence of a mechanism
- Not always just a single cause-effect relation. It can be much more complex.

Problem Solving – Network of Causes



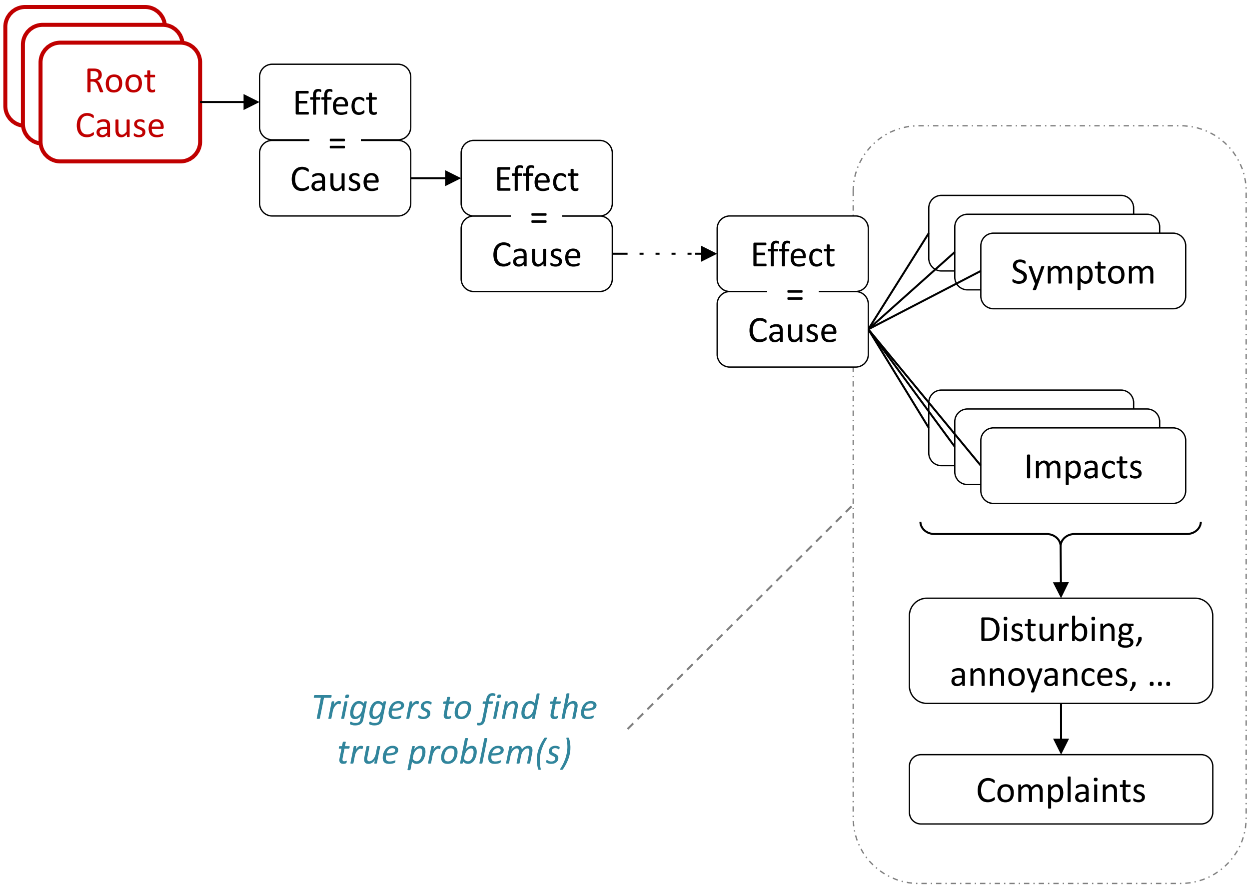


Sometimes, no root cause can be identified. It might be better to start solving one or a few causes. This may activate a dynamism that will solve many problems.

Note that a cause alone may not materialise on its own. Circumstances also play a role. Are these circumstances normal? What caused these circumstances?

Example: finding a job may solve many other of someone's problems.

Cause – Effect Mechanism



Treat anything labelled as "problem" or as "cause" as an "effect"!

- This is the problem to be solved.
- Really ? What caused the problem
- This is the cause.
- Really ? What caused the cause?
- This is the cause of the cause. (or "These are the causes…")
- And what caused the cause of the cause of the problem?
- Etcetera.

Basic Problem Solving Approach (1)

Clear and easy solution

Build, Implement, Apply the solution

Assumption: The solution is simple and known.

Solution is unknown or complex

Solution Conception → Build, Implement, Apply the solution

Assumption: The problem is known.

Problem is not clearly identified and understood

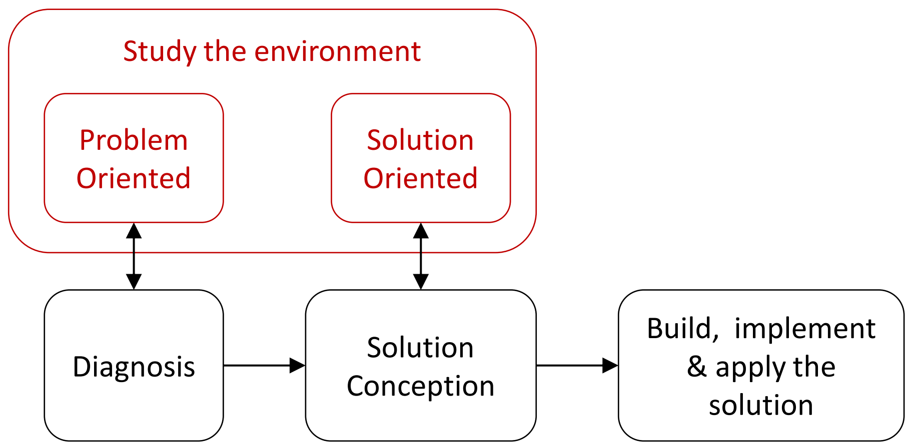
Diagnosis → Solution Conception → Build, Implement, Apply the solution

Assumption: The environment is rather simple and very well known.

Communicating the diagnosis is important. The diagnostic has to be established and shared. Only then individuals can work together on a same solution.

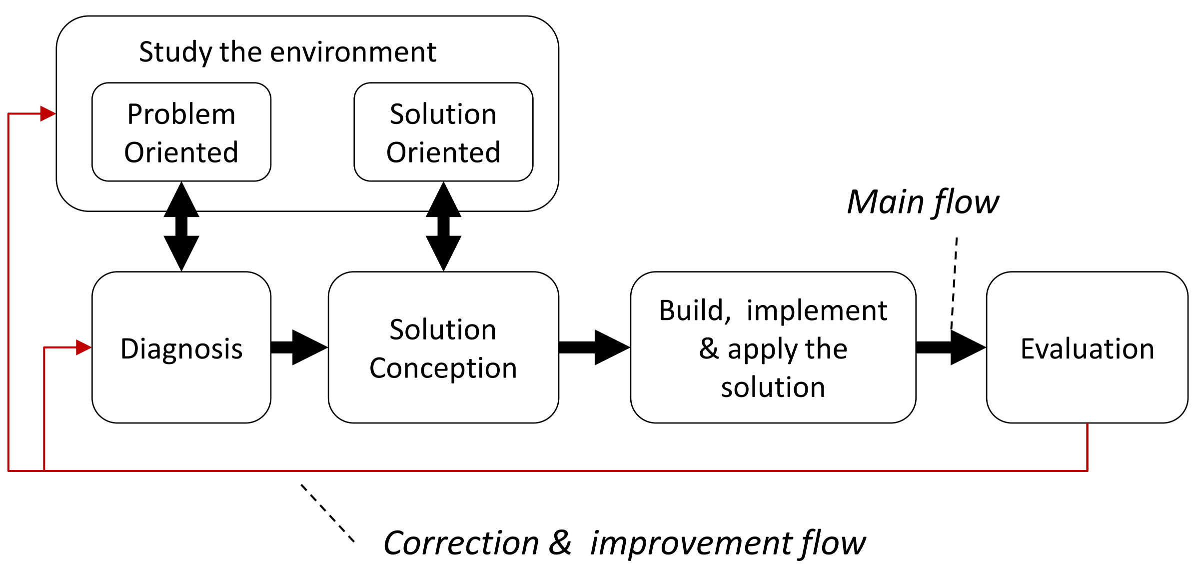
Basic Problem Solving Approach (2)

Complex environment, problem is not clear - solution is complex



Assumption: Assumes the solution is built flawlessly from the first time.

Second built solving teeth problems & continuous improvement

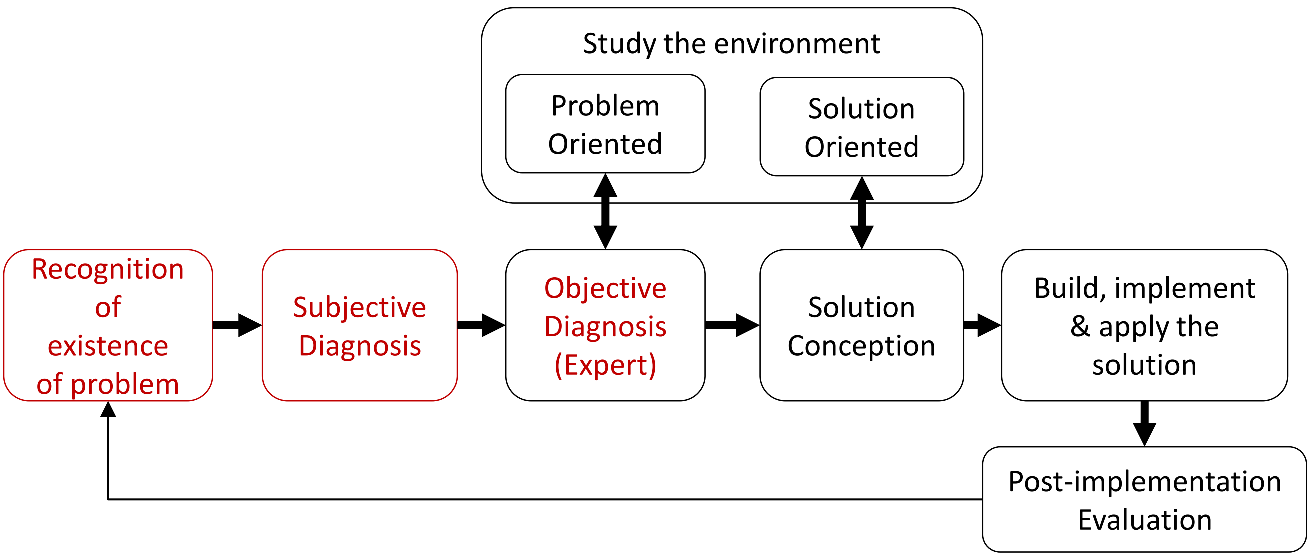


In general, the main part of the solution can often be built rightly from the first time. The backward loops are necessary for rectifications, adjustments, improvements and subsequent additions.

Basic Problem Solving Approach (3)

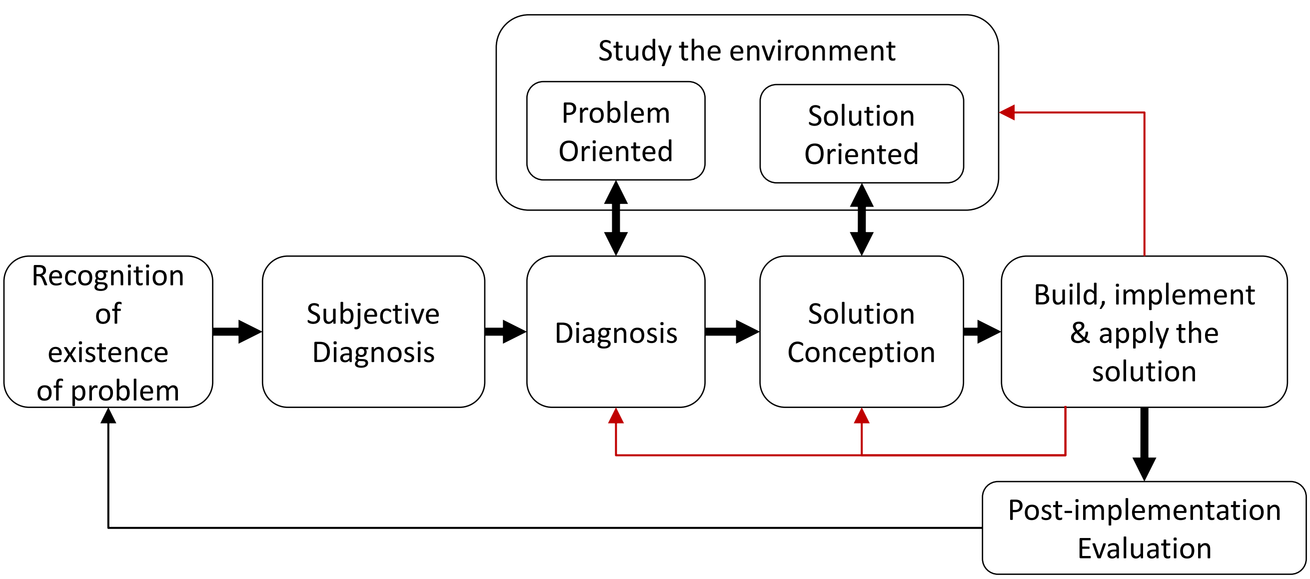
Diagnosis has to be performed by an expert

The person detecting the problem, isn't an expert. An expert is needed for rightly diagnosing the issue.



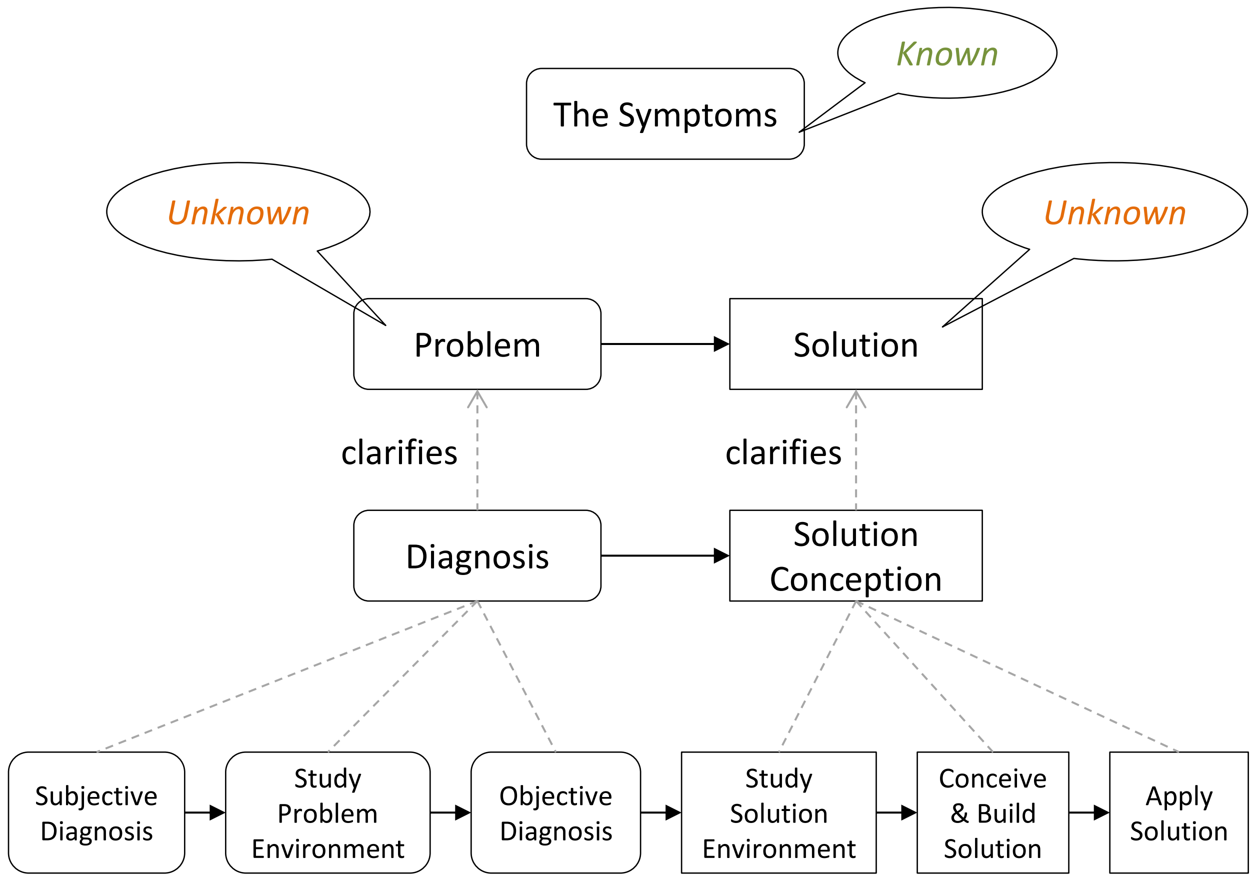
Each task (phase) isn't necessarily performed flawless

Although it is not intended, work of earlier activities may have to be clarified, checked, corrected, refined or expanded.

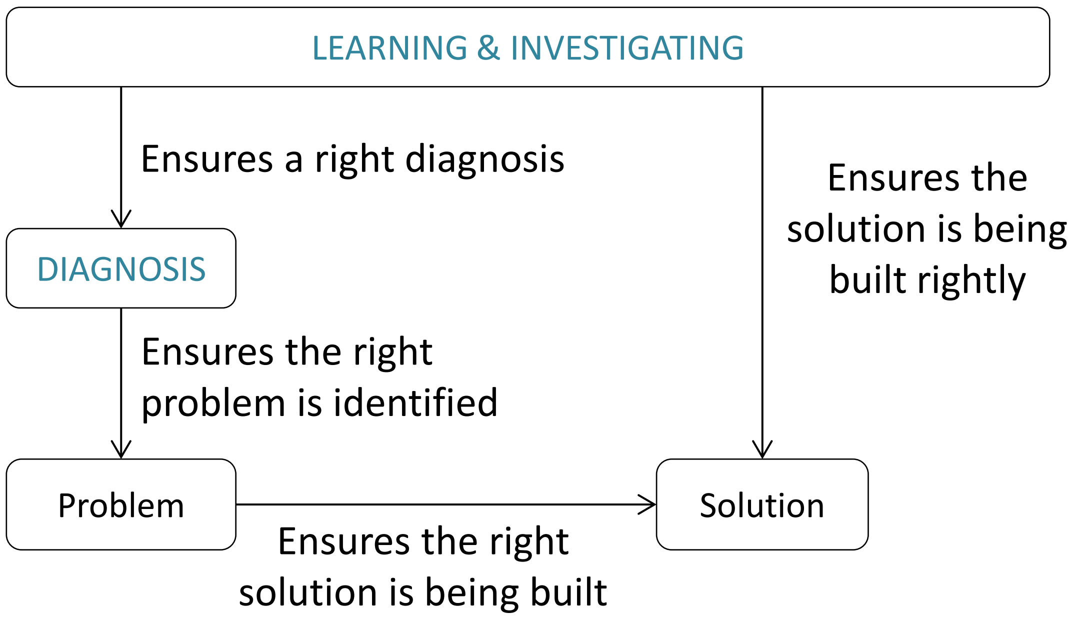


Subjective diagnosis vs Diagnosis: subjective diagnosis is diagnosis of non-specialist. Diagnosis is posed by expert.

Solving the Unknowns



Core Idea



A problem can't be solved unless the diagnosis is right.

A solution can't be devised before the problem and its environment are properly understood.

Engineering

= Methodical Approach

= Based on Problem Solving Approaches

Doesn't fit the true spirit of engineering :

- Taking actions with little understanding
- guessing
- repetitively trying until success
- counting on luck and accept increased risks.

A Simple Problem Solving Process

1. Define the Problem

2. Gather data

3. Cause Analysis

4. Conceive the Solution

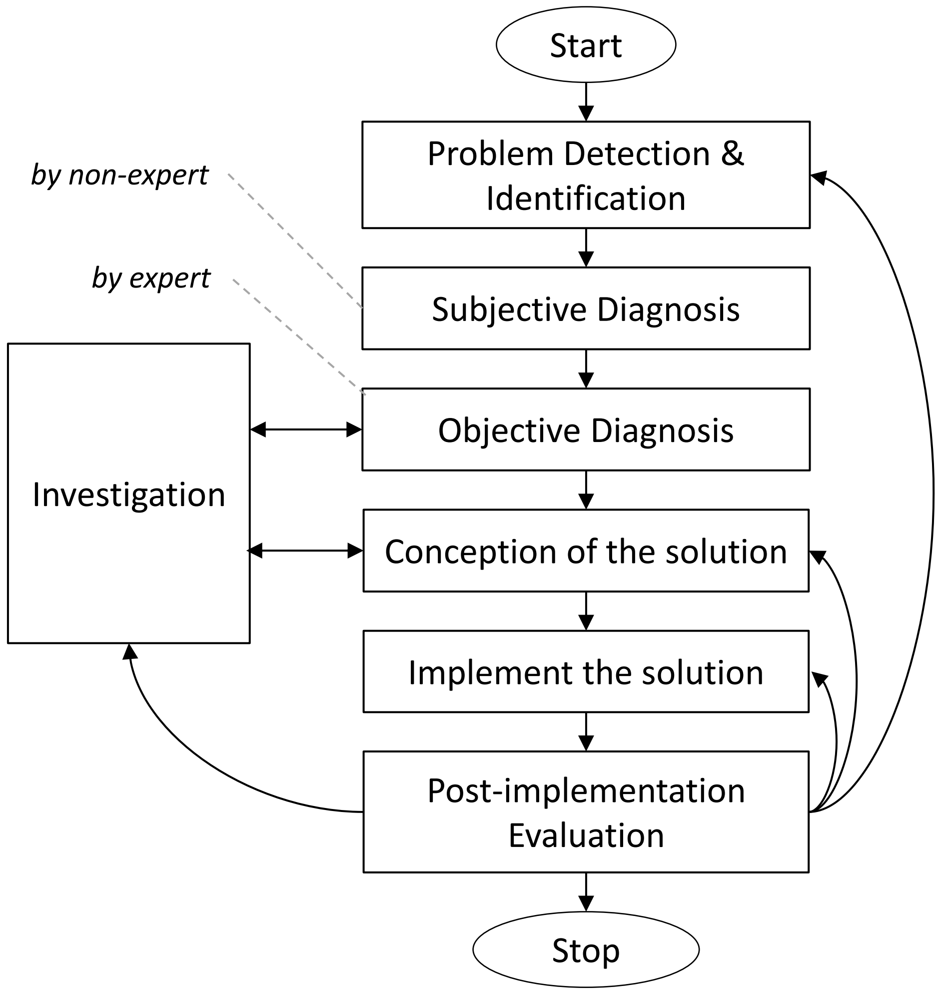
5. Build the Solution

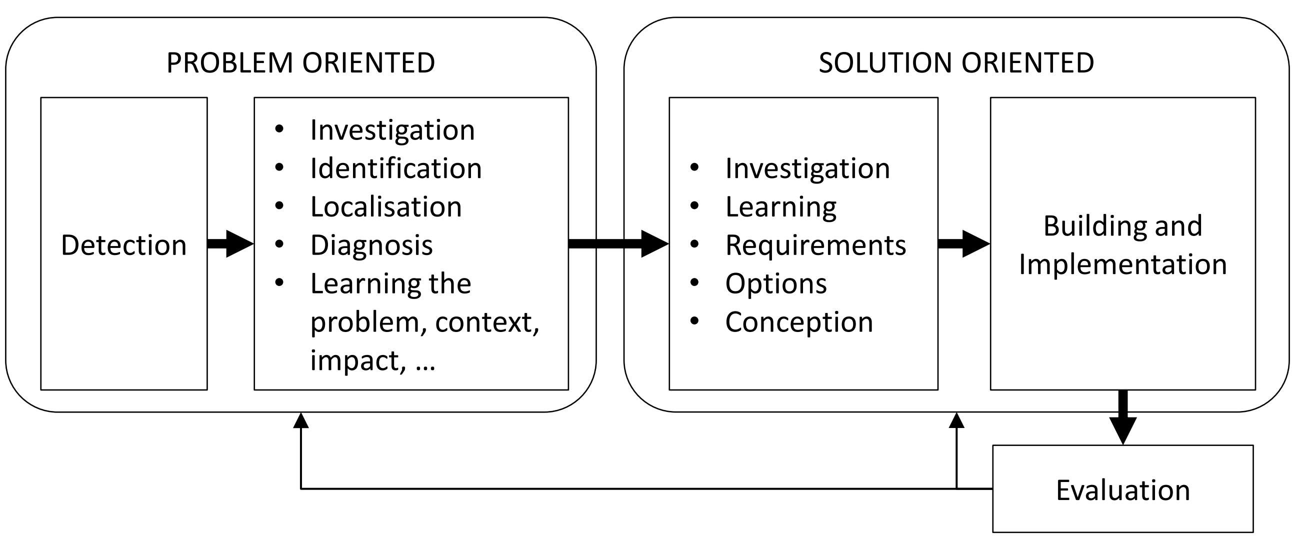
6. Evaluate the Effects of the Solution

7. Solution Candidate for Standardisation

8. Evaluate the Process
(what could have been done better?)

Problem Solving Approach





Problem Identification

1. Awareness of the existence of a Problem

   We are aware that "something" is wrong but we don't know what. The problem itself can not be pinpointed. This happen often through symptoms, consequences and results.

2. Identification of a Problem

   The problem is recognised. It is vaguely located and vaguely known to "get a name".

   Trying to solve the problem at this state is likely to result in symptomatic solution.

3. Localisation of a Problem

   The problem has been precisely localised. The circumstances and cause(s) are known.

4. Understanding of the Problem

   The true root cause(s) is/are identified. The whole mechanism leading to the consequences and symptoms are understood. The consequences throughout the company are identified. The behaviour, evolution and importance of the problem are precisely understood.

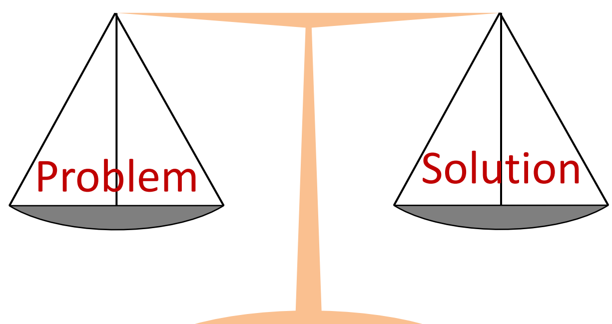
5. Deeper Understanding of the Problem

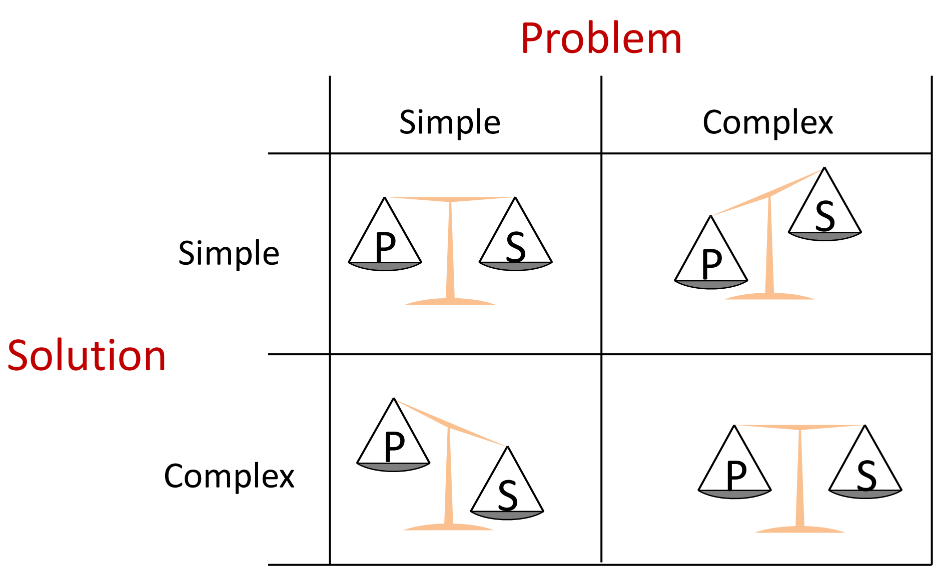
   These understanding is about the underlying principles, beliefs, the assumptions, the designer's reasonings and reasons, the WHY's, …

Complexity of Problem and Solution

Do we need to spend more attention on the problem or on the solution?

Note that if the diagnostic is wrong, it will be hard to solve the problem (guess, luck, 'intuition', many trials, ...).





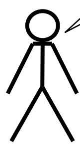
No relation between complexity (or size) of problem and complexity (or size) of solution.

A complex problem may be solved with a simple, small and/or cheap solution. A simple problem may require a complex, huge and/or expensive solution.

Decision Making in Problem Solving

Art, Leisure, Clothing & Candy Shops

I want …
And I would like … I prefer …
This is nicer.



Not a big deal

- Likes & dislikes
- Preferences
- Aversions
- Choices
- Wants

- Picking
- Guessing
- Assuming
- Trying
- Exploring

"Corporate IT is not a candy shop"

Secondary importance

REAL PROBLEMS

Primary importance
(approach, methodology, decision making, techniques, ….)

- Real life problems
- Practical problems
- Problems in systems and environment

Real problems require real solutions

- Understanding of the situation, real world, system
- Right diagnostic, real solutions
- Decisions, reasoning, arguments
- Tastes, preferences and the like are of secondary importance or optional.

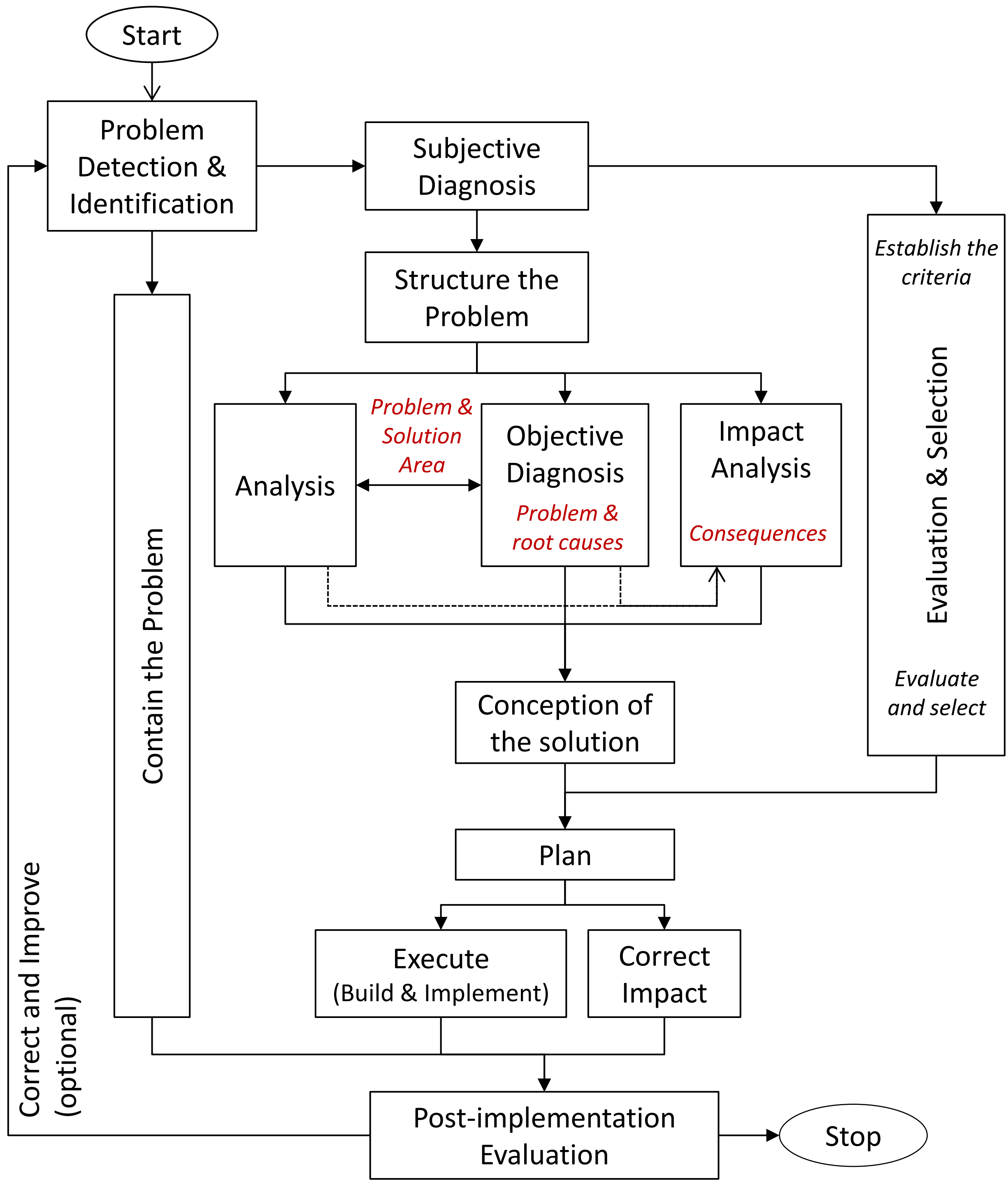
Some Considerations

- These model depict a general, ordered and ideal process. They show a sequence of aspects to be considered.
- They don't describe a strict sequence.
- Overlaps are possible.
- If something is wrong, unclear, ambiguous, unverified, … perform the activity that solves it and go on.
- If necessary or useful, the problem solver can jump backwards or forwards in the process.
- A step can be as short as the mind considering an aspect and may happen in a blink of an eye. But it may take hours or days as well.
- The problem/solution environment might already be known. However, often a problem occurred because we didn't understand something of this environment. A deeper understanding might be required. Problems teach us something.
- The study of the problem environment may provide the required insight and therefore may make the study of the solution environment useless.
- Such a process model is a basic template that has to be adapted and enriched to the specific problem. For example:
  - maybe different smaller solutions may together solve a single problem
  - maybe some preparatory work needs to be done
  - maybe a solution has to be applied in phases

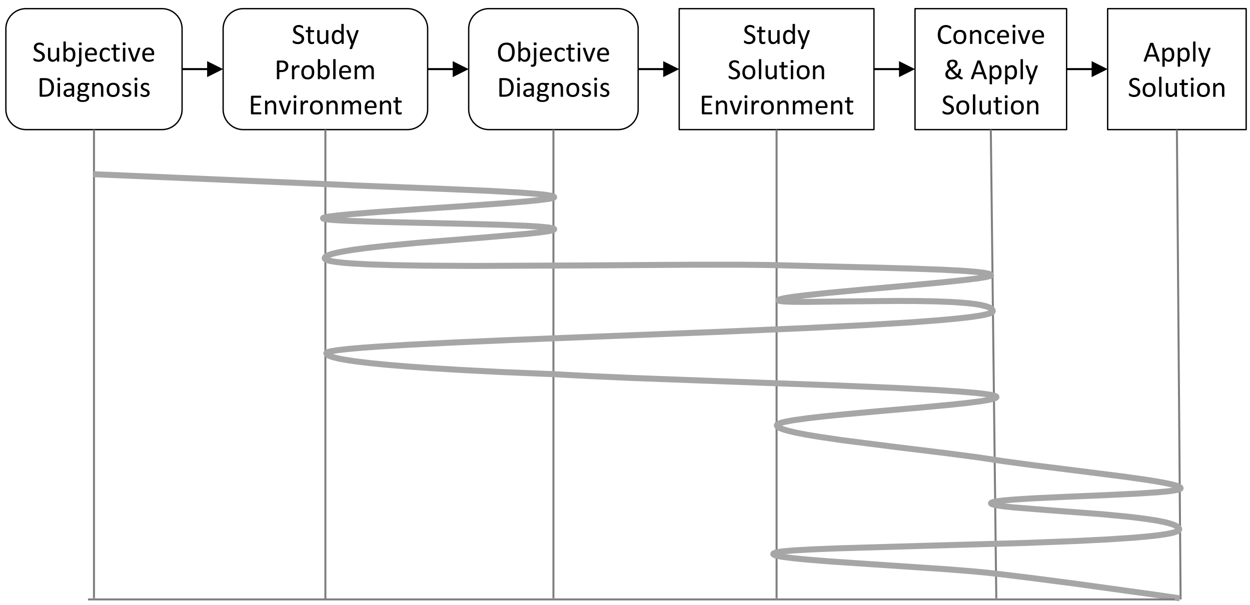
More Problem Solving Activities

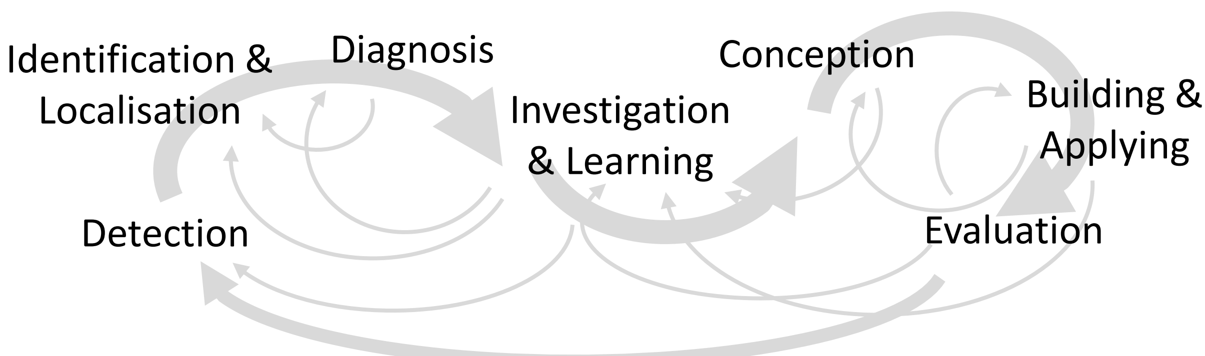
1. Describe the problem
2. Determine nature of problem
3. Categorise the problem
4. Describe the objective
5. Information gathering
6. Symptoms analysis
7. Stakeholders analysis
8. Do background research
9. Analyse the context and situation
10. Understand the problem
11. Identify assumptions
12. Determine the causes
13. Determine the factors contributing to the problem
14. Determine the root cause(s)
15. Determine the impacted areas
16. Determine and evaluate the impact (damages)
17. Conceive a solution to clean up the damages and apply it
18. Determine solutions to contain the problem
19. Determine solutions to solve the impacts
20. Establish what is fixed, unchangeable, beyond your span of control and what can be adapted, changed, replaced, …
21. Establish requirements
22. Verify requirements
23. Find elements of solutions
24. Generate ideas (brainstorming, finding analogies, …)
25. Think of alternative solutions
26. Identify feasibility, implications, obstacles, risks, limits, cost, resource requirements per alternative solution
27. Elaborate a proof of concept, mock-up, prototype
28. Investigate collateral effects
29. Establish criteria to evaluate the alternative solutions
30. Evaluate the alternatives
31. Select the best alternative solution
32. Implement solutions to resolve the impacts
33. Implement the solution
34. Evaluate the solution
35. Improve the solution
36. …

A More Elaborated Approach



The Mind in Problem Solving





The mind doesn't think or learn perfectly from the first time. The first analysis or answer may be imperfect. It doesn't work in a strict linear or sequential way. It jumps back to a previous step to correct or to complete a question already dealt with, and seconds later it may leap forward. There is a clear convergence towards a definitive insight and solution.

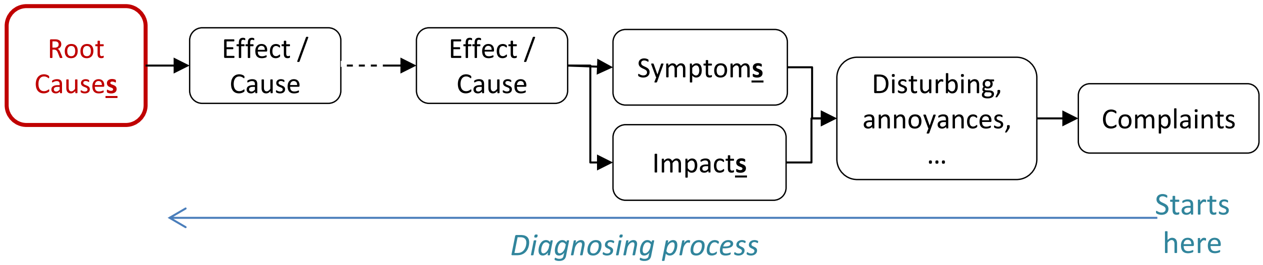
The global process won't be perfectly or strictly sequential. But a pattern of different phases can be distinguished.

The mind can somewhat be guided. By establishing what has to be resolved in what order, our attention, our focus can be better controlled. This reduces the erratic behaviour and increases the tendency towards a structured approach.

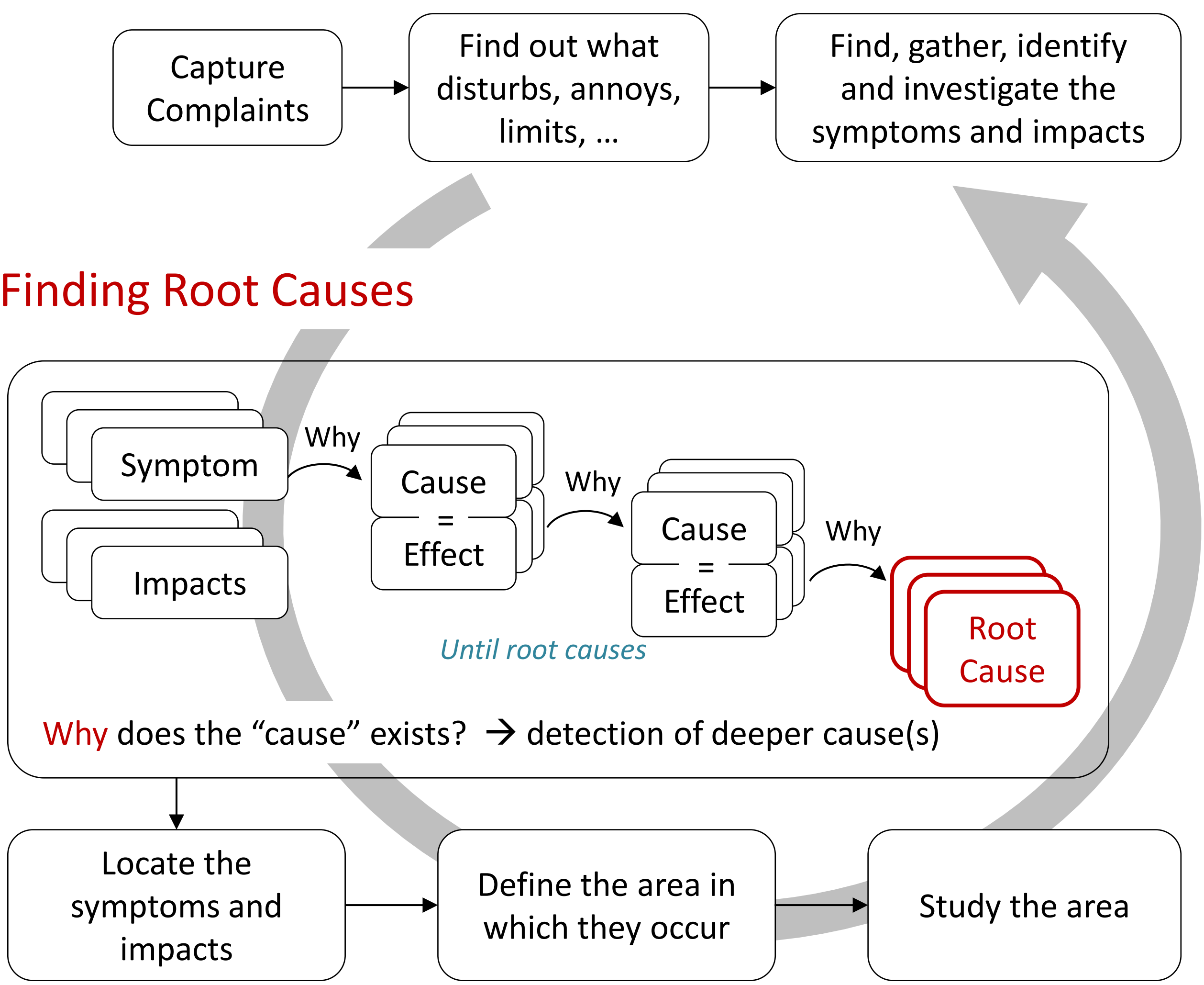
A superficial, improper and incomplete performed task produces a bad result. Learning happens then through result. More corrections are needed. More iterations will be required or each iteration will concern a larger change. Sloppy thinking and sloppy work lead to more iterations and more rework.

Diagnosis Process

30/10/2018



Starting Point



Notes:

If the symptoms or other disturbing effects (impacts) are labelled as 'problem', no effort will be made to question their occurrence and no investigation to find the true problems, the root cause will be initiated. Result: symptoms will be solved and true causes will remain.

Diagnosing

Rules of Tacks (Medical)

1. If you are sitting on a tack, it takes a lot of aspirin to make the pain go away.
2. If you are sitting on 2 tacks, removing one does not lead to a 50% improvement.

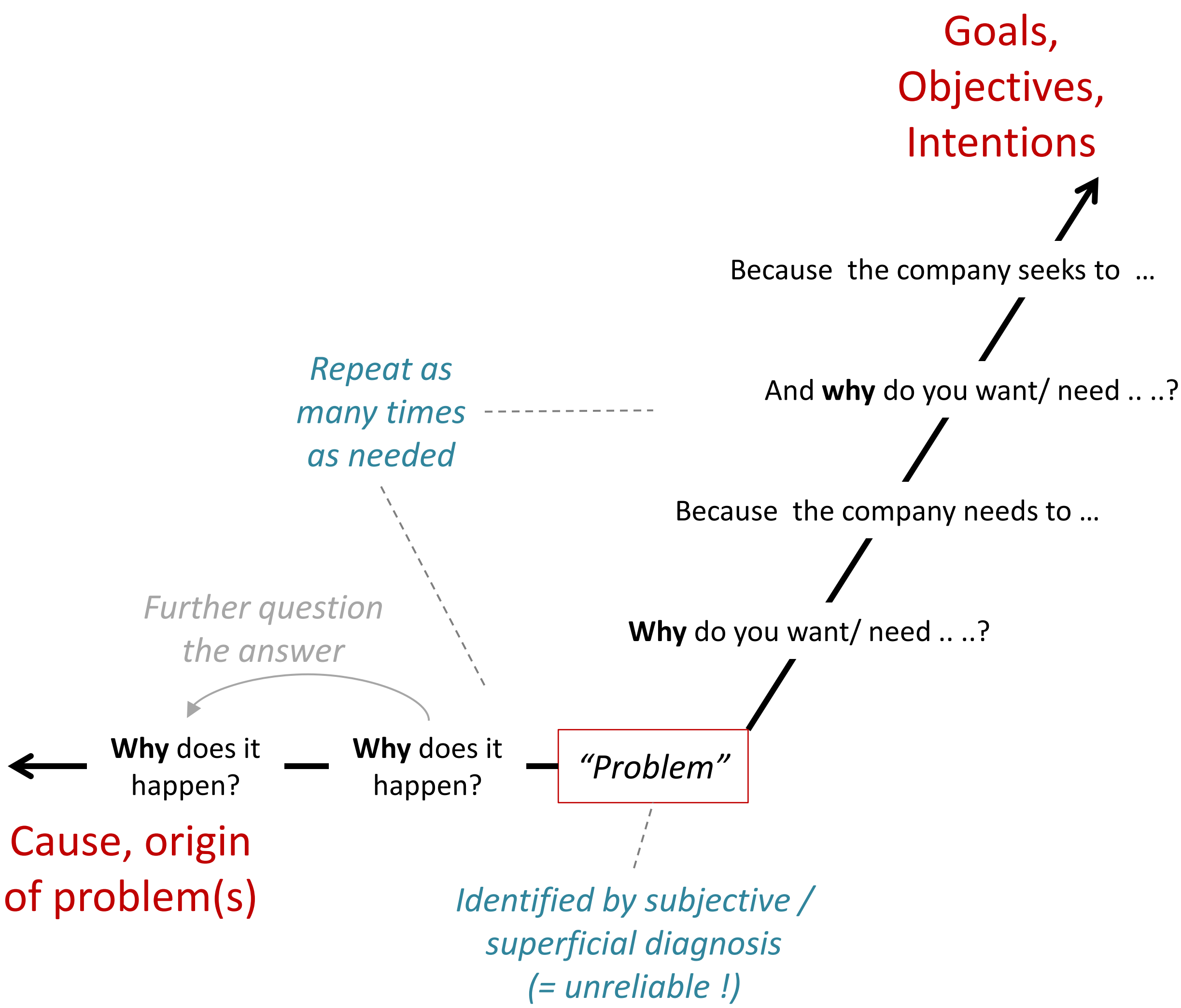
Syd Baker, M.D.

Accurate diagnosis is important !!

- Do not rush to build solutions solving the symptoms
- Symptoms (complains, obstacles, flawed design, late delivery, …) are messages about underlying problems. Don’t ignore these messages.
- Remove tacks where possible. Treat underlying causes.

Notes:

Diagnosing Process



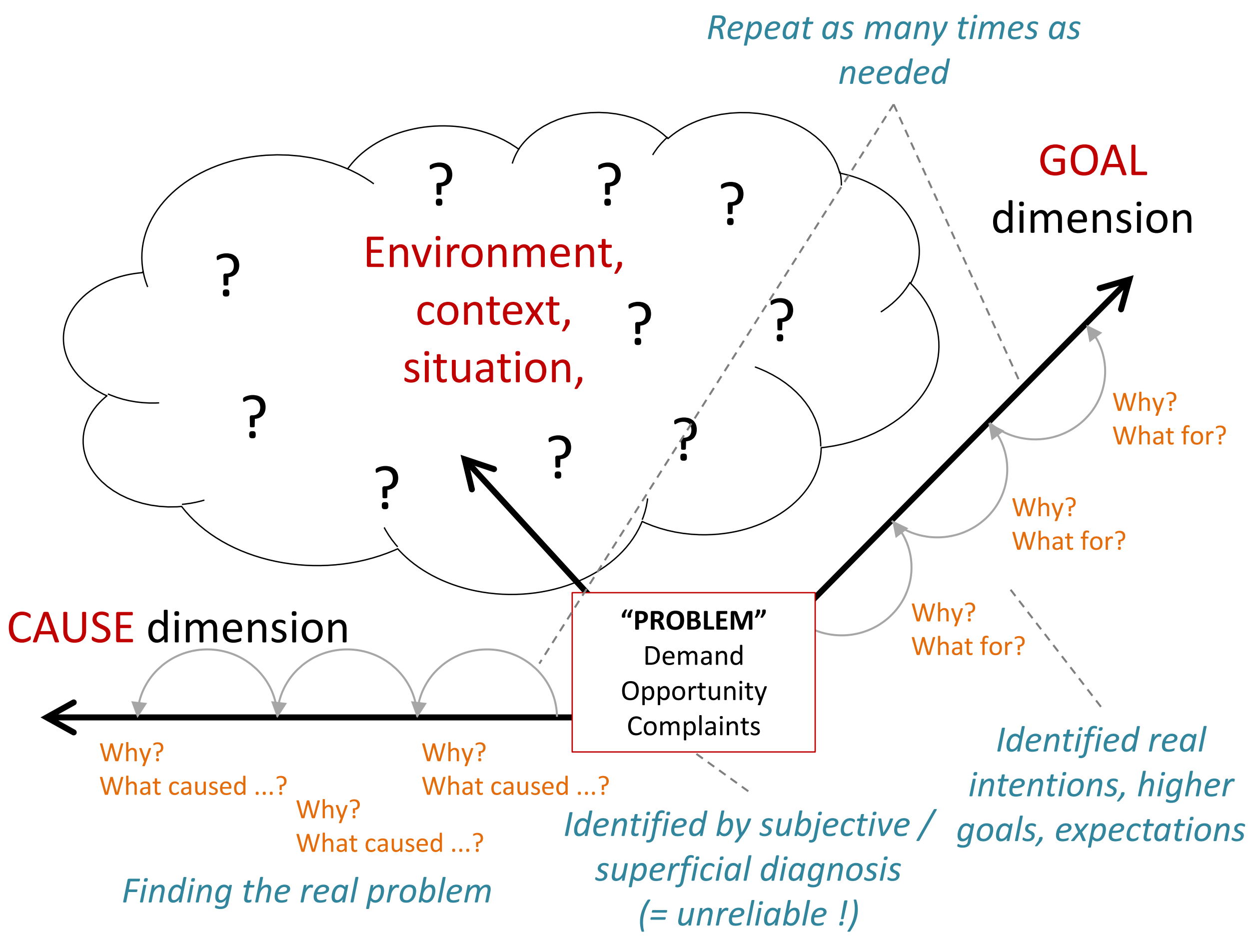
"We fail more often because we solve the wrong problem than because we get the wrong solution to the right problem.“

(Russell L. Ackoff)

Note:

The subjective diagnosis can be right. We don't know if it is right. Cause and Goal dimension allows to get a confirmation and a valuable broader insight, even if the subjective diagnosis is right.

Diagnosing Process
ASKING QUESTIONS



Two directions to pose questions

- Objectives
- Causes

WHAT and WHY

Never enough questions can be posed about the demand, the assertions, assumptions, context, situation, evolutions, …

HOW can it be solved rightly

Efficient Problem Solving

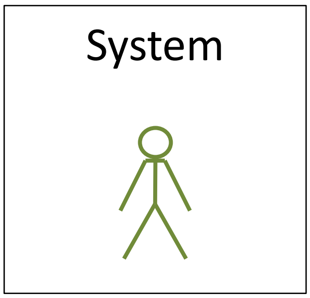
During problem solving, the mind runs continuously and iteratively (without specific order) through a myriad of questions like:

- What is the essence?
- What is at stake?
- What are the boundaries?
- What do we know?
- What is the root-problem? Diagnose it!
- What is the main objective? Identify it!
- What is important? What do really matters?
- What doesn't matter?
- What is impacted?
- Where can we get information?
- What do we assume?
- How reliable is an information? Can it change?
- What can we deduce?
- What don't we know? Maximise the knowledge and insight?
- Is what we "know" true? (not an evidence at all)
- What can we change?
- What can't we change?
- What will mandatory have to change?
- What are the mandatory steps?
- What is likely to be changed?
- What are the solution elements which may be part of the solution ?
- What are the options?
- Are their different ways to the goal ?
- If this or that is changed, what is the impact? What are the consequences? What does it imply?
- Can something be more detailed?
- Can something be clarified ? Remove ambiguity.
- What is still unclear? What do we assume? What did we forget?
- …

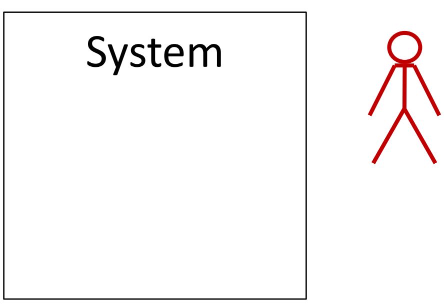
Notes:

Increasing and repeating the number of questions the mind is running through improves the problem solving skills.

Solving Problems in Systems



A person can be a part of the system.
It is harder for a person who belongs to the system, who is inside the system to contemplate that system from a higher perspective with a higher level of thinking. Similarly, it is also harder for the system builder to contemplate the system (s)he builds to consider it with a different way of thinking used to build and or to adapt it.



It is easier for a person outside the system and for a person who didn't build or adapt the system to consider that system with a higher level of thinking and a fresh view.
Issues and opportunities may more quickly be noticed.
But knowing the whole system may take some more time to know the entire system/situation.

Layered Problem

City Planning
Focus: Roads, industrial area, agricultural area, parks, energy supply, emergency services, religion, administrations, education, cultural aspects, shops, parkings, public transportation, sports, nature, communication network, waste water system, …

Building of individual items of the city, such as roads, buildings, specific infrastructure, …

Building: Purpose, size, number of rooms, foundation, shape, bearing walls, size and purpose of the rooms, doors, electricity network, water supply, …

Design of room: floor, wall paper, furniture, decoration, illumination, …

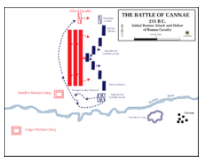
A building is much more than a set of rooms. A city is much more than an amount of buildings. Each level adds new specific elements and aspects.

Layered Problem

1. Military Strategy

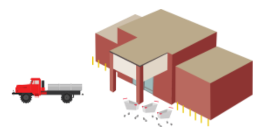
Plan to invade a region or country

2. Military Tactics



Plans for individual battles can only be devised when the strategy is known.

2. Military Logistics



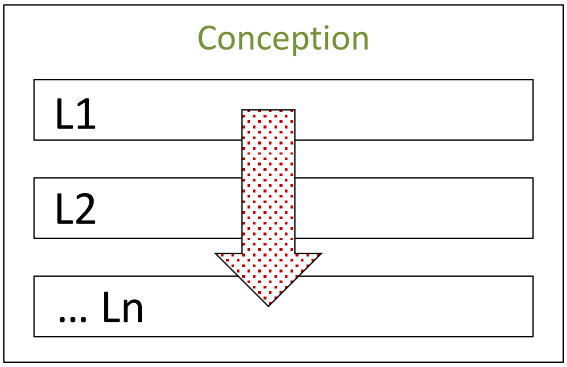
Logistics can only be designed when the strategy is known.

Of course, movements of enemy troops, new information, outcomes of battles, possibilities and impossibilities of logistics, and so on, can influence a strategy. I will then have to be adapted. A strategy is a dynamic plan.

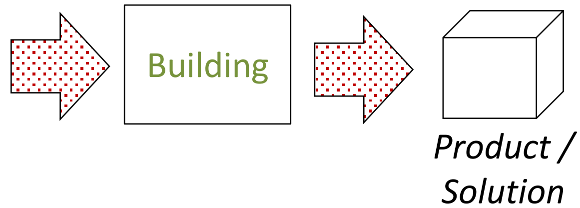
Important Principles:

- Each layer resolves the problem at a certain level only. It solves specific questions.
- It has its own purpose, intentions, goals, perspectives, matter and elements, obstacles etc..
- The nature of each problem is very different of the problems solved at other levels.
- The problems of the higher level needs to be solved before the question of the lower level can be solved.
- Each level requires specific knowledge, competencies and requires a specific way of thinking. The knowledge, ways of thinking and competencies of one layer are inappropriate to solve questions of the other layers.

Layered Problem



Layered problem ≠ Top-Down !!



A Layered Problem is a problem that has to be solved by answering questions, by taking decisions, by dealing with issues and by conceiving a part of the solution within in subsequent layers.

One layer deals with matter of a specific nature and solves certain types of problems proper to that layer. Generally speaking, these problems can't be resolved in another layer. Each layer has its own intentions, goals, priorities, elements, aspects, principles, knowledge domain, expertise, way of thinking, …

Only when the solution is conceived within one layer, it can further be conceived in the next layer.

It may happen that possibilities or impossibilities in lower layers influence the conception in a higher layer.

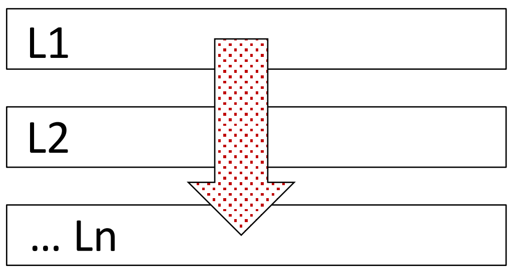
If a problem is layered in nature, this has to be respected in the solving approach. It is crucial to recognise this type of problems. An indication is when different fields of expertise are required.

Layered Problem

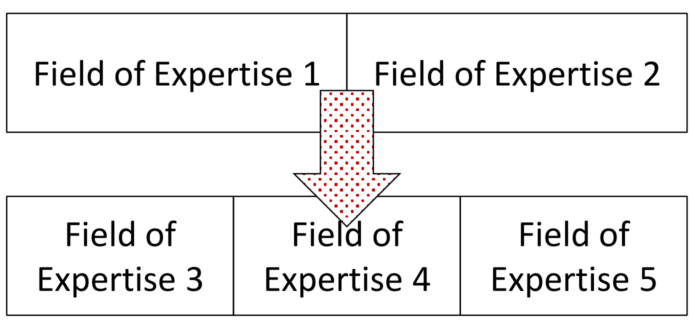
Fields of expertise are at the same level

Different experts collaborate together.

Layered Problem



Layered Problem requiring different Fields of Expertise

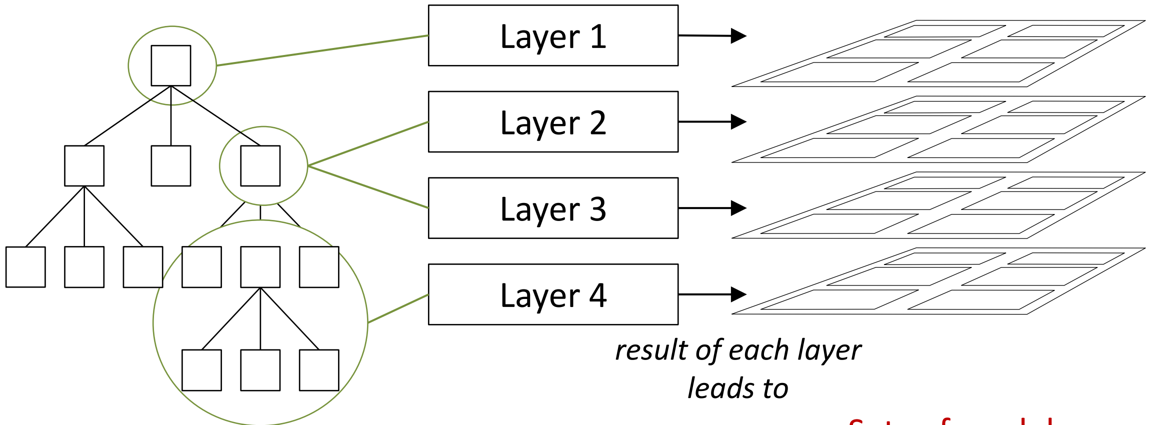


Each layer may require different fields of expertise to collaborate.

If a problem is layered in nature, then the approach and the collaboration must respect and reflect this.

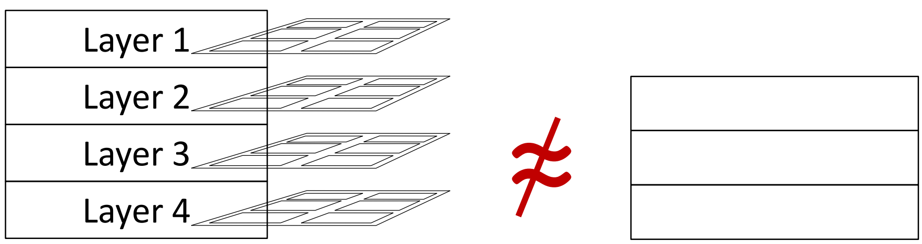
Else, it's like, for the conception of a airplane, putting all the engineers and the designers of all the different necessary disciplines together in a single room in order to conceive that plane.

Layered Problem



Hierarchy of Goals | Layered Approach | Sets of models representing the solution in that layer.

BEWARE



Layers of Approach | Layered Solution

- A layered problem is often linked to a hierarchy of goals.
- The solution to a layered problem can be represented to layers of conceptual solutions.

  For each layer, one or more models can be drawn representing the solution at that level (/ in that layer).

- A Layered Problem does not necessarily imply that the physical solution has to be organised in layers, or that these layers matches the layers of the problem.

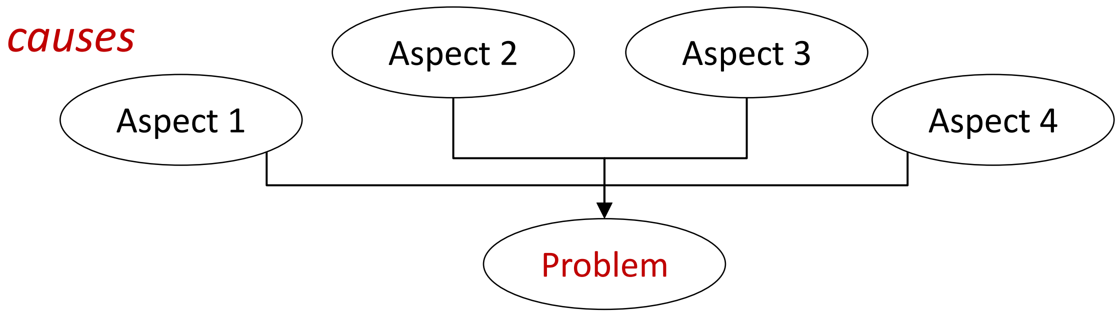
Layered Problem

- A Layered Approach may lead to the definition of lower level goals.
- In a Top-Down approach, the matter, intention, goals, expertise, etc. may remain the same.

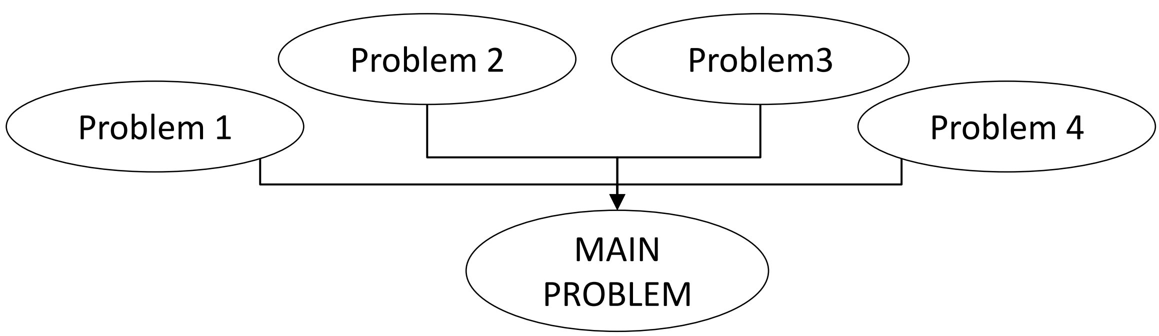
  For example, a process that is being decomposed and further detailed.

- A Top-Down Approach and a Layered Approach provide a good basis for architecture.

Multiple-Cause Problem



- Different causes, often of different nature causing together a problem.
- Often, this can be seen as different elements, aspects and/or circumstances aren't right and together they cause a problem.
- They have all to be tackled in order to solve the problem.
- Its a kind of multi-problem problem.
- A composite problem is a problem consisting of a set of interacting sub-problems. (composite problem analysis)



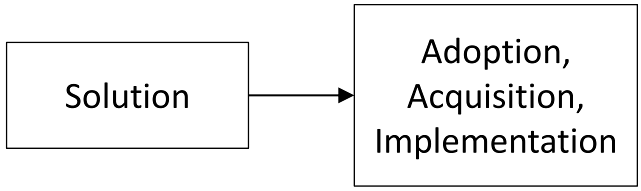
The problem can't be solved by solving only one cause.
By solving problems 1 to 4, which are individual issues and may be different in nature, in time, in place, in importance, in size, … automatically will solve the main problem.

For example:

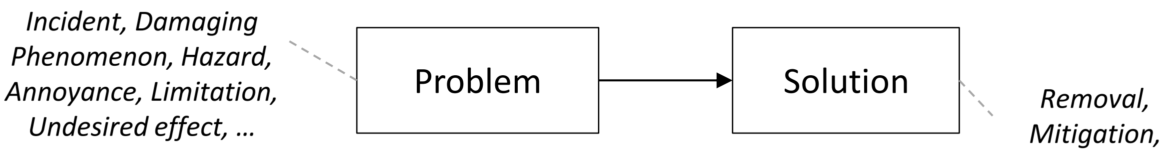
- A company isn't doing well. Marketing strategy has to be adapted. The products and services have to be improved. And the motivation of employees have to be increased and their skills adjusted and sharpened. These problems are unrelated. They are of different nature. Together, they may make the company profitable again.
- A person feels a bit depressed because of various circumstances. To feel better, (s)he can eat healthier, sleep better, go in nature, do sport, meet friends, create something, help people, be kind. (S)H may feel much more energised again.

Using Simplistic Problem Solving's Models

10/01/2020

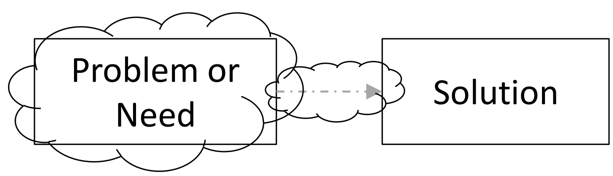


No problem or need?

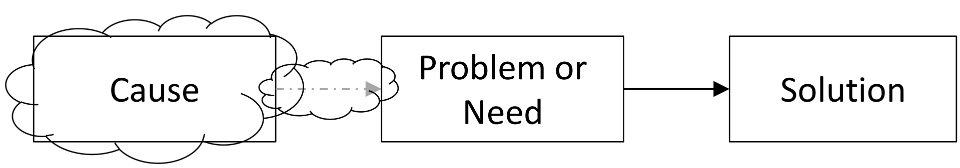


No Causes)?

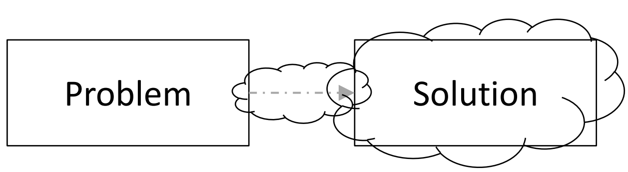
Only one cause? What caused the cause? What caused the cause of the cause ?



Vague idea of the relation between problem and solution (assumptions) and/or superficial understanding of and a lot of uncertainty about the problem or need.



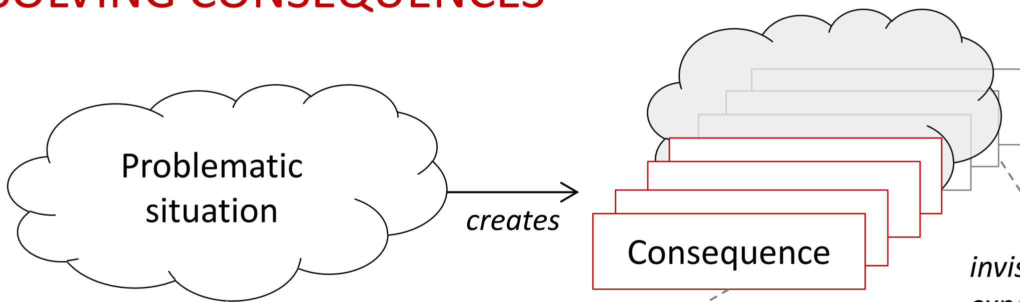
Vague idea of the relation between problem and its cause(s) (assumptions) and/or superficial understanding of and a lot of uncertainty about the cause(s).



A vague understanding and many assumptions, beliefs and hopes about how the solution will solve the problem and/or about what the solution will be.

Problem Solving Traps

1. SOLVING CONSEQUENCES



invisible, not experienced, unawareness and/or unknown, …

Complex, fuzzy, unclear, not in plain sight, demands an effort

Visible, experienced, concrete → known, awareness

Real causes don't disturb us.
We rarely experience them.
Why should we solve them?

Unpleasant, disturbing experience

- Limitation
- Destroy
- Waste
- Conflict
- Nuisance
- Annoyance
- Embarrassment
- Discomfort
- Pain
- Irritation
- …

Desire solve or eradicate the consequences

↓

Strengthen the focus

Focus is on Consequence

↓

Easily labelled as 'problem'

Closes the mind for investigation for deeper understanding of the problem and searching for real causes

Result:

1) Bad solutions

2) Problematic situation (real causes) and invisible consequences remain unresolved.

3) Symptom → "solution" → Chaos

Systematically solving symptoms creates chaos

Any 'problem' should be considered by default as a consequence, until no problem can be found that created that consequence.

Problem Solving Traps

2. PROBLEM = THE MISSING SOLUTION

"The problem is that I have no umbrella"

The actual problem is:

Since it is raining, you will be wet when going outside

Problem $\xrightarrow{\textit{solved by}}$ Solution

Once we have the solution, the problem disappear.
But, the problem is that the solution is missing.

Solutions: use a raincoat, find/buy an umbrella, go by car or by train, find a shelter, leave when rain stops, …

In practice:

"We don't have a database that…"

"I need such a software feature"

"I want a tablet to …"

"We need a website ."

etc.

Missing solutions

Solutions to what problem or need ?

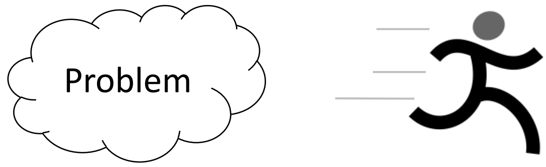
Talking about desired solutions, not about problems.
They can be built and delivered, but will they solve the real problem?
If not, what is the created value? Obtained satisfaction?

The business community needs <u>information</u>. It has a <u>information problems</u> and <u>information needs</u>.

Information is needed for business activities, for decisions, … to achieve business objectives.

Problem Solving Traps

3. RUNNING AWAY FROM A PROBLEM



- Minimising the issue
- Postponing taking measures

  "Not now because…"

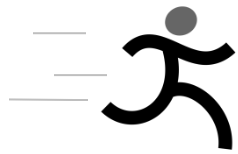
  "First we have to…"

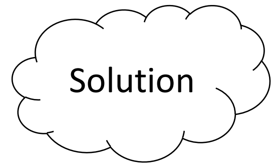
  "Too busy now…"
- Take some initiatives, doing some attempts

  Not with the genuine intention to solve it (you never know), but with the idea that we did something. This brings a peace of mind. But it doesn't solve the problem.
- Avoidance:
  - Wait and do nothing. Look the other way. Ignore it.
  - Pass the problem to someone else:
    - Informing someone about the problem.
    - Making sure someone else notices the problem
    - Letting the problem grow until it becomes too big for you to handle.
    - Externalisation: privatisation, outsourcing, consulting, disinvestment, … (getting it solved by someone else)
  - Quitting. Stop the plan, the practice, the activity.

Problem Solving Traps

4. RUSHING TOWARDS A SOLUTION





- without knowing or assuming knowing the problem
- without knowing or assuming to know the problem's context
- Attraction to solution: Solutions ease our fears.
- Once the solution is known, the building can start. This makes progress more tangible and visible. Many prefer 'doing' over 'thinking'.
- Common mistake: wanting a particular "solution" instead of wanting to have a problem solved. Very different in approach, talk, attitude and result !! We may end-up with a "solution" but the problem is badly or not solved.
- Assuming too quickly the understanding is sufficient
  - → No proper diagnosis
  - → No Proper understanding of the context, situation

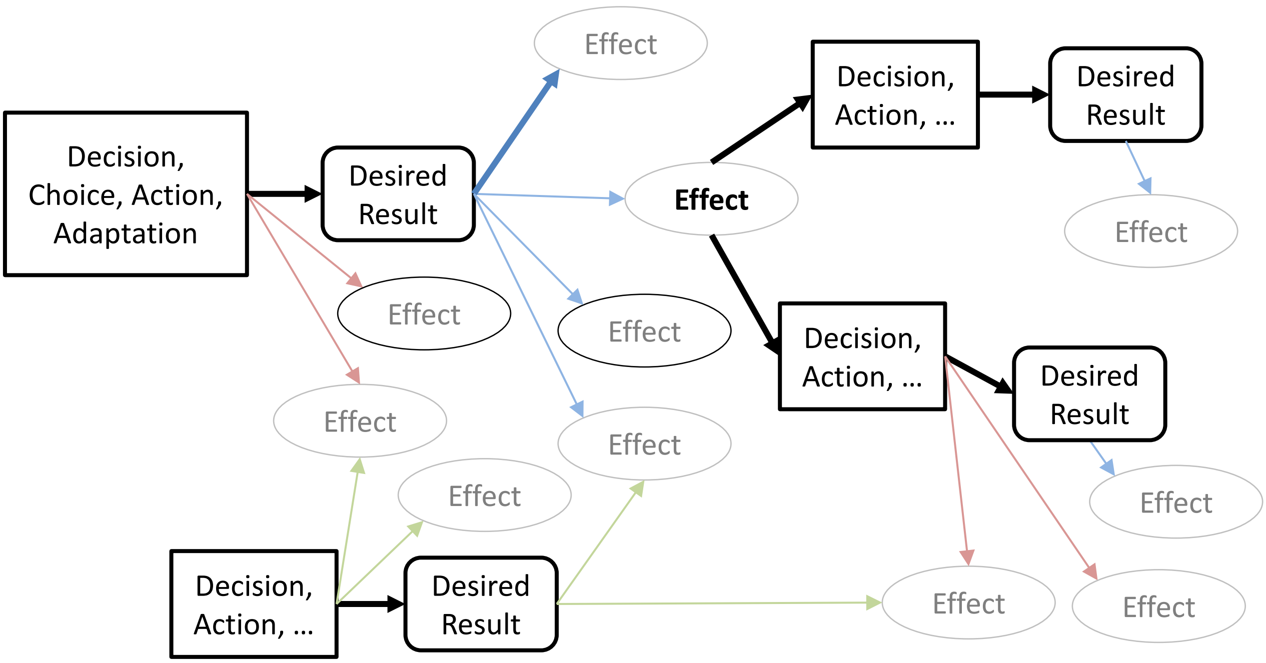
"YESS! We have a Solution", "We know how to solve it", "We know what to do"

Overly focus and to early focussing on the Solution

Early engaging in searching for a solution, in solution thinking, in conception of the solution

Result: Non-solutions and more problems

Unawareness of Consequences



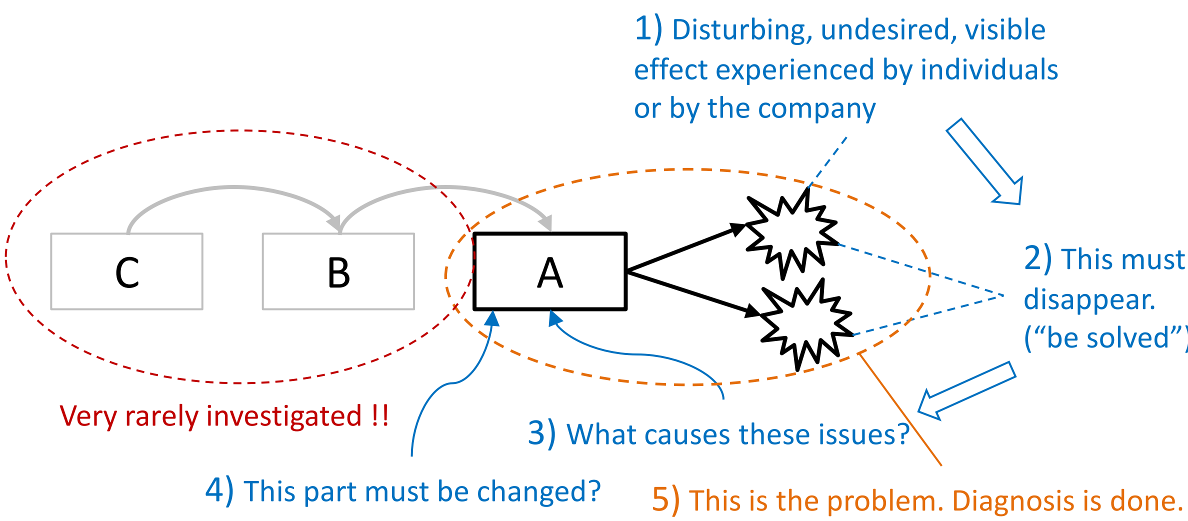
1. Decisions and actions are (sometimes) motivated by the desire to get a specific result (**bold black** = what is known and desired).
2. Attention goes to the decision, action and outcome (the intended and the real outcome).
3. Decisions and actions have effects on the system, environment, resources. These are consequences. Something that changed. (red arrows)
4. Even the simple presence of a new system or object in an environment changes this environment.
5. The obtained outcome (result) also has effects on the system, environment and resources. (blue arrows)
6. These effects (changes, consequences) may alter the capacity, the capabilities, the behaviour or other characteristics of the system. The effects may also have no further (significant, noticeable) impact on it.
7. These effects may create circumstances for an adverse event, from small to catastrophic, to happen.
8. Or, they may increase or decrease the impact of future changes and events.
9. Other effects, particularly the indirect effects are not observed. We may remain unaware of the effect. Or, we may not be aware of the link between a decision or action and some of its effect (light grey ovals).

Examples:

- Motivation or demotivation of people is the result of other factors.
- An awkward design may make maintenance or future changes on the system very costly. The effect of this additional cost is unlikely to be recognised.
- A change of colour of a car won't affect the car's characteristics. But in some circumstances the colour may, as a camouflage, make the car lesser visible '*causing*' an accident.

Mediocre Problem Solving

1. Limited DIAGNOSIS – Solving Consequences

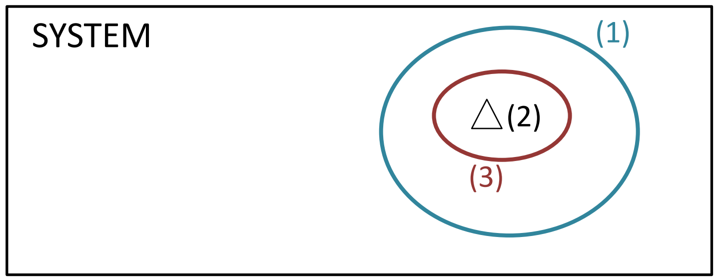


'A' is seen as the cause. It produced the unwanted effects. It is not considered as a consequence. B, and a fortiori C, remain unresolved.

→ Not much fundamental matter is learned.

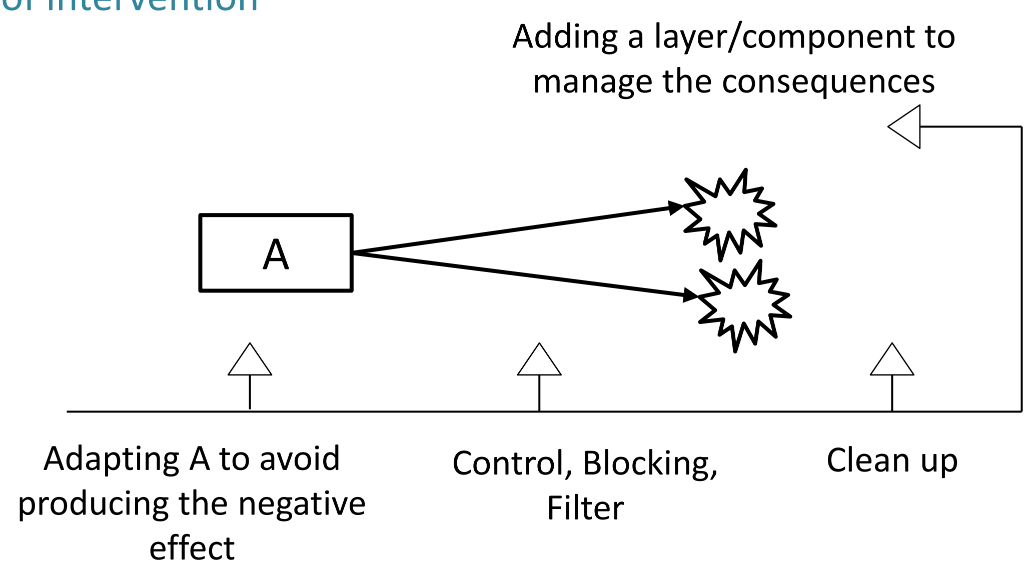
Mediocre Problem Solving

2. LOCAL SOLVING



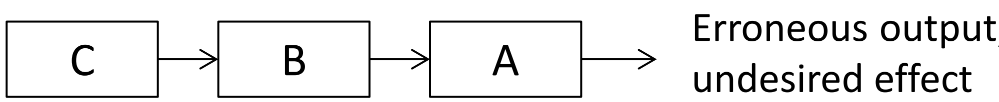
1) Locate the area in the system producing ‘the problem’
2) Locate ‘the problem’ (from broader area to a more precise area)
3) Analyse that part of the system
4) Look how it can be adapted – come up with a few solutions
5) Decide how to adapt or add something to the system
6) Adapt the system
7) Test if the adaptation offers the desired behaviour

Points of intervention



Mediocre Problem Solving

Limited Diagnosis – Solving Consequences



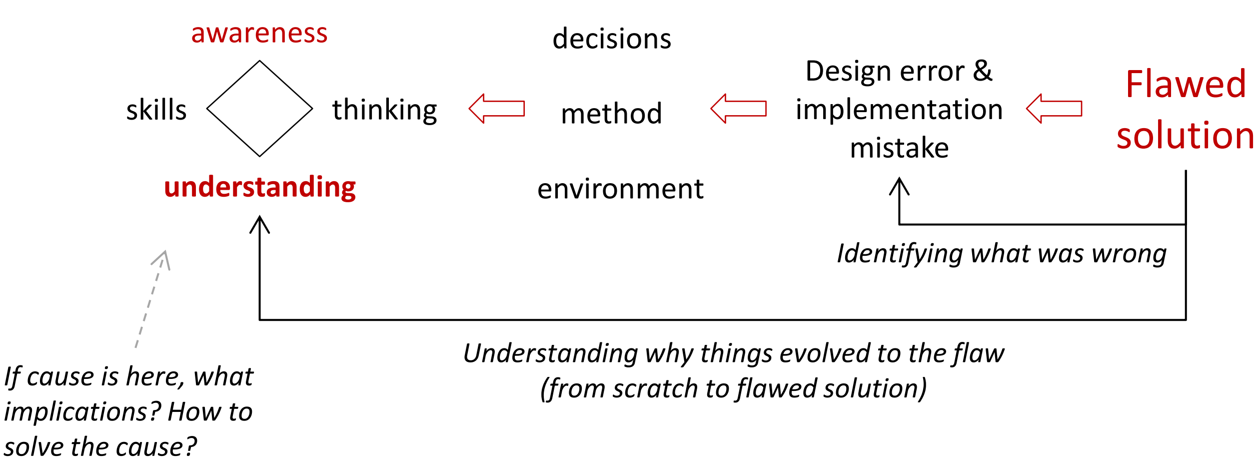
A process (chain of steps) or a set of connected systems, or other chains of similar or physical components can be investigated to find the root cause. This makes sense to correct mistakes, but not to prevent further similar mistakes. It prevents from learning at a deeper level and to improve in a more fundamental way. Often a true crisis or a repetition of similar flaws forces us to leave this investigation path and to search for a new one.

We consider only the question "where did what go wrong". The question how we evolved to that situation, what is missing or wrong in the design process that created the flaw is not raised.

Finding the True Causes

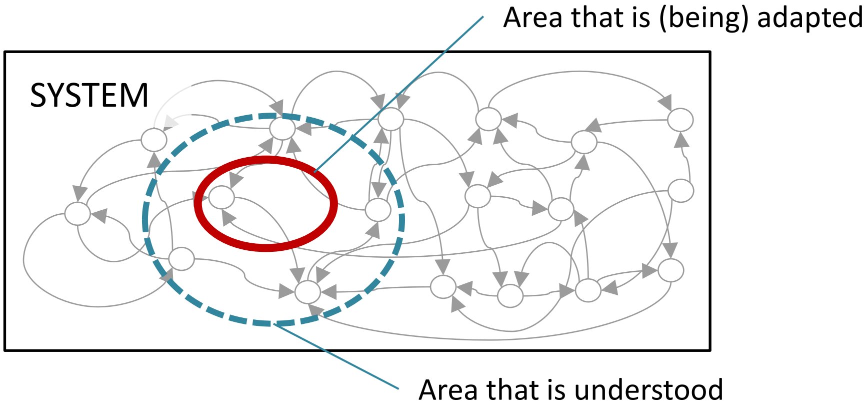
All kinds of flaws come in a design because of bad choices and decisions, incorrect methods and unsuitable work environment. Work environment include here things like collaboration, communication, mutual support as well.
The cause of unsuitable decisions, methods and environment can be traced back to the lack of skills, too little thinking, insufficient awareness and a lack of understanding. The latter one is the most important. Learning is key.

Backwards investigation (analysis) towards the root cause



Mediocre Problem Solving

Risks in Local Intervention (Local Adaptation)



Knowledge after local investigation:

- Global understanding of the system and environment
- Investigated local area
- Still many vague or unknown areas and interactions
- Requires (also) knowledge of the internal organisation of the system

Risks:

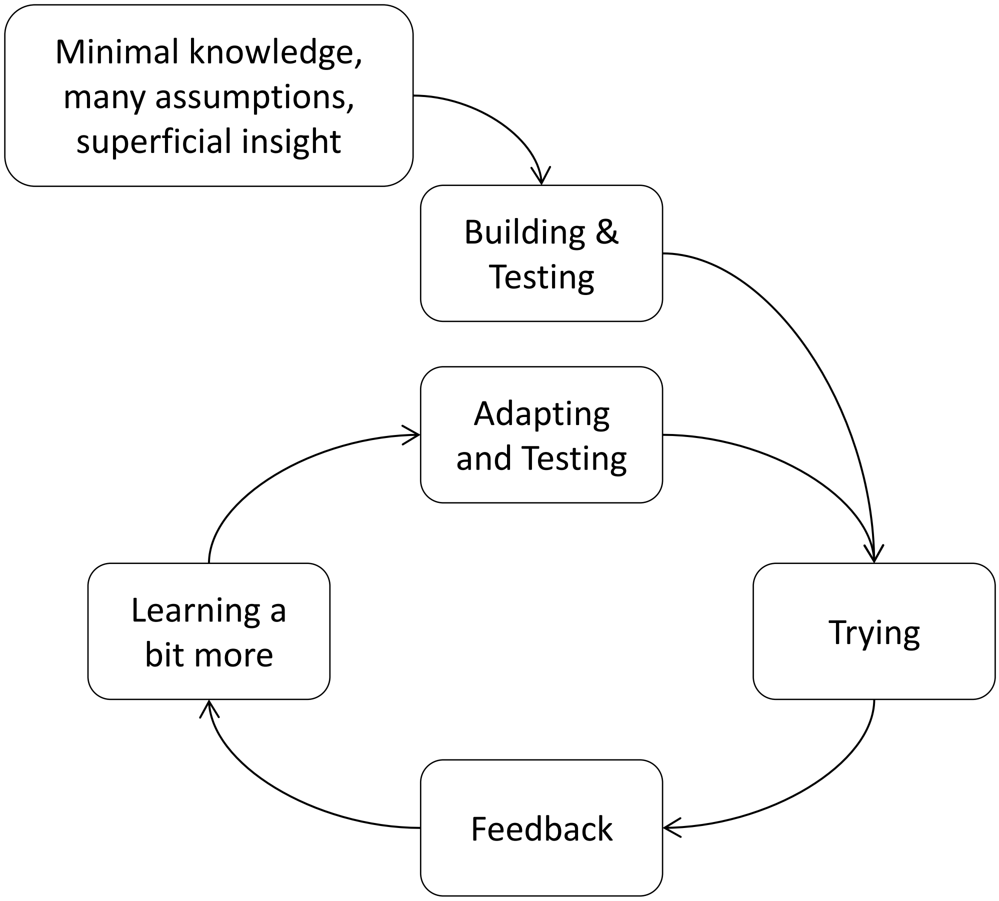
Adapting or influencing the functioning of a system or its environment, may have undesired effects (not always immediate, not always visible) due to pre-conditions, interactions, limits, relations, behavioural aspects, …. not taken into account (ignored)

Intervening on a complex system which is not fully understood is taking a huge risk.

The more we know the system, the fewer problems will occur due to ignored interactions.

Analysis, controls and simulations may help to reduce these effects.

Mediocre Problem Solving



<u>Notes :</u>

- Useful for matters which are difficult to predict like response of people (preference, interests, …)
- Useful for concrete, local, practical aspects like User Interfaces improvements
- Trying is good if no other alternative does exist.
- Not very useful when a broader, deeper more holistic insight is required.
- Adaption: Redo some work; some work has to be thrown away and replaced by new → includes a waste of time and resources
- What is the guarantee that what we learn is valuable and that after learning it, no other iterations will be required?
- How much do we learn compared to the time spend on building a non-solution? Is there a faster way to learn that? Can we learning by trying and by getting feedback in a system (the whole organisation) where everything is connected, but where knowledge and insight is more specific and local ?

Problem Solving Traps

Rushing into problem solving

I understand the problem and what we have to do. Let's design the solution or adapt it.

Let's build the solution

Let's implement and apply the solution

Let's use it

It didn't solve the problem. There are new problems. Let's look what we can learn from it and so we can fix it.

Problem Solving Traps

Mind is driven by

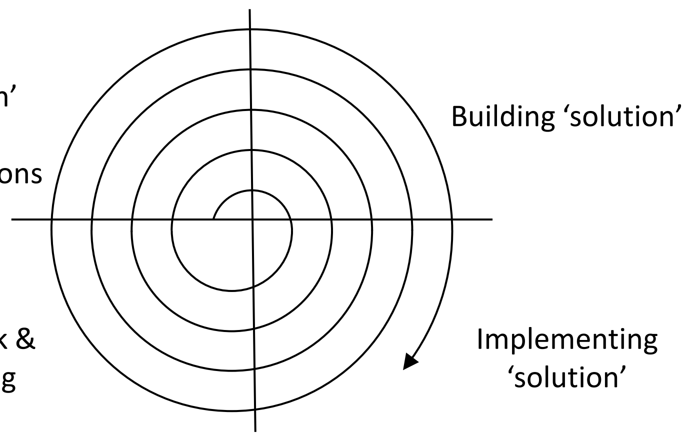
- "What solution is required?"
- "What should the solution look like?"
- "What solution will solve the problem"

Focus

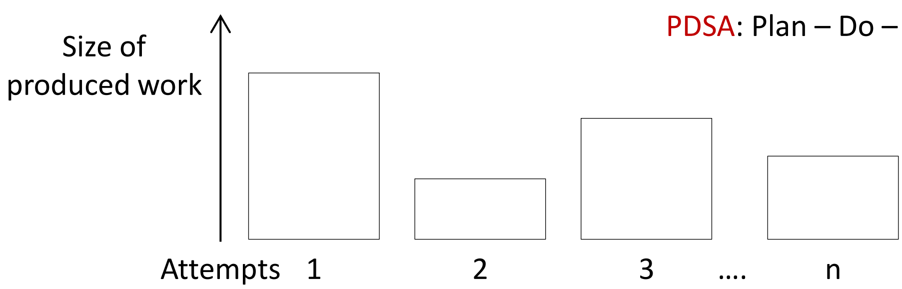
- on "solution"
- on "action"

Rushing into problem solving with too little insight is not without consequences.

1st cycle:
Conceiving 'solution'
Subsequent cycles:
Conceiving corrections



PDCA: Plan - Do - Check - Act
PDSA: Plan – Do – Study - Act



Problem solved after *n* attempts

BUT

- Will it ever be solved (certainty)? Predictability of required cycles? Predictability of timing?
- How well solved? How much rework will it take?
- If solved, then cycling until we learned what is necessary… or not even that.
- After n cycles, possible conclusion that the wrong problem is being solved
- What is learned is certainly useful. But no guarantee that we learned what we need to learn.

Learning comes late in the process.
Building solutions with superficial insight is inefficient and risky.

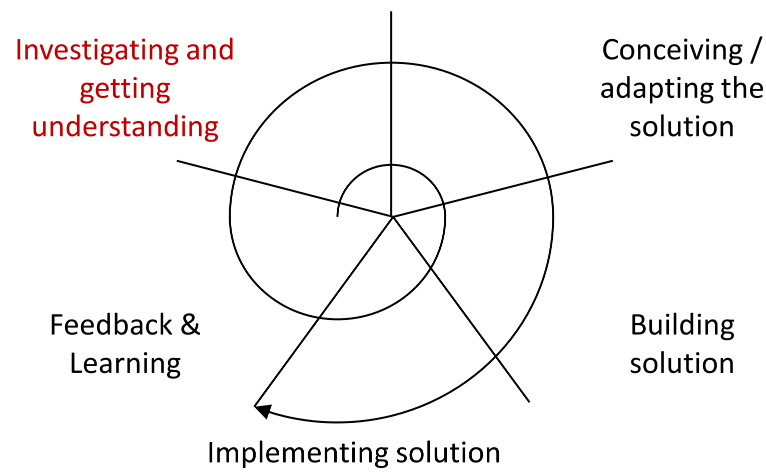
Limiting the Iterations

Cause of number of attempts:

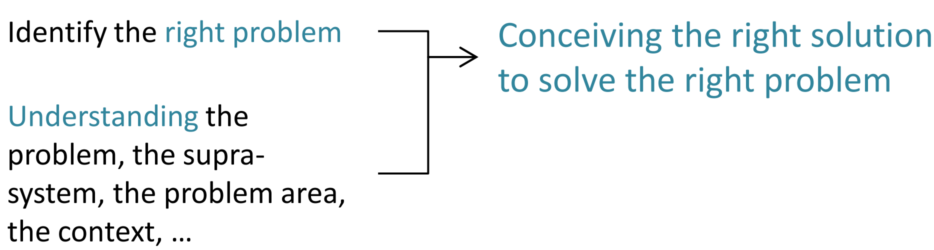
Lack of understanding when building

How to limit the number of attempts?

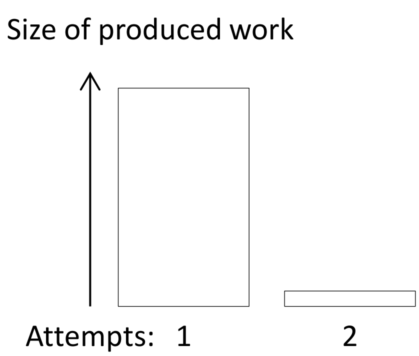
- Put learning, acquiring understanding early in the process
- and learn from the result



Two prerequisites:



KEY: HUMMILITY – CURIOSITY – QUESTIONING



Ensuring to tackle the right problem
Problem solved (preferably/more likely) after 1st iteration.
Ensuring problem is correctly solved.
Doesn't exclude (minor) corrections or future adaptations.

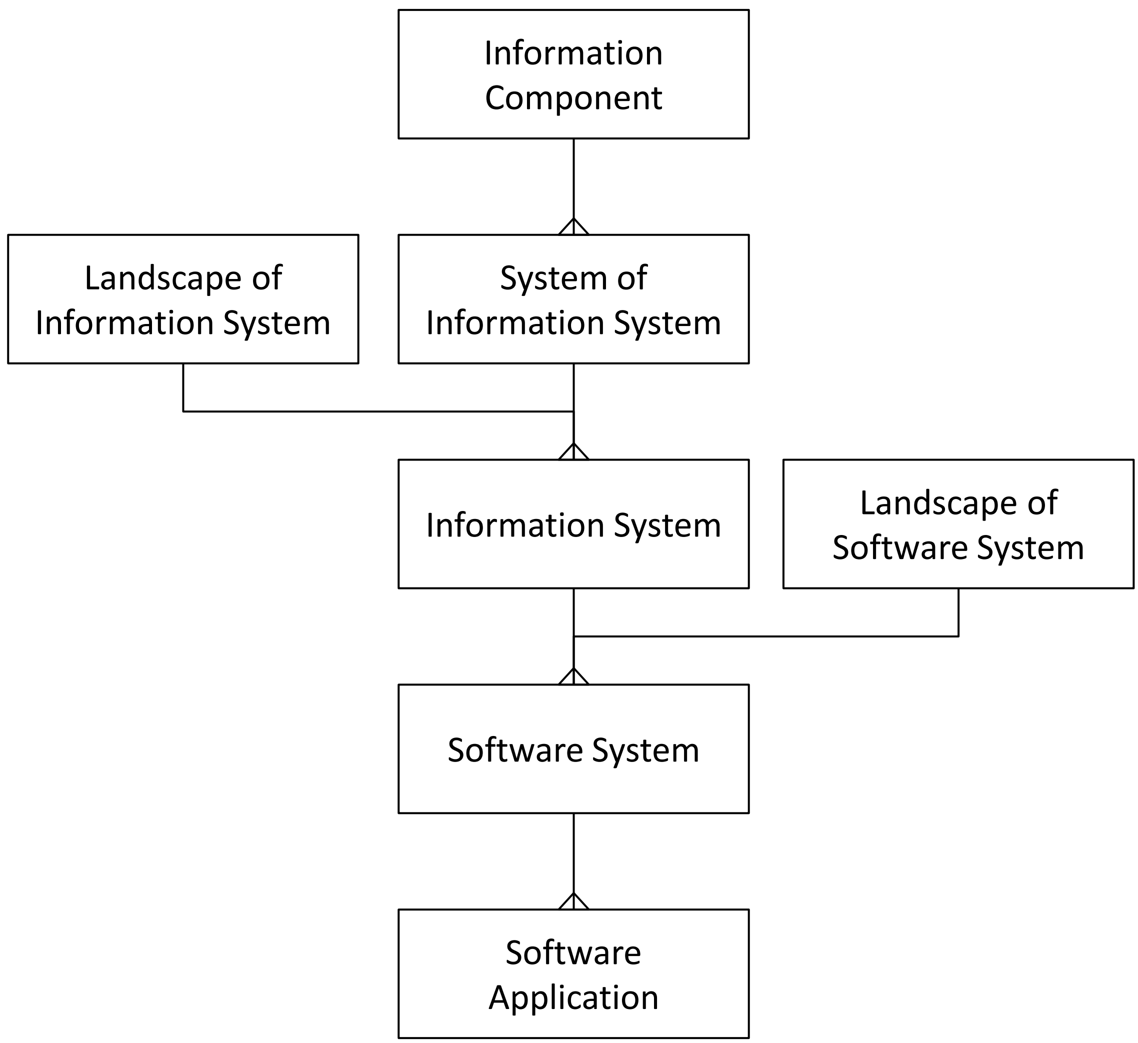
Problem Solving Traps

- Confusing the “understanding of documents, of demands, of requirements” with “the understanding of the situation”
- Confusing ‘knowing‘ with ‘understanding’
- Not identifying the unknowns & the assumptions; not verifying the assumptions; filling in the blanks with own answers; guessing
- Choosing instead of deciding (based on unimportant aspects; based on an interpretation, assumptions and preferences; taking uninformed / ill-informed decisions) The choice based on preference (like for taste, smell, colour, fashion, meals, deserts, …) is fundamental different from decisions about systems, solutions, and so on.
- Oversimplification (= ignoring some existing complexity)
- The brain doesn’t like complexity and effort. This is why a simple but wrong solution (or idea, concept, …) has far more chances to be accepted and to be spread than a complex but right one. Anything, like abstract thinking, requiring an effort of the brain is unpopular and everything requiring no effort is popular (neuroscience).
- Avoidance by externalisation (= avoiding to have to deal with existing complexity). Avoidance is a missing chance of strengthening the own skills.
- Going along with the first answer, accepting the first solution (fear disappear as soon as we have a solution. Proposed alternatives creates a new problem (which one to chose, which one is better, new discussion, … a new effort for the brain)
- Fake alternatives: Often a set of alternatives are proposed. Only one of them is / looks like a real solution (which is the one someone wants to sell), the other “solutions” are obviously worst. This is a fake choice among fake alternatives.
- People often are not aware of what they need. They confuse what they want and what they need.
- People may define the missing solution as being the need, instead of what it is supposed to solve. “We need a new database. So, the missing database is the need.”
- Believing the labels: “solution”, “business”, … Accepting anything that has been labelled as “solution” or which just looks like bringing progress and is related to the problem.
- In a choice between the truth or conforming with the choice or idea of the group, people will often chose for the latter. Choosing for an answer (the truth) different of that of the group may lead to exclusion, rejection (survival strategy). Result: weakest ‘solution’, lesser innovation, …
- “We have acquired a solution. Let’s now look how we can solve the problem with the solution. (no understanding of the problem, no cause identified, …)

INFORMATION COMPONENT

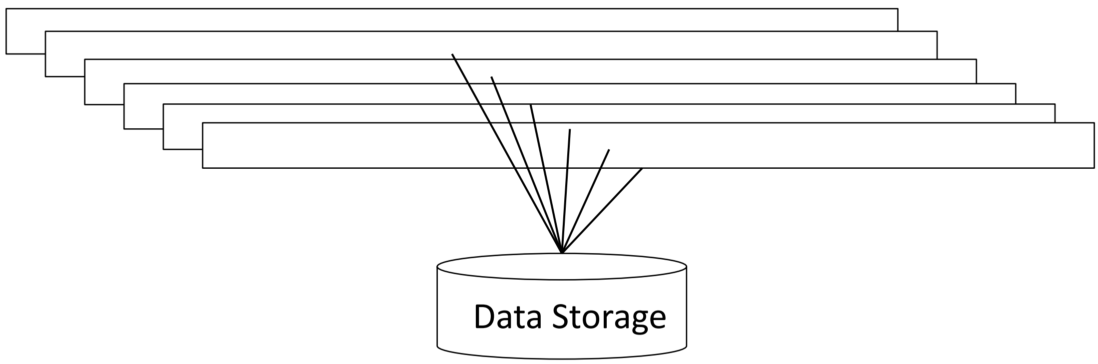
Systems in Information Component

The information Component is that part of the organisation that organises, regulate and formalises information and the way information is processed and managed.

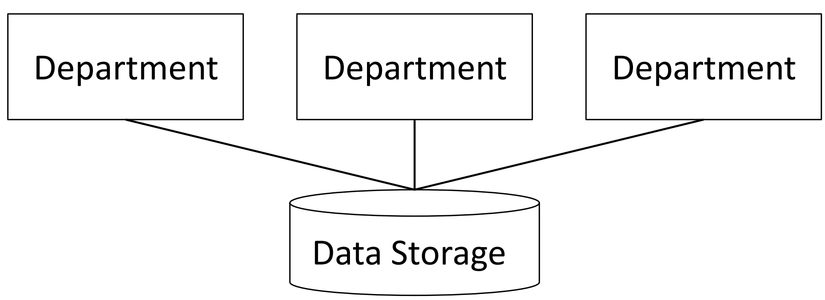


Sharing Data in the IC

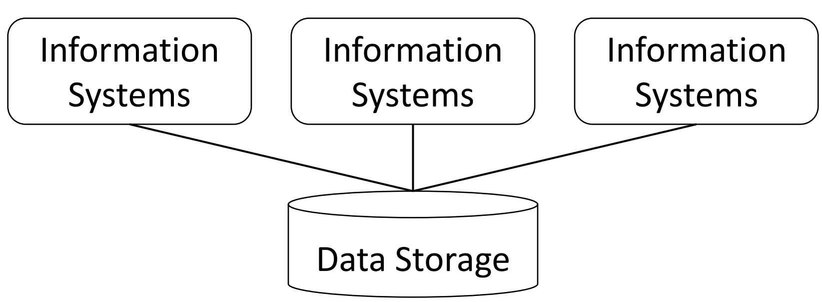
Business Processes



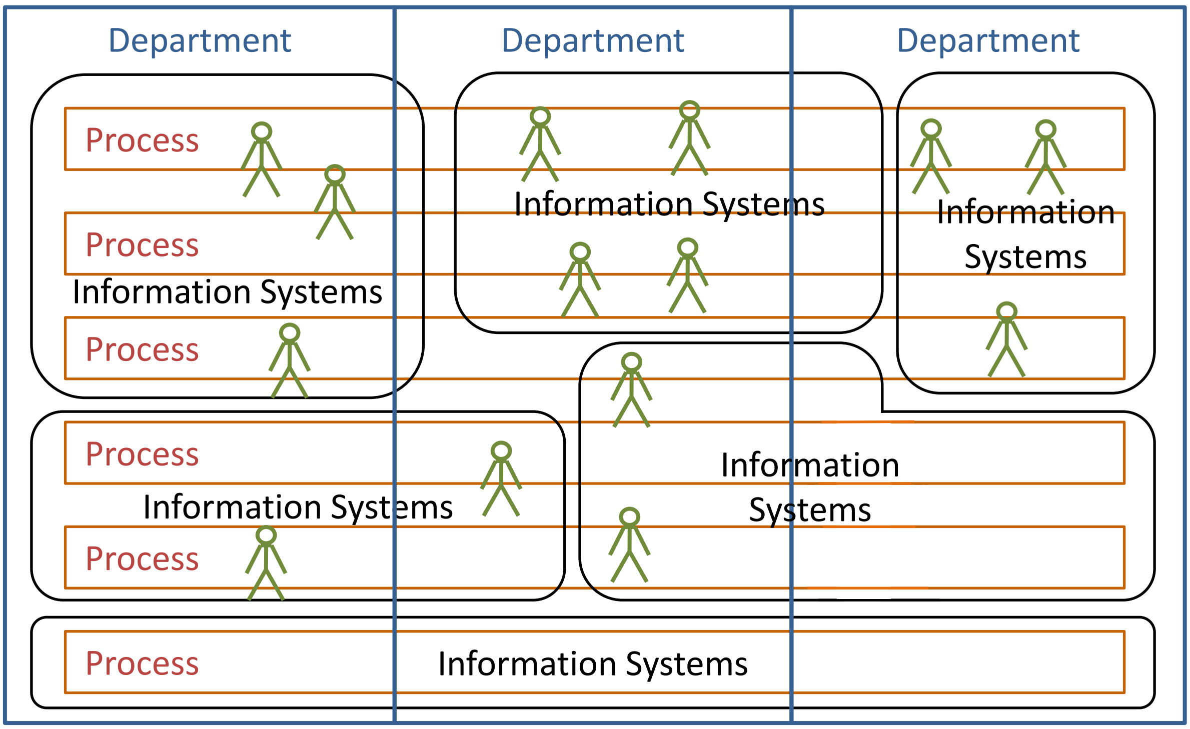
Departments



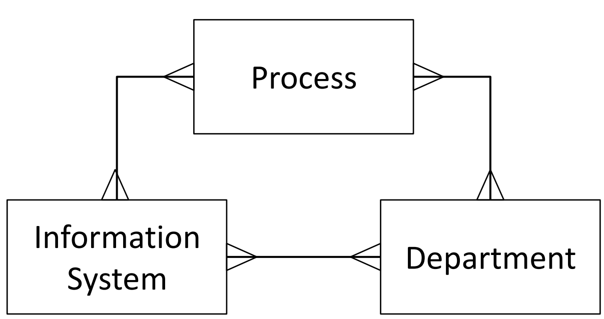
Information Systems



The IC: a heterogeneous multi-dimensional system



- Roles
- + Purposes
- + Communication channels
- + Collaborative relations
- …

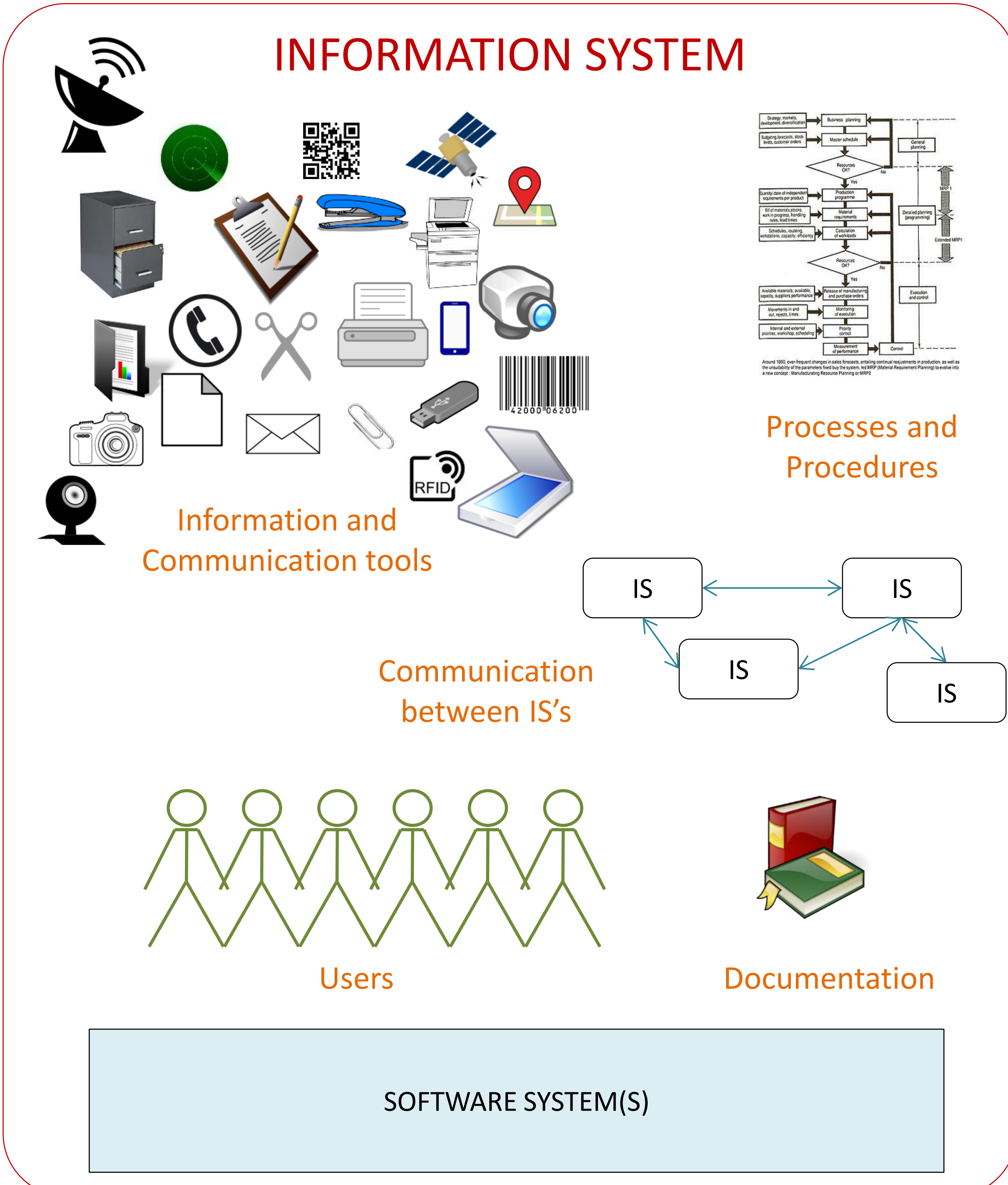


Notes:

Indicating all parts, motives, aspects, dynamics in a single model would make it too complex. However, it gives a general idea, although it is still simplified.

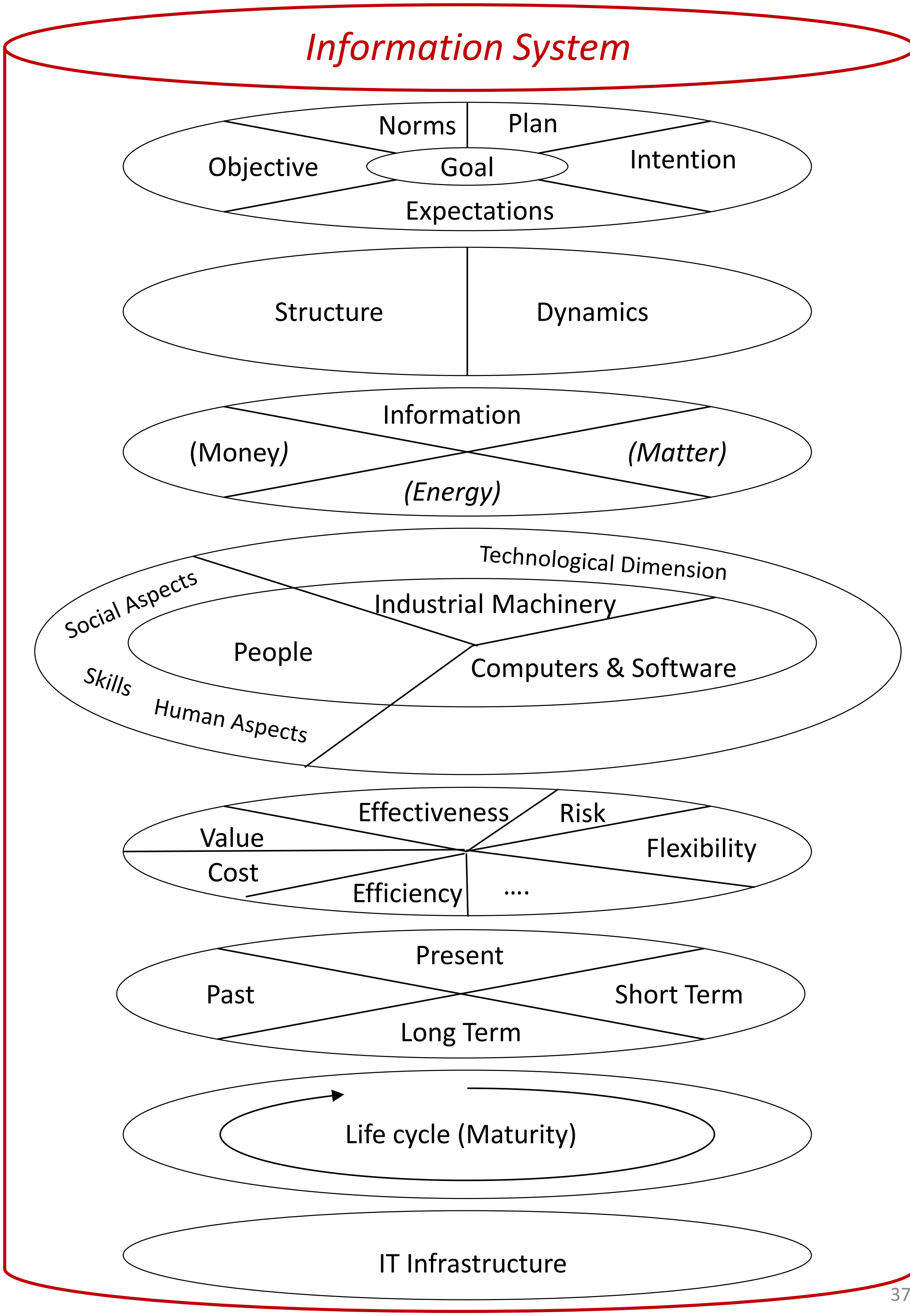
This forms a whole in which harmony has to reign.

Information System



Today, the focus is essentially on engineering software systems. Engineering the whole Information System is rarely considered.

Perspectives on IS



ENTROPY

'Entropy' is here defined as "the gradual decline into disorder of systems or societies".
(Remark: different meanings and definitions do exist for the term 'entropy')

Information systems (and software systems) are subjected to the tendency of entropy:

1. Degradation of Design

   Wrong abstraction have been used, changes of purpose, inelegant design, wrong concepts, …

2. "Degradation" of source code

   Bad programming: elegance of code; organisation of code; containing inefficient code; unused remains of old code cluttering the source code; inappropriate object, variable, function and method names; …

3. Information contained in the system

   Unreliable information, not updated, incomplete, encoded differently, not respecting standards and formats, old information, abuses of the system, ...

4. Technological fragmentation and chaos

5. Increased misalignment with co-systems, supra-system(s) and environments

Reflection:

"How do you combat entropy in Information Systems?"

Find as many principles, approaches, techniques, and other ways as possible.

Types of Software Systems

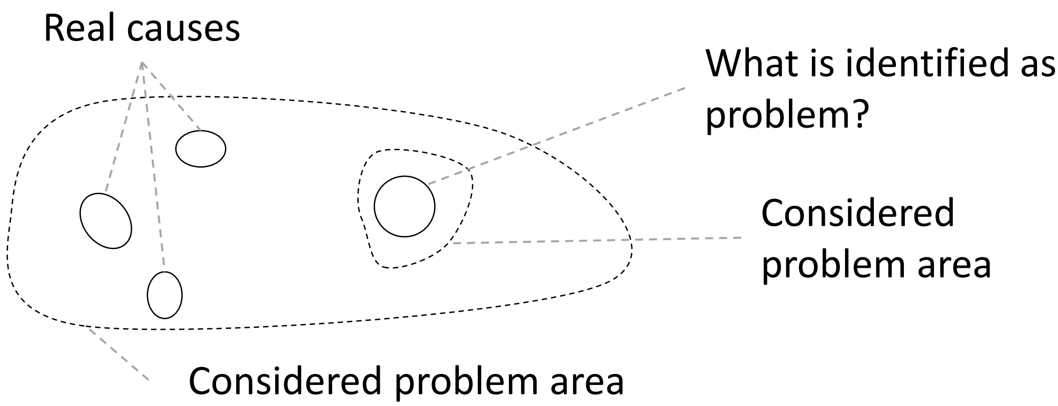
- Mainframe System
- Client-Server System
- Single/multi-User System
- 2, 3, Multi-tier System
- (Near) Real-time System
- Batch systems
- Distributed System
- Networked System
- Agent-based System
- Web-based System
- Intelligent System
- Embedded System
- Back-End / Front-End System
- Enterprise-Wide System
- Communication System
- Centralised / Decentralised System
- End-User Software
- Operating System
- Cloud System
- Workflow System, Routing Systems
- Messaging Systems
- Peer-to-peer System
- Pilot system, Prototype System, Test System
- ...

- Executive Information/Support Systems (EIS)
- Management Information Systems (MIS)
- Decision Support Systems (DSS)
- Knowledge Management Systems (KMS)
- Expert Systems
- Content Management System (CMS)
- Operations System
- Office Automation Systems (OAS)
- Transaction Processing Systems (TPS)
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)
- Data Warehouse System (DWH)
- Enterprise Resource Planning (ERP)
- Just-in-Time Systems (JIT)
- Monitoring Systems
- Alarm Systems
- Financial, Accounting, Inventory, Human Resource, Logistics, ... Systems, Electronic Health Record System, GIS, ...

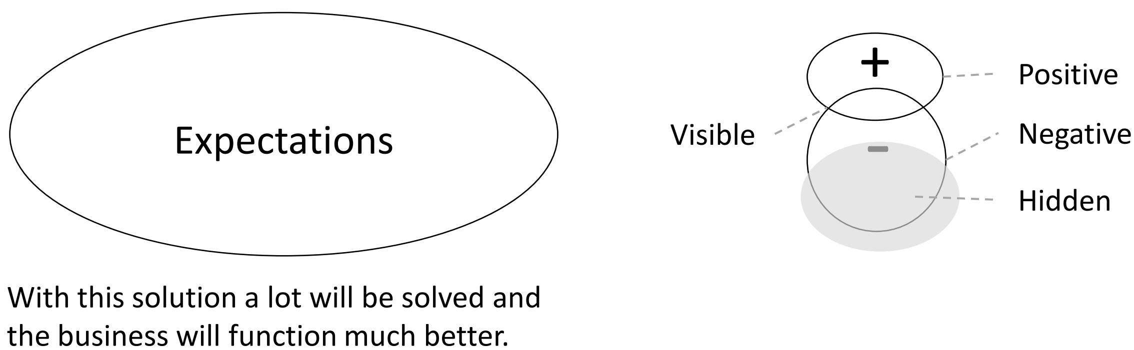
BUSINESS KNOWLEDGE & EXPERTISE

Common Issues in Contemporary IT

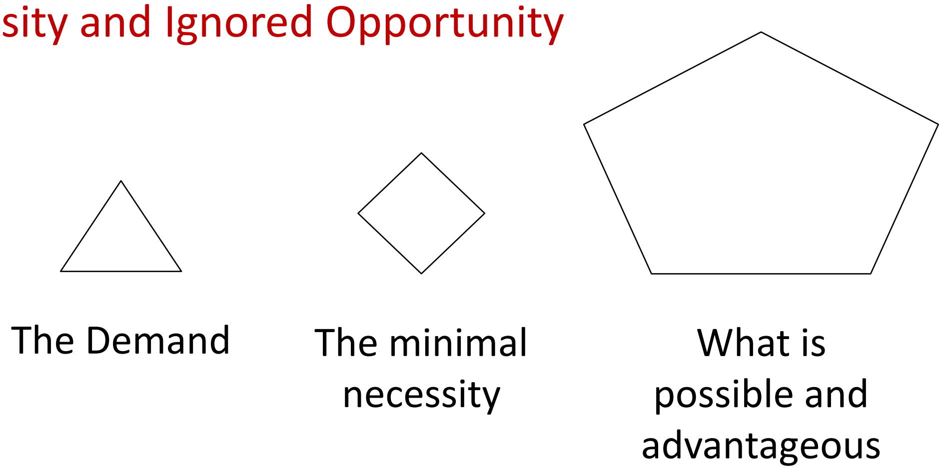
Problem Definition



Expectations versus Results



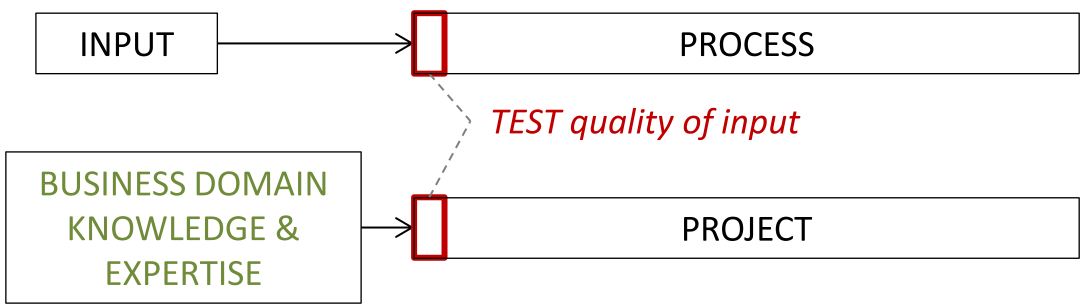
Demand, Necessity and Ignored Opportunity



Let's investigate some causes

Business Domain Knowledge and Expertise

Business Domain Knowledge (BDK), Business Knowledge and Business Expertise (BKE) is critical. It is the INPUT of the project.



Need for understanding "Business Knowledge and Expertise"

- What is BDK, BKE, …? And what doesn't belong to these fields?
- What level and quality of this knowledge and expertise is required by the project?
- What is the quality of the available business knowledge?
- What is the quality of the source?
- What are the limits of competencies of Business People in relation to systems development?

Assumptions about Business Knowledge

In general, nobody knows the business better than the business experts.

Assumption 1

Business experts know the business very well / well enough

Assumption 2

Business experts are the only source of business knowledge and expertise

Assumption 3

The business knowledge is sufficient and readily usable for information systems development

Assumption 4

Business experts are able to estimate what business knowledge the Analysts and other IS engineers need to know, when they need to know it and, more importantly, what they don't need to know (filter). They are rightly controlling the flow of knowledge to the IS Engineers.

Assumption 5

Business experts are able to communicate all the required knowledge (completely, unambiguously, degree of certainty, guesses in a methodical way, …)

Assumption 6

Business logic has to be determined first. This creates a first global picture of the solution. Non-business logic can be determined later and added to the solution.

Organisations, approaches, collaboration and decisions are based upon these assumptions. We can't simply continue with assumptions. They must be investigated, clarified and checked to know whether they are true, to what extent, and so on.

Business Knowledge

BUSINESS DOMAINS	
A) Industry Car manufacturing Car Leasing Telecom Railway Travel Agency Logistics Building Company Insurance …	**B) Business Function** Management Marketing & Sales Research and Development Operations Customer Support Administration … Financial Resources Human Resources
C) Academic Fields: management, mathematics, psychology, operations research, economics, …	

For every statement (or decision) it is important to understand to which discipline it belongs.

Who captures information, where and how it is captured, where it is stored, how it is processed (partly), what information is kept, what information is measured, how it is shared, … all this doesn't change how business is conducted. It is not business domain. It's informatics.

Note:

EXERCISE (useful!): For some industries and for every business function think of statements which do belong to the industry or business function and also to which they don't. This helps in identifying the limits of these areas. It will help to identify when an SME in one area talks outside his/her area of expertise.

Beware of labelling any logic other than user interface management or data writing or retrieval logic as "business logic" !!

Business Knowledge vs Non-Business Knowledge

Examples of Business Knowledge and Expertise

- Everywhere we do business we use as much as possible local products and raw materials and do business and collaborate with local companies.
- No ship shall enter or leave the port without the permission of harbour master's office. This regulation does not apply to tug boats and pilot vessels while conducting ships entering or leaving the port.
- New orders above the 10k € have to be validated by a manager if the client has still overdue invoices.
- Our company sells standardised items and customised items. Customised items require meeting the client in person and discussing the customisation before any order is placed.
- In dealing with immigration, the first step in the administrative process is to identify the person.

Examples of Real World knowledge

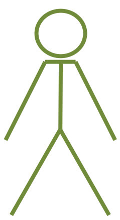
- A family is a group consisting of at least two persons and can be described as one or two parents and their children living together as a unit.
- Every city is located in a single country.

Examples of Informatics

- The client information has to be sent to the account manager.
- The clerk has to capture the information.
- This information will be stored, but we won’t keep that information.
- We need to be able to search for these orders with these criteria in the database.
- This feature needs to do this and that.
- The resulting features have to appear in this screen.

Required Business Knowledge

WHAT BUSINESS KNOWLEDGE PROJECTS NEED



SME

- 100% of the Business Knowledge and Expertise
- Multiple business domains knowledge
- Enterprise-wide knowledge
- Multi-level: from operational to strategic
- Relevant
- Complete
- Coherency between predefined logic and applied logic
- Clear, Unambiguous
- Detailed
- 100% certainty
- Structured, organised
- Mainstream and exceptions
- Realistic, applicable, achievable
- Settled in time: difference between what is valid now, what is valid later.
- About "As-Is" and "To Be"
- Coherence among the stakeholders
- Immediate (right) definitive decisions (no guesses, trials, partial, conflicting, …)
- Accessible
- On time
- Stable
- …

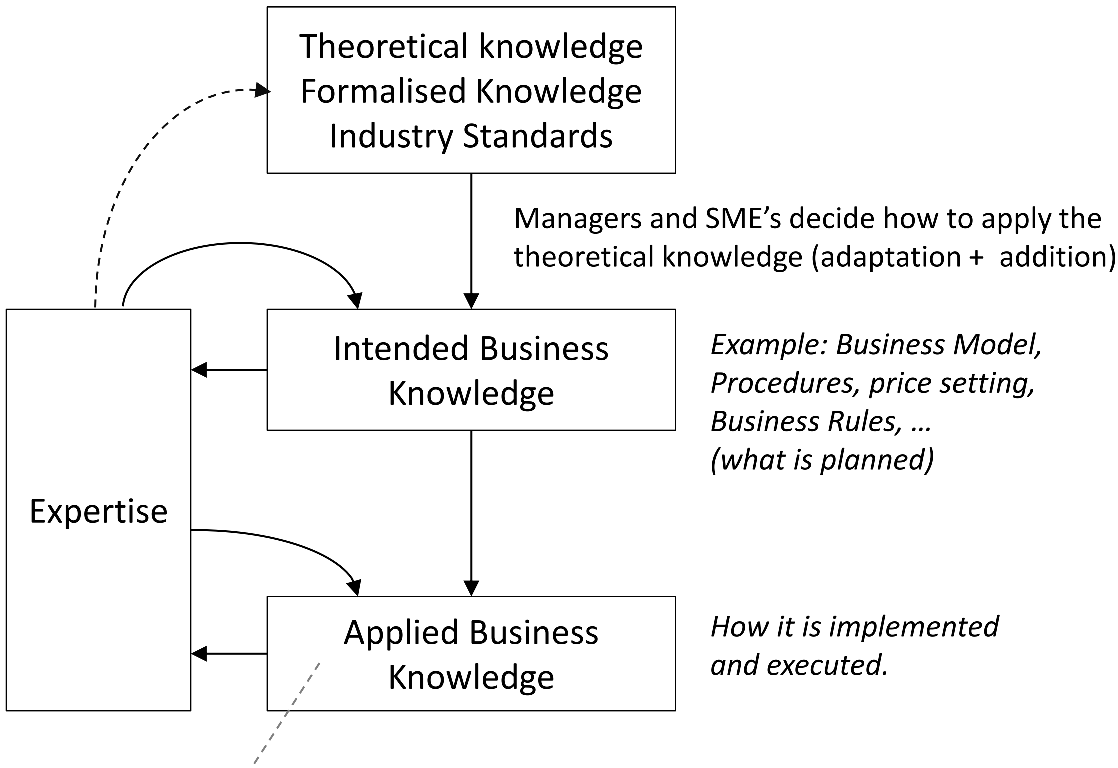
REQUIRED? YES

REALISTIC? NO

PROBLEM!

(= job of the Analyst !!)

Business Knowledge



In practice, the intended business knowledge to be applied is adapted and expanded

- Unforeseen events, situations and exceptions happen
- Problems have to be solved
- People can improvise to cope with lack of details
- Learning path
- Interpretation of the intended business
- Memory (knowledge is variable)
- Not all individuals do the job the same way
- Some degree of freedom in the application. (Example: determined price isn't used, but is negotiated with the client)

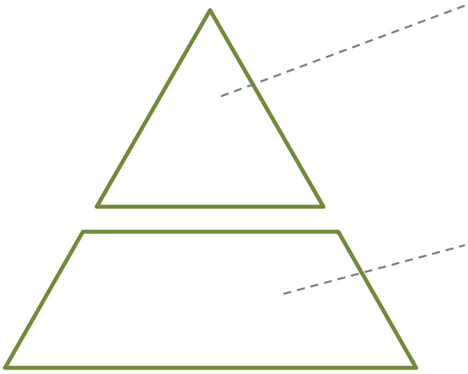
Proposed definitions:

Business Domain Knowledge: Academic field, business theory, generic knowledge that can be used by different companies as a foundation.

Business Knowledge: The specific BDK and business logic implemented in the company.

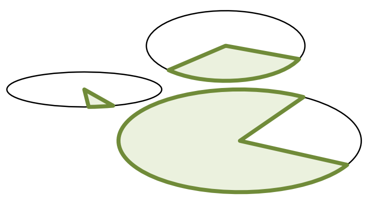
Business Expertise: Knowledge and experience in how the company conducts business and how it turns out in practice

Business Knowledge and Expertise



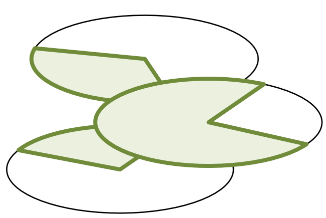
Managerial level:
The knowledge at this level is broader, global and may concern the past, present and the future. Knowledge of objectives, intentions, plans, policies, ... Knowledge of the details and practical experience, as needed for practical execution, can be fuzzy, unreliable or missing.

Operational level: The knowledge is detailed and practical. Operational objectives, habits, exceptions, concrete gaps, hindrances, local opportunities for improvements, …



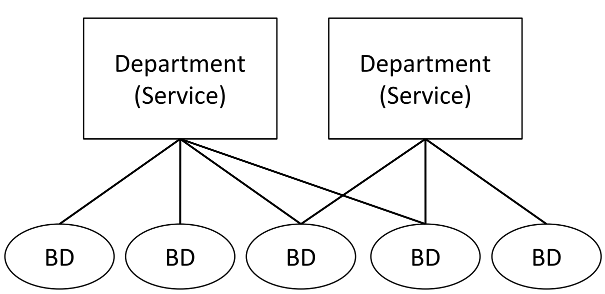
Services, departments

An employee or SME knows his role fairly well. The own service or department is also known. However, this knowledge may be incomplete. Knowledge of other roles, services and departments becomes much more superficial and uncertain. Only the information usage and the parts of the business processes in the own department or service is known. A more global picture can be lacking.



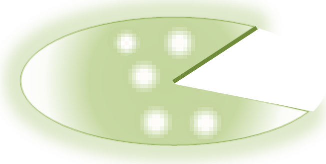
Business domains

A business subject matter expert has expertise in one or in several domains. Business domains often overlap. The business subject matter expert may have some knowledge of other areas as well. His/her expertise in other domains may be lesser. Being an expert is not a generic qualification. Someone can be an expert in an area, but <u>not in other areas</u>.

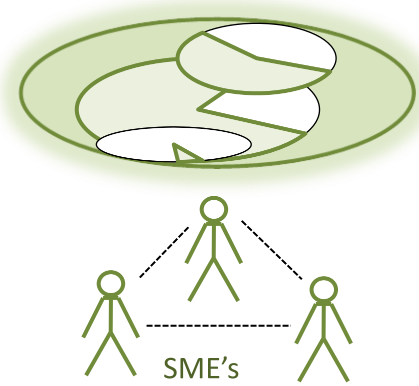


Usually, each organisational unit has (0?,) 1 or more main business domains.
There is <u>not necessarily a 1-to-1 relation</u> between a department or service and the applied business domains. A department may use this knowledge for its own purpose, for a global goal or to suit the needs of other departments.

Business Knowledge and Expertise



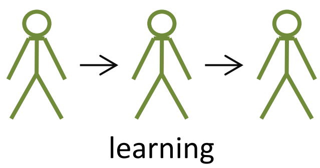
An SME has knowledge of his business domain. Some of this knowledge is well-mastered. **“Knowledge”** (and expertise) is not collection clear, nicely delimited, concrete, factual amount of information. An SME knows some areas of his domains. There might be blind spots, vague areas, unknown areas, distorted knowledge and so on. Knowledge is not black or white, true or false. Many qualities of knowledge is a matter of gradation. Additionally, there is a difference between knowledge and understanding. It is also a matter of perception, perspective and belief. Some knowledge is not always consciously present. Some knowledge can be inferred. An SME can always correct, improve and expand his expertise in his domain. Knowledge is not a static fact. It may increase or decrease. Memory is volatile.

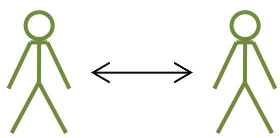


A company has usually different persons with business domain knowledge. So, there is more business knowledge present in the company than there is in the head of a single SME of that company. The business knowledge of each SME of the company varies. They have a lot of knowledge in common. But there might be nuances, gaps and contradictions. SME’s may have a different knowledge, a different understanding, a different perspective on a domain or issue. SME’s consult each other to exchange knowledge. They don’t always agree with each other. The application of business knowledge is often a combination of business knowledge and knowledge of the daily world (the reality).

There is more business knowledge or knowledge useful for a particular domain in the world (universities, libraries, web, companies, organisations, other experts) than present in the company. The business knowledge outside the company, although useful, is not necessarily the knowledge the company uses.

Business Knowledge and Expertise





The function or term of "Expert" is not a measure of solid business knowledge. Some SME's do a genuine educational effort to improve their expertise. They are keen to select the sources they learn from. However, a common learning tactic is to learn on the field. The SME learns from colleagues. These colleagues learned themselves from other colleagues. Activities, work approaches and methods are transmitted. Belief systems and habits are perpetuated in the company. Norms and expectations aren't raised. They are used as objectives. So, some tend to be satisfied with somewhat better than average, being average or not so bad. The knowledge of the expert may not go beyond the functioning of the own company and is not backed up by a solid knowledge of the theories or broader industry knowledge. Many people don't deepen their insight and further develop their skills. Some don't like reading or are demotivated for one or another reason. Some persons are considered as expert already after a few years. Some experts may acquire 1 year of new experience and then repeat this experience for the next years without fundamentally learning something new. These tendencies are not favourable for the development of real expertise. The Analyst has to take such situations into account.

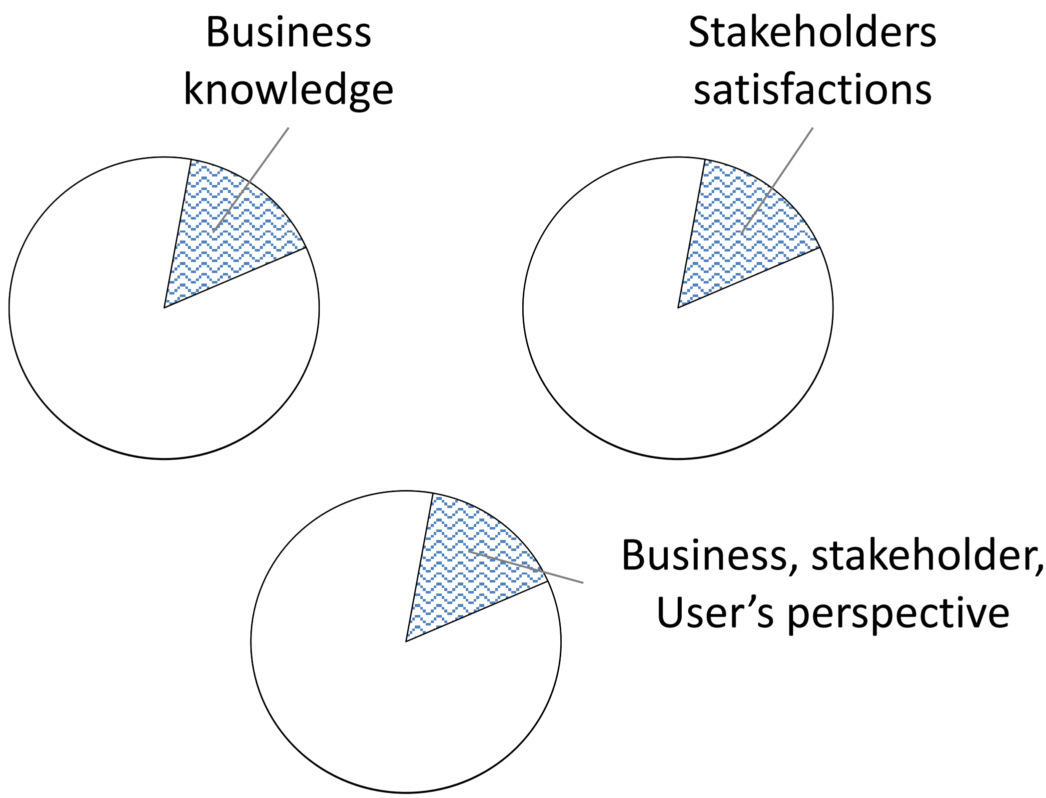
Business expertise is developed and learned to be understood and used by people. Its purpose is to allow people perform their job. People understand high level instructions. They can interpret them, evaluate and decide to act in the best way accordingly to the issue and to the circumstances. They can deal with uncertainty. They can adapt and improvise. This knowledge and expertise is meant for people. It has NOT been developed for software applications and computers.

The quality of information, particularly knowledge and instructions, meant for people is very different from the quality required as input for engineering information systems.

Notes:

The Analyst has to verify the information received from the business community and to deal with these types of difficulties. If the Analyst doesn't, the system design may be conceived based on weak information.

Business Perspective



Business knowledge is a narrow view of all the knowledge required to <u>diagnose</u> and to <u>conceive</u> suitable information solutions, let alone to innovate.

Users satisfaction is, as criteria, by far insufficient to evaluate a system properly. It is based on this same perspective.

The users/business perspective, although essential, is inappropriate to conceive and to evaluate a system.

<u>Note:</u>
Can a driver (user) decide whether a car (system) is safe and roadworthy?
Customer and Business perspectives and their knowledge are important. They are important to be taken into account in the design. But they are insufficient to diagnose, to design (conceive) and to fully evaluate information issues and information systems.
Is it possible that a solution satisfies the business stakeholders, yet hinders, limits or harms the company as a whole?

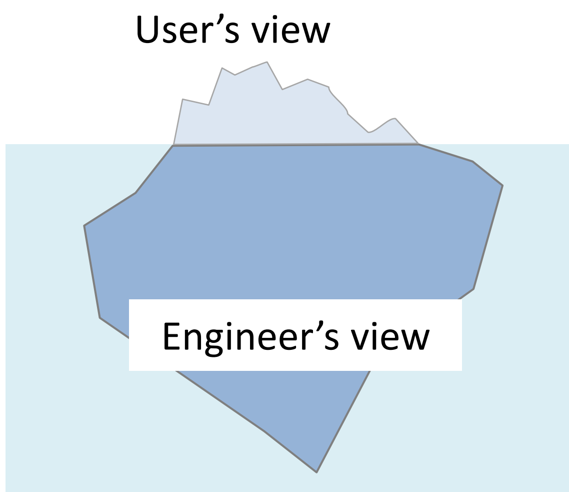
Engineering vs Usage

	Engineer	User
Focus	System oriented	Usage & Result oriented
Driver	How can I make the system better? How can I make better systems?	How can I use the system in a better way?
Thinking	Systemic Thinking, Engineers Thinking, Holistic, Methodical	Actionable Thinking

< CONFLICTING >

Iceberg

Ice above and below the waterline



In IT

The part above waterline is different from part of below waterline. GUI is by no means comparable with internals of systems.

Both parts are different

- in nature
- in possibilities
- in size
- in complexity
- in conceptual approach
- in required knowledge and competencies
- ….

< MISLEADING >

An engineer's brain is differently wired than a non-engineer's brain. They have different world view and have different thinking patterns.

Reflection:

A User is NOT an Engineer !!

- Does a car driver understand the car engine?
- Can he/she engineer a car or provide car requirements?
- Can he/she lead a team of car engineers?
- Can he/she says when the car is roadworthy?

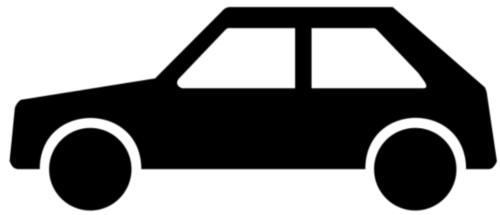
Car: The dashboard, steering wheel and pedals (users view) is very different from chassis and engine (engineers view). → Ability to drive a car ≠ Ability to engineer a car.

A System is more than Features

What the users know of software applications

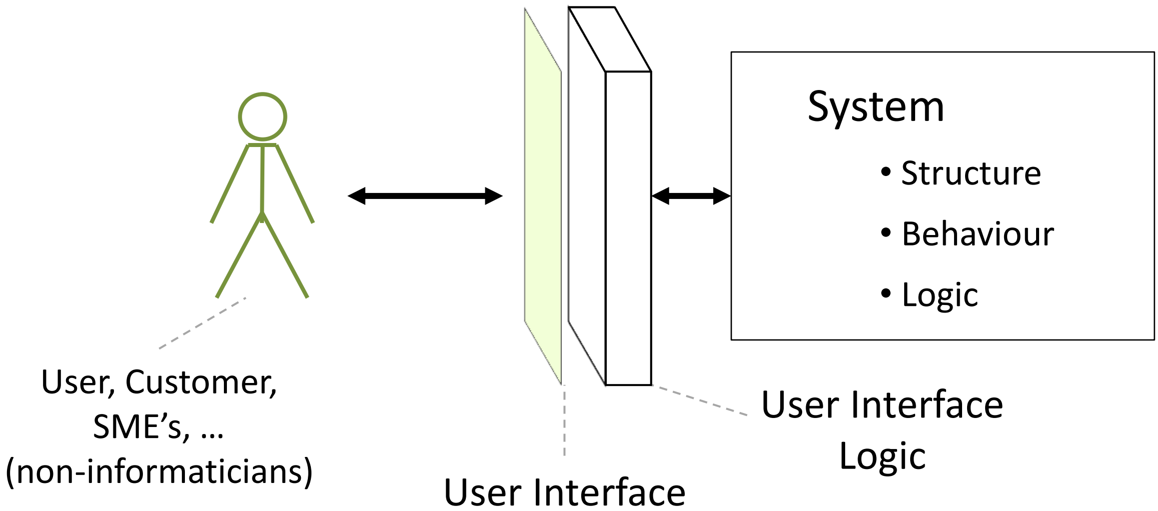
"User Interface" and "features"

What a software applications is



- Does a driver (user) understands the car (system)?
- Can a driver judge and value a whole system through its interface?
- Is the dashboard a relevant picture of the car's internals? Does it reliable reflects the engine? Or are both of different nature?
- Is it the role of the driver to engineer the car?
- Can a user engineer a car?
- How would the car look like if it was engineered by a user? Would it be roadworthy? Can a driver even evaluate whether his/her car is roadworthy?

User Interface is not the System



What is visible, what the UI-Logic allows the user to see :

- Results
- Means to manipulate some data

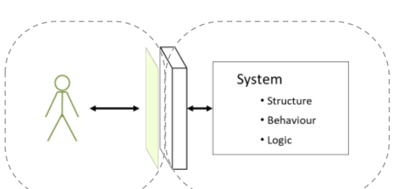
Major Assumption

The UI reflects the system sufficiently and reliably

(it's nature, its content, its functioning, its logic, …)

"The User Interface is a Lie"

- protects the User from having to know the whole complexity of the system
- protects the User from having to know too much
- provides a distorted and simplified view on the system
- and hides the reality, the true system, the real complexity, …



This knowledge ≠ this knowledge 💣☠

Because using a system requires lesser knowledge about the system than conceiving it. These are 2 different jobs.

Consequence:
"The customer doesn't know what he wants"

Business Activities vs Enterprise

ENTERPRISE
(COMPANY's BODY, SYSTEM of Systems)

BUSINESS
Activities deployed by using the Enterprise

- Business defines the activities deployed by using the Enterprise.
- Business defines some(!) of the capabilities of the Enterprise

Business, as activity and as field of expertise, **impacts the design** of the enterprise as a system, but it **does NOT define it**.

Why? Because the business perspective is only one perspective; a partial, on-sided and limited view. It does not provide a holistic view combining all the perspectives.

Notes:

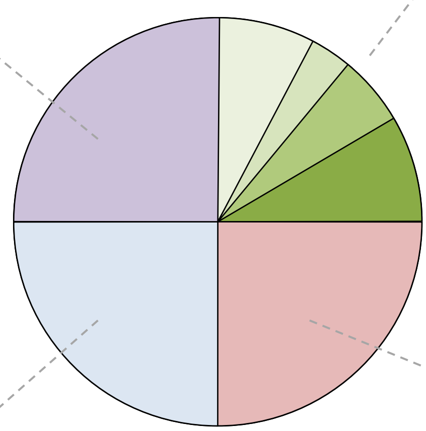
The physical activities don't define our body. They defines the capabilities required by the body. Training creates these capabilities. The need for survival impacts the design of the human body much more.

A same business (same business activities) can be implemented by **very** different systems of systems. These systems implement different concepts, different logics, different architectures, but they implement the same business logic. (like "one problem can be solved by different solutions").

Business Knowledge and Expertise in Software Systems

Company, enterprise's perspective
Supra-system's perspective

Different business domains, business **activities**, different organisational units, different roles
⇩
different knowledge and perspectives



IT

- Programming logic, technical mechanisms
- Technological integration
- Configuration
- Deployment
- Access Management
- Operation and Maintenance
- Administration
- Security
- …

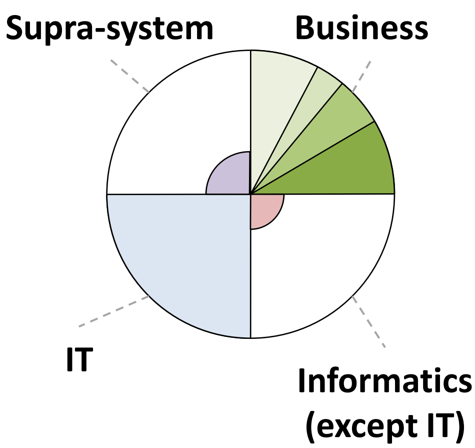
Informatics (except IT)

- Functional Integration
- Information organisation
- Information management
- Information controls
- Information processing
- Internal functional system mechanisms
- …

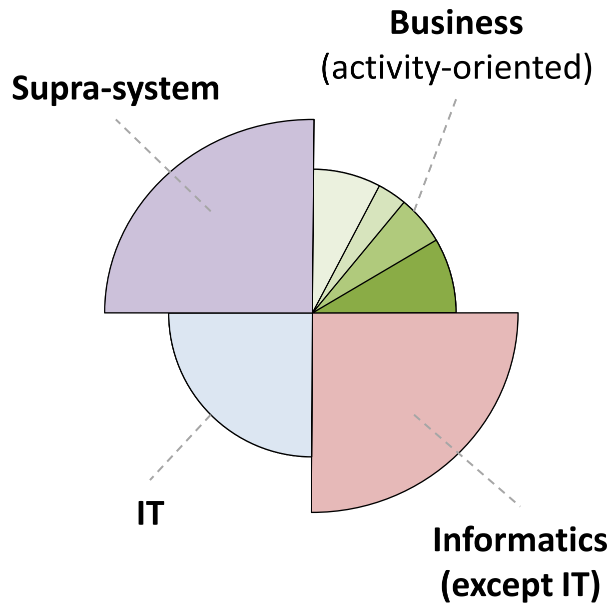
Besides the business logic, software applications contain a lot of other logic that matter very much as well.

Implementing business logic with just enough of other logic (like screen and menu management and logic to store and retrieve in interactive software application) is unlikely to lead to robust, well-functioning and lasting systems.

Business Knowledge and Expertise in Software Systems



Can be true for simple problems, concrete and local logic, small(er) solutions



Larger, sharing, multi-business-domain, integrated more complex software systems require more of THIS model

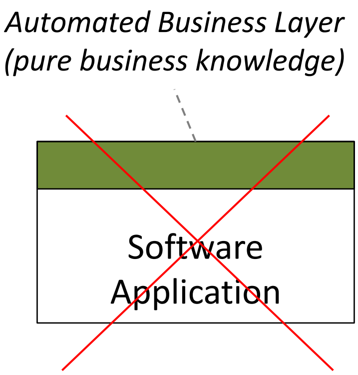
CAUSE OF FAILURES OF LARGER PROJECTS

is the <u>underestimation</u> of the required degree of Project Management expertise, Systemology and Informatics (non-IT part) expertise required by the project.

This leads to

- ineffective project organisation and forms of collaborations
- and to the non-respect of principles in the above-mentioned disciplines.

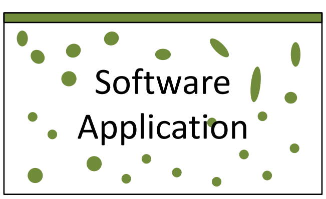
Business Knowledge and Expertise in Software Systems



The implemented (pure) business knowledge does rarely/not necessarily form a uniform upper layer in software.

Implemented business logic appears more as tests, computations, connections, calls, and so on. It is spread throughout the software application's logic and databases. It is intermingled with other types of logic.

Not all logic used to guide activities executed by business people is business logic.



If business logic would fundamentally define the solution then once the business logic is settled, only one possible solution can be created. This isn't the case. Business knowledge and expertise influence the solution, but doesn't define it. It may determine parts of it.

Non-IT people are not used to deal with such abstract, detailed and formalised logic. All the program logic behind the user interface is completely different from the logic end-users are accustomed to deal with. It is the formalisation of a very detailed mathematical precise formalised fixed(*) logic. (*:people can interpret instructions, computers execute the code like it is written). End-users also know pieces of logic implemented in a software application and the result of some functions.

We know (common complain):

“The Business doesn’t know what they want”

- Given the nature, the quality, the fragmentation, the spread of business knowledge,
- Given that the role of the business community is to make the business running
- Given that most people don’t know what computers can do or can’t do
- Given that most people have no clue about IS engineering, Systems Science, …
- Given that most people’s brain is not wired like that of an engineer

and

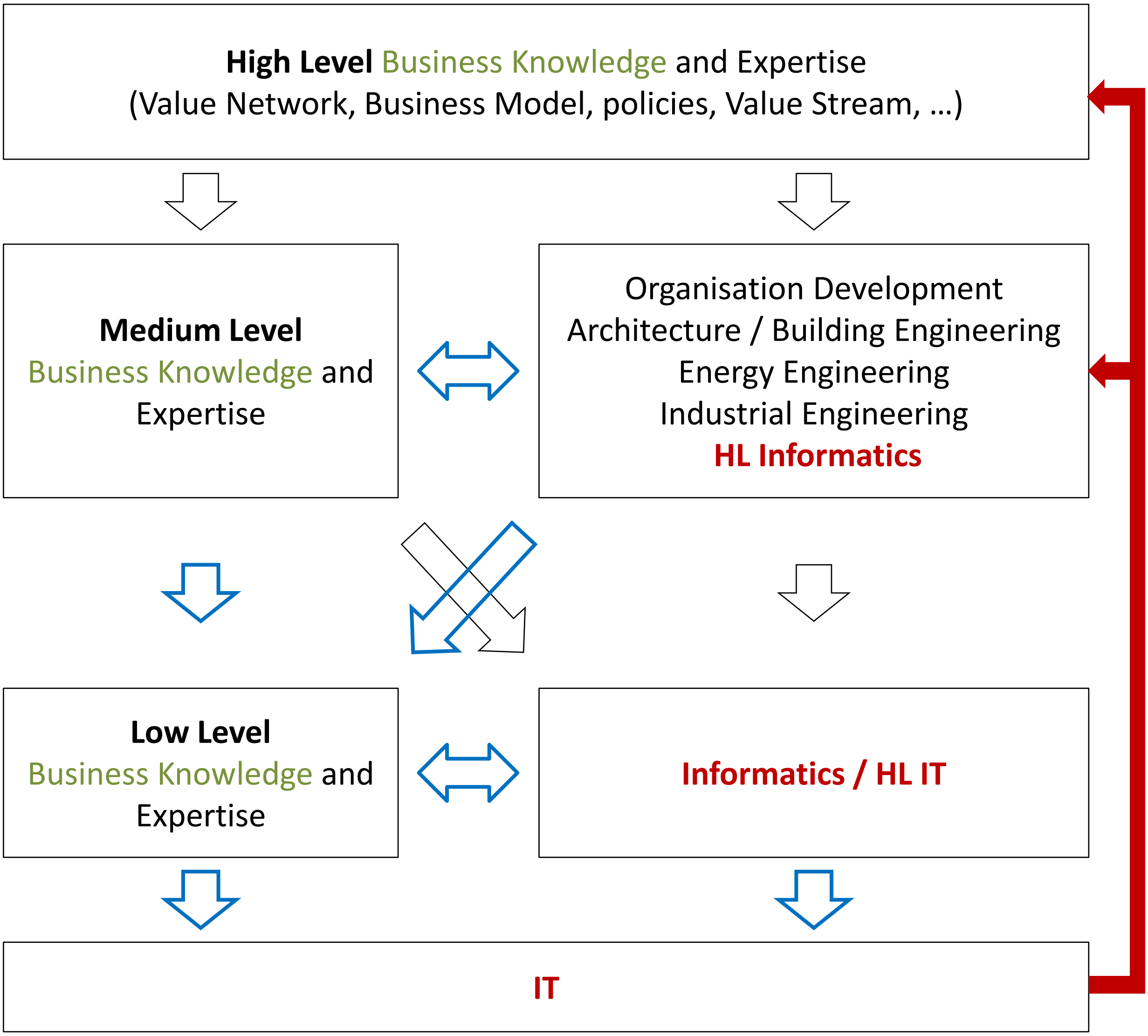
- Given the business community is not qualified to engineer information systems

any approach expecting the business community to define its information needs, to specify what information solution and its outline they need, taking informatics decisions and even “guiding” IS projects is a way of working to avoid.

Notes

Business community should take business decisions. Informaticians should take decisions related to information, information organisation, information processes, information systems, …

Business – IT Knowledge



- Information products & Information services change business models
- Web, RFID, Smart devices, BI, Big Data, AI, … change the organisational structures, the collaborations, how business is conducted, and even business models. ( )
- The power of Informatics is at the level of information concepts, information organisation and information processing (example: AI). Although this is "abstract", this shouldn't be underestimated. Therefore, one need to know what software and computers can do and can't do.

Business – IT Knowledge

OLD Paradigm

Business Knowledge and expertise

⇩

IT

Business knowledge governs the IT expertise.
"IT serves the business."

Consequently:

Habitual Project Methodology or Approach

Business Knowledge and expertise ⇨ IT

1. **Business stakeholders guides the IT projects**
   (determines, defines, controls, manages, …)

2. **"Throw-it-over-the-wall" - approach**

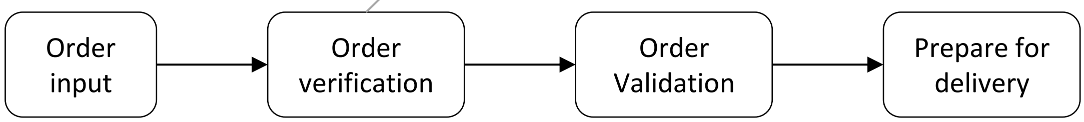
First, determine the Business knowledge and expertise to be implemented. Pass it on to IT. IT implements it and also adds its own logic.

This belief does <u>not</u> match the reality, yet it is commonly implemented in approaches and applied. It is a source of problems and serious limitations (among others, inhibiting innovation).

Business Process

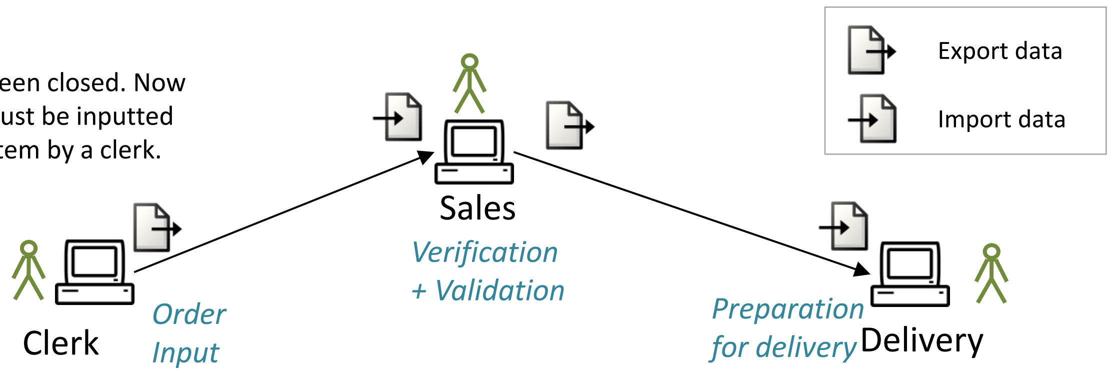
Pure business logic

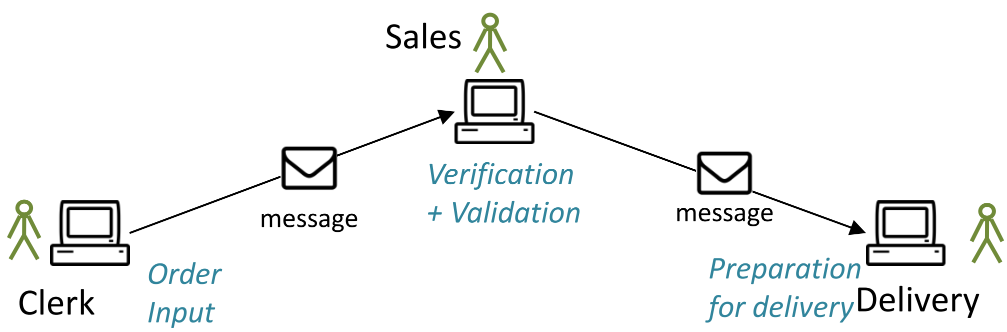
- Check client history (unpaid orders)
- Check order with available stock
- Optionally provide discount

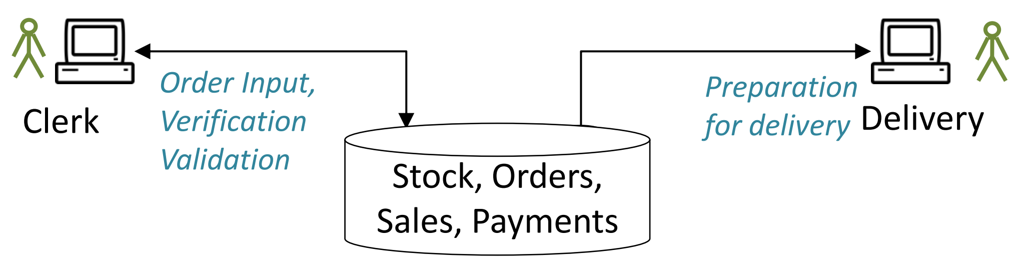


IT

A sale has been closed. Now the order must be inputted into the system by a clerk.







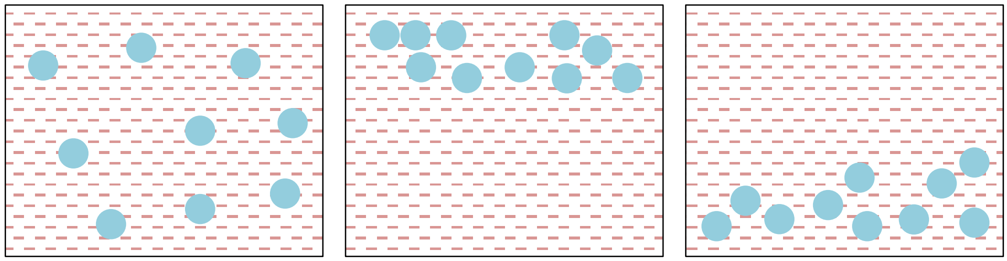
Verifications and validations are done by software. Sales person doesn't need to intervene anymore between order input and order execution (except in case of negative validation).

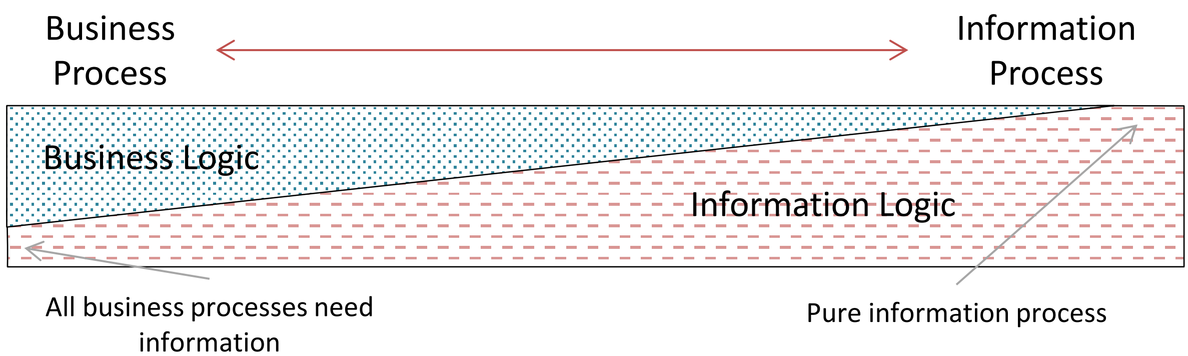
Notes:

The business logic remains the same in the 3 implementations. But the actions executed by the business community are changed.

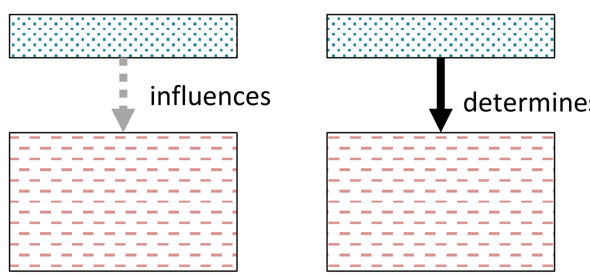
Business & Information Logic

Business Logic may be dispersed in an information process and can be more or less concentrated in one or another area.
(example: business rules)

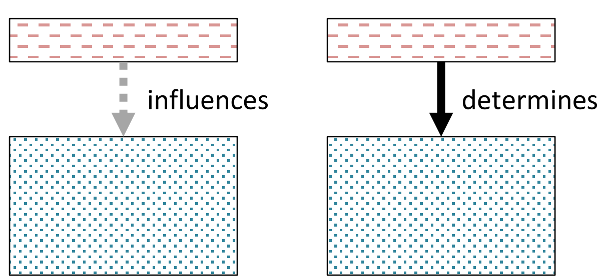




Business logic may influence or determine the structure of an information process



Information logic may influence or determine the structure of a business process

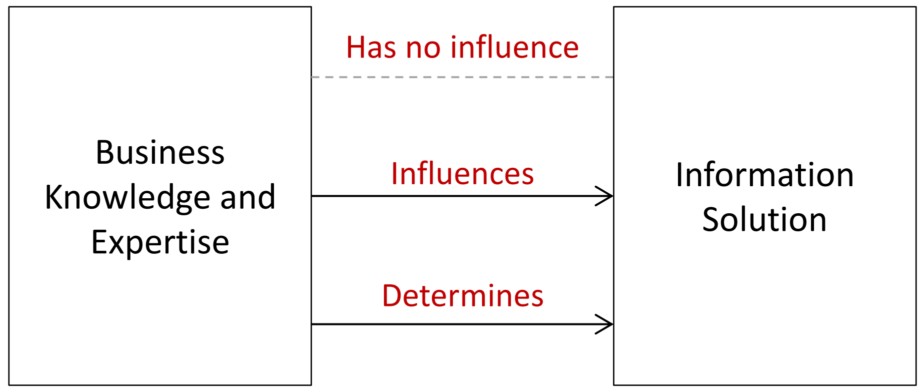


Notes:

This impacts the design approach, the priorities, the focus, the leading competencies, …

2nd drawing: shows only the amount of both types of logic. It doesn't show 'layers' of knowledge.

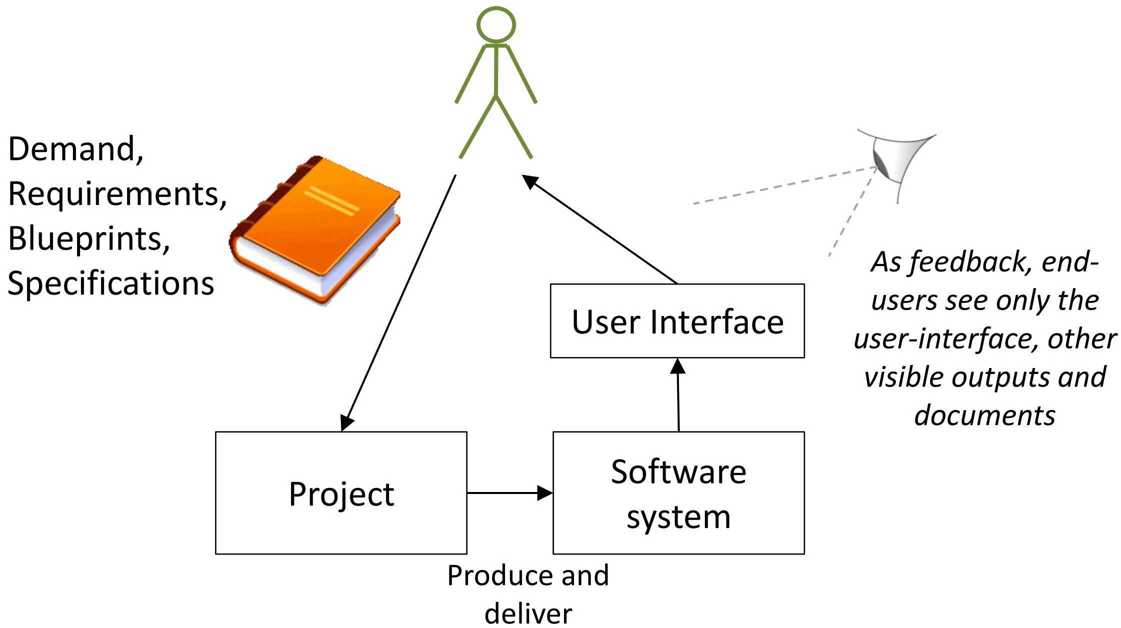
Business Knowledge ↔ Informatics



Notes:

- Some business knowledge has no influence on the concerned information solution.
- Or, its influence is local and limited to the execution of it (like a specific formula).
- Some business knowledge influence the information solution. For example, some parts of the business may be very strict and formalised and use procedures, while other area's are more free and function based on *cases*.
- Some business knowledge determines how information is processed (like the computation of price). However, not every information processing is determined by business knowledge.
    - Example:
        - Selection algorithms
        - Sorting algorithms
        - Matching algorithms
        - Identification of data elements
        - Data quality verification
        - Prioritisation algorithms
        - …

Software Applications Under Control of Non-IT People



1. The user may assume the demand, requirements, blueprints and specifications are implemented in the software application.
2. The user may deduce the internal logic and behaviour of the software application through its user interface and other observable outputs.

AND

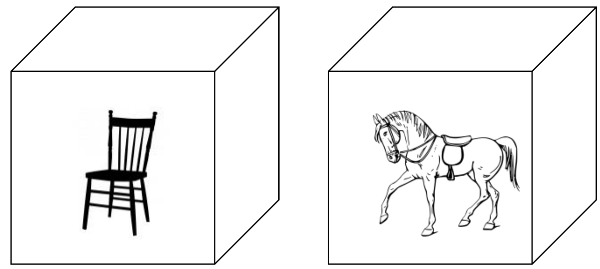
3. The user may imagine how the logic expressed in the transmitted documents have been implemented.

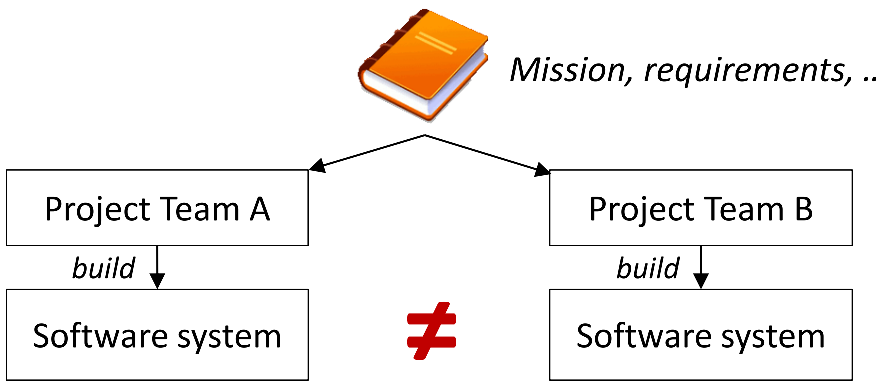
THE CONTROL IS VERY WEAK,
NOT TO SAY ILLUSIONARY

Software Applications Under Control of Non-IT People

What is in the black box?

"It must have 4 legs and it must be possible to sit on it."





Same requirements for same problem, same environment, same … going to 2 different team lead to 2 different solutions implementing the same business logic.

Why?

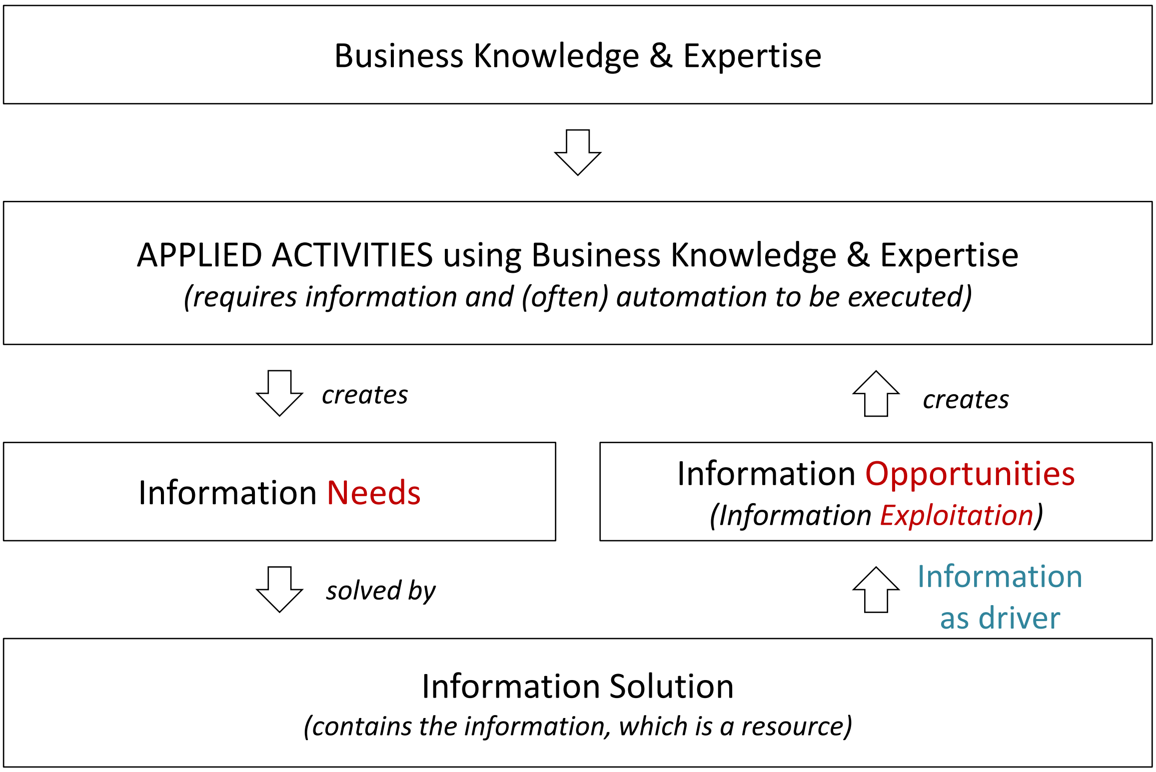
- A same business logic can be executed by different mechanisms.
- A software application is also guided by non-business principles and contains a lot of non-business logic and even complete non-business mechanisms.
- Business logic often influence, but does not necessarily determine the architecture.

Although useful, requirements are insufficient to conceive and to build the right solution. And it is still a control, but it is a control which is still too weak.

Notes

If requirements are given to the teams, the differences may be important. On the other hand, if specifications are provided to the teams, the differences will be smaller.

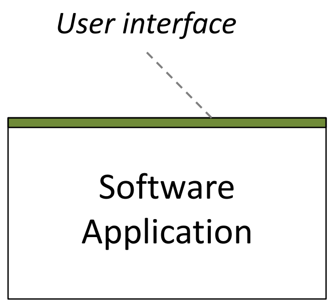
Business Knowledge ↔ Informatics



Notes:

- Without information, business activities can not be applied. The application of business knowledge and expertise creates information needs. Solving these information needs can only happen with information capture, processing, transport and storage and retrieval.
- While the information aspect has to respect the business logic, one should not confuse both. They are NOT the same.
- But information, through its intrinsic value, provide also opportunity for business activities. Available information and potential of informatics creates opportunities to improve business activities.

Knowing Software Applications ?



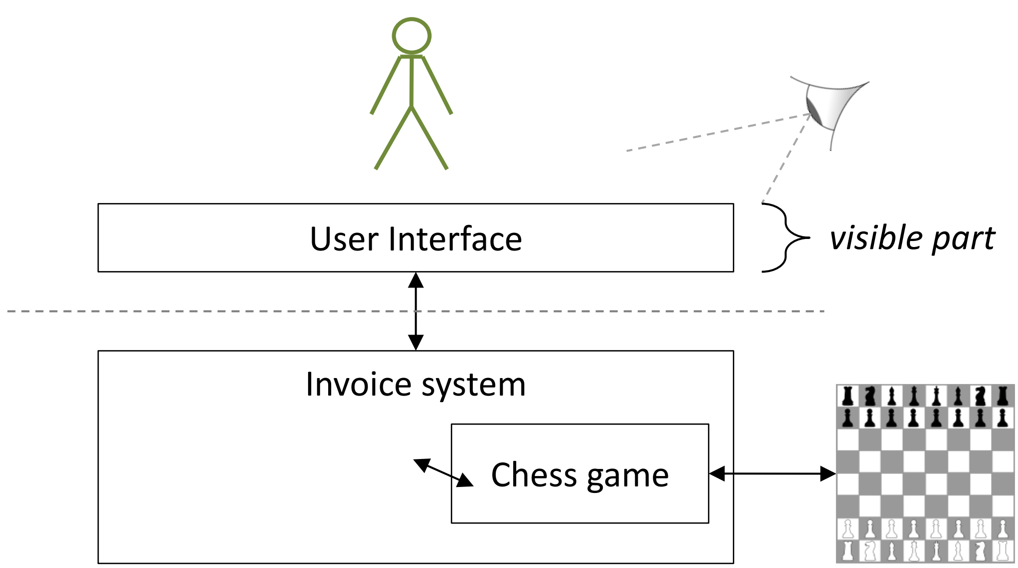
The user interface (together with some concrete outputs) is the only part of the software application visible to end-users. The end-users know and can use the user interface.

The user-interface forms a barrier between the end-user and the rest of the software system.

It prevents the end-user to see the internals of the software application. It is like a concrete layer on top of the software application. They have no access to anything beneath the user-interface.

The user-interface is like the dashboard of a car, a drink distributor or a movie. A dashboard is very different from the car engine. It tells very little about it. Knowing how a drinks distributor looks like and knowing how to use it, does not imply knowledge of the internals of a system. Or a movie tells little about the movie set.

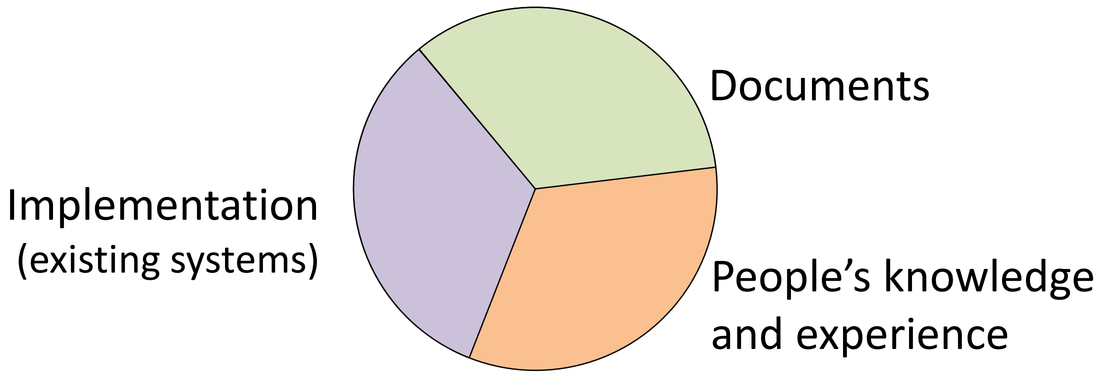
Knowing and being able to use software through the user-interface is very different from knowing the internals of the software application.



What prevents developers to convert invoice data into chess moves and to send them to a chess game? The end-user wouldn't notice anything.

Sources of Business Domain Knowledge

Three Types of Sources



Notes:

Documents

- Policies, documentation, procedures, …(present); Mission, vision, strategies, tactics, objectives, plans, novelties, opportunities, …(future)
- Formalised, but can be outdated

Implemented and Execution

- Existing systems, existing procedures, communications, actions, work, organisational structure, decision making processes, structures, concepts, principles, …
- It is the present, the "as-is" … and it is an important source for diagnosis

People's Knowledge and Experience

- Knowledge, understanding, insight, experience
- Thinking patterns, beliefs, norms, values, priorities, expectations, fears, tendencies, habits, decision forming, unspoken objectives, personal drivers, cultural aspects, limiting beliefs, …
- Through communication
- Subjective, interpretative
- Relies on memory → variable, different perspectives, different understandings
- Different persons may have contradictory 'knowledge'

We may find information in one source that we don't find in another. It is up to the Analyst to put it all to sort it out (and to get confirmation and consensus).

Wrap-up

1. Business knowledge is
   - intended to people and human activities, not to software and computers.
   - high level, partial, ethereal, uncertain, fuzzy, variable, not always complete and coherent, ambiguous, interpretable, …
   - hidden in many forms, places and of different natures
   - not readily available for usage
   - constitutes only a part of all the required knowledge

2. Information solutions don't solve business problems (unless the business is about information). They solve information problems experienced by the business community, allow information needs to be solved and it is a way to seize opportunities offered through information (improving the exploitation of information). This is why business knowledge is only a part of the knowledge required to diagnose issues, understand environments and design solutions.

3. The required competencies to diagnose, fully understand and conceive information solutions and software systems are: information, processes, Systemology, engineering, Systemic Thinking, Information Science, understanding of possibilities and limits of software and computers, …

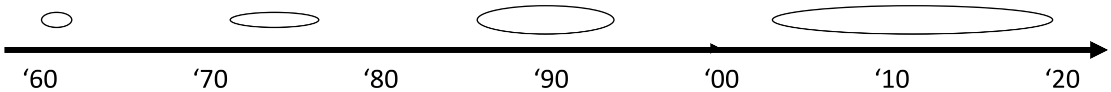
4. Software applications are, basically, black boxes to the business community. The mastery and understanding of software application is based on assumptions and confused with the usage. The control of their internals, which is what matters, is rather an illusion. IT people are also users of software applications, but they know the software applications they developed themselves.

There is a huge work for the Systems Analyst (or BA) to search, to gather, to study, to consolidate, to stabilise and to verify and to select the necessary business knowledge, as one of the inputs of the required knowledge.

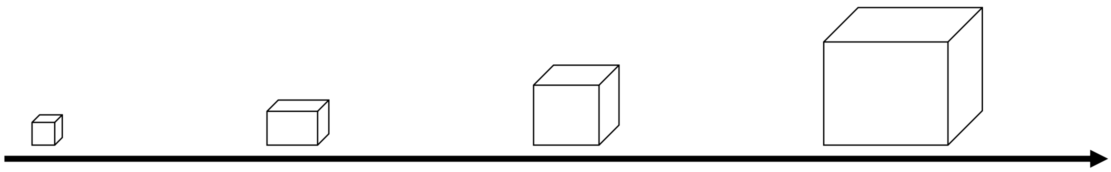
HISTORY

Evolution

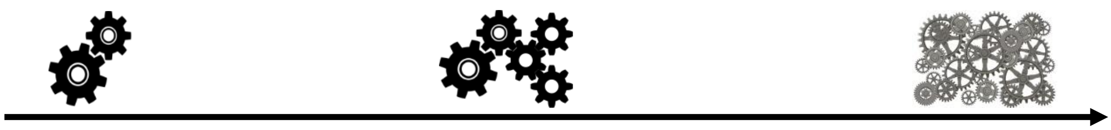
Problem Scope & Functional Breadth



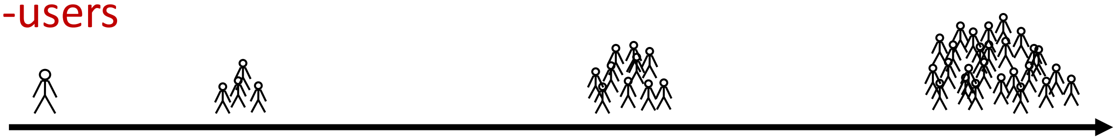
Size



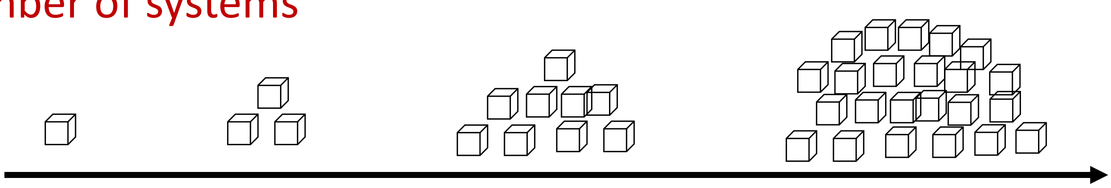
Complexity



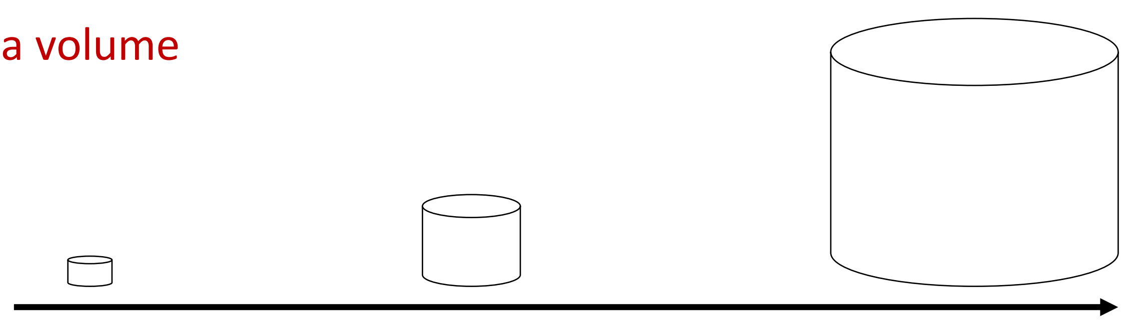
End-users



Number of systems



Data volume



Evolution

Relation between automated work and organisation

System supporting a **specific task**

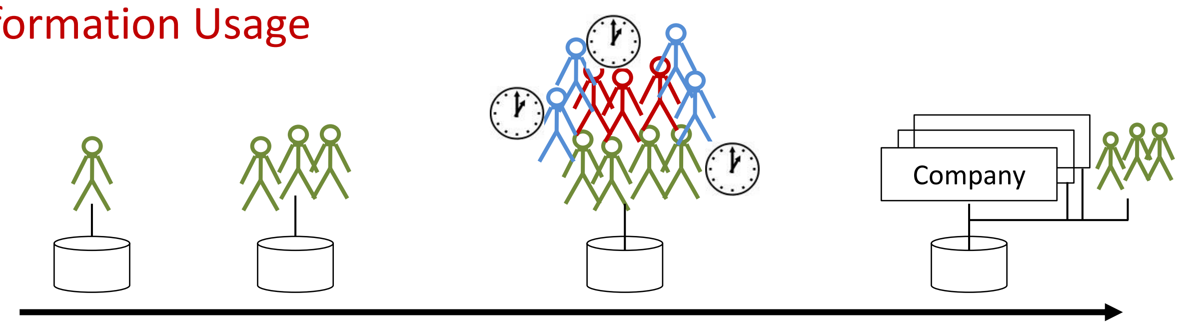
System supporting a limited number of an end-user **activities** for multiple users

System supporting a **business function** (like a service or dept.)

Systems implementing **processes** running **across** the **company**

System **integrating** people and systems **outside** the company (example: extended enterprises)

Information Usage



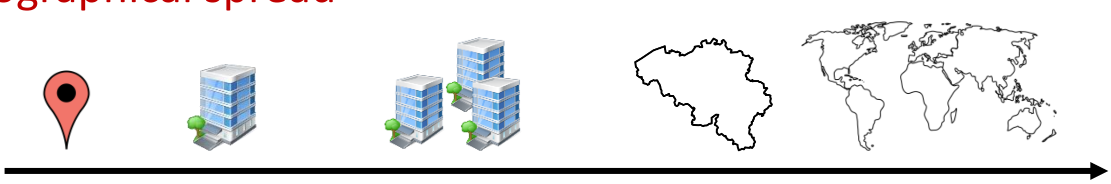
'personal' data

Data shared for similar usage

Data shared among different people, for different usages and purposes, at different places in the organisation at different moments in time.

Data shared with other organisations and with individuals outside the company

Geographical spread



Architecture

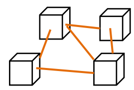
Monolithic

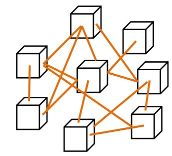
- Modular
- Layered
- Agent-based

- Connected
- Tentacular

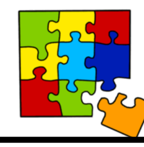
Evolution

Inter-systems Interactions





Integration



Focus of Engineering

We are here

Programming — Design and architecture — Integration — Right Solution — Right Problem

Development Languages and Techniques

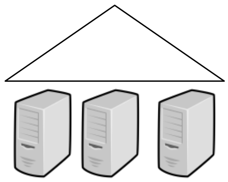
Elementary programming languages (assembler), limited technology, limited computer power, memory & storage capacity	Structured Programming languages	Object Oriented languages, middleware, more technologies	Web technologies	AI

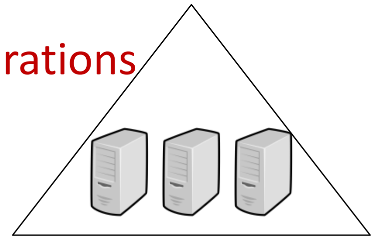
Technological Fragmentation

Single to limited number of technologies	Larger ensemble of technologies (mainframes)	Single (limited number of) technology (4GL/integrated development environments)	Huge fragmentation of technologies (WEB-environments)

Evolution

Role of Software Systems in Business Operations

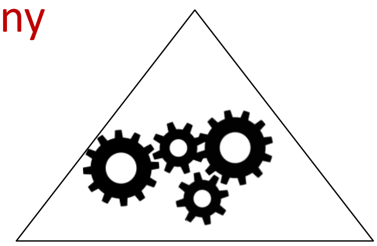




Supporting business operations

BEING the BUSINESS
Executing the main business operations or executing the major share

Role and size of Soft. Syst. in the Company



Tool

Integrated Part
System of Systems

Timing

Working hours
Start the computer
Launch the Application

24/24 – 7/7 – 365/365

Contribution to the Business

Solving a Need or Problem

Improve operations

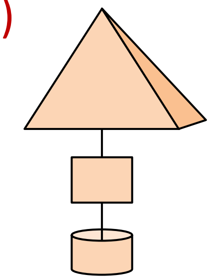
Contribute to higher objectives

Innovate;
Shape the business;
Drive the business

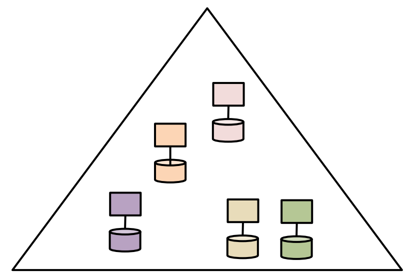
Evolution

Evolution of IT Systems in the Company (1)

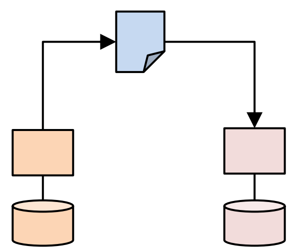
1) A new system supports administrative tasks or executes some administrative tasks of an organisational unit.



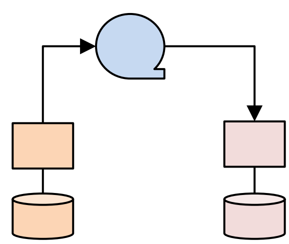
2) More systems are built independently from each other. Issues: different technologies; duplicated data; no consideration of reuse, enterprise-wide processes, sharing data, …



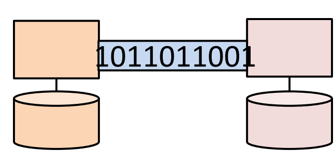
3) Communication between the systems happens by printing data on paper and re-encode the data in the other system.



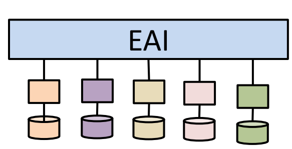
4) Communication between the systems is automated: file transfer (E.g. FTP)

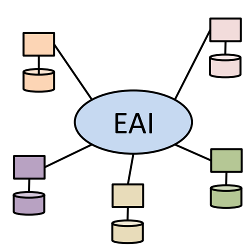


5) Middleware



6) Enterprise Application Integration



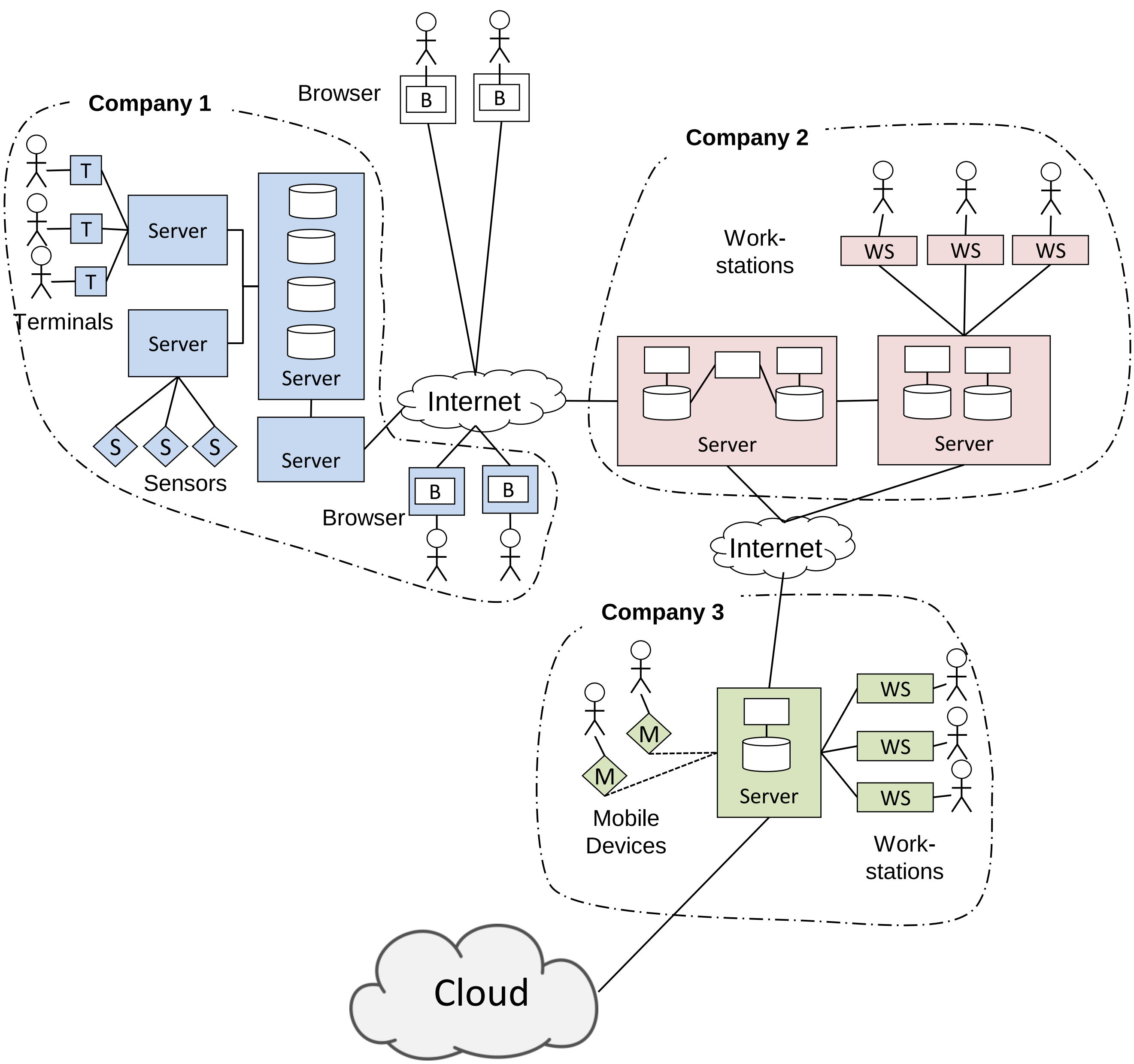


7) Enterprise Systems Bus

Evolution

Evolution of IT Systems in the Company (2)

7) The **Extended Enterprise**:
systems goes beyond the company's borders, connecting systems of different organisations with each other.



Evolution

End-User Computing Power

Period: 1975 - 1980
CPU: 8-bit, 1 – 4 MHz
RAM: 4 Kb, 8, 16, 32, 64 Kb
Storage: 32 – 128 KB

Professionals and hobbyists.

Period: 1980 - 1985
CPU: 8 – 16 bit, 4 – 12 - 25 MHz
RAM: 128 KB – 1 MB
Storage: 360 KB – 300 MB

PC was introduced for individual use, first in the office and later at home to the population in general.

2018
CPU: 64 bit, 4GHz
12 MB L3 Cache
RAM: 32 GB
Storage: 1 – 2 TB

The early software systems consisted of a software application running locally on one computer using data stored locally and was operated by a single end-user. Likely, this software has been written in Assembler. It is very demanding to develop software in Assembler. The computer hardware had very limited computing power. The first software applications were rather small.

Better programming languages appeared. Among them the so-called structured languages and later the 4GL languages. They facilitated the development of larger software systems. At the same time, hardware became more powerful. The number of users for a single software application increased. First, multiple users using each an occurrence of the same software application and later the multi-user systems appeared.

The Analysts and software engineers faced challenges that couldn't be solved with the regular approaches and techniques used by then to conceive software applications. New analysis methods were invented to surmount those challenges. Now, even larger software systems could be developed. The object-oriented programming languages and middleware appeared. New architectures could be developed. Again, the habitual methods were not adapted to the OO-philosophy. New analysis and design methods were needed. Case-tools followed the development of new analysis and design methods.

The size of developed software system continued to increase. Project management and methodologies facilitated the execution of such larger projects. Their importance increased. They became a necessity to respond to the size and complexity of the systems.

Needs drove innovation. These inventions increased the scale and complexity of the systems. The inventions and the larger systems brought new issues in matters of engineering approach and methods to the engineers. New methodological solutions were found to cope with them.

EVOLUTIONS

EVOLUTION OF SOFTWARE SYSTEMS

Increasing number, size and complexity of systems

TIME

- Single systems → Automated exchange of data between systems → Sharing of data → Sharing data and services → Functionally and structurally integrated and aligned systems; tuned capabilities
- System supporting a limited number of an end-user activities → System supporting a business function (like a service or dept.) → Systems implementing processes running across the company

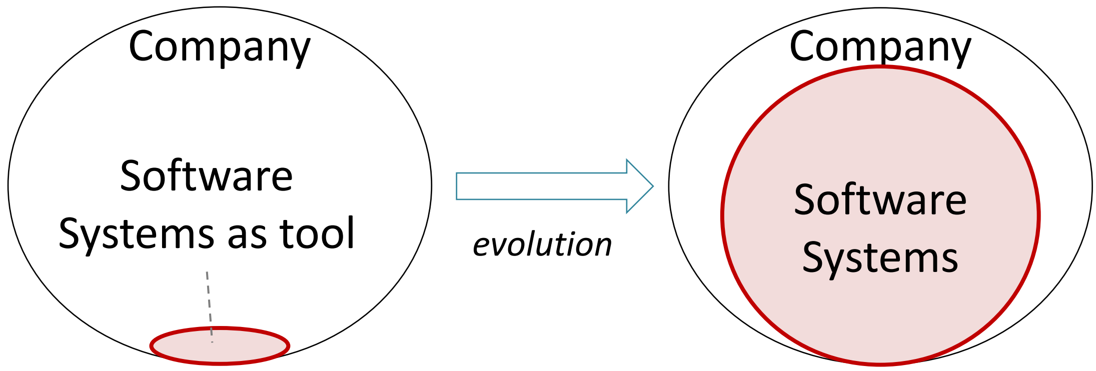
EVOLUTION OF SOFTWARE DEVELOPMENT

- Developer = User → Developer ≠ user → Appearance of many roles (Programmer-Analyst, Analyst-Programmer, Functional Analyst, BPA, BPE, IA, BA, …) → Reduction of roles (Product Owner, PM, BA, developers, …)
- Independent methods → Methodologies growing in size → PM, EA, BPM & Governance Frameworks → Very light methodologies
- IT → IT Architecture → Vertical expansion to EA (basically from an IT perspective)
- **IT Lead** 1970s EDP dept. in ivory tower → Transfer of authority (and responsibility?) → **Business triggers** **Business leads** from 1990s to present
- IT = Value Provider → IT = cost Centre → IT = Value Provider

The evolution doesn't stop here

- Evolution of competencies? Transfer of competencies?
- Building a small piece of software application is relatively easy. Larger software systems are a challenge. They have their own specific issues and needs.
- What triggered these evolutions? Is this evolution logical? (we need to think way further than the conventional answers)
- Does the evolution of systems and the challenge of developing them match the evolution of software development?

From Tools to Integrated Core



- Small
- Lesser critical
- Limited complexity
- Specific role/function (limited local scope)
- Supporting end-user's activities
- Serving 1 user, later a few users
- Without inter-system information exchange

- Large
- Critical
- Complex
- Broader goals
- Performing the core activities
- Performing a huge share of the activities performed by the company
- Interconnected
- Crossing boundaries
- Inter-organisational information exchange

From building set of tools
to

Conceiving the 'core engine'

of the company

+

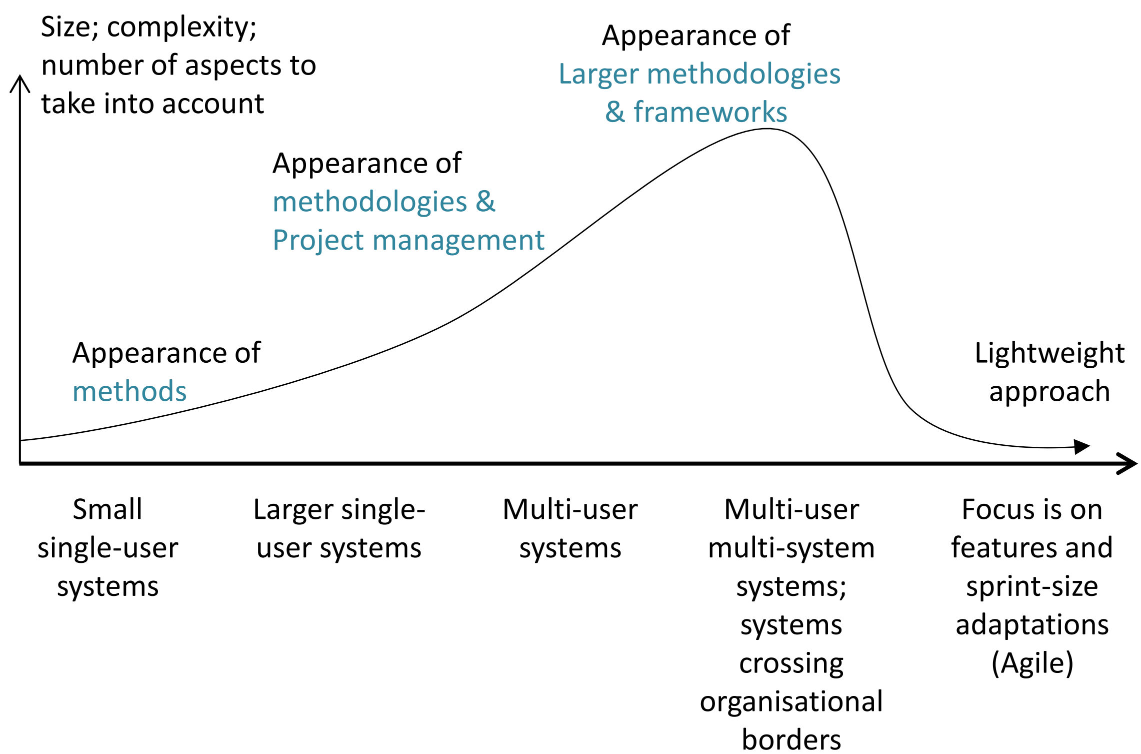
Explosion of information, communication, systems and connections

Fundamental Change

The Importance of the Role of Analyst INCREASED
and became CRITICAL

This is absolutely not about more of the same or the same at larger scale. It is a much deeper change requiring a different way of thinking, different competencies, ...

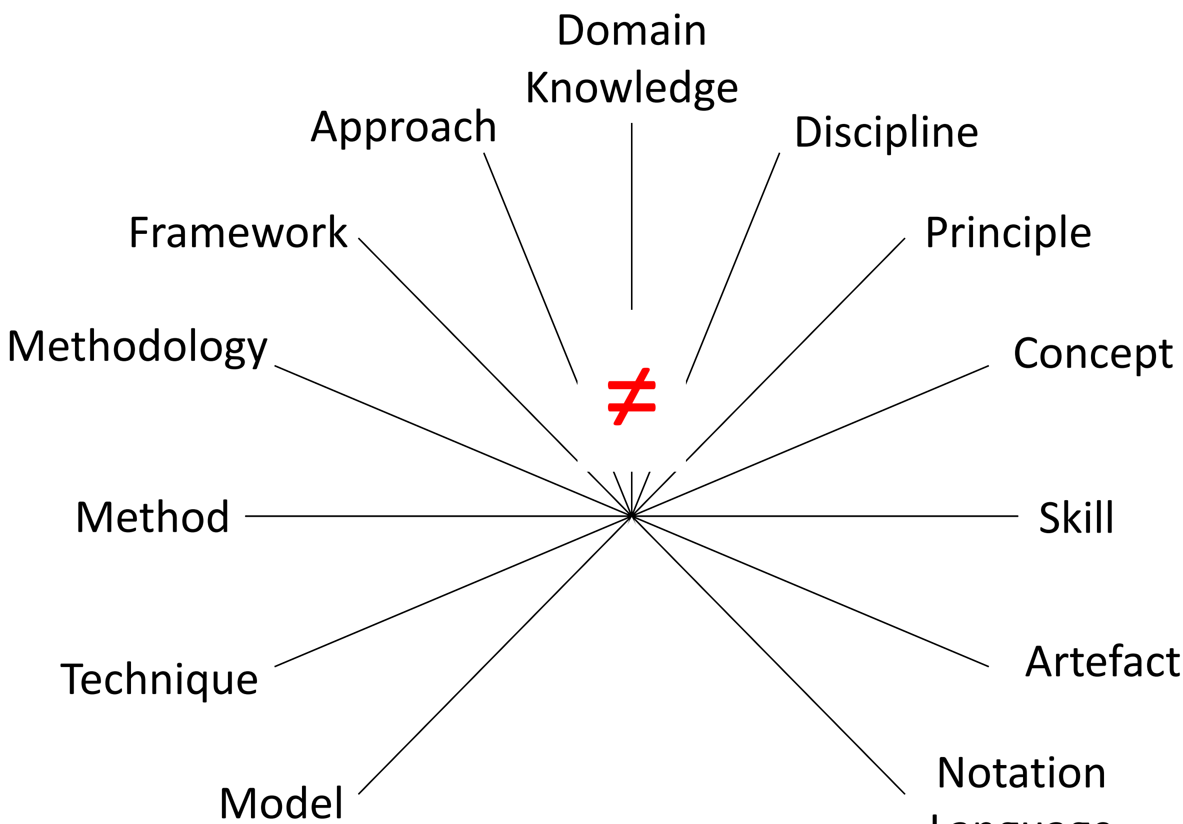
Evolution of Methodologies



Methods, methodologies, frameworks, project management developed in response to issues and needs created by the increasing size, complexity, risks and cost of software development projects and to increase the efficiency. Each step in the evolution was a learned lesson and it enabled them to cope with the encountered issues.

GENERAL SUBJECTS AND VIEWS

Different Terms

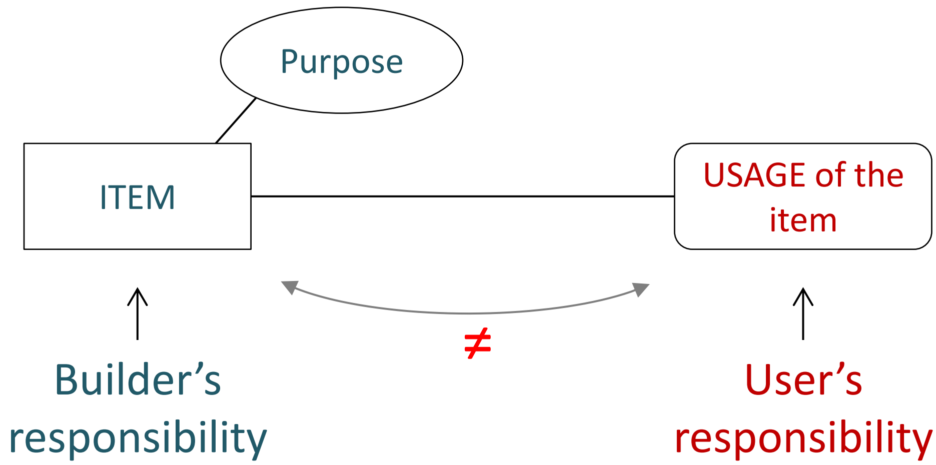


It is important to use these terms correctly and to classify elements correctly (to avoid confusion).

Examples:

KPI is a concept, tool, metrics; not a method.
UML and BPMN are languages, not SE methods or methodologies. It can be a method of representing something.
Agile is a philosophy, not an SDLC or a methodology.
SDLC is not a project management methodology.
Waterfall is an SDLC, and as SDLC it is a methodological concept. But it is not a methodology. Some methodologies are based on the Waterfall SDLC.
Process Analysis is a discipline, not a method.

Item and Usage



ITEM:

Set of rules
Structure
Policy
Plan
Standard
Methodology
Tools
Features
Roles
Skills
…

How is the *item* applied, used or respected ?
How does it need to be applied?
Does the usage need to be strictly as prescribed?
Does the user uses 'common sense' and is the usage appropriate to the situation?
Does the usage require specific skills?

Unsuitable item → Bad result

Incorrect usage → Bad result

Builder's '*responsibility*' to train the user (create competency) for ensuring a proper usage

---

The item or its usage can be adapted to suit a specific situation or to solve a specific issue. The decision can be made that "the best thing to do" for a specific issue or a particular situation is more important than to stay between the lines and follow the prescribed rules.

Always questioning: Wrong application/usage or unsuitable item? It is useless to blame the item for an inappropriate usage.

MODELS

A **MODEL**

- is an abstractions
- is perspective
- represents a part of a world, real or imagined
- represents a concept, and idea

All models are incomplete (thus wrong).

However models are or have to be useful

- to master complexity
- to support thinking
- to facilitate communication

A MODEL is Worth a Thousand Words

Using Models

A model represents an idea, a concept, a process, a structure or a mechanism.

Models are useful because

- they provide (some) insight
- they help to master complexity
- they guide the mind during a thinking process
- they support the communication of an idea or mental construct.

A model reflects a part and/or an aspect of reality or of a mental construct.

It represents an abstraction, a generalisation, a perspective or a part of the reality or of a mental construct.

But it always represents a simplification. There is always/often a difference between the model and the reality.

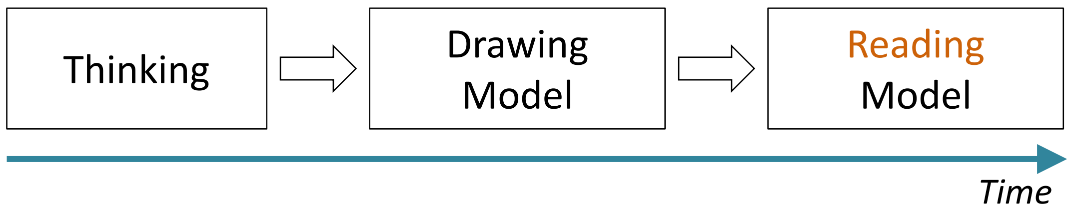
Consequently, strictly spoken, all models are wrong. They have to be interpreted correctly and (often) adapted and applied in a way that suits the specific situation. Or, they may be interpret inappropriately. Neither may we assume they always can/have to be applied "as is" (literally). It is the information or idea that they convey that matters and which should help to take the decisions.

This applies to the models the Analyst makes,
but also to the models in this course.

Using Models

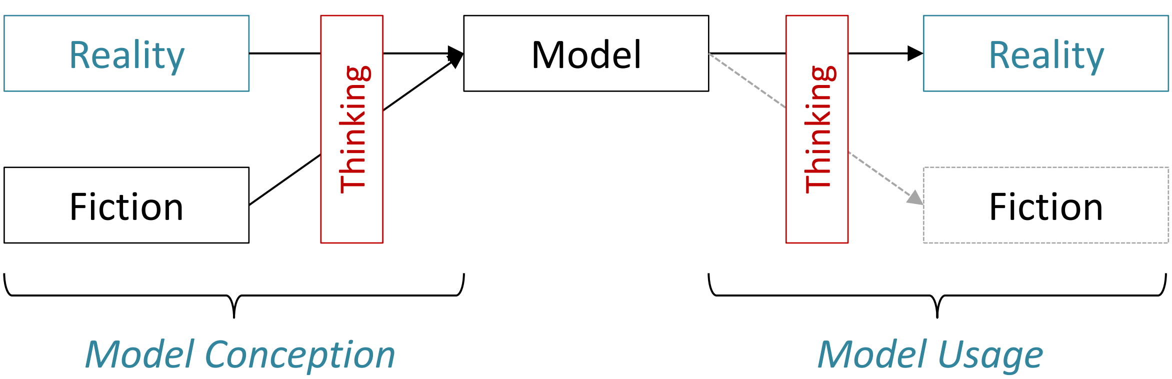
Models is a Basic Technique for Analysts

Model used as a Communication Tool



Models are PRIMARILY a Thinking Tool

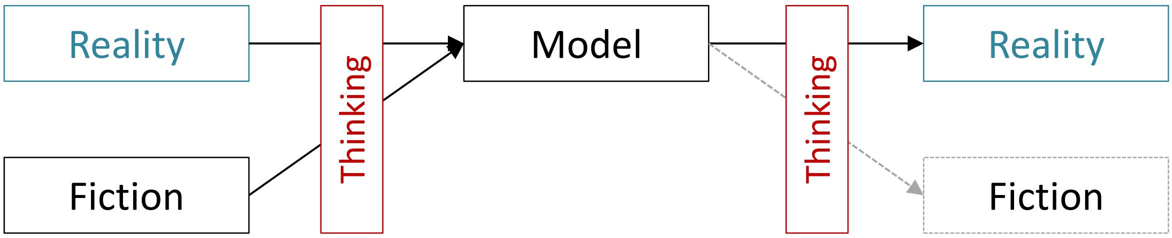
This usage allows to tap into the real power of Models

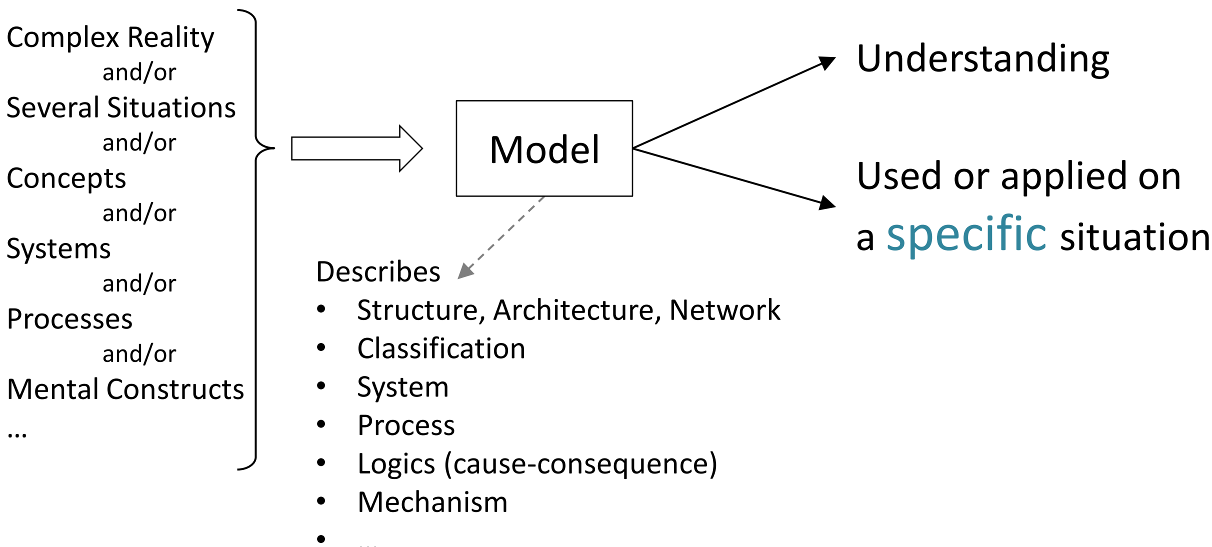


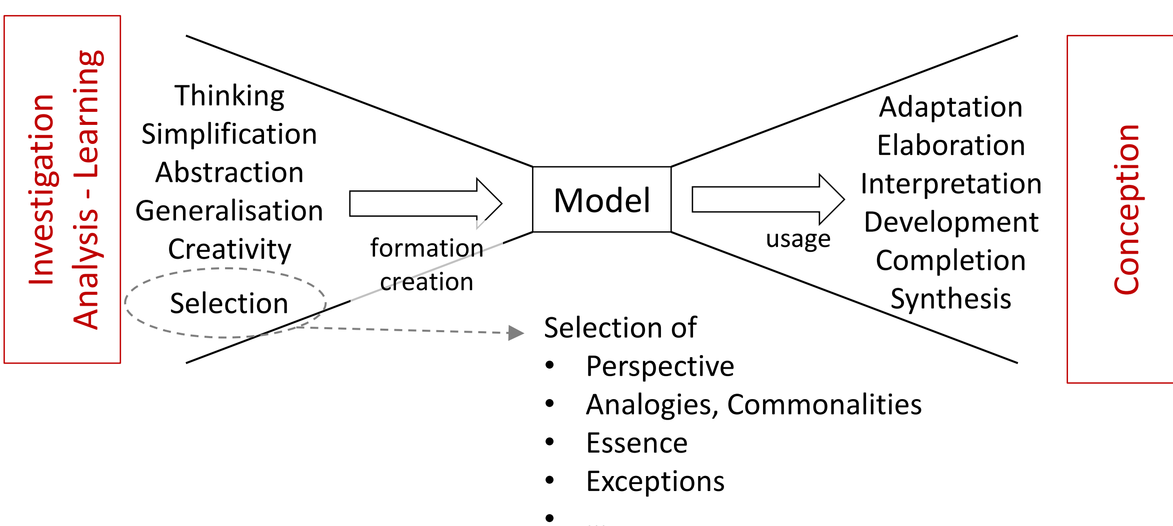
This is a dynamic, an active, usage of the model blending investigation, thinking, exploration, reading and other mental activities with the drawing or 'reading' the model.

Using Models

Model used as a Thinking Tool



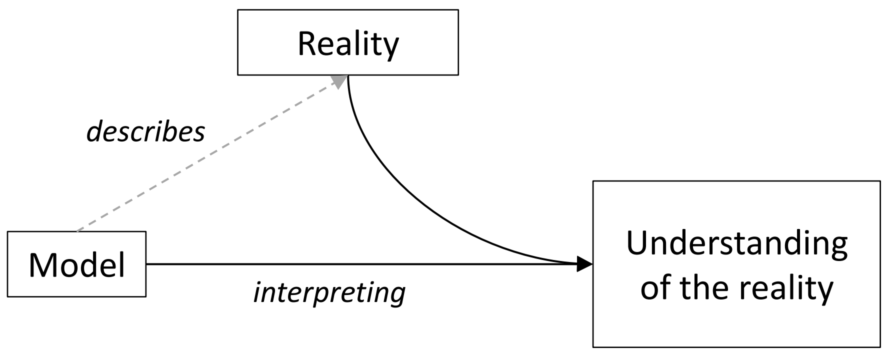




Using Models

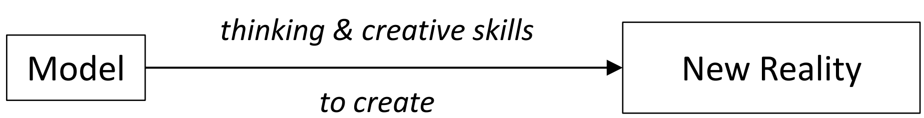
Model used as a Thinking Tool

Understanding of a more complex reality

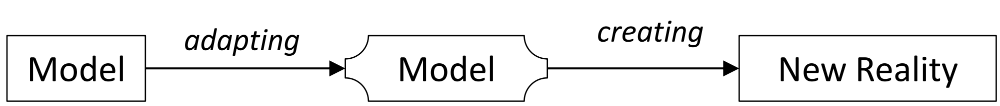


Note: knowledge ≠ understanding

Creating a reality

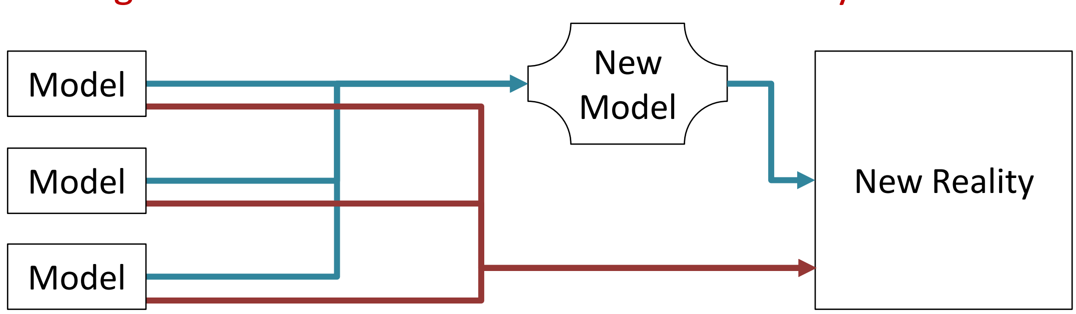


Adapting Models

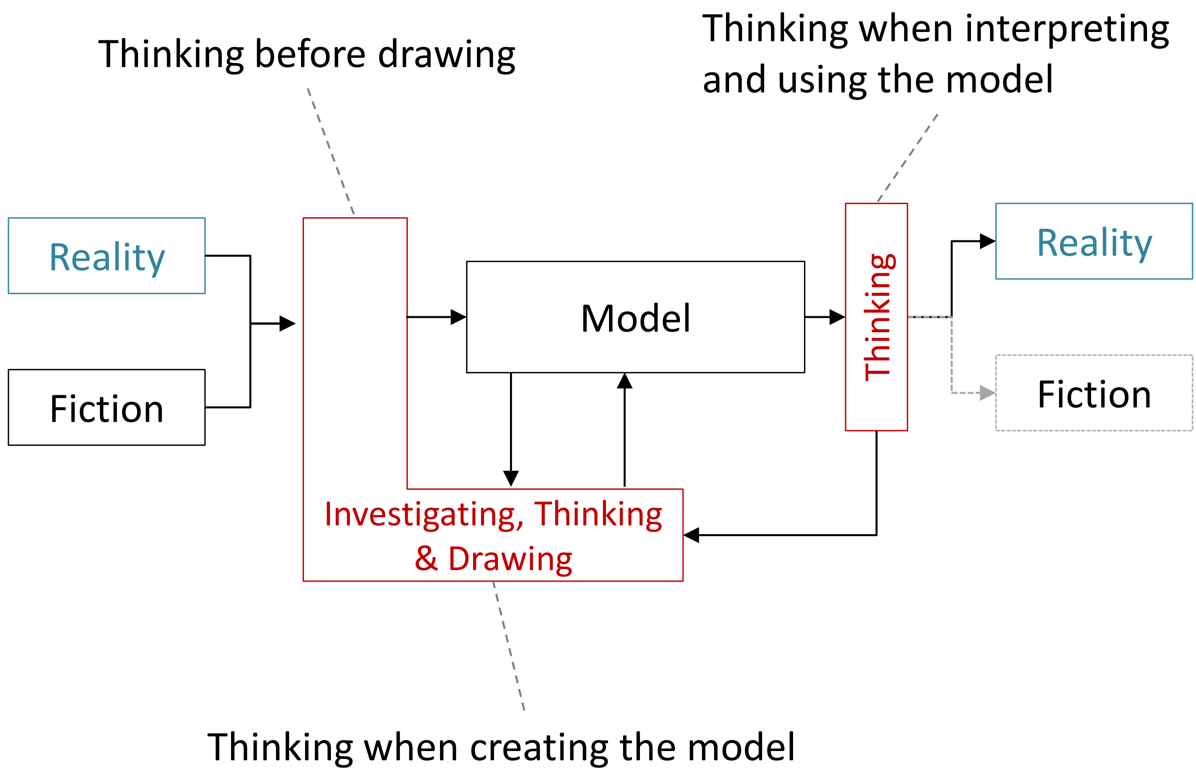


This new model suits the reality we want to create.

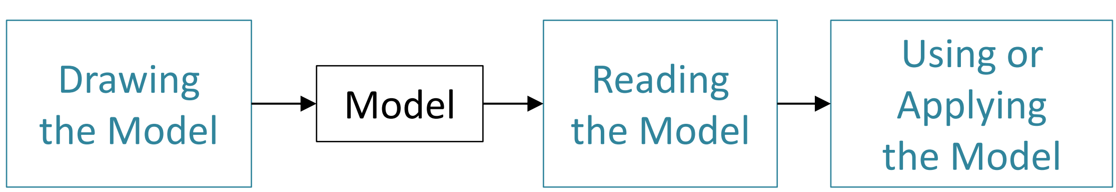
Synthesising Different Models to Create a New Reality



Using Models

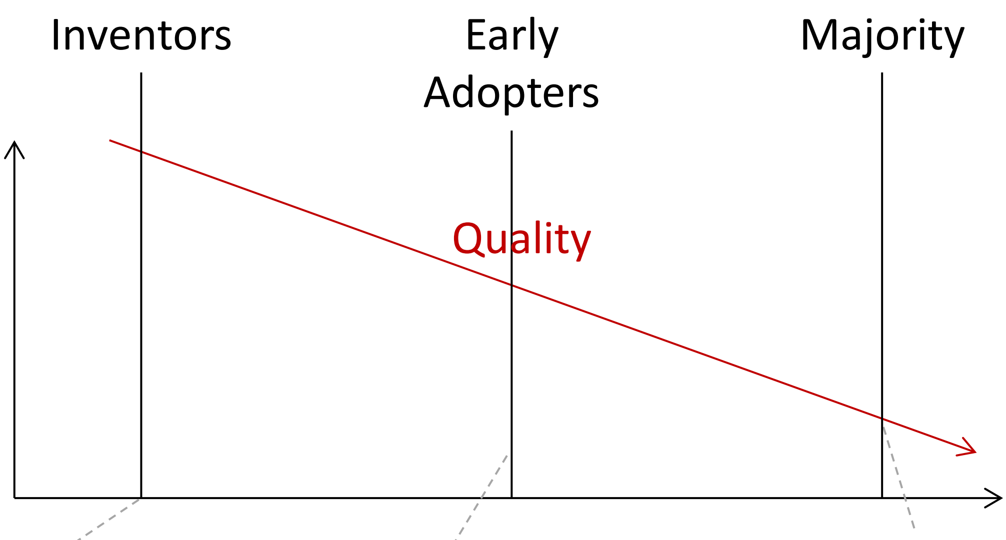


Superficial & Inefficient use of Model



Quality of Application and Usage

Application of Theories, Principles, Concepts, Methodology, Methods, Systems, Tools, …

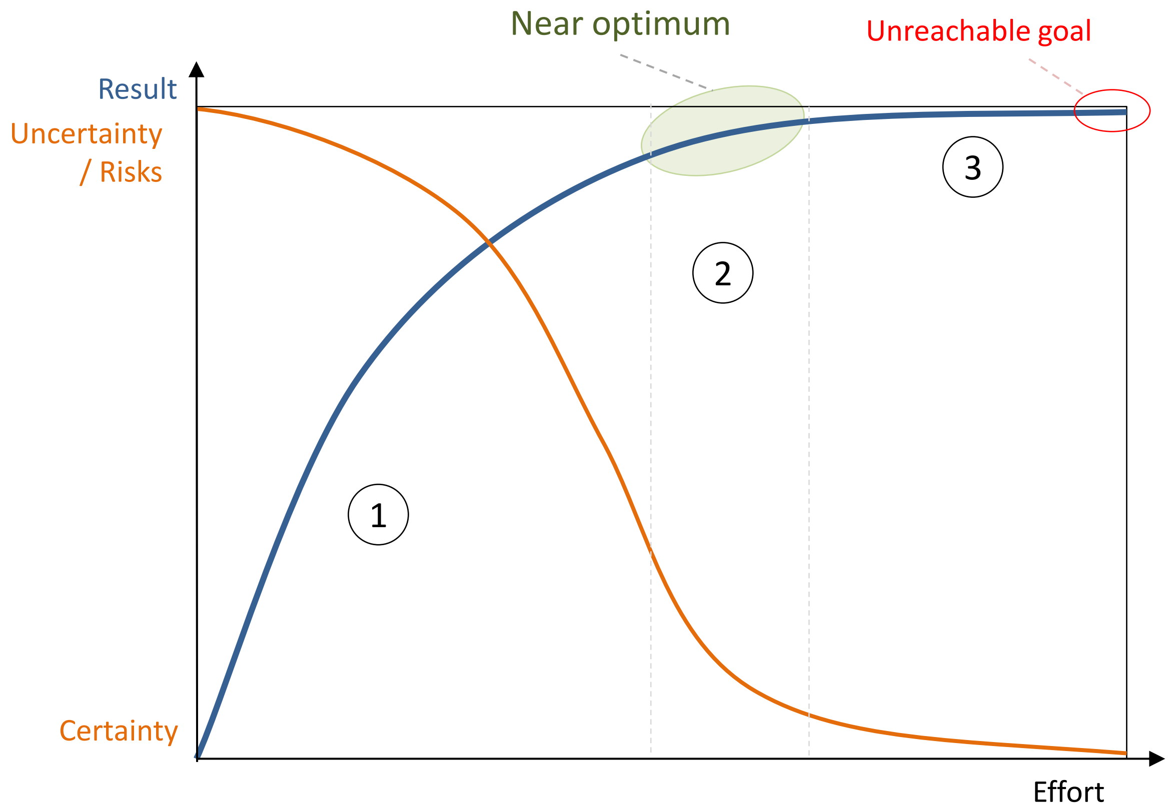


Excellent
Deeper understanding

Genuine Application
Faithfull to the original way
Often (real) experts
Trying to grasp the underlying ideas, reasons,…

Superficial understanding
Literal application
Either strict or very loose application (cargo cult)
Watered-down versions
Oversimplifications
More assumptions
Personal interpretations
Preferences and cherry-picking
Individual adaptations
Irresponsible usage
Politics
Abuses
Copying (w/o understanding)
Used by unqualified individuals
…

Principles of the Genuine Effort



1) Too little effort, Small result Inferior result High uncertainty and risks	2) Good balance between effort – quality results - uncertainty and risks	3) Huge additional effort for little additional result and small decrease of risks and uncertainty

GOAL:

Executing with the firm intention to get a good result,
not simply for the sake of doing.
Balance between effort and good quality with limited risks and uncertainty

Some major risks can often be eliminated fairly quickly. But a lot of smaller risks (smaller impact) may remain for a while.

At a certain point, most new information will confirm the present understanding and little new insight is acquired or the new insight concerns details. This is the point where we can go on.

The arrival of new information invalidating major insights or having a major impact on the design can never be ruled out. But the likelihood that this happens becomes gradually smaller and smaller.

Reality of Software Development

MYTH, ILLUSION or HYPE	REALITY
• Easy	• Complex
• Fast	• Arduous job
• Cheap	• Slow
• Highest Quality	• Difficult and Risky
• Linear	• Non-Linear

Small and simple software applications or smaller parts, such as software features, are easy, fast and cheap to develop. This is not the nature of most present-day systems in corporate environments.

Accepting reality and finding wise ways to deal with it

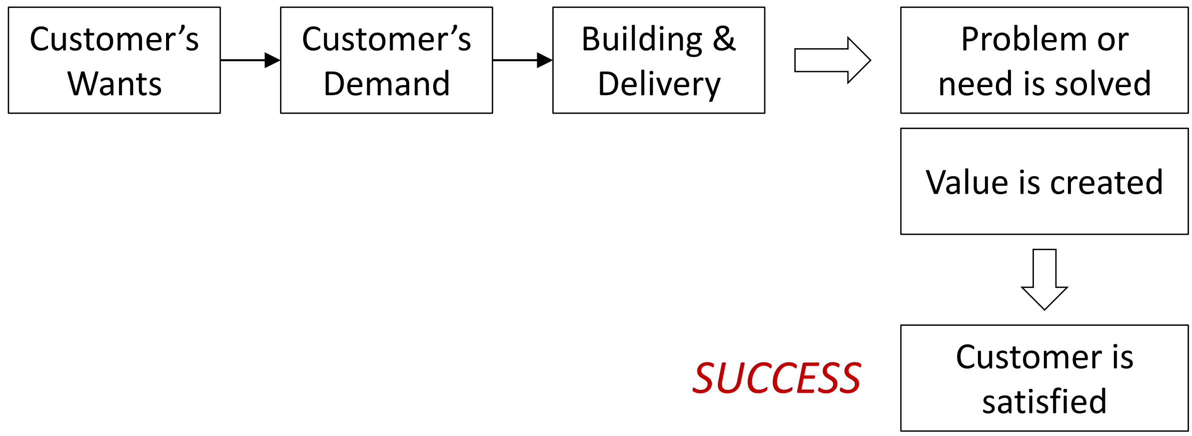
Danger: oversimplification, simple but wrong answers, short-cuts, …

Notes:

Novice may not understand the purpose, value and right use of decisions, techniques or tools. They may unwittingly take wrong decisions and short-cuts creating issues, increasing risks, limiting the solution, technical debts, ….

This is even more true for laypersons.

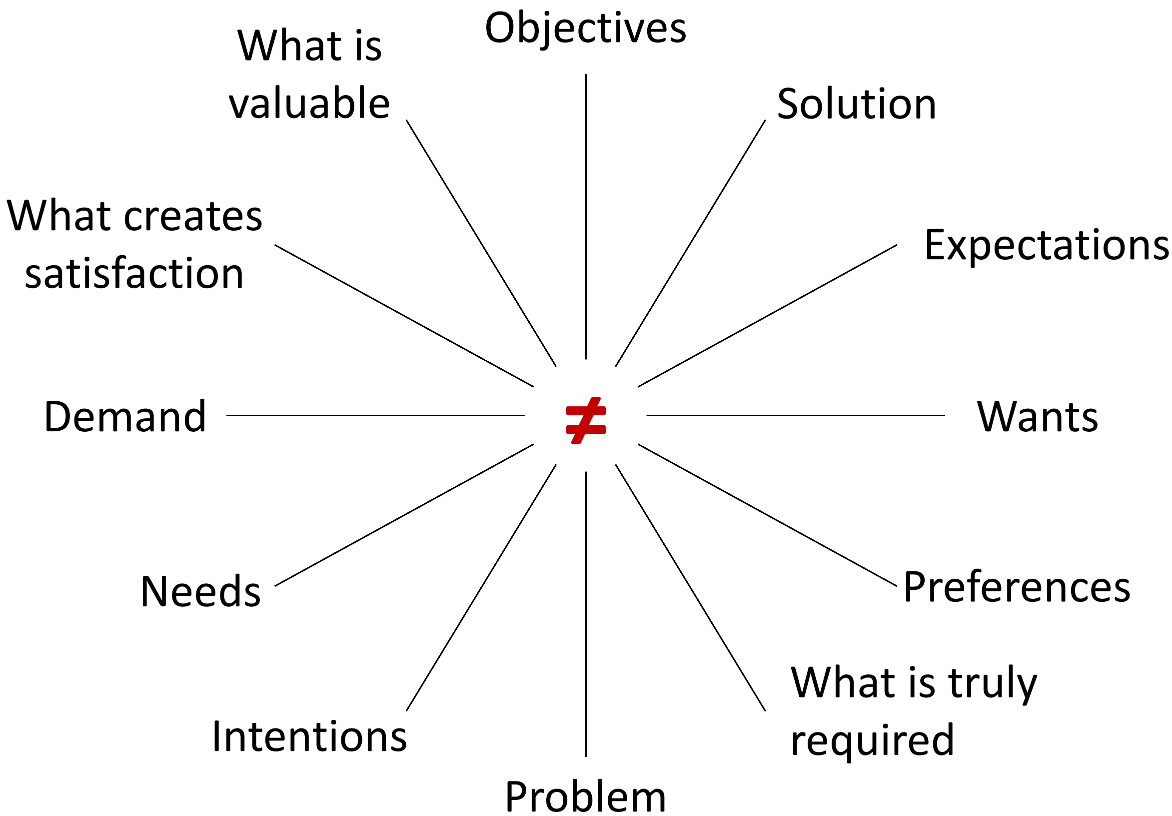
Customer Satisfaction



If a customer can articulate what he wants, he is more likely to get it. What the customer wants is articulated in the demand, as well as his desires and preferences. This demand describes the needs and what is needed. Therefore, it expresses what is required. The customer's problem or need is solved by building and implementing a solution which complies with his demand. Value has been created. It is by responding to the customer's demand that his needs and expectations are met and customer's satisfaction is achieved. The product will contribute positively to the overall organisation.

!! MANY ASSUMPTIONS !!

Customer Satisfaction



These are totally different concepts !!

<u>AND</u> the correspondence between these elements <u>may never simply be assumed</u>.

What is wanted is not necessarily what is needed. What is demanded doesn’t always reflect what is required to solve the problem or need. It doesn’t always allow to meet the expectations. Building accordingly to the demand doesn’t always create satisfaction. The envisioned solution doesn’t always increase the value for the company. And so on.

Customer Satisfaction

Customer satisfaction is important for a few reasons:

- Indication products and services are good
- Increased earnings
- Increased volume of business
- Increased reputation
- Expansion of customer base
- Facilitation of business development

Nature of Customer Satisfaction is

- Intangible
- Personal
- Variable - Temporary
- Vague
- Unexpressed or partially expressed

Delivering what the customer wants → *leads to* → Customer Satisfaction

Not necessarily !!

What a customer wants and what will satisfy a customer
are two different questions.

Satisfying a customer does not necessarily lead to future decisions or actions from which the supplier can benefit.

If knowledge or insight is missing → the desire is incorrectly identified, still immature, unstable or not well expressed → no customer satisfaction

"The client doesn't know what he wants"
Or "he knows what he wants, but it is not what he needs"

Customer Satisfaction

Freedom

Responsibility to chose

Lazy and Lame Approach	The Professional Way
Do and/or ask what we want	Do what is necessary
↓	↓
Aims to create satisfaction	Aims to solve problems
↓	↓
May lead to unsolved and new problems	Not always what we want or expect
↓	↓
Creates dissatisfaction	Solved problems create satisfaction

Example 1: Do-It-Yourself Store

Vendor 1: Sells the product the customer asked for, choses or wants. If the client buys the wrong product, it's his/her problem. The client might be satisfied. If it doesn't solve the problem, the purchase of the product was unnecessary and dissatisfaction will follow.

Vendor 2: Asks the customer what problem (s)he wants to solve with it and what the situation is. The vendor uses his/her knowledge to advice more appropriate products, better solutions and tips. The vendor may sell a different product than asked. Once the problem is well-solved, the client is satisfied about the solved problem AND about the delivered service.

Example 2: Diet and Lifestyle

Many people prefer to eat unhealthy food. Over time, they may start feeling in a bad shape and get sick. They will feel better or heal once they eat the right healthy food and switch to a healthy lifestyle (doing what is necessary, doing the right thing).

Example 3: Planet

We may like the modern life standards and try to maintain it. However, it is unhealthy and unsustainable. It is destructive for the planet. As long as we ignore to do what is necessary, reasonable and responsible, the effects will backfire and we may not like that.

More than the desired "solution",
people want the problem being solved without new problems or annoyances being created.

Doing what is necessary is important, doing what is wanted is supplemental.

Both are not necessarily mutually exclusive. Sometimes they can be combined.

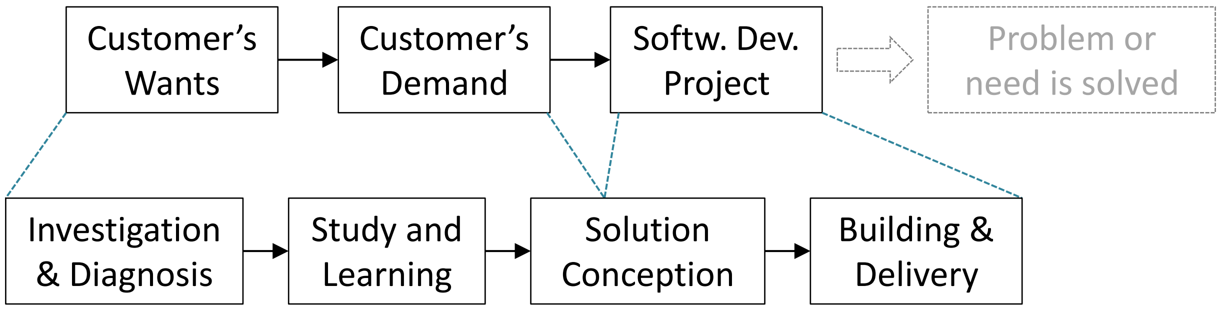
Customer Satisfaction

THE BUSINESS DEMAND

Expresses Needs and Demands, Wants, Desires, Expectations

- Subjective: Based on an interpretation of the situation and 'diagnosis'
- Often symptomatic (Consequences of problems are noticeable. The experience of the consequences are upsetting. They have to disappear.)
- Can be influenced by emotions; like impatience and frustration
- Different visions may exist (different persons may have different wants, expectations, desires, …)
- Can be the result of a compromise (ends up loosely related to the real problem)
- Lack of alternatives (have they been investigated?)
- Hard to capture
- Can be misaligned or conflicting
- Based on uncertain facts (partial insight)
- Can easily be changed, even in a blink of an eye (while a system's lifespan is several years)
- Can be unrealistic
- Demand may not be inline with intentions, wants, expectations, …
- Vague and partly unexpressed (not all wants, intentions, reasons, desires, expectations, …)
- Based on personal insight of the situation, limited perspective and scope
- Based on understanding of the possibilities and limitations of software systems, which may be a flawed
- Based on understanding of how to deal with information, which may be based on limited insight in this matter, false beliefs and assumptions
- No guarantee that it constitutes a solution
- No guarantee that it leads to added value for the company
- Can be desired, wanted and asked, and, once built, not used.
- May undermine the company (truly damaging)

Customer Satisfaction



Responsibility of the Customer in this line of thinking

- Posing the diagnosis: detection of problem, limitation, opportunity
- Determining the objective, intention, goal and scope
- Articulating the "needs" and/or "wants":
  - Requirements
  - Conception of nature of the solution, the role and main functions, solution description in business terms
- Evaluating the solution to accept it or refuse it

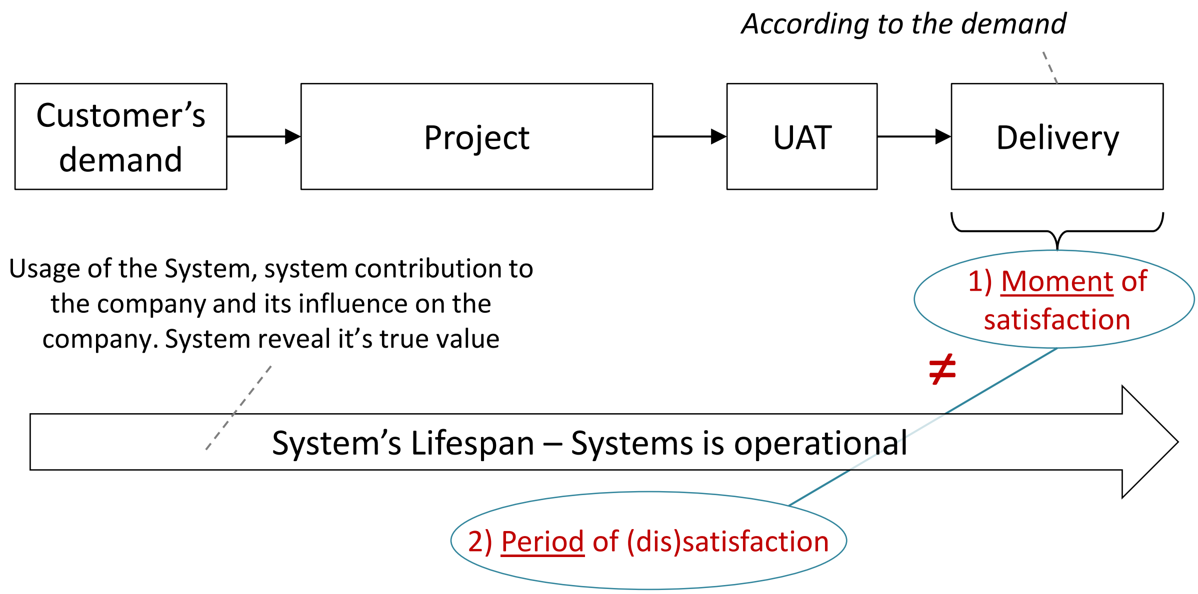
= ANALYSIS !!

Misalignment between responsibility and competencies

Brief overview of required skills to pose a diagnosis and to conceive a solution (in information issues in corporate environments)

- Business knowledge and situational expertise
- Overall business and company knowledge
- Insight in the company's systems and processes
- Profound understanding of "Information"
- Profound understanding of "Systems"
- Real Problem Solving skills
- Thinking like an Engineer

Customer Satisfaction



- Some stakeholders may be satisfied, while others are not.
- Stakeholders may be satisfied, while the 'solution' doesn't solve the problem, create new ones, bring in risks and limits, is inefficient, is awkwardly designed or does not fully exploit possibilities.
- The competencies of stakeholders is only one perspective to judge a solution. It is limited.
- The satisfaction at the delivery (1) does not guarantee or imply a satisfaction during its operational lifetime (2)
- Even if customer satisfaction is obtained at the delivery, the day after the customer may change his mind and not be satisfied anymore. Systems exists beyond customer's satisfaction.
- A system, a good system, is tangible. Customer satisfaction is intangible. Value?
- Successes are too sporadic and won't last. Impossible to meet on regular basis to create permanent satisfaction.
- Focussing on satisfying a "delivery according to a demand" is way more easy than seeking to get value and satisfaction over the long term.
- Seeking to have appropriate systems and solutions requires a different way of thinking, organisational setting and approach from what is required to respond to a pre-established demand.

Customer Satisfaction

CREATION OF CUSTOMER's SATISFACTION

Customer's Wants → Customer's Demand → Building & Delivery ⇒ Customer is satisfied

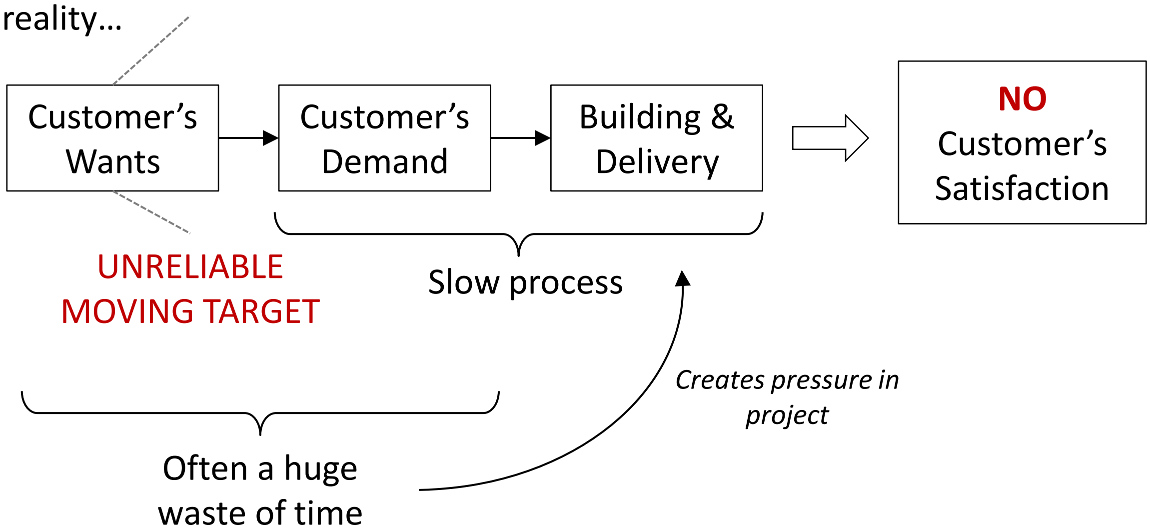
success

Successes are too sporadic and won't last. Impossible to meet on regular basis to create permanent satisfaction.

Even if customer satisfaction is obtained at the delivery, the day after the customer may change his mind and not be satisfied anymore.

PROBLEM:

Vague, intangible, changeable, linked to emotions, different visions (no unity), unreliable, interpretation, alternatives, hard to capture, can be unrealistic, can be misaligned, uncertain, can be conflicting, local, short term, thinking small, personal, subjective, based on interpretation of reality…



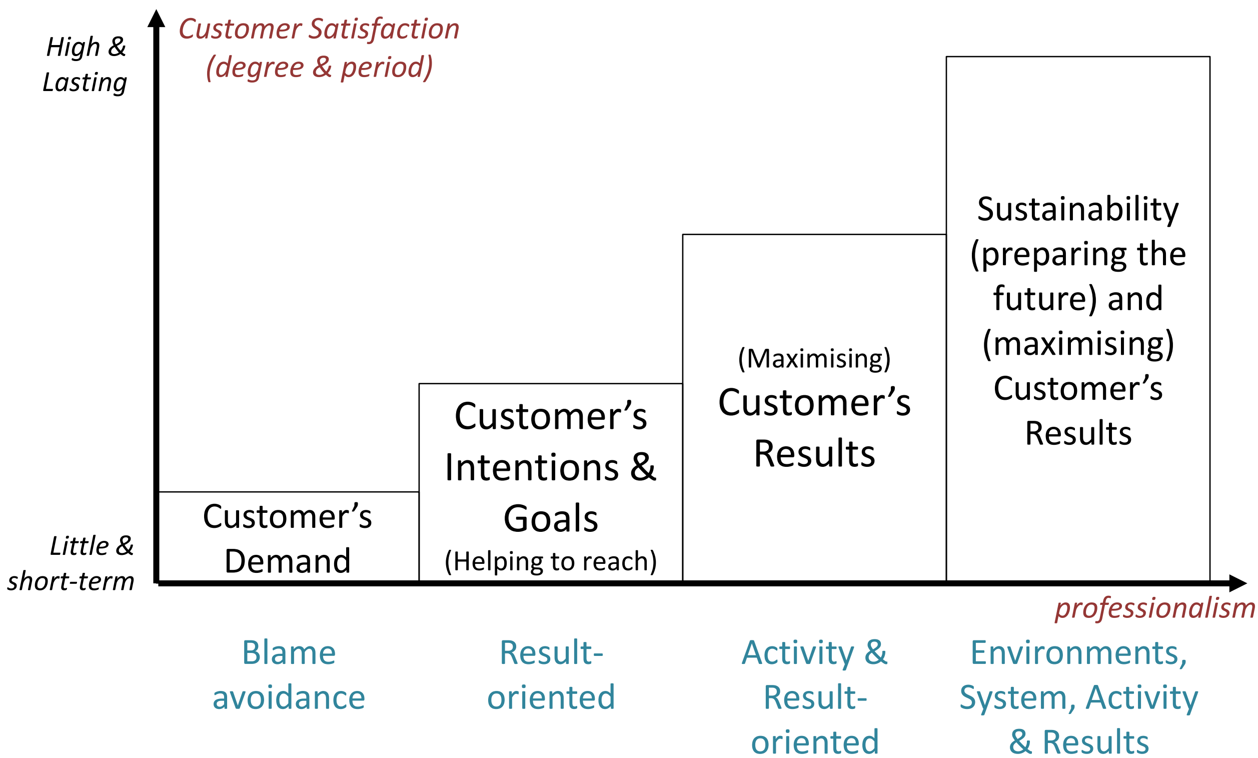
"If I had asked people what they wanted, they would have said faster horses."
- Henry Ford

Customer Satisfaction

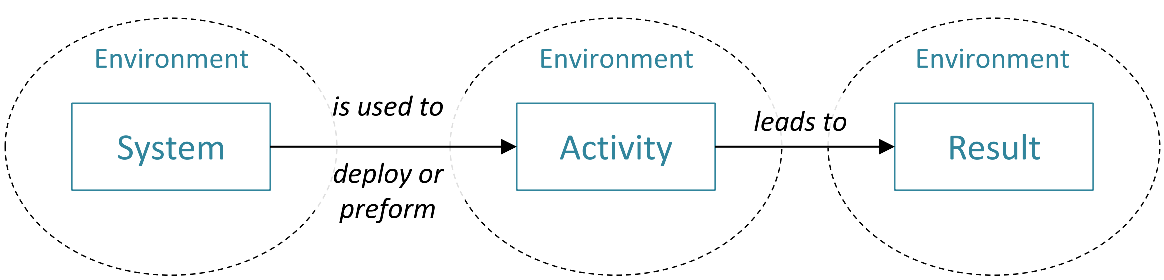
WHAT DRIVES THE PROJECT TEAM?

- On what is being focussed?
- How are the mission and project goal defined?
- What is expected?

WHAT SHOULD DRIVE THE ANALYST ?



Result? Activity? System? Environments ? … see diagram below



Who is the Client?

WHO TO SERVE?

Is the **User** the client?

No. Software applications may facilitate the work of software users. They benefit from software application to do their job. However, they are part of the Information System. Their work needs to create value for someone else.

Is the **Sponsor** (sponsoring business stakeholder) the client?

Yes and no. Projects can be funded with the budget of a business unit, department or service. Would it be different if the money came from a budget from the top of the company or from the IT department itself? The money, wherever it comes from, belongs to the company and the company can fund projects in a different ways. The product of the project should benefit to his/her organisational unit. Information system should belong to the company, particularly if they or their data is shared across the organisation. A sponsor is rather a key stakeholder than a client.

The client is not simply the one who asks or fund.

Who Are the Real Clients?

1. EXTERNAL CLIENT

The client outside the company to whom the company delivers products and services. The real client can be a person, or organisational unit, member of the organisation. The company's main role is, its main mission, is to serve society.

1. THE COMPANY (also 1)

The company, as the overall entity, is the second real main client. This overall system has to function well and to thrive.

How useful is it to have one organisational unit that is doing well, while the entire company goes bankruptcy ?

All the funds come from the company. The organisational units received budgets from the company.

2. INTERNAL CLIENT

Higher organisational units defining the purpose, values, directions, strategy and higher goals for the business are also clients. (ex. Business Units)

2. INFORMATICS DEPARTMENT (also 2)

Huge parts of larger companies are automated. This tendency to automate as much work as possible will keep on. The role of the Informatics Department will thus increase. This also means that it has to prepare and to strengthen itself. An Informatics Department finding itself in a position where it is unable to conceive appropriate information solutions and implement them or to manage and adapt the implemented information systems constitute a major danger for the company.

3. LOWER LEVEL ORGANISATIONAL UNITS

4. USERS GROUPS AND USERS

Users shouldn't be ignored. They posses valuable knowledge. Their needs and ability to work are important. However, their needs, suggestions and requests should be taken in consideration together with all other necessities, objectives and priorities of more important clients.

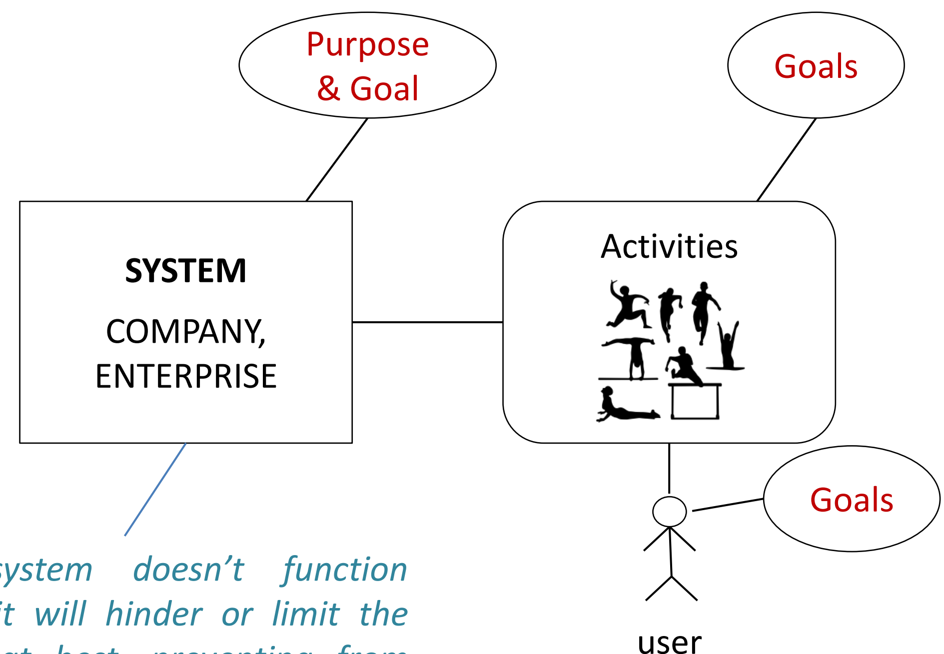
Higher Goals

CUSTOMERS ←— have —→ GOALS

Main Customers =

- ENTERPRISE (company's body)
- COMPANY
- COMPANY's CUSTOMERS
- SOCIETY

- Often and mainly hierarchical
- Some subset of goals may contain a network or circular pattern



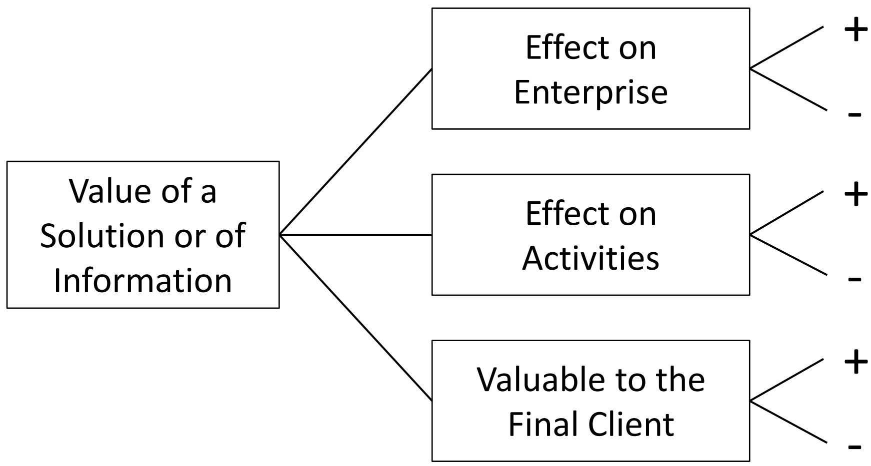
If the system doesn't function properly, it will hinder or limit the activities at best, preventing from reaching the objectives. It may lead to bad products and services for the external clients.

Notes:

A taxi company can't thrive if the car (taxi = system) is old, dirty, worn out, regularly broken, ….

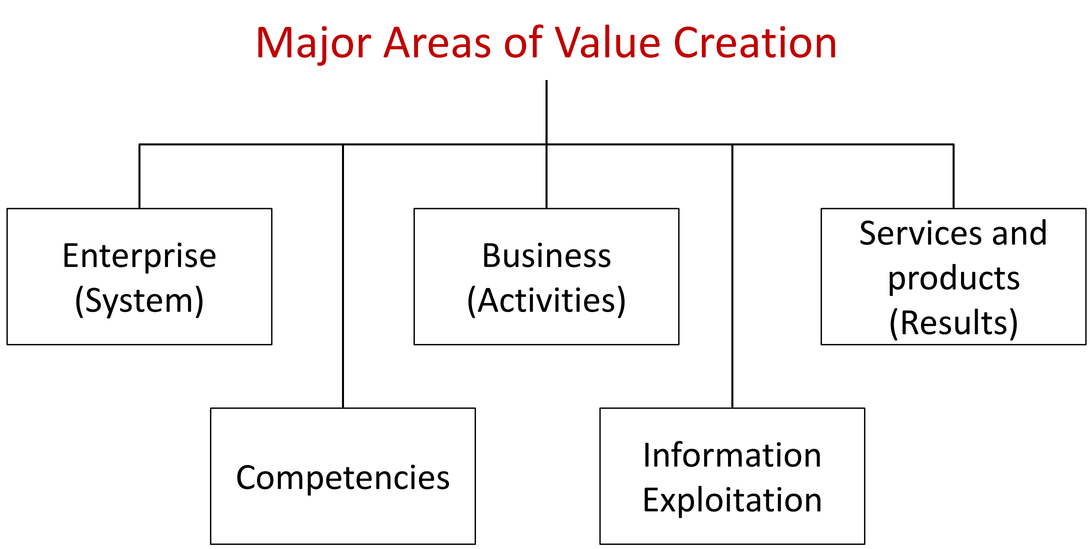
Value Creation (1)

Value is defined by the final net positive contribution



The value for final (external) clients can be estimated by interest, sales, price ready to be paid, …

Evaluating the "value" for the company requires a deep understanding of all the effects an item or solution has on the company.



Value Creation (2)

Ideas with little solid ground
FALSELY affecting the estimation of value of a system

The product/solution/feature has value because:

- it is the goal and mission of the project
- it is the delivery of what is agreed on
- the product correspond with the demand
- the software application works as expected, looks nice, is attractive, …
- it is our product, the project's product, …
- a lot of effort spent building the product
- building it or acquiring it costed a lot
- the company has now new features, new processes, new software
- the system is adapted or expanded. Features have been added.
- It can do more.
- the new is better than the old, the old was outdated
- the product is desired
- the product or new solution facilitates the job of the end-user
- the end-users, stakeholders, sponsor or business community are satisfied
- the product is useful to the company
- our people, the project team members, are competent
- everybody implements it these days
- it has been advised by solution providers
- the builder is proud of his work
- …

Value Creation (3)

Possible Obvious Effects

- New functionalities
- Information needs being solved
- Additional Capabilities
- Increased Capacity
- Improving the products and services to the final clients
- Improved information exploitation
- Innovation
- Better KPI results (like reduced throughput time)
- Better alignment with the environment
- Lowered cost
- Reduced waste
- New competencies
- …

More Possible Hidden Effects

- Increased maintenance and/or operational cost
- Increased fragmentation
- Inefficiencies have been introduced or shifted to elsewhere
- Incoherencies, conflicting logic and bugs,
- New weaknesses, bottlenecks, SPOF's, risks have been introduced
- New hindrances, difficulties and obstacles in usage
- New hindrances and limitations (impossibilities, closing doors) in evolvability
- Increased waste
- Solving consequences, masking the causes (real problem)
- Increased complexity
- Loss of knowledge and comprehension
- Decreased manageability
- Hidden mechanisms undermining the system from within
- Risks of misuse and abuse
- …

Value Creation (4)

We can’t judge a gift based on its wrapping paper.

A solution or system can’t be judge on superficial facts, impressions or unfounded criteria.

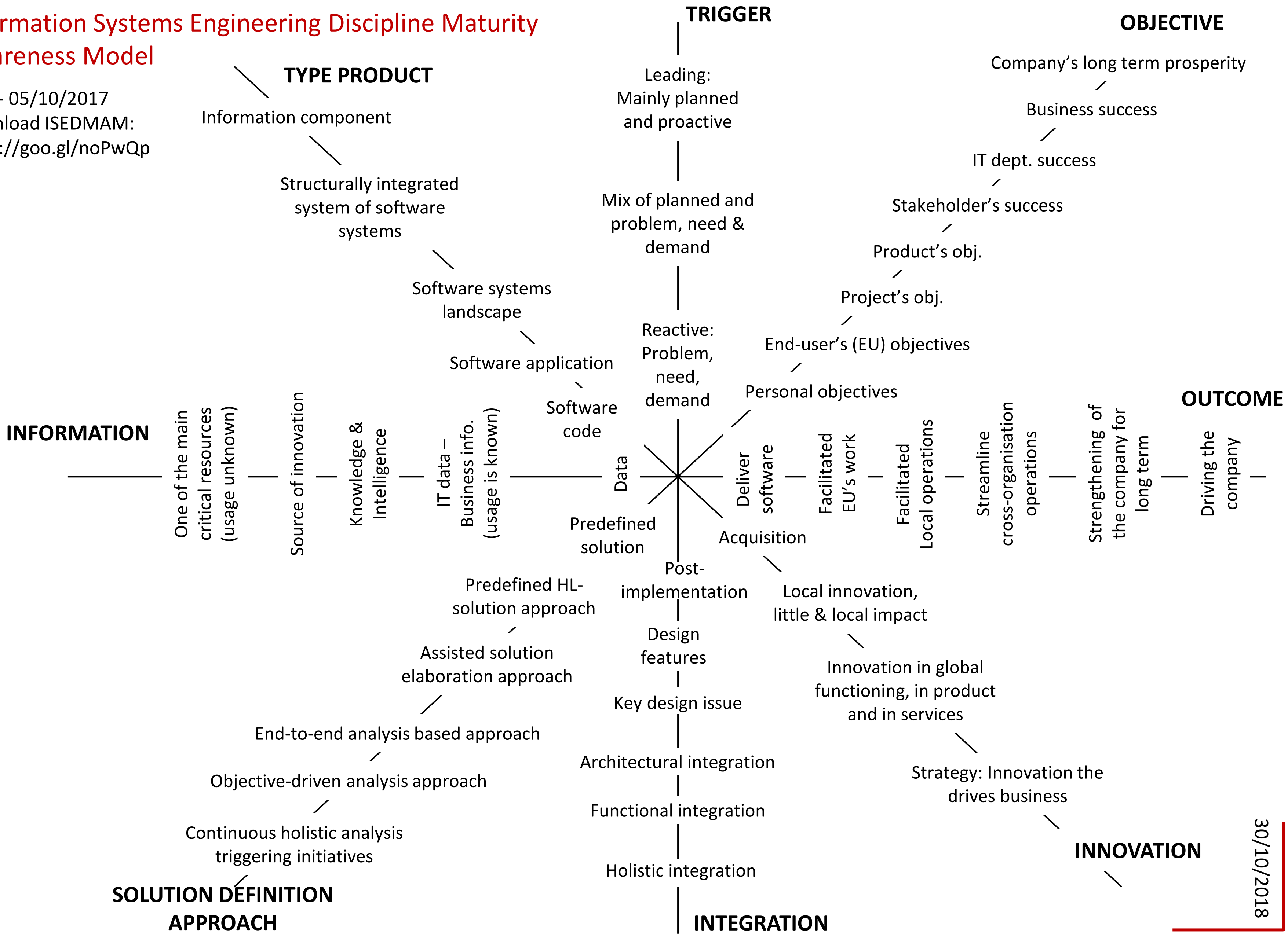
Main Aspects to Value of System (non exhaustive)

- Purpose is ethical, useful and accepted
- Fulfilling its role swiftly and with sufficient capacity
- Solves root causes or satisfies true needs
- Producing benefits and minimising costs
- Design intent in line with purpose
- Elegantly designed
- Contributes positively to the supra-system
- Respects supra-system
- Respects the environments
- Respecting harmony in the system and in the supra-system
- Respects system’s qualities like manageability, evolvability, …
- Acceptance by people
- No degradation mechanisms or effects

ISEDMAM

Information Systems Engineering Discipline Maturity Awareness Model

V1.1 - 05/10/2017
Download ISEDMAM:
https://goo.gl/noPwQp



People vs Computers

HUMANS

- Able to set and define goals
- Have intentions
- Able to execute high level instructions
- Able to deal with imprecision
- Able to interpret
- Able to evaluate
- Able to adapt
- Have specific skills and knowledge
- Can learn and accumulate experience
- Are creative
- Are irregular
- Have preferences and dislikes
- Is physical active and mobile
- Have social relations, collaboration
- Have emotions
- Have intuitions
- Have a behaviour, a character, ego
- Volatile memory
- May shifts in focus
- May have misunderstandings
- May make mistakes
- May have antipathies, conflicts
- Can be tired or sick

COMPUTERS / SOFTWARE

- Number crunchers
- Executes complete, detailed, formal sets of elementary instructions
- Perform repetitive work
- Is extremely fast
- Requires a huge degree of coherence
- Very precise
- May contain very abstract structures and mechanisms
- More constant, linear
- Need pre-defined logic
- Is engineered
- Can gathered immense amounts of information
- Can interact with many systems and people at once
- Can have bugs (bugs are undesired and unintended programmed logic)
- Overloading can “make it slow”
- Can work 24/24 – 7/7
- Can be very reliable (more than people)
- Can break down

Reflections

What are the consequences of these differences?

Can we simply copy (w/o adaptation) work done in the human world to the computer world?

Can we design computerised solutions by not taking the characteristics (strengths, weaknesses, possibilities, limits, risks, …) of computers and software into account? Without a thorough understanding of the specificities of this world?

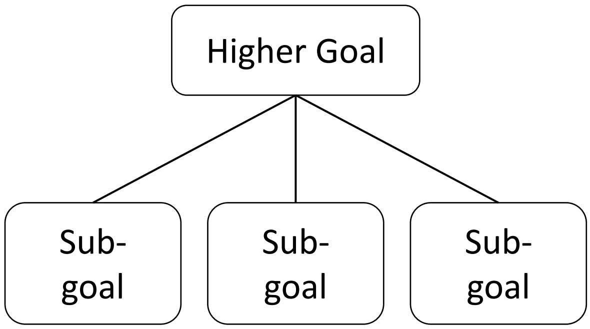
Do we need a different way of thinking when designing computerised solutions?

Notes

Computers may be equipped with logic simulating human qualities, like rules system, fuzzy logic, back tracking, Artificial Intelligence (AI). But most systems aren’t that far yet.

An IS has a “human part” and a “computer/software” part. Both have to collaborate. Both have to be engineered to form a single system and to work in harmony.

GOALS



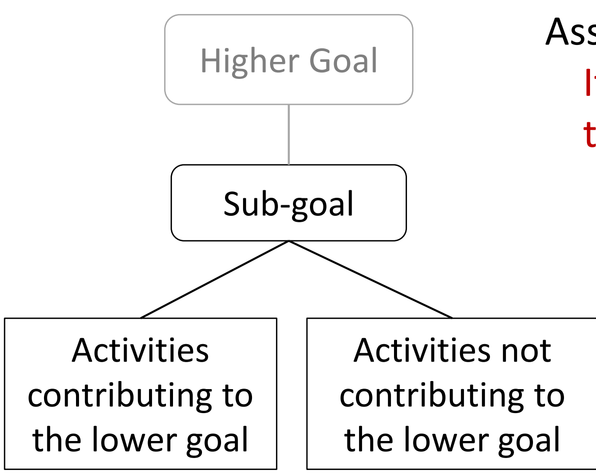
Aiming for higher goals
leads to
greater achievements

More difficult to achieve – more demanding

- Requires different roles, focus, approach, methods, techniques and tools
- Requires higher norms
- Requires stronger competencies
- Requires different beliefs
- Requires a more global and holistic view
- Much more thinking

- Tests the competencies
- Probably more
  - Aspects to take into account
  - Contradictions
  - Uncertainty
  - Assumptions

Focusing on lower goal only



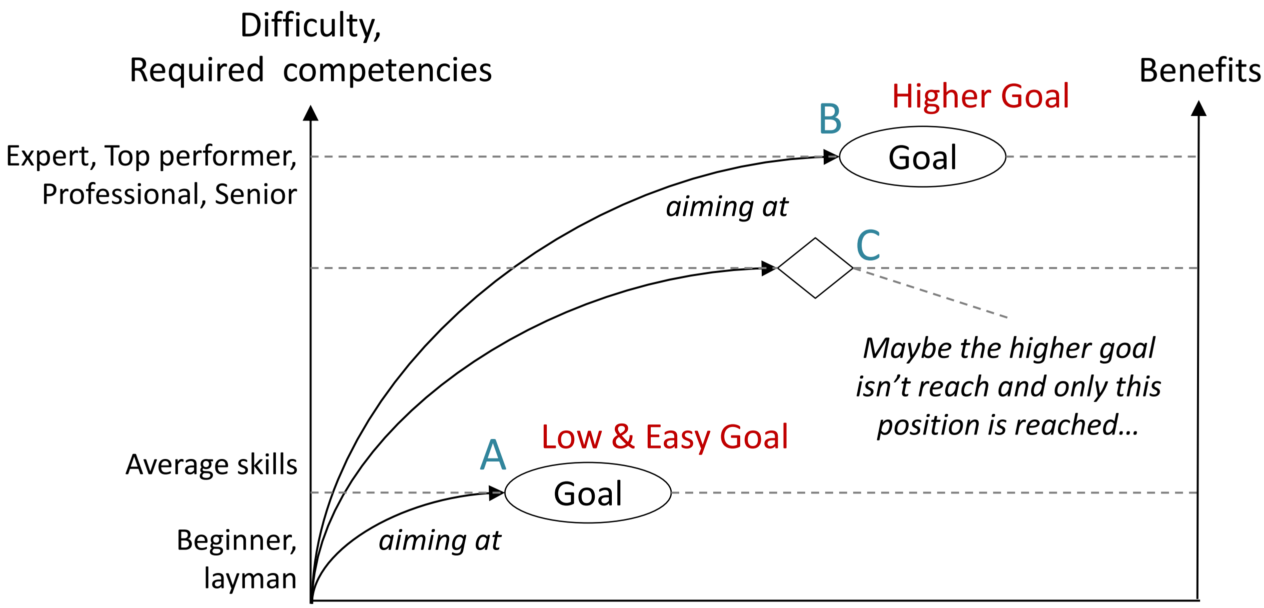
Assumption:

If all sub-goals are met,
then the higher goal is achieved.

More local thinking
Lower norms may be used
Little pressure to improve our skills
…

- Activities contributing to the lower goal (sub-goal), ignoring the higher goals, may unwittingly work against the higher goal(s).
- Risk: Activities that don’t contribute to the sub-goal may unintentionally hinder reaching the higher goal even more.

Aiming for Higher Goals



- If we aim at a lower and easy goal (A) then that goal can and will be reached. The benefits of reaching that goal are rather low. Basic skills may suffice. Anyone can do this. If the endeavour is too easy, not much will be learned.
- Aiming at a higher goal (B) and reaching the goal successfully will create yield greater benefits. This requires professional skills, expert's skills, skills of a senior profile.
- If we fail to reach the goal (B) and reach only point (C) then the obtained benefits will be somewhat lower. But these benefits will still be higher than the benefits obtained by reaching goal the lower goal (A). And at least progress has been made and more interesting lessons can be learned.

Notes:

In some cases failing to reach an objective won't provide any benefit at all. It may create a waste, a cost, a loss or damage.

AUTOMATION

COMPANY

Executor	INDUSTRIAL COMPONENT	HUMAN COMPONENT	**INFORMATION COMPONENT**
Way of execution	Automated	Manual	Automated
Storing / Processing / Transporting	Material, Energy	Material & Information	Information
Nature of processes / processing	Pre-defined processes	Interpretation, variable logic, ad hoc decisions, explicit and implicit knowledge	Pre-defined processes

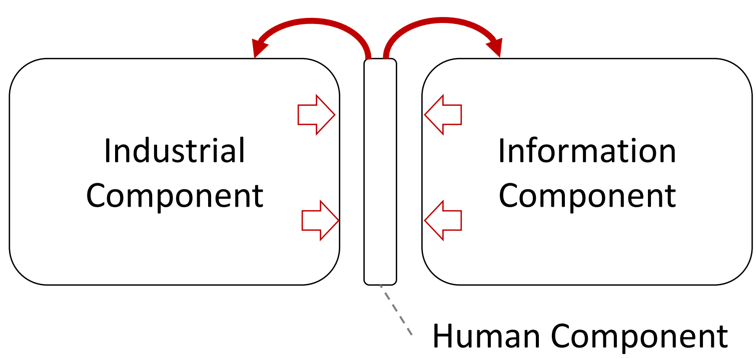
mechanisation ←

informatisation →

Robotisation = mechanisation + informatisation

Evolution

Human Component is squeezed between the two other components due to work transfer (automation).



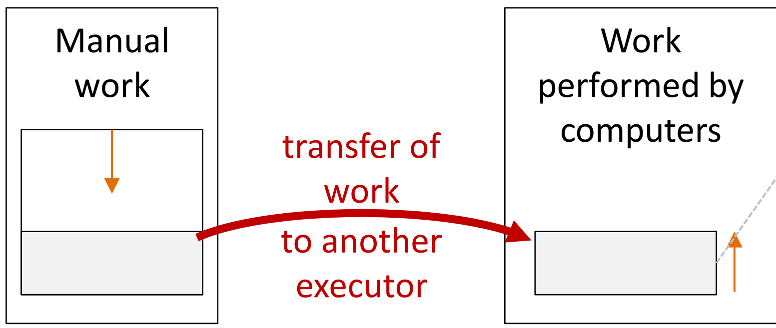
Reflections

Over time, what human activities and business community will be left over after large scale mechanisation and informatisation ?

Note: Industrial component is optional. Not all organisations are industrial.

Evolution of Automation

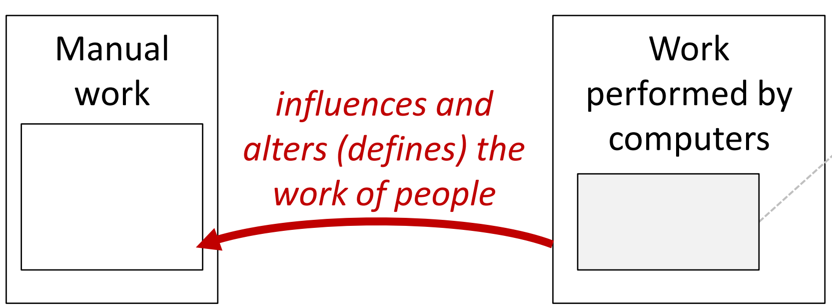
Automating the “As Is”



Same work previously performed by people executed in the same or very similar way. Work designed for people executed by computers.

“Copy-paste” of work (or work is slightly adapted) from people environment to computer environments. Basically, a same way of thinking is applied. Mainly repetitive work is transferred. It values the work of the people.
With this transfer people can do more and other work. Productivity increases.

Exploitation of the ability of computers and software

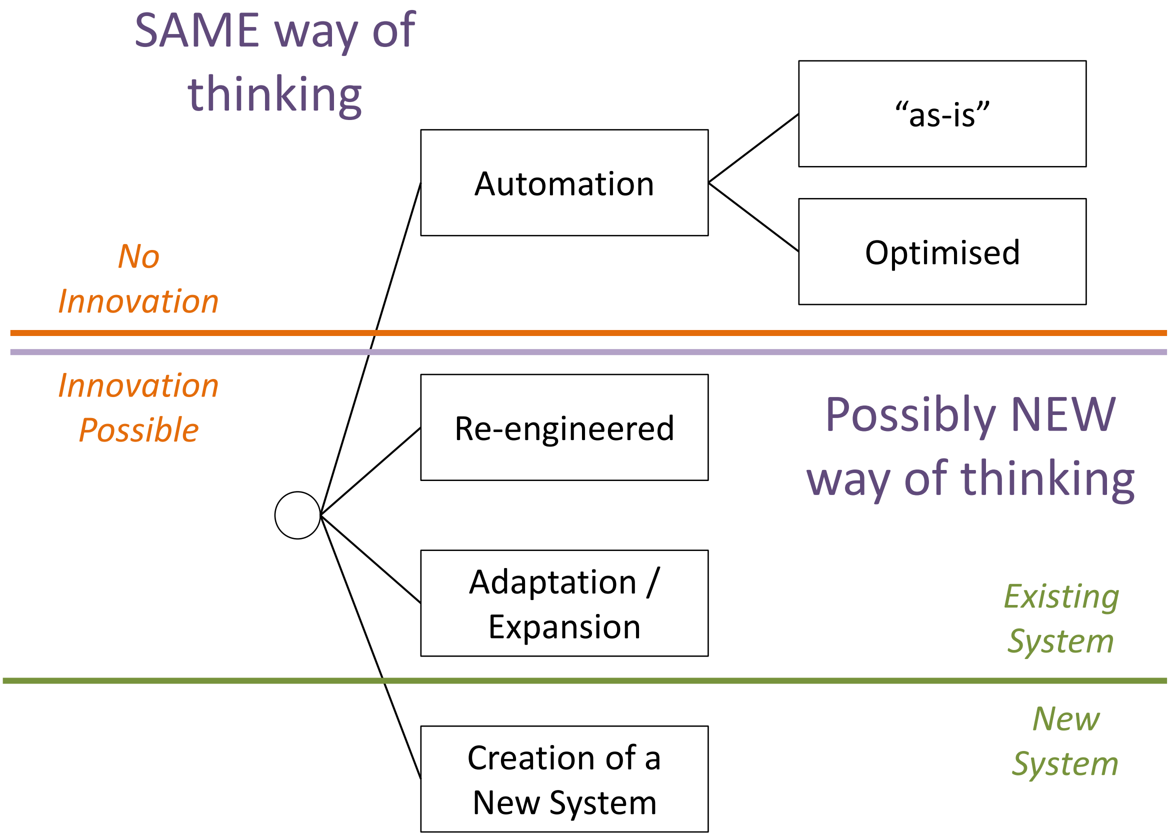


Work designed for computers and software

Maximally exploiting computers and software is achieved by designing systems, not based on human abilities, but based on the specific abilities of computers and software. Work of computers is valued. People do work computers can’t (yet) do. Requires a way of thinking different than thinking in terms of people and work performed by people.

Notes:

-



Remark: Not all new systems are innovative.

INNOVATION

1. Innovative software features and interface
2. Innovative and more powerful algorithms
3. Innovative concepts
4. Innovative system architecture
5. Innovative processes
6. Innovative information usages
7. Innovative information products & services
8. Innovation supporting new forms of organisation
9. Innovation in learning and capability development
10. Innovation contributing to business models
11. Innovation allowing new or better strategies

Reflection:

Why is innovation in 1 and 2 easier?

How often does the IT department come up with innovation on points 3 or higher? If the answer is “rarely” of “never”, then why doesn’t it happen frequently ?

Should this happen frequently? How can this be changed? What conditions are missing?

INNOVATION

Innovation doesn’t start with a vision or good idea. It starts with an attitude, curiosity and learning, an open mind and an appropriate environment.

Innovation needs …

- Goal, direction, a problem
- Context
- Constraints
- The right mind-set (curious, investigative, what-if, …)

Innovative Environment

- Structure, guidelines (but not strict structures, unbreakable laws, …)
- No pressure or stress, peaceful environment
- No fear
- Failure is allowed. Failure is learning.
- Some freedom
- Some autonomy
- Time, Resources
- No strict plan, deadline (pressure)
- Innovation often happens at the crossroads of two or more domains (or concepts) (overlap of domains)

Revolutionary Idea – Three Phases

1. Ridicule
2. Dangerous
3. Obvious

Innovation Inhibitors

- Authoritarian hierarchical structure (**STRICT** rules and structures)
- Lack of support
- Fearing risks and failure

  Control (or "transparency") linked to judgment, evaluation and potential punishments, fear of job loss (restructuring, rightsizing, outsourcing, …)
- Pressure
- Internal politics, personal agenda's, ego
- Obligation, procedures to follow, rules
- Chaos, firefighting
- Frequent interruptions, one-hour time sliced day
- Divide and conquer as strategy to manage the company
- Organisational silo's
- Job silo's

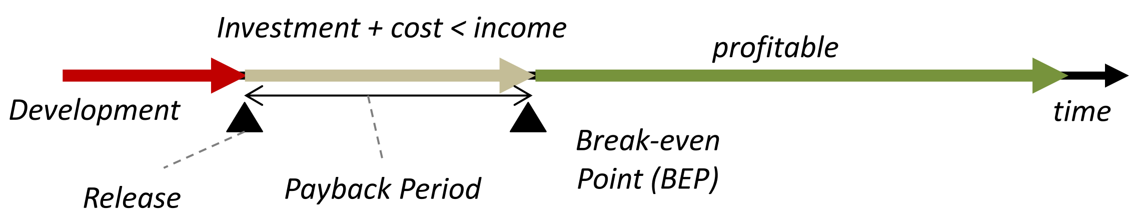
  the job description, the function, the authority and responsibility define what activities one may execute, what the individual may think about or to what activities (s)he may participate.
- Knowledge silo's, job specialisation
- Superficial knowledge, lack of insight
- Short-term thinking, cost-thinking
- Low norms
- Attitude of maintaining and protecting; a defensive attitude
- Dependent thinking, group thinking, single thought, mainstream thinking
- Rejecting and banning disagreements, different thoughts, …

"If I had asked people what they wanted, they would have said faster horses.“
- Henry Ford

Change as Investment

A Change is an Investment

First the effort, cost, issues, … the benefits follows.



Downsides

- Effort
- While experts implement one change, they don't work on other developments/changes
- Risks of introducing incoherencies, conflicts, inefficiencies, …
- Additional stress
- Requires (re-)training
- Risk of confusions between old and new
- Cost
- …

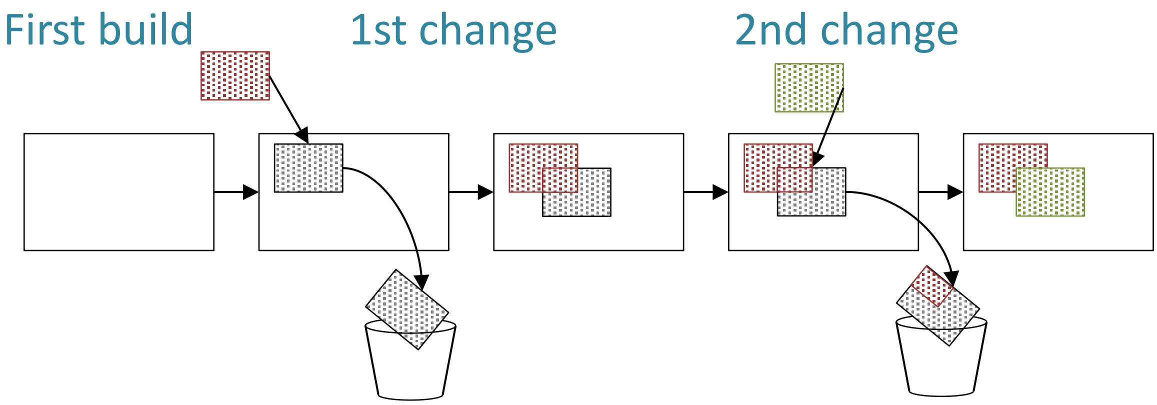
Benefits

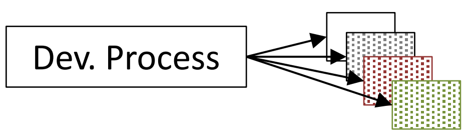
- Learning, Improved skills, new experience
- Improved system, situation, …
- Create additional value
- Retain or bring customers
- …

Some negative implications (such as bugs, new limitations, bad quality, …) may appear much later, when the change is implemented and operational, even after being operational for a longer period of time.

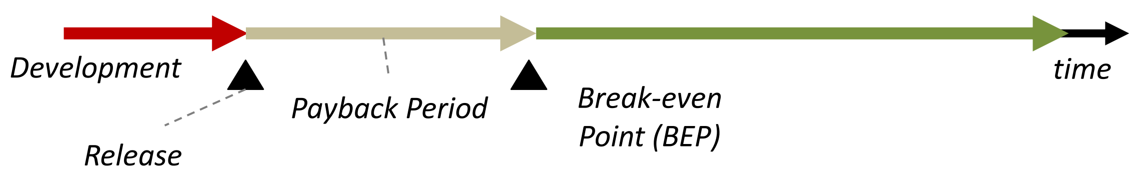
Change

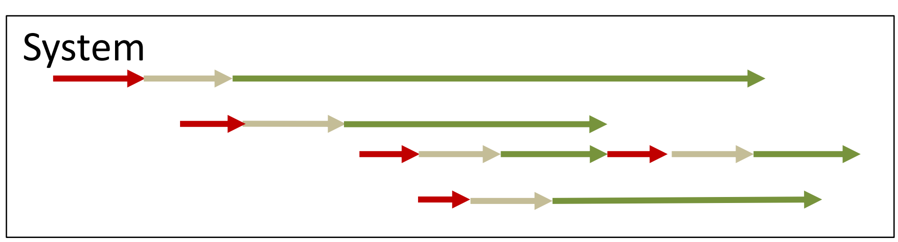
How successive changes destroy the profitability





Every piece of source code has passed through a development process





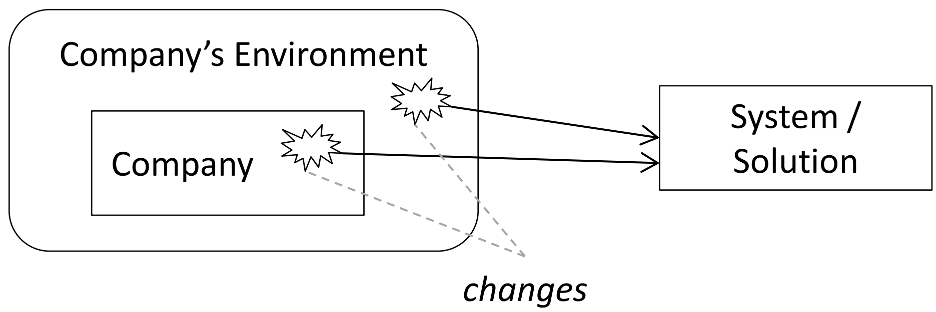
Σ Cost(Change) < Σ Benefit(Change, time period)   (simplified !!)

Some Principle

- Every change is work, an effort.
- Every change implies waste (old work thrown away).
- Every change uses resources (analysts, engineers, developers) which can ‘t be allocated to other work
- Every change is a cost.
- Every change has a payback time.
- Every change influences the profitability of the entire system, first negatively (increased cost), later maybe positively (increased profit). A change is not necessarily beneficial simply because it is a change.

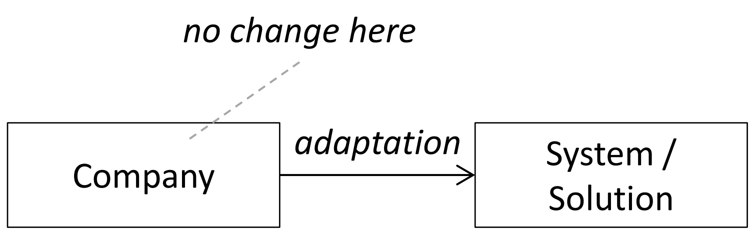
Change

Real Changes



SOMETHING changed in the "Company's Environment" or in the Business part of the company.

"Fake Changes" – Corrections – ANALYSIS BUGS



NOTHING changed in the "Company's Environment" or in the Business part of the company, yet the system has to be adapted. They result from bad decisions and choices. Some main causes are a lack of insight, thinking or skills.

SYSTEMS ANALYSIS PREVENTS FAKE CHANGES

Some fake changes are acceptable (adaptation of strategy, new idea, investigation led to new insight). Even a decent Analysis can not prevent all fake changes. It limits them, particularly the most impacting fake changes.

TIP:

If too many changes are due to lack of information, lack of insight, lack of thinking, lack of skills or other similar causes, then solve the causes.

Changes

External Change	• Change is not under control of the company. • Sometimes hard to predict • Can be imposed on the company Examples: Legal changes, market decline, technological progress, partnerships, …
Internal & Controlled Change	• Management decision • Triggered internally • Under control, Rather predictable Examples: Strategy, plans, goals, intentions, policies, reorganisations, R&D, … Job of the Analyst. Analysts must be informed of discussions or coming decisions.
False Change	• Causes: Lack of insight, changing minds • Not caused by a real change • Root cause**S**? ……………………………………………………………………….. (fill in) • Solutions? ……………………………………………………………………………… (fill in) • Unpredictable, Most are avoidable

ANTICIPATE

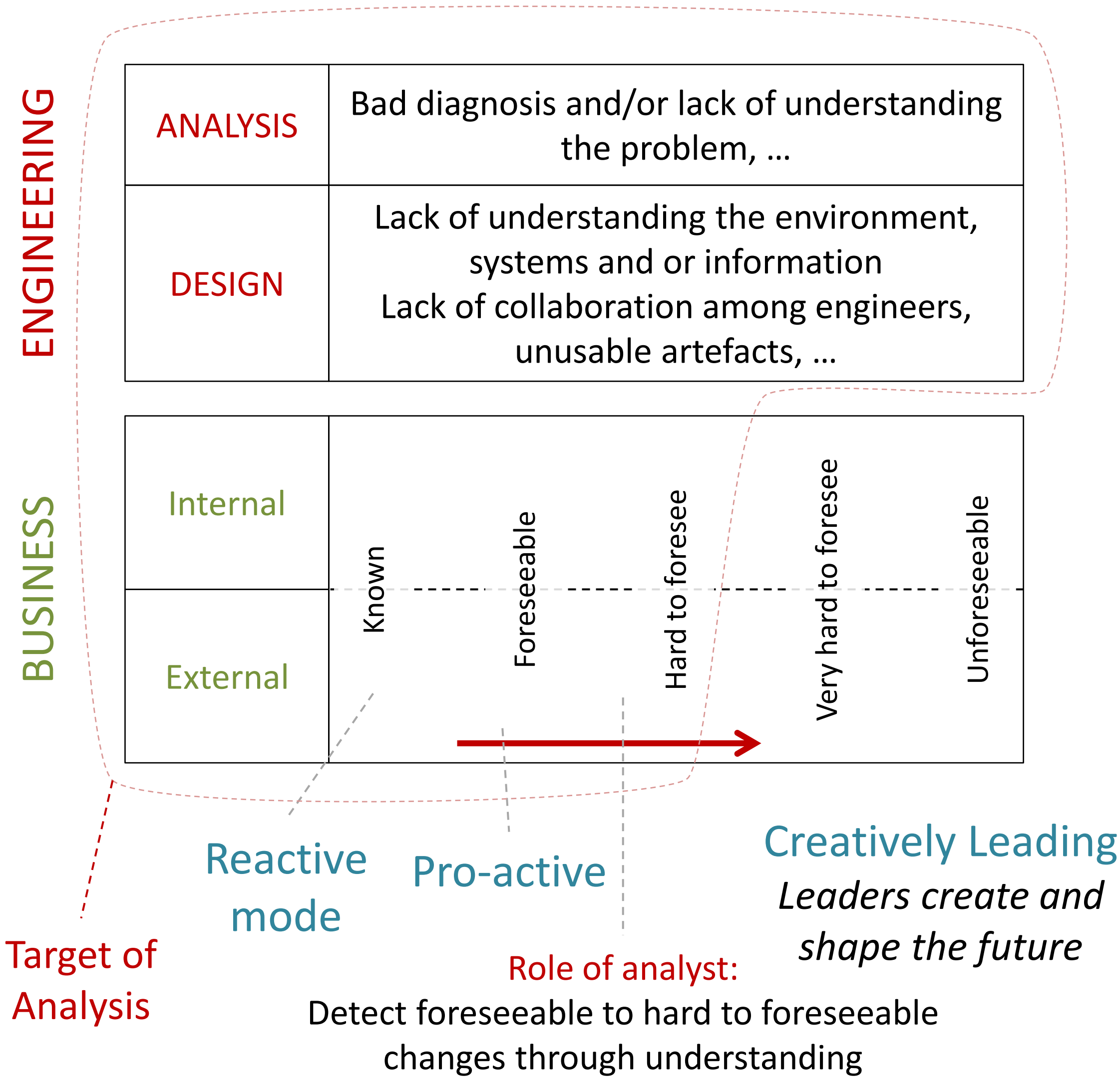
Changes in Systems

MINIMISE

Analysis Bugs	• The worse the analysis, the more analysis bugs. • Causes: Lack of skills, information retention, pressure, lack of collaboration, .. other organisational factors or factors in the work environment. • Often hard to avoid all of them. • Can be similar to false changes.
Design Bugs	• Similar to analysis bugs, but now instead of related to the understanding, the bugs concern the design.
Programming Bug	• Causes: Lack of insight, changing minds

Changes in Systems

Change

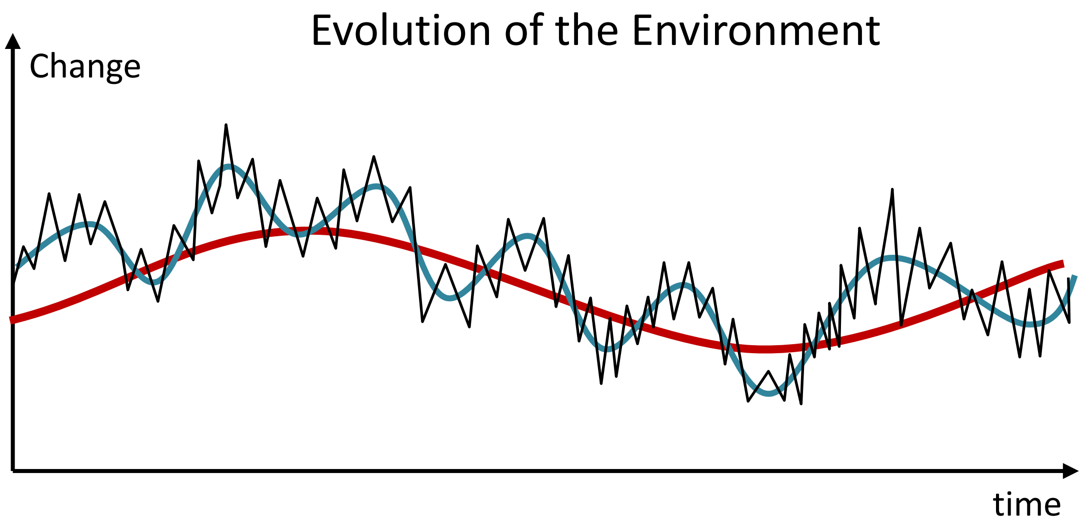


To be able to foresee:

- Understand systems (general systems theory)
- Understand evolution of company's systems
- Understand evolution of business
- Consult plans
- Look at objectives, usage of systems, complaints, intentions

Some internal changes are easier to foresee or are under control of the company itself.
If the management functions in an ad hoc and fire fighting mode, then they are taking a lot of decisions that truly couldn't be foreseen.

Change



Superficial Environmental Changes

- Times scale: a day, a weak, a few months, a year
- appear and disappear quickly
- lack of direction
- easily noticeably (newspapers, magazines, advertisements, …)
- superficial, minor, small opportunities
- responds doesn't take a great effort
- pick the battles

Medium Environmental Changes

- Times scale: several months to several years
- Harder to notice (visible tendencies in society)
- Some tendency and direction can be observed
- Can be worth setting a project or programme for it
- Harder to escape from it

Profound Environmental Changes

- Time scale: many years to several decades or more
- Hard to notice, requires to consider the long term, knowledge of the past (history)
- Clear direction
- Obligatory to follow it

Notes:

What type of changes should shape the architectures? What should not be used to shape the architecture?

Resistance in Change

Resistance of change is bad because change is inevitable. The resistance must be broken. Those who resists fear the future. They don't understand or they can't adapt. They are nostalgic and can't let go the past. We live in modern times and need to progress. Such unfortunate clichés are well-known.

Resistance is natural and is inherent to change. It is healthy to have resistance. Resistance is there for a reason. It is a signal that must be captured. Its message has to be understood. First, resistance prevents us from accepting and responding to every opportunity of change. It tells us something about what and how we do things. If we would do things correctly, then why would there be a resistance?

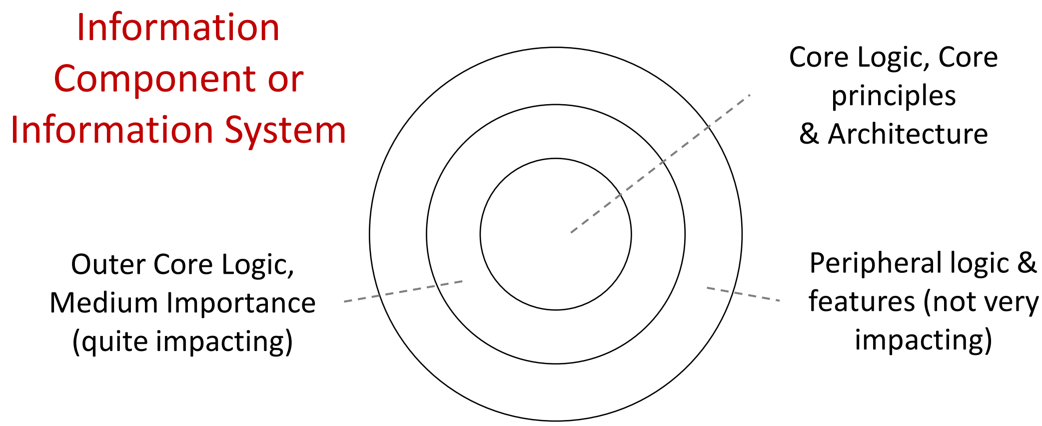
Resistance exists

- Because of a **loss** for a concerned party
  Is the loss justified? Can this loss be compensated?
- Because of **fear**
  Fear is or should be abnormal. What is that fear? What created it? How do we deal with people? Can we reassure people? Or take measures to resolve the fear?
- Because of **uncertainty**
  Change means uncertainty. And uncertainty is close to fear. But it is important to listen to what these uncertainties are. Maybe we created them and maybe they can be resolved by listening, by providing more and clearer information and by taking specific measures.
- Because there is **disagreement** with the decision
  A disagreement can be justified. If there is a disagreement, then maybe something has been overlooked.
- Because a **lack of confidence** and belief
  This should also be investigated and measures can be taken.
- and indeed because of change requires an effort and not all persons are ready to do the effort.

In some cases, resistance is created by lack of communication, by a lack of information: what are the intentions? What do we know and what don't we know yet? How much do we care about the people? How will we deal with people during the transition?

Key concepts: right intentions - information and communication – empathy and caring – respect – support

Changes and IS Projects



The design of what layer of logic should be based on what evolutionary wave? (superficial, medium or profound)

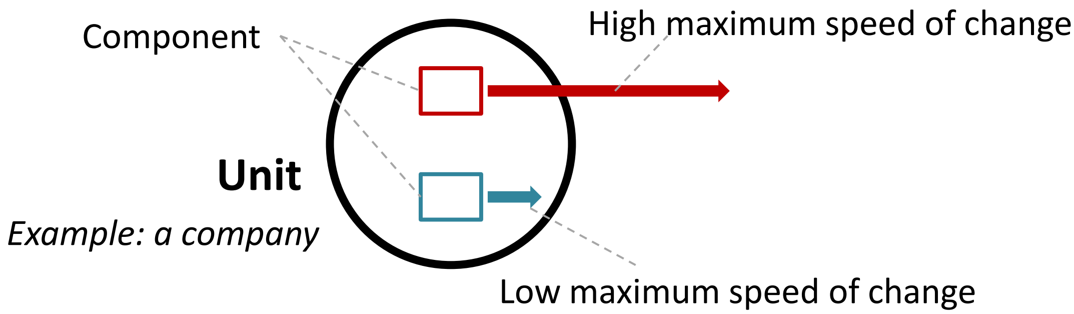
Type of Environmental Change / Evolution / Opportunity

	Profound, Long Term	Medium	Small, Superficial
Peripheral logic and features	👍👍	👍	👍?
Outer-core Layer of Logic	👍👍	👍	👎
Core Logic & Architecture	👍👍	👍?	☠️

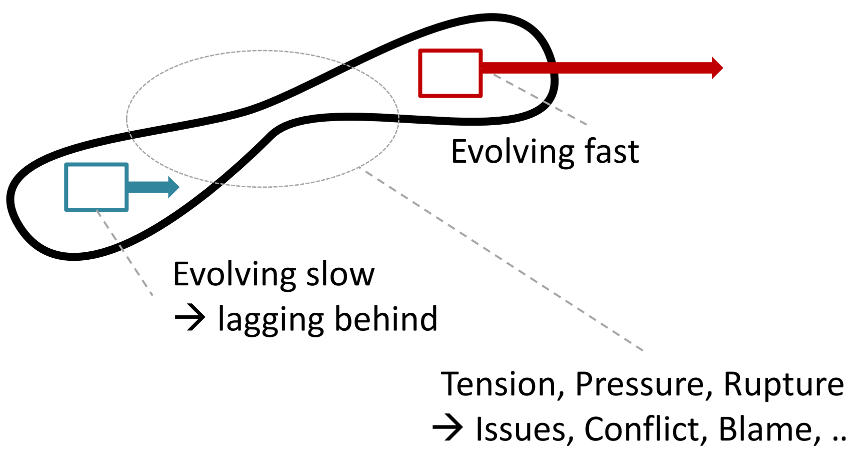
The design of the core, shouldn't be based on superficial changes. It should be based on the more stable deeper, long term evolution.
It is important to understand if a piece of logic is fundamental (long term) or if it is likely to change every few months, so to speak.

Size of change, its criticality and its profitability have also to be considered in the light of the type of environmental change (evolution).

Change : Speed



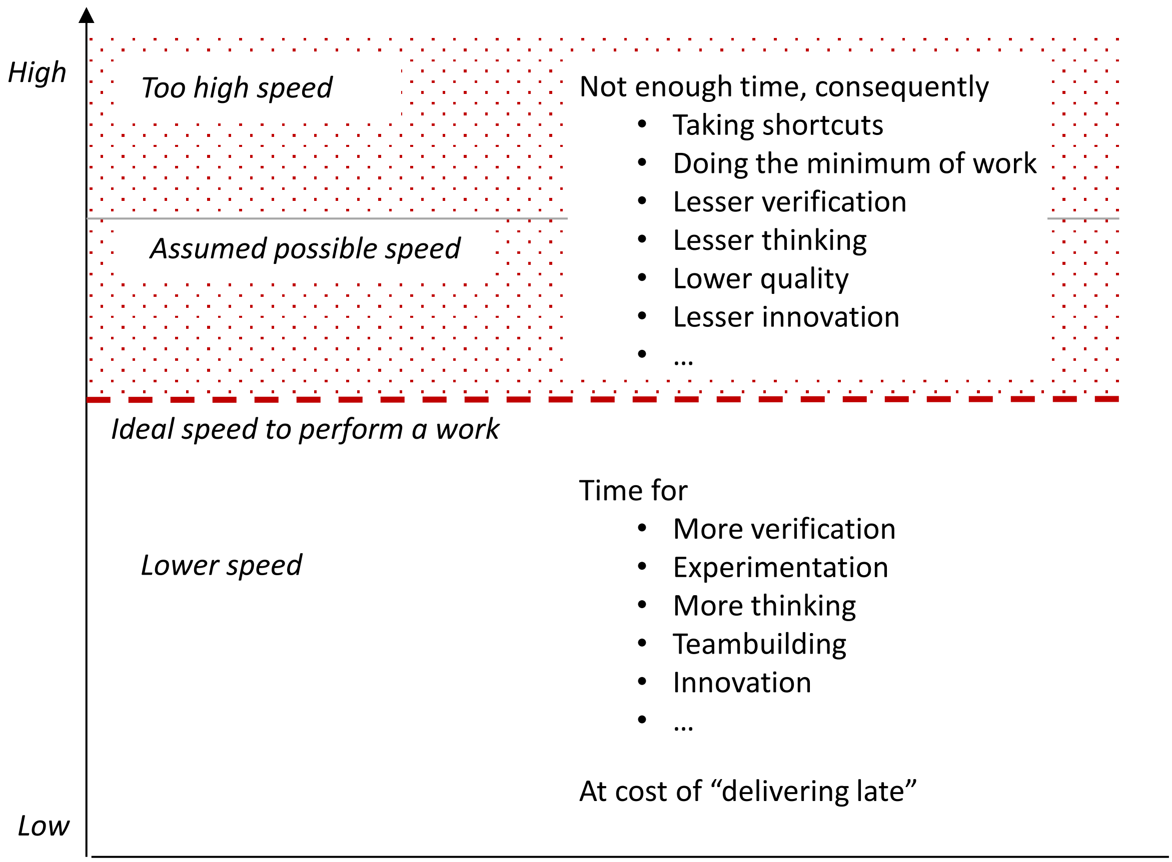
Let all the system's components change at their maximum speed



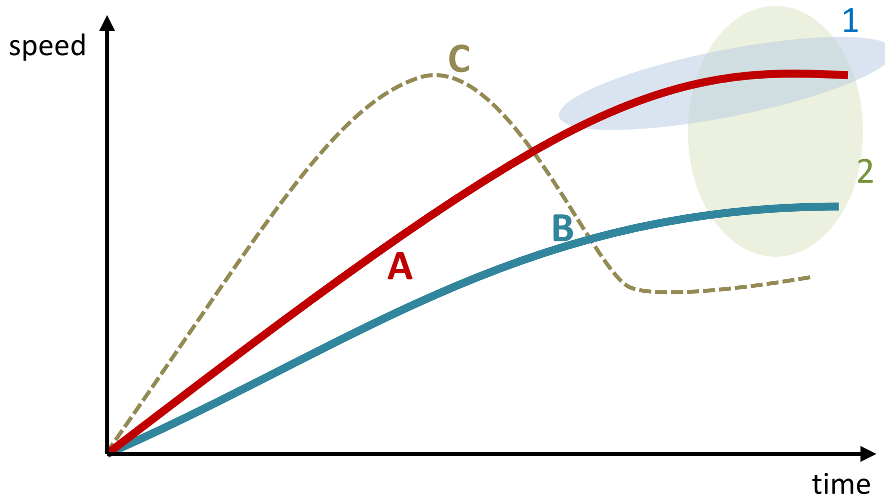
The element slowest to change should define the pace of global change.

Make the slowest components faster
However …

Change : Speed



Change : Speed



1) Evolution of speed

Line A: Increase of speed is not limitless. Likely companies may meet a plateau, a maximal speed **(blue area 1)**. The increase of speed of change creates pressure.

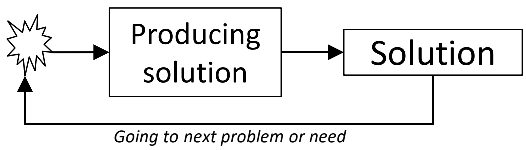
Line C: Fast-Cheap-Local-Tangible (short-cuts, quick wins, technical debts, reactive initiatives under pressure). Wanting to go even faster may lead to an overshoot. Pressure and speed may lead lack of quality and various kinds of problems. It's a kind of "speeding ticket". Understanding and awareness of the consequences of speed may lead to a downwards regulation of the speed and pressure and an increment of cost and risks in the medium or long term. We may not be aware of these cost and risk increment or fail to link them to the speed and pressure. They are considered as normal, while they are and should be avoided.

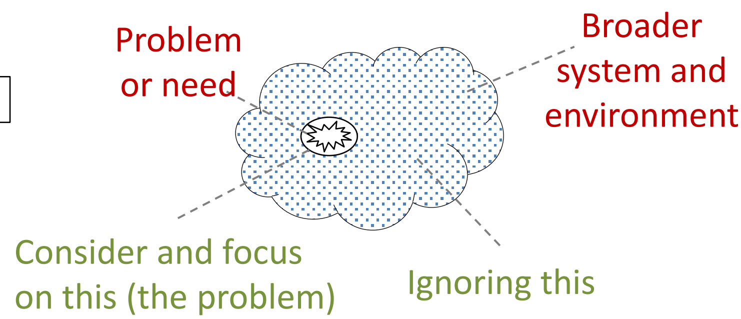
2) Different pace of change

A change in a company often requires many components and aspects to be changed. Not all components in a company can change at the same speed (**Line A** versus **Line B**). Often, this difference in pace of change puts a pressure on the components with a slower pace of change **(green area 2)**. They slow down the whole change. This may also put too excessive pace of change and pressure in some areas which lead to lack of quality and other kinds of problems.

Bottom-Up - Approach

As an opportunity presents itself, appropriate decisions are taken to progress. Principle: perform a step, contemplate the situation, decide of next step, perform the next step.



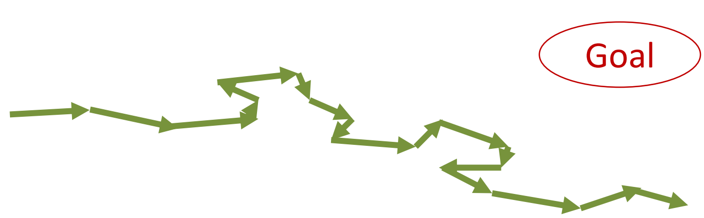


Advantages

- Resolving existing needs (or needs that are about to materialise)
- Concrete cases or demand
- Tackling known ones problems. They are the most annoying and limiting ones now. No need to search for unknown problems or demands.
- Better fit with reality. Possibility to provide an answer that suits the local situation
- Effective on local level and short term. Some end-users, can work better immediately.
- Possibility to have quick-wins

Disadvantages

- Directionless, unknown destination, has no direction, no predefined goal
- Reactive, opportunistic, follows
- Constant pressure (when problem or need already exists)
- Lack of consideration for the effects and implications on the future
- Clueless about what will be the end result over longer period of time
- Does not recognise or consider the overall system, the supra-system the overall environment
- Not scalable
- Risk: One change may create issues else where due to limited scope
- Risk of oversimplification because of reduced scope and thus bad solutions
- Greater risk for symptomatic problem solving
- Ineffective at global level: risk of sub-optimisation, incoherencies, following wrong priorities, unnecessary work, no value creation, …
- Ineffective in the long term: over time is likely to lead to fragmentation and chaos
- Unpredictable



Bottom-Up Approach / Demand-driven

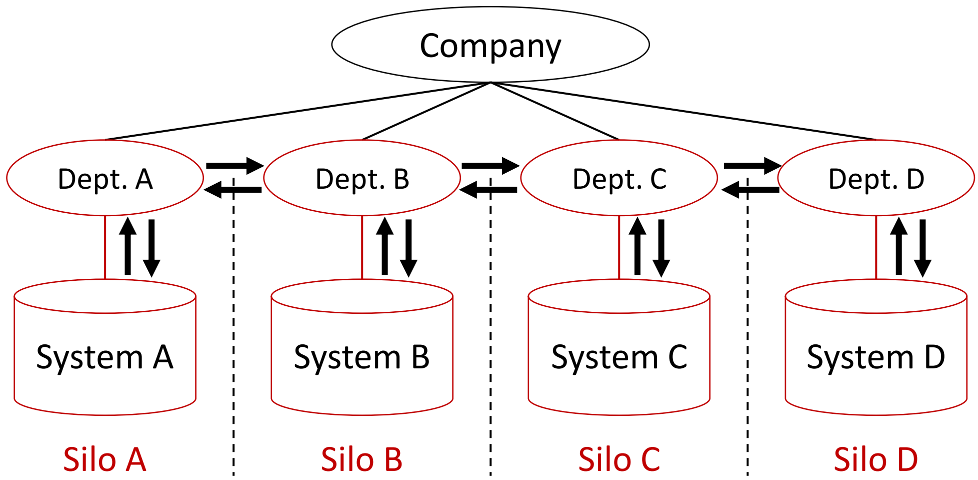
Electricity & telephone cable network

Principle: A wire (feature, process, …) is added when needed, when demanded. And this is repeated, and repeated, and repeated, … endlessly.

- We are only interested in the results … the concrete, tangible & visible results.
- What works is good enough. Really?
- This is what source code looks like (the picture represents metaphor; the source code is actually significantly more complex). The source code is not visible to many. So it is ignored.
- Efficiency? Adaptability? Evolvability? Finding bugs? Fragility of the system? These are also results, time (delays), cost & risks
- Yes, but … no technical debt is allowed and we do refactoring, …
- Really?
- Demand-driven, by definition, creates lag. Lagging means pressure. No time for rethinking, re-engineering, refactoring or even cleaning up source code.
- Imagine this after 100, 1000, 1000000 repetition of new demands and changes … without clean-up

Same is true in many domains, such as rules, policies, processes, data, etc.. It’s all hidden under the surface.
We don’t see it or/and we don’t want to see it.

Lesson from Silo Development



Historical:

Each department, service or business function was automated. It received its own system. Scope was limited to the organisational unit or business function. Systems were build sequentially over several years. They were built independently from each other. Sometimes different technologies were used.

Main Problems:

1. Communication between systems was troublesome or impossible
2. Incoherencies in logic within the different systems
3. Lack of standardisation, fragmentation
4. Logic is Double logic – No reuse
5. Information sharing is difficult
6. Overall solution is very inefficient

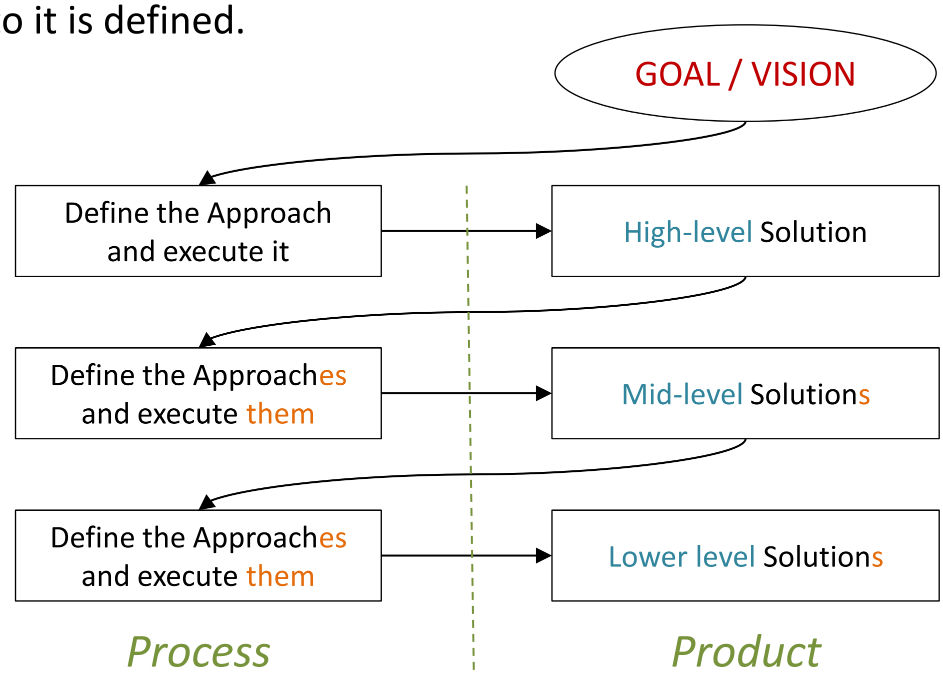
Causes / Lessons to be Learned:

1. The high-level overview with which is started is still too low
   (in the top-bottom approach, the top must be higher)
2. Problem domain and scope are too limited (limited to the problem). It must be wider.
3. Cross-boundary view is missing

Note :
EAI solved the consequences and made everything more complex. It didn't solve the causes.

Top-Down – Approach

Companies and organisations are driven by a vision, an intended future situation and by goals. They create the future they want. The path to it is defined.



- An approach is defined to conceive a global solution that will meet the goal.
  By executing it, it will produce a high-level solution.
  This solution can be broken down and approaches can be defined to conceive the mid-level solutions or to detail the global solution more.
  This refining process is repeated.
- We may have a layered problem or a layered solution.
- The solution may be expressed as an architecture and many kinds of different models.

Top-Down – Approach

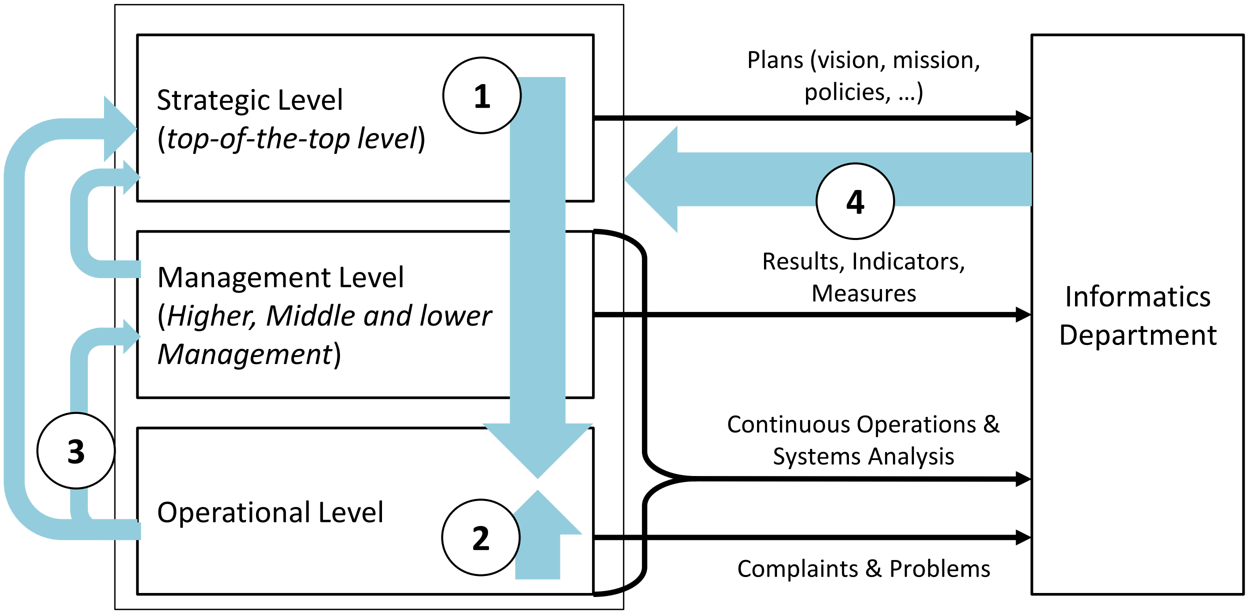
Advantages

- Often driven by higher vision, mission, goal, purpose, strategy
- Allows to build a certain future
- Is necessary to undertake larger and more complex initiatives
- Fits most company cultures and core of the companies or organisations
- Allows to conceive solutions at all levels
- Greater visibility over time
- Direction and greater clarity
- Easier to design an architecture and thus to have a clearer view of the product organisation, qualities, functional and logical coherence, security, etc.
- Easier to keep a structure and organisation clean
- Scalability in product
- Scalability in process
- Easier to identify ‘all’ the business stakeholders
- Dependencies can be more easily identified
- Easier to guide, coordinate and manage
- Allows to be much more multi-disciplinary because the scope is larger.
- Alignment of teams and means (resources)
- Allows to better manage pressure
- Overall optimisation is possible
- Allows to better consider impact in a broader area and effects in the longer term
- Requires advanced skills. Employees are more competent.
- Issues can be tackled at their true level of complexity
- Lesser changes

Disadvantages

- Risk of not matching the low level practical reality and smaller needs. But this is easier to solve.
- We may discover skeletons in the closet
- May fit globally, but it may not match the practical issues, difficulties and needs at the operational level. *If the overall system is well-designed, it can then more easily be adjusted to this practical reality.*
- Not suitable to obtain quick-wins

Induction Flows of Changes



1) **Top-Down**: Guidance based on plans. Long Term. Defines the overall structure and main functions. Pro-active. Vision based. Strategy implementation. Business Model implementation.

"THINK BIG, ACT SMALL"

2) **Bottom-up**: "Think Small – Act Small": Solving local problems, filling gaps, fine-tuning, removing local obstacles, short term, local needs, reactive

3) **Bottom-up tackled top-down**: e.g. emerging strategies becoming overall strategy; groups of local issues requiring top-down approach in order to ensure alignment and integration with top-down (avoiding opposite evolutions)

4) **Engineering-driven and Technology-driven changes**:

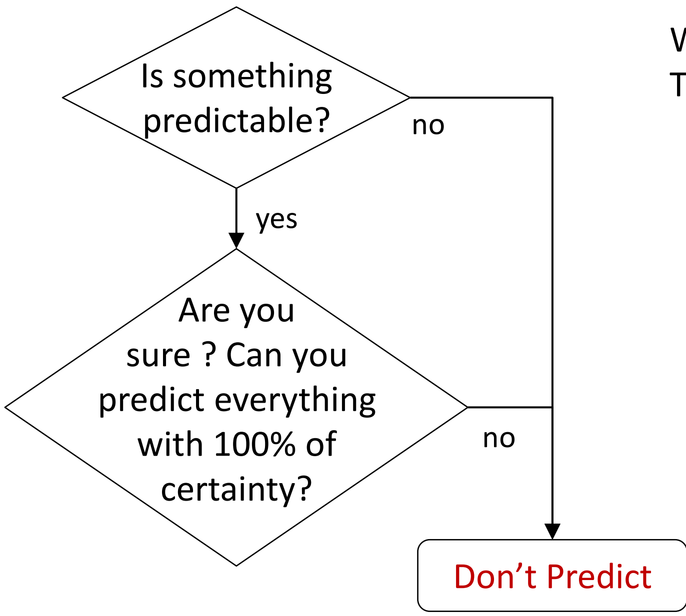
Engineering-driven: through continuous Analysis, new concepts, ideas, optimisations, and other improvements and innovations

Notes

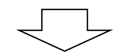
Environmental scans may detect changes, obligations and opportunities in the environment. These may trigger one of these flows.

"Think small, act small" = short quick wins; no fundamental changes; creates chaos.

Predictability



World = Constantly Changing.
The future (world) is unpredictable



Don't predict

Lazy thinking
& fallacious reasoning

- Some things are predictable, others aren't or are lesser
    - Statistical
    - Estimations
    - Cause-consequence relations
- Degree of uncertainty (not black or white)
    - "x% chance that …"
- Predicting under some assumptions
    - Expressing assumptions or conditions under which the prediction is made. ("Assuming that …, then this is likely to happen")
- Accuracy of the prediction
    - expressed as a range (margins; between x and y)
    - as a set of possible cases (this, that and/or that)

Predictability

Making prediction is not guessing or thoughtlessly expressing a possibility

Predicting is a genuine and painstaking effort

Increasing the quality of the prediction

- Having good information
- Understanding the matter
- Understanding the forces at play and the evolution(s)

An alternative to predicting :

BE THE LEADER - CREATE THE FUTURE

It is obvious that without the right information, without understanding and without being able to envision the future or doing the effort of envisioning it (analysis of the future), it is unlikely to make useful predictions.

"It is not because someone can't that it is impossible."

Dealing with Unpredictability

Unpredictability is inherent to software development projects … but ...

Reducing the Unpredictability

- Analysis aims to reduce the unpredictability and limit the issues
  - Learning and understanding
    - Business domain knowledge, Business expertise
    - Business environment
  - Right diagnosis done early
- Study of plans, objectives, intentions and expectations
- Verify, don’t assume
- Understanding of people
- Understanding the medium and long term evolutions (history, deeper underlying currents)
- Think, imagine, what-if, …
- Leading, creating / shaping the future, having a vision and goals

Ability to deal with unexpected changes

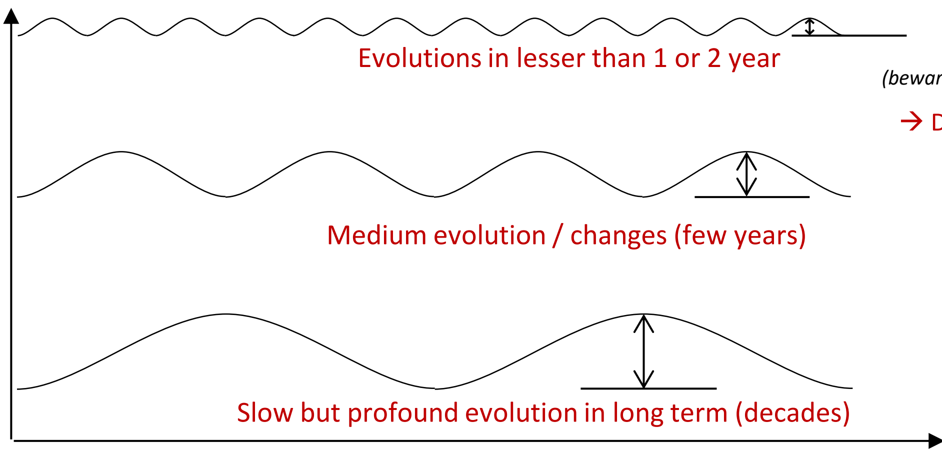
- Vigilance to detect conflicts, issues and opportunities early
- Be flexible and reasonable
- Increase flexibility through
  - A well-designed Architecture
  - Component Based Development
- Adapt plans

Before accepting the ‘Change’

- Investigate the cause and nature of the change
- Could the change have been detected through Analysis or through some more thinking?
- Is it worth (cost / benefit) (effort/benefit) ?
- Refused or accepted? Alternative solutions?
- Can different changes be regrouped?
- Do the different changes have something in common?
- Should the change be implemented now or later?
- Can the present solution be prepared for a future implementation? Or is a partial and phased implementation possible?

Environmental Evolutions and Systems

surface



deep

many – small – quick – little impact –
unpredictable –
short time frame –
short term survival
(beware of effect of high numbers)

→ Deal with it bottom up,
in an adaptive way

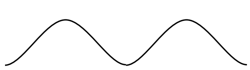
few – large – slow –
hugely impacting –
quite predictable –
planned –
guided –
long term survival –
used to shape the future

→ Deal with top-down

A Few Examples

- Advertising, Product promotion
- New products, changes in products or services
- Seasonal changes (predictable)
- Competitor suffering an adverse event
- Small political conflicts, economical glitches
- …

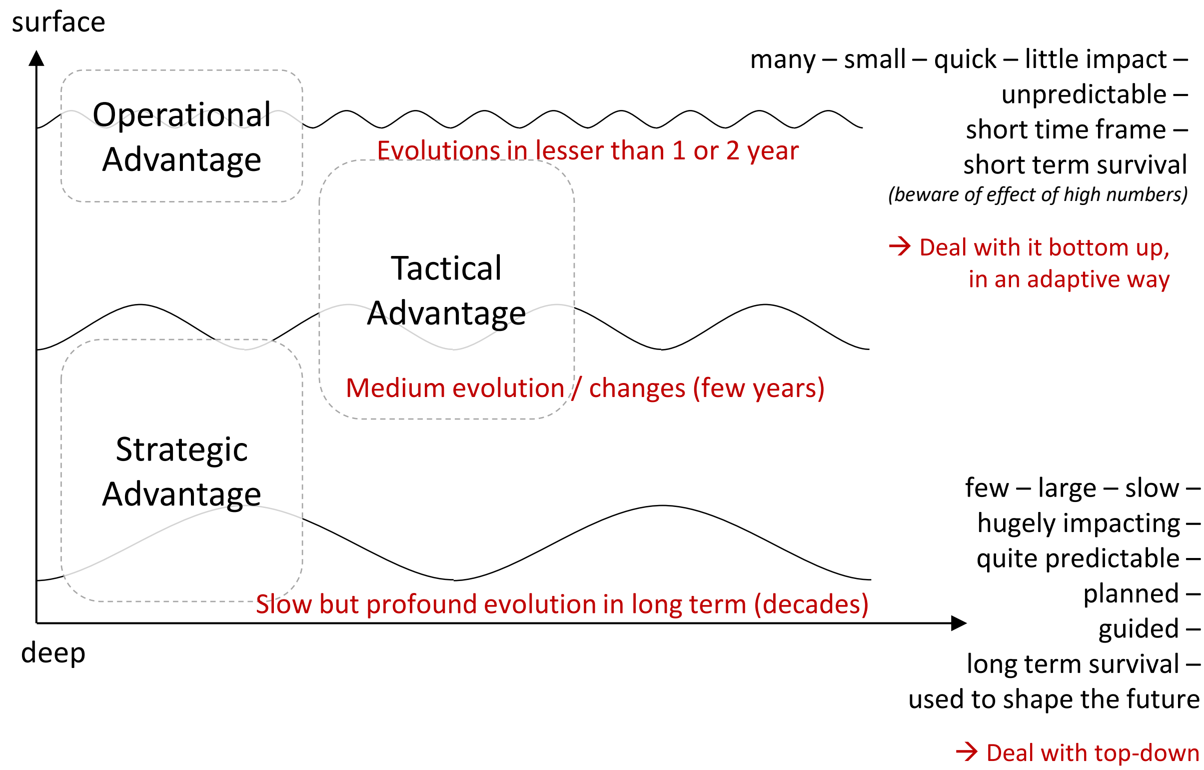
- New laws, new government and politics
- Changes in distribution network
- Changes in collaborations
- Products and services having a greater impact on society
- …

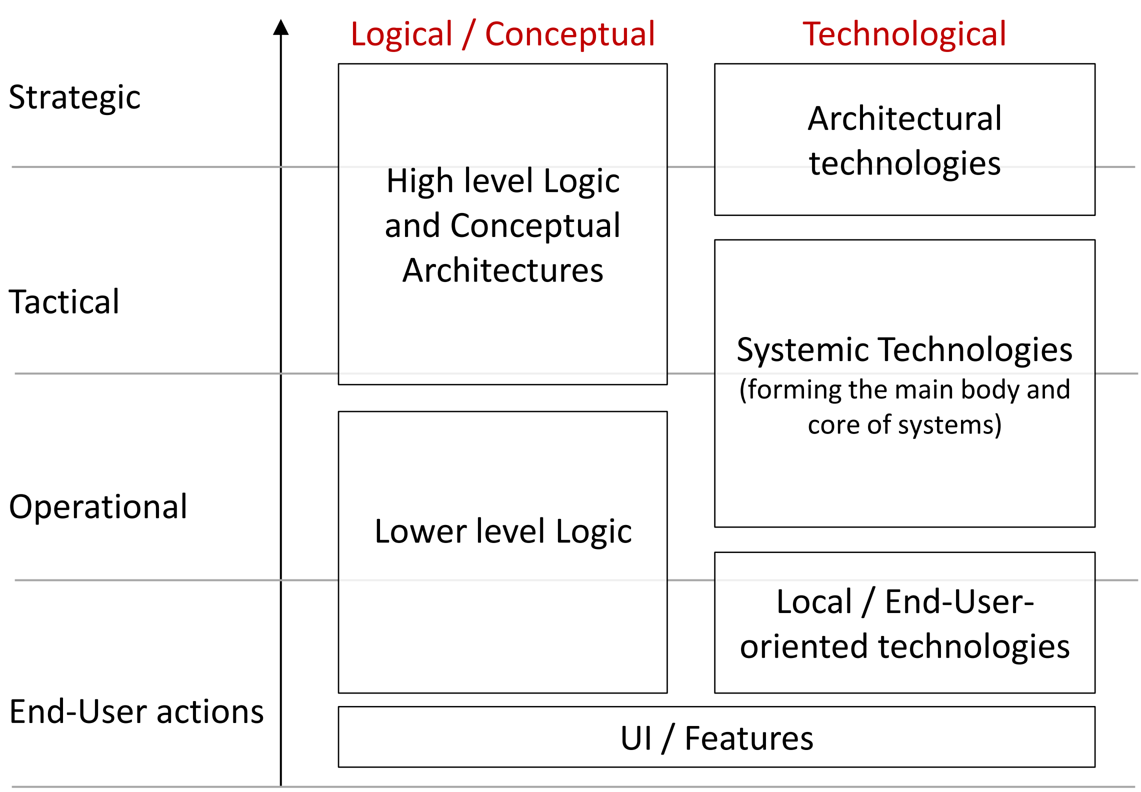


- More diversified, smaller and localised energy production
- Increasing automation
- Artificial Intelligence
- Evolution of education
- Aging population
- Imbalances in society
- Emerging economic powers
- Transition from fossil energy to cleaner forms of energy
- …

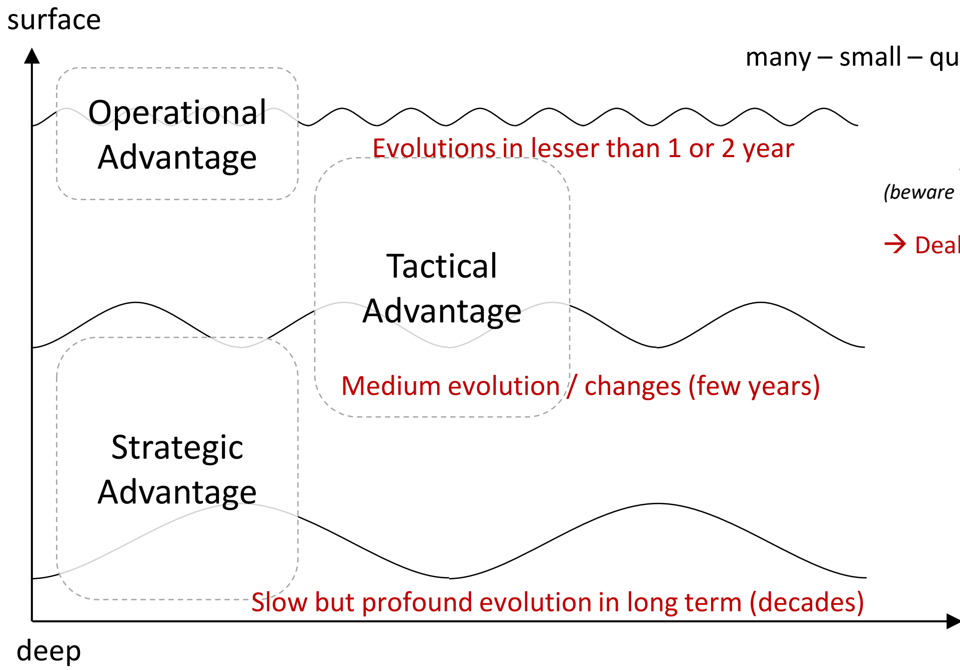
To ponder:
What is the most suitable to base the architecture of a system of systems upon ?
And what is the worst?

Environmental Evolutions and Systems





Environmental Evolutions and Systems



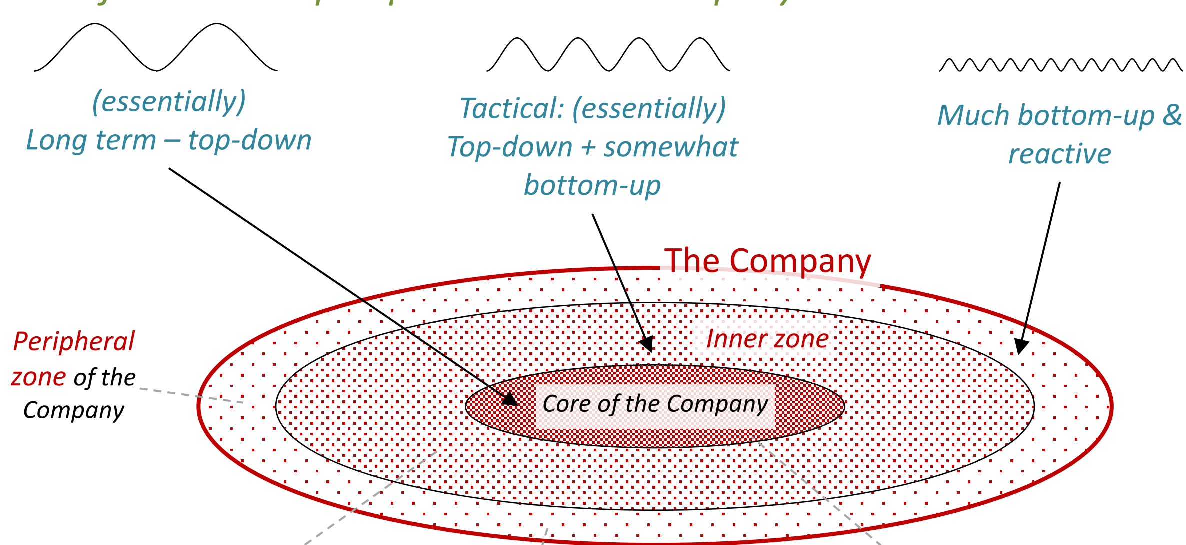
many – small – quick – little impact – unpredictable – short time frame – short term survival
(beware of effect of high numbers)

→ Deal with it bottom up, in an adaptive way

few – large – slow – hugely impacting – quite predictable – planned – guided – long term survival – used to shape the future

→ Deal with top-down

Logical (conceptual, functional), process (activity) and informational perspective on the company



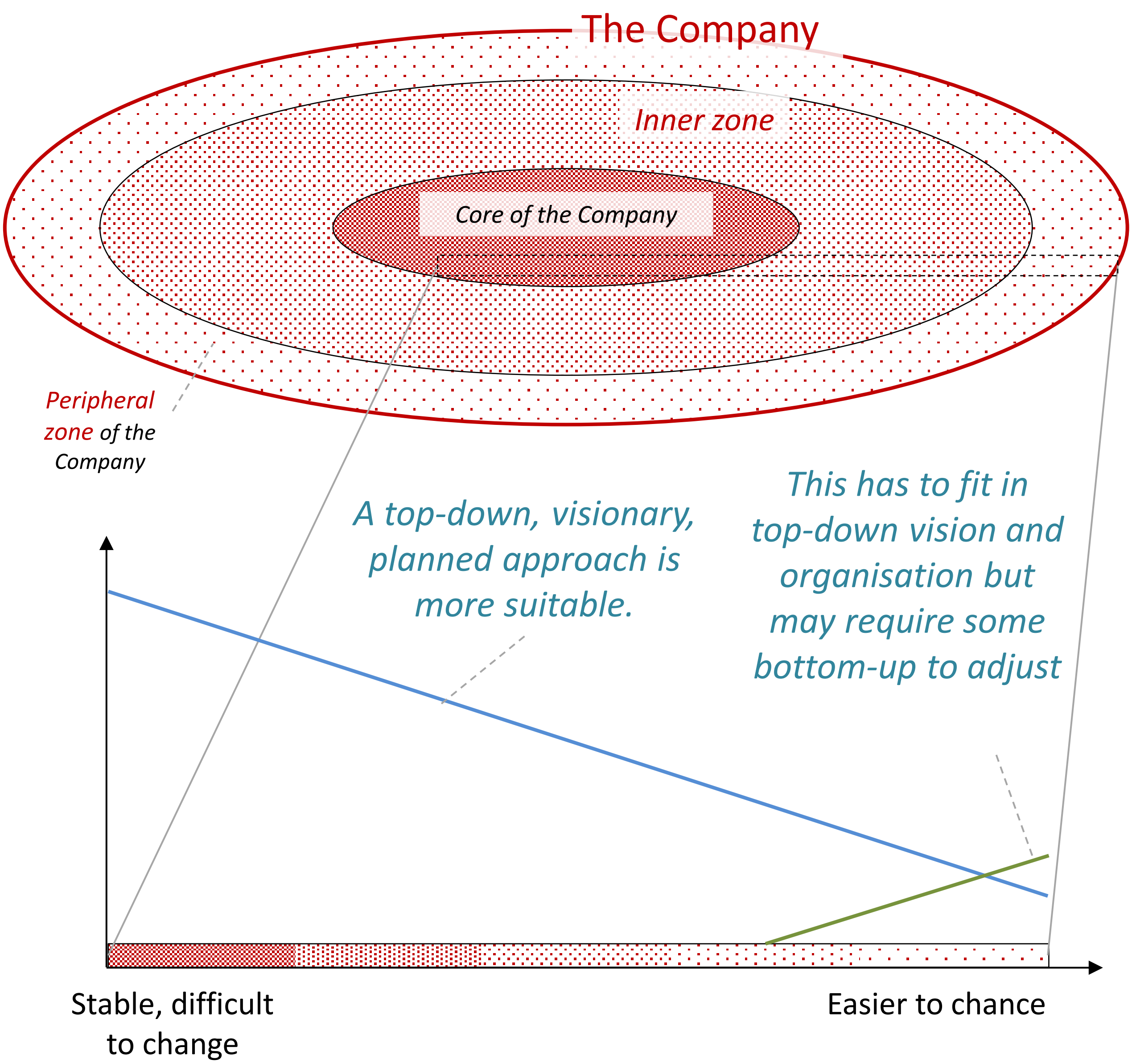
- Tactical logic
- Main operational systems
- Business Processes

- Core Logic of the Company
- Core Systems of the Company
- Enterprise–wide Core Architecture

- Peripheral systems (quickly changing, unpredictable, based on short-term logic)
- Detailed logic
- Logic related to end-users actions

Environmental Evolutions and Systems

Logical (conceptual, functional), process (activity) and informational perspective on the company



Note:

This represents a general idea and has to be understood as "in general, more likely to be more" (or "to be less"). It doesn't matter whether lines are linear or curved, or whether they cross each other or not.

Every company, situation and even specific issue is different. For each case, it is advised to think about whether the system, the company, the mission, the architecture, the design is more driven by a vision, a strategy, a plan, a global model or by spontaneous opportunities, or what part is most driven by what. This influences the choice for the approach, among others.

Chaos vs Structure (1)

We live in a Chaotic World

WORLD

Uncertainty
Dynamic
Hectic
Variability
Erratic
Vagueness
Opportunities
Purposelessness
Blurriness
Unpredictability

Create the needs of

Vigilance
Reactivity
Adaptability
Responsiveness
Spontaneity

The world is full of chaos. However …

There are countries, cities, road infrastructure, energy networks, companies, traffic rules, law systems, laws of physics, laws of biology and chemistry, thinking patterns, languages, planetary systems, ecological systems, economical system, software systems, and so on…

We live in a Structured World

WORLD

Organisations
Rules
Laws
Taxonomies
Logical mechanisms
Principles
Structures
Patterns
Systems

Allows us to

- Understand the world
- Deal with the world
- To anticipate
- Shape the world
- To function more easily
- To collaborate
- To communicate
- To evolve
- To invent and innovate
- …

Notes:

Note that the product of innovation is always a system, method or technology (something structured), something to get a predictable result.

Chaos vs Structure (2)

Purposefulness
Intention to shape the future
Limited resources
Competition
Investments
ROI

⇩ create needs of

Guidance
Control
Effectiveness
Efficiency
Speed
Focus

⇩ create needs of

Manageability
Measurability
Controllability
Predictability
Stability
Clarity
Evolvability
Harmony
Anticipation

⇩ create needs of

Rules
Structure
Method
Plans
Models

Chaos vs Structure (3)

DANGER ZONE

No delivery
No ROI
Chaos
Standstill

Uncertainty
Change
Opportunity
Reactive
Concrete

Quicker result and benefits on small issues
More in touch with real needs
Bottom-Up

Visionary
Predictability
Shaping reality
Control
Leading
Investment in future

Objectives
Management
Purposely
Ability to build foundation
Planning
Faster
Top Down
Anticipation

DANGER ZONE

Death March
Unsuitable product or system

WEAKNESSES

- Lack of higher purpose
- Short term-driven; lack of direction
- Reactive; lagging; pressure
- Following; not leading
- Constantly changing (rework)
- Moving target
- Foresightless
- Lots of unsuccessful attempts and failures
- No predictability
- Inefficiency, sub-optimisation
- Fragmentation
- Incoherence
- Slow
- Costly
- No idea of the end-result, of the global system being created, of the final destination
- Evaluating real progress in long term evolution
- Responsibility?
- Manageability?
- Security? Other required system's characteristics?
- No long term expectations
- How to get investments?

RISKS

- Are the emerging system, emerging architecture and emerging characteristics good or bad?
- May lead to inefficient systems
- May lead to overly complex systems

WEAKNESSES

- Harder to stay in touch with reality
- Harder to guide and plan in tune with reality
- Slow to detect opportunities
- Difficult to detect changes and to adapt
- Difficult to get balance between productive activities and control and managerial activities

RISKS

- Assumed predictability
- Ignoring uncertainty
- Overly rigidity
- Losing touch with real needs, issues, ..
- Bureaucracy over progress and results
- Overly control
- Sticking to plans and to models

Some mechanisms can be put in place to reduce and even reduce risks.

Chaos vs Structure (4)

Chaos	Structure
Difficult to grasp	Easier to understand, Clearer
Hard to maintain systems	Easier to maintain
Hard to manage systems	Easier to manage
Hard to measure (except I/O)	Easier to measure
Hard to optimise systems or their environment	Easier to optimise
Difficult to change	Easier to change
Risk of side-effects	Smaller risk for side-effects
Hard to react in case of problems	Easier to react
Lesser likely to be scalable	More likely to be scalable
Confuses the mind	Guides the mind (thinking)
Steep learning path	Smoother learning path

STRUCTURE IS IMPORTANT

A structure means something organised and defined. It doesn't mean "fixed", "unalterable", "set".

A structured and organised environment supports the normal activities. We don't need to think too much about it. The focus can then be directed to creative activities.

Example: We can rely on public transport system (structure) to commute daily to work. If we had to spend two times a day to find out how to get to the job or to home, we would waste a lot of time and energy. This time and energy can now be spent to more creative activities. Similarly, some habits allow us to save time and energy.

We can play follow the structure or (temporarily) stepping out of the structure. A structure can be adapted when needed.

A structure (rules or any other formalised element) doesn't allow to deal with a specific situation. The structure doesn't allow this. We stop following it and do what is necessary, while staying as close to the structure. Once the job is done, once the situation allows it, the structure is followed again.

Chaos vs Structure (5)

The world is partly structured. → A company needs to be able to deal with both parts ← The world is partly chaotic.

What we don't want: Chaos

→ Confusion, steep learning path, unpredictability, how to produce desired results in a chaotic environment?, difficult to understand and to control, inefficiencies, risks, costly, difficult to adapt, paralysis, …

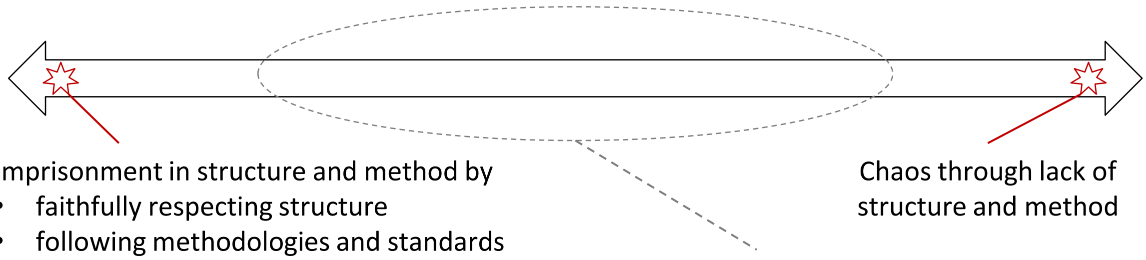
How To Solve this? Structure and method

Structure and method organise, bring order, provide clarity, allow efficiency, effectiveness and provide structural flexibility, allows to deal with a higher degree of complexity

Need for manageability, efficiency, effectiveness, control, clarity ⟺ Need for ability to change, flexibility, adaptability, reactivity

Conflicting?

Chaos vs Structure (6)



Imprisonment in structure and method by
- faithfully respecting structure
- following methodologies and standards
- applying principles systematically and strictly

A more flexible way to deal with structures, procedures, rules, …

Chaos through lack of structure and method

Systems, structures, procedures, processes, rules are put in place to increase the efficiency and effectiveness. That's their purpose, their goal.

They should not hinder work !!

1) Implement structures (processes, …) containing alternatives and "free area's"

   The executioners can decide how they work within predefined free area's, boundaries, …. (example: case based processes, methodologies, …)

2) Following the structure, processes, .. in a more flexible way

   A situation which can't be solved by following the predetermined pattern (system, structure, …). Either the pattern is adapted, be it temporarily and locally, or the particular situation is dealt with outside the predefined pattern. The executioner stays as close as possible to the predefined pattern and follows it again as soon as possible.

3) Implement structures suitable for adaptation

   The more modular the structures, systems, processes are, the easier it is to adapt them.

4) Capability of Vigilance

   Mechanisms offering Vigilance can be implemented in systems, processes, … This is the implementation of monitoring mechanisms, controls, functions of environmental scanning, mechanisms to collect complaints, ideas, issues, opportunities, innovation, …

5) Adapt systems, structures, processes, procedures, plans

   They should improve and evolve over time.

<u>Notes:</u>

Systems, structures, processes and other guiding structures make sense, are valuable and are meant to help. It makes sense to follow them as long as they are suitable and to handle in a different way when necessary. Getting a result is more important than blindly follow predefined patterns.

Chaos vs Structure (7)

Predefined structures are often considered as

- to be respected and executed literally all the time
- static
- unalterable
- dictating
- rigid

This assumption is often a matter of perception, interpretation, preconceived ideas and maybe a few other reasons. It is our own mind that deals with it in a rigid way.

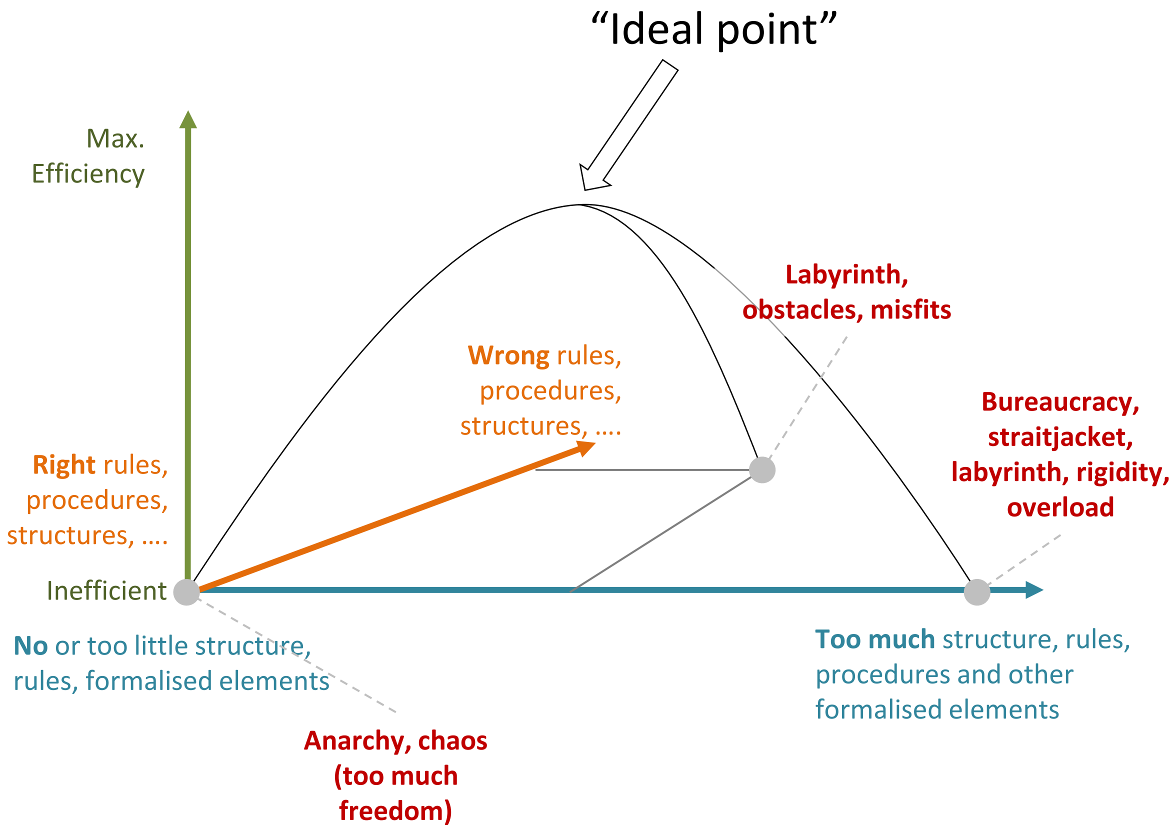
They are very useful and offer a great flexibility, freedom and facilitate the functioning of the mind.
Our society is based on systems, structures, processes, and so on.

A lot depends on:

- How they are designed
- What higher authorities impose as mandatory
- How the structures are used (or misused)

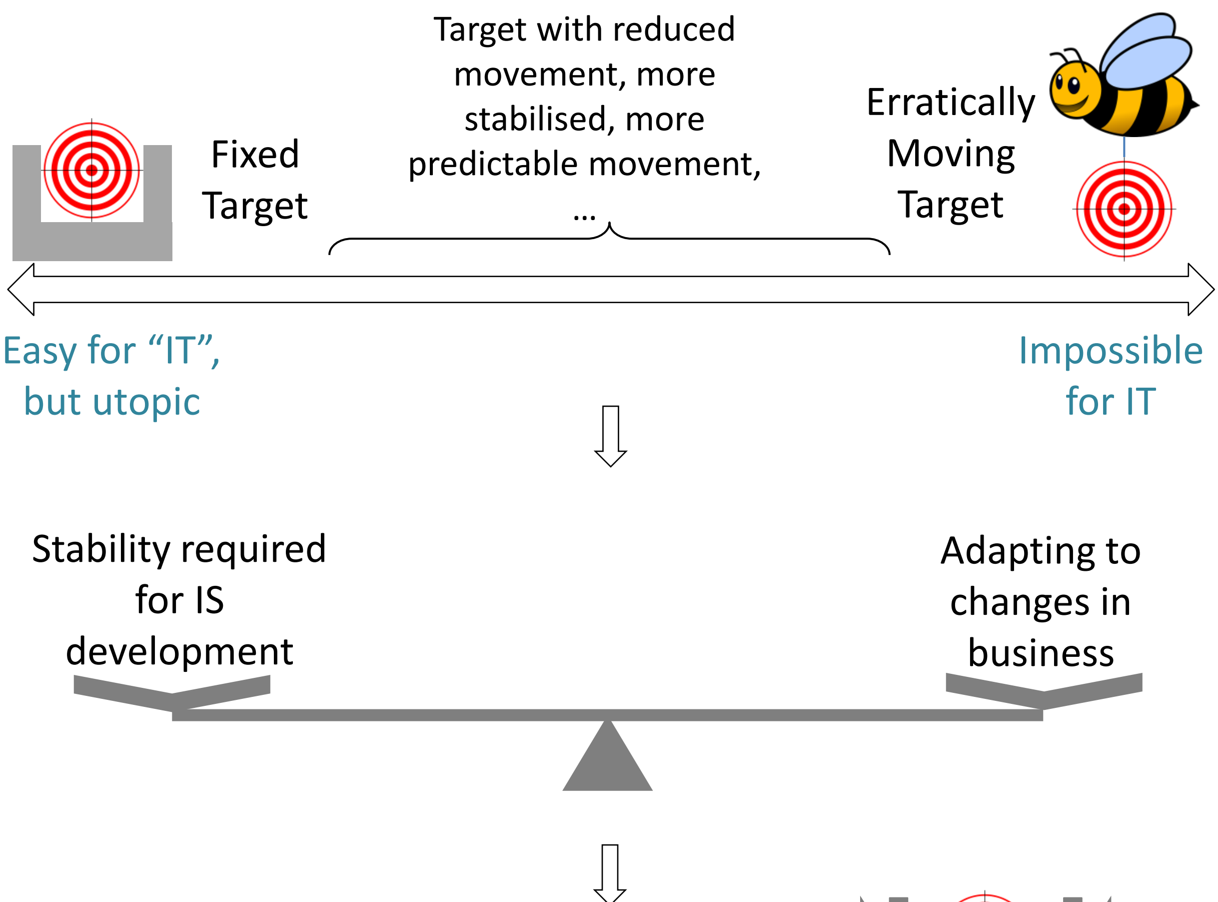
We shouldn't blame
the idea of "structure"
because of
a wrong design, application or use.

Chaos – Bureaucracy - Misfit



- A right structure is needed. It organises and clarifies a way of working. We don't need to worry about solutions already provided by the structure. The structure forms a foundation.
- But the structure shouldn't be strict. We have to be able to decide that, to resolve a specific situation, the best way is to temporarily and to a minimal degree ignore the structure. Once, this necessity is over, we fall back again on the structure.
- A structure may have periods of freedom and 'unstructured' areas, domains, zones, … of built in.

Changes vs Stability



Solution:

- Choosing target that is more/most stable
- Reduce movement of target
- Vigilance – shortening the path between target, movement, changes, issues detection and reaction
- Anticipate movements, changes, needs, …
- Offering flexibility

IS development is a slow and arduous job. It requires a maximal stability. But business and the business environment is not static. Both needs have to be taken into account.

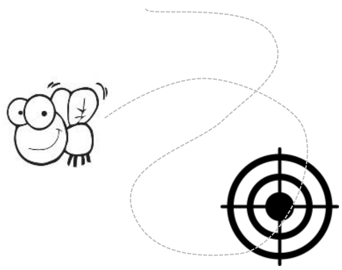
Variability of the Target

Project lifespan: -- Several months or even years

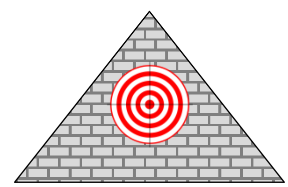
Duration of Customer Satisfaction: -------------------------- can be extremely short (individual & subjective)

Lifespan of a software system: -- 10? 15? 20 years?

Primary Target?
Secondary Target?



Moving Target



More Variable

More Stable

Lower-level Business Goals
Local Needs
End-users needs
Stakeholder's wishes
Stakeholder's satisfaction
Stakeholder's requests

Global Business Goals
Global Business Needs

Company's needs
Systems characteristics
Long term goals, mission, vision, …
Situational requirements

Value of Customer Satisfaction vs Value of a good system
(Appropriate, well-designed, …)

Control

Control is a VERIFICATION

Purpose (Why do we control?)

- **Guidance**, readiness for further progress, course correction, **adaptation**
- Evaluation, validation and **learning**
- Checking for issues and preventing **issues**.

Control is necessary to increase certainty, to ensure, to learn, to guide, to correct or adapt, to align, to take new decisions and to prevent problems, misuses, aberrations, discrepancies, deviations and regressions. It is necessary for decision making and to keep things on track.

Step 1: Verification → Step 2: Decision and action based on verification

Notes

Control and control mechanisms require effort and time. They cost.

Problematic uses (misuse)

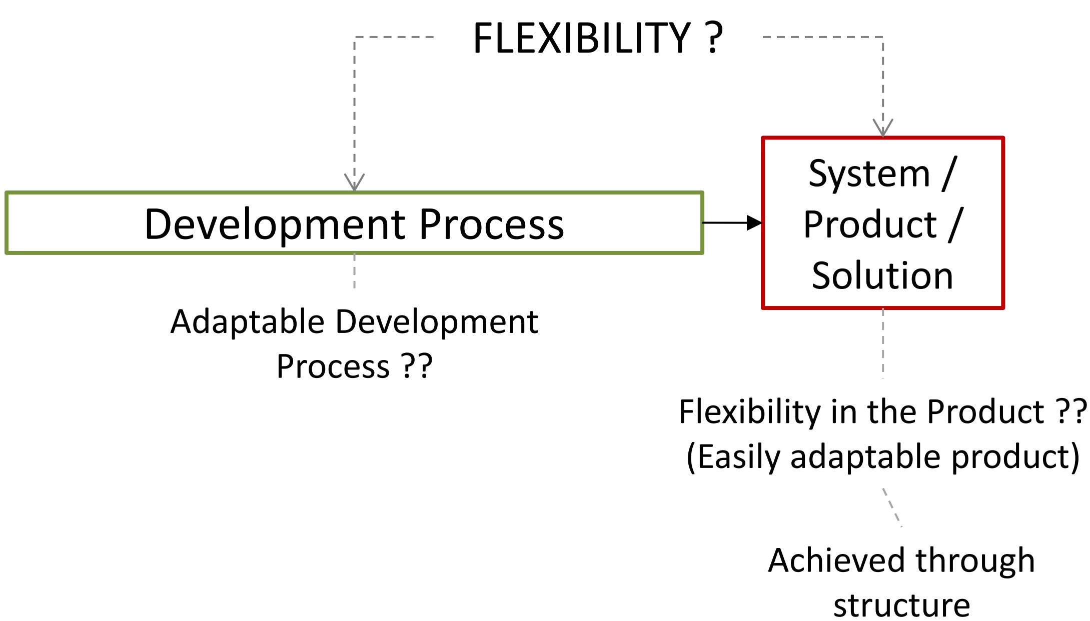
- overly guidance (usually at the cost of other important things); to pilot something that doesn't need or want to be piloted
- Control as verification if we stick to plans, respect rules, as a way to impose rigidity
- tool to exercise and increase power over something)
- freedom limiter (where freedom is required)
- creativity killer (imposing own ideas, decisions, …)

This might be the consequence of the attitude of the controller and the decisions and actions following the control. Control is then misused in an inappropriately exercised role or in a unhealthy relationship.

Flexibility (1)

"Need for Flexibility" doesn't mean anything

- Where do you need flexibility ?
- What kind of flexibility is needed ? How much?
- Why do you need flexibility ?



We are interested in flexibility offered by the product's structure and internal organisation. This allows

- to adapt easier to unforeseen circumstances
- to adapt the course of a strategy when needed
- to implement new ideas
- to more quickly seize opportunities

Flexibility (2)

Flexibility in the Development Process

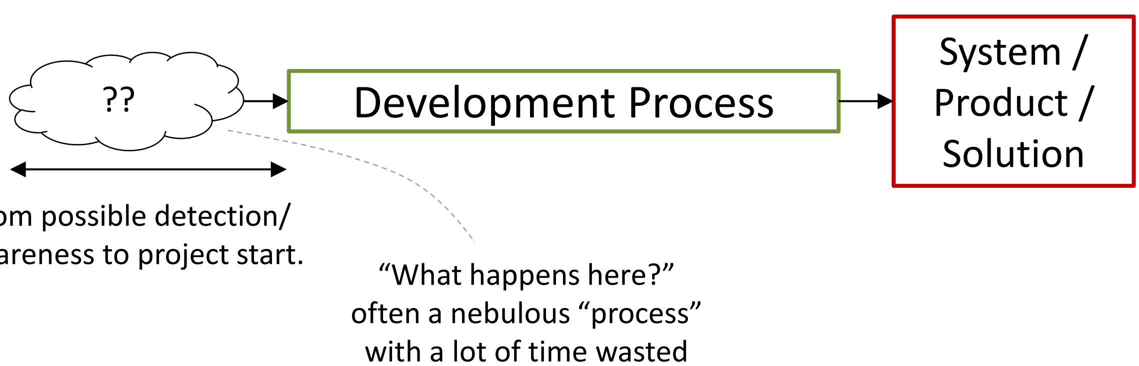
Inevitably, there will always be some need for changes in the development processes.

But flexibility is not the right solution to correct hasty and wrong decisions caused by a lack of understanding, which is caused by sloppy thinking or by a lack of good documentation.

It's better to solve the causes instead of the consequences. It's better to do things right.

"We may need flexibility to speed up the development process"

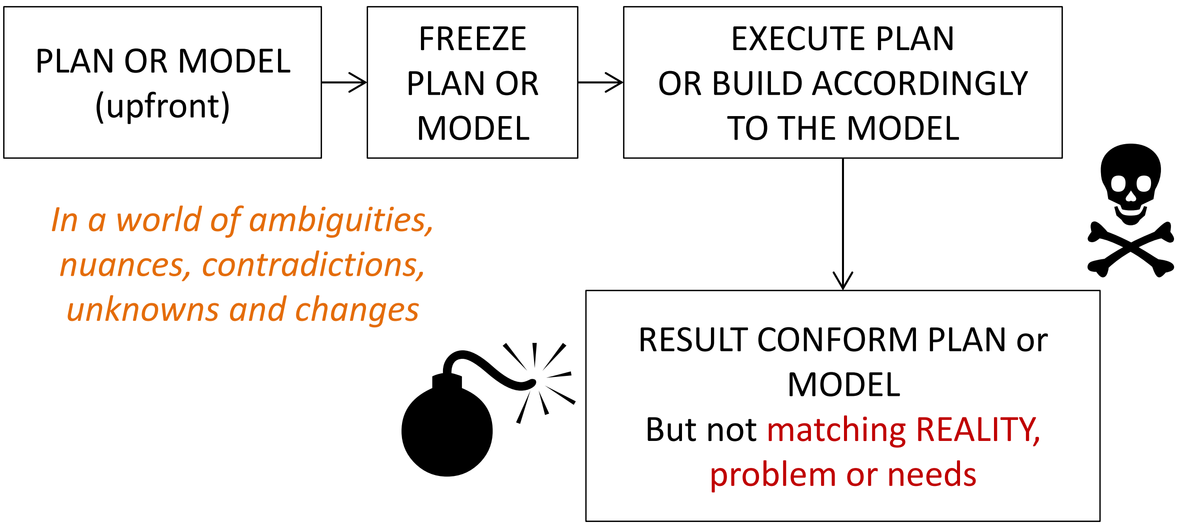
This is an assumption that is very questionable. Every change implies rework, thus some waste.



Notes:

If a lot of flexibility of software development process is demanded, it is a symptom of lack of mastery in the discipline; lack of understanding in the environment, system and mission; bad guiding and so on. Flexibility should, in essence allow to respond to unforeseen issues, not to alleviate lack of competencies, a bad approach or any other similar type of issue.

Planned and Modelled Systems



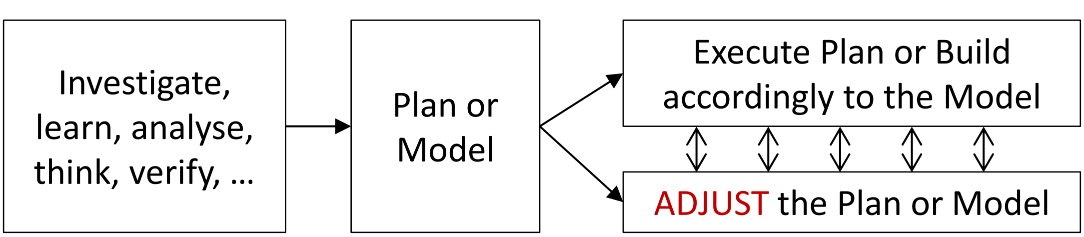
The risk for a failure increases when:

- the upfront plan or model is detailed
- the planning or modelling has been done, respectively, by a planner or a modeller lacking of appropriate skills, knowledge and insight and who is not in touch with the reality.

The mistake is NOT the upfront planning or modelling itself.

This model is based on the assumption that the plan or model is perfect and the denial of the existence of uncertainties, unknowns and changes. The mistake people made is to refuse the need for adjustments and adaptations later in the process. This is rather an elementary issue.

A Rudimentary Model to Plan or Model "Upfront"



Notes:

The adjective "planned" is often interpret as "determined upfront, sometimes by ill-informed or unskilled people, frozen(at least for some time) and executed as is". This interpretation has a very negative connotation.

Validation - Freezing

Validation

Confirmation that something is right, that the project is still on the right track. Validated elements has been investigated, analysed, verified and found correct. They are ready for further use. They should be stable. They are not meant to change anymore. Only, in exceptional circumstances like unforeseen events, they still can change if beneficial to the project. Change means also a delay, a cost and a risk.

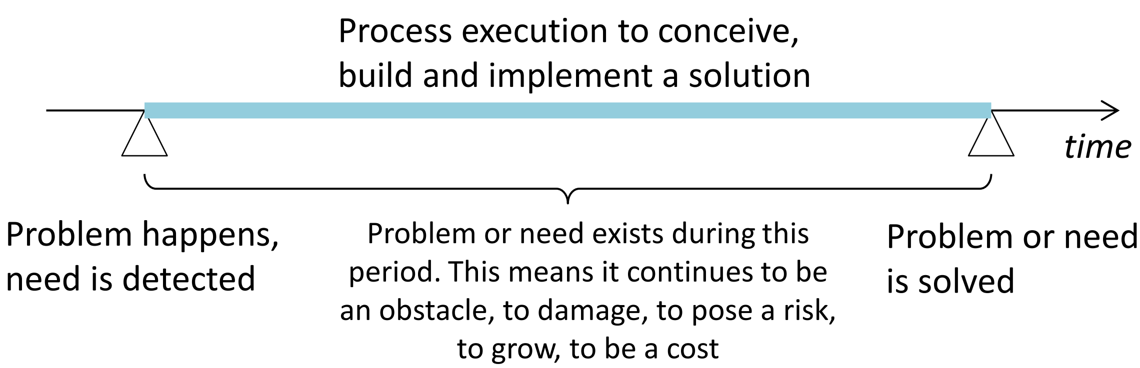
Freezing

Putting yourself or the project into a straightjacket until the end of the project.

Proactivity (1)

Proactivity is NOT about building features which are not asked for, which are unnecessary, just in case they might be needed.

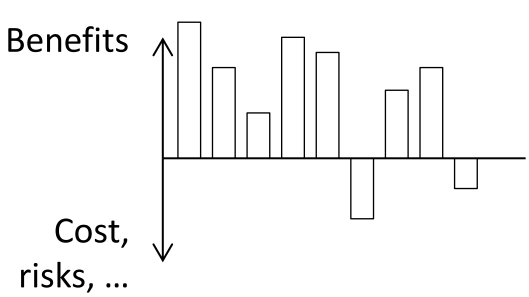
Reactive approach is acting in response to an issue that has already become a problem, responding to a demand



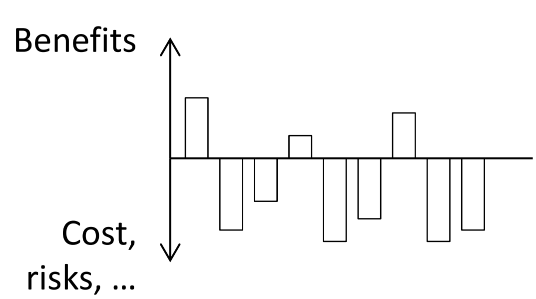
How to limit these costs and risks?

Proactive approach is to respond to potential problems and to future needs before they take place.

GOAL:
Benefits of profitable measures
> Loss caused by unfortunate measures

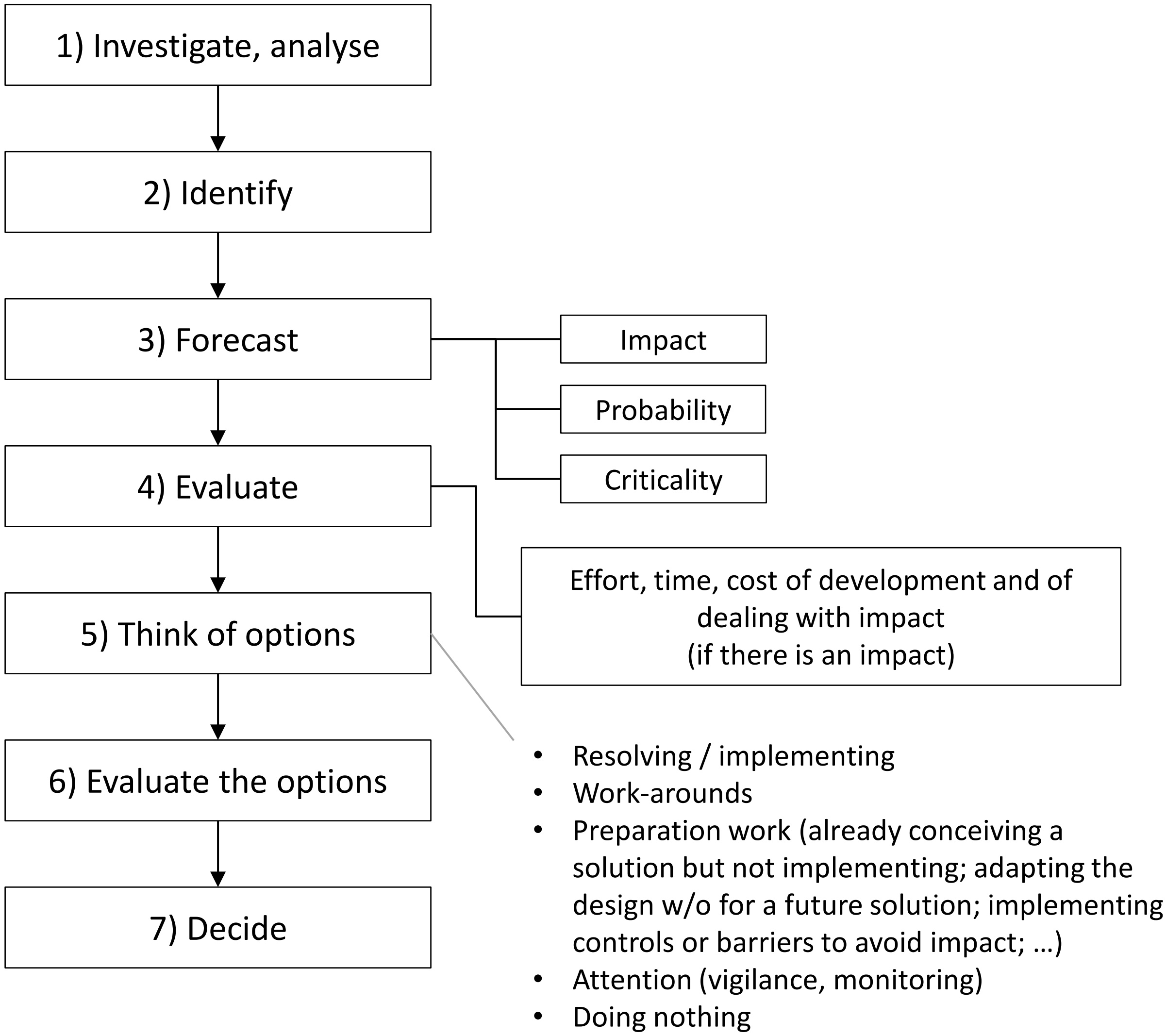


Result of right proactivity



Result of failed proactivity

Proactivity (2)



Proactivity is a conscious decision and an intentional action taken for each individual issue or opportunity.

Proactivity **can not be successful without understanding** the systems, the environments, the involved domains, the evolution of the company and without empathy. It requires mastery of the systems analysis discipline as well.

Notes :

This formal flowchart is often reduced to a few questions like : "Will this be useful?", "Does it cost a lot of effort?", "Is it good to implement it now?", "What is the best way to deal with it now and later?"

- We don't wait to implement breaks in cars until the driver needs it. Proactively, we forecasted that the driver will need breaks.
- We listen to the weather forecast to evaluate if we proactively have to take an umbrella or wear raincoat when going out.

Proactivity (3)

REACTIVE ATTITUDE / APPROACH

- Allowing the environment and events to control the course of actions; following the events as they happen
- Focus is on problems
- Being overwhelmed by problems, large back log.
- Under permanent pressure
- Not feeling in control
- Lacking of foresight
- Being unprepared
- Increased uncertainty
- Forced by circumstances to take decisions and to act
- Dissatisfied customers. Frustration. (experiencing many problems, waiting before they got solved, working under pressure → lower quality, …)

PROACTIVE ATTITUDE / APPROACH

- Avoids or diminishes future problems and firefighting
- Requires being truly competent
- Focus is on what can be changed and improved.
- Driven by higher values (get the most out of the environment)
- Define the course of actions
- Not just seeking to solve problems presenting themselves, but actively study the situation and look for opportunities.
- Much more planned progress.
- Increased grasp on future and evolution.

From Problematic to Innovating IT

5. Innovation	• Services • Working methods • Organisational structure • Capability acquisition • Business Model • Partnerships	*About sizeable innovation in business (not about small innovations with little impact)*
4. Driving existing business	Increase business volume, market share, profit margin, quality of service, reliability, reputation, ...	Strong & independent IT department
3. Alignment	Simply responding to present needs. Can be a normal and limited delay. Business is fairly satisfied.	Pulling Upwards
2. Misalignment	Not responding to the present needs. The business community can work. Existing IT solutions support some business activities.	Dragging Downwards
1. Problematic Enterprise Information Solution	IT solutions are more detrimental to the business than it delivers benefits.	Weak & dependent IT department

TCO – Total Cost of Ownership

SET-UP

- Purchase research & purchase process
- Hardware acquisition
- Off-the-shelf software acquisition
- Licenses, warranties
- Customisation
- Software development project
- Data migration
- Testing
- Set-up and deployment
- Training & documentation
- Development or configuration of interfaces to other systems

OPERATIONS

- IT Personnel
- Energy
- Audit & Testing
- Administration & Maintenance
- Support
- Security
- Insurance
- Upgrades and patches
- Training
- Change management cost
- Changes and enhancements
- Downtime, outages and failures
- Disaster recovery
- Depreciation
- Data centre and Infrastructure (acquisition, installation, configuration, management, maintenance, upgrades, replacement, ..)

LONG TERM

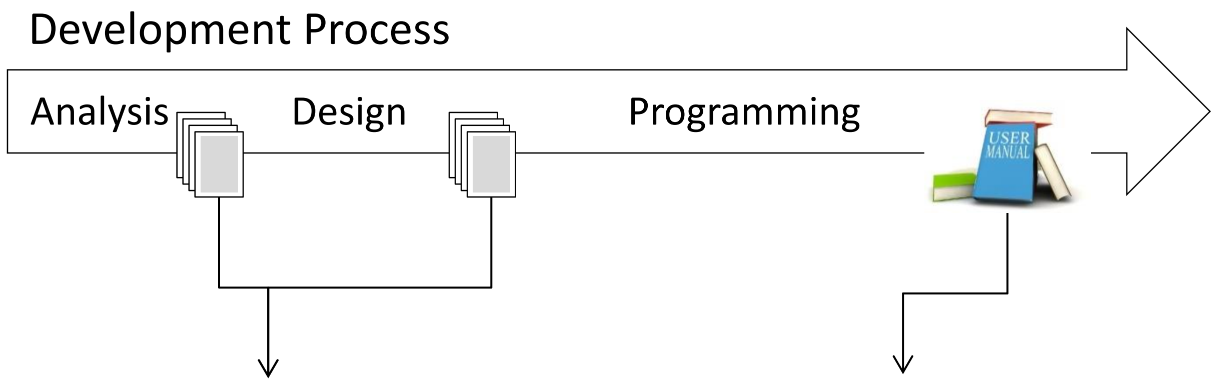
- Scalability expenses
- Replacements

DECOMMISSIONING

- Data export / migration
- Dealing with the archived data

- A 'solution' may not solve the problems or may solve the symptoms and create more chaos.
- A system may create problems. Cost for resolving these new problems.
- A solution may not be optimal. A better solution could have lowered the cost or bring more benefits.
- A sub-optimal solution may put barriers, obstacles, limitations.

SA/SD Artefacts ↔ Documentation



SA/SD Artefacts
Supporting the **thinking**
Supporting the **conception**
Supporting the **communication** among team members and stakeholders
Meant to facilitate the building process
"what has to be built"

For Analysts, Architects, Engineers, Developers, …

Documentation of what has been built. Produced often late in the development

"**MANUALS**" meant for users: installation, deployment, maintenance, administration, usage, limits, prerequisites, capabilities, …

System Documentation

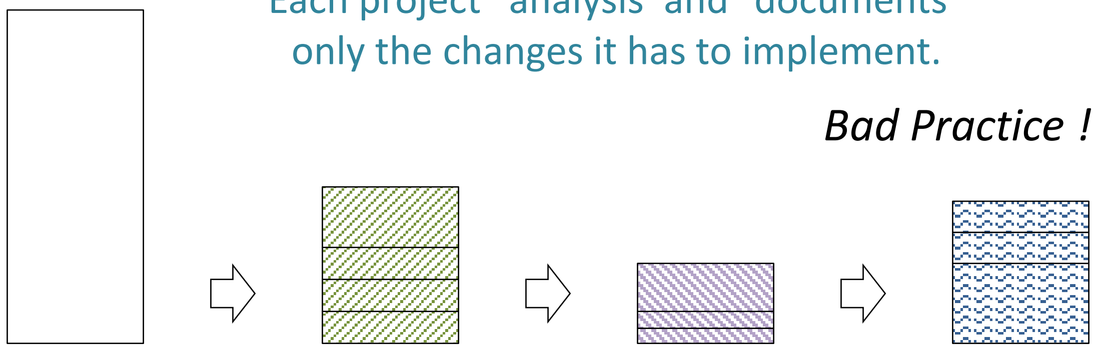
Serves as "input" in next engineering round. (else you need to re-describe the "as-is" every time again. Former to-be becomes new as-is. No need to re-describe it.)

Documenting Differences

Analysing / Documenting Only the Differences

Each project "analysis' and "documents"
only the changes it has to implement.

Bad Practice !!



1st Release
(initial project)

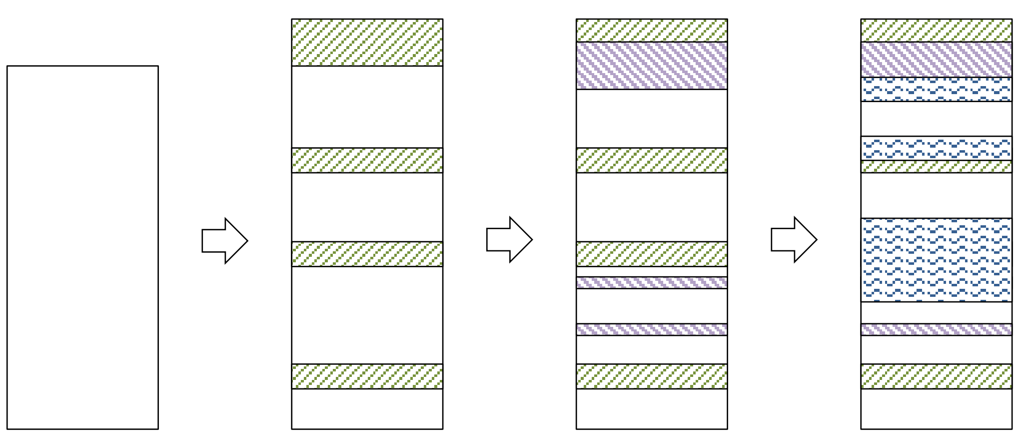
Changes of
2nd Release
(project 2000)

Changes of
3rd Release
(project 2001)

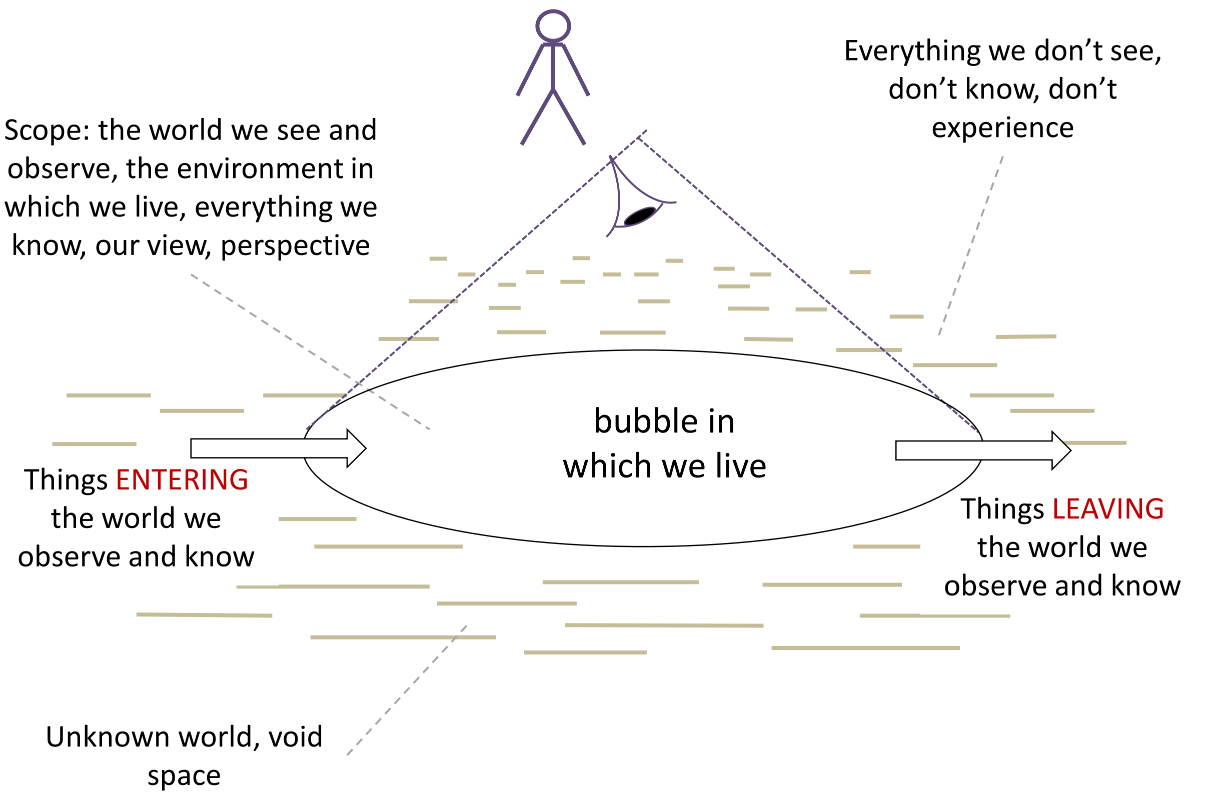
Changes of
4th Release
(project 2002)

- Advantage: Easier, smaller documents; Changes are easier to locate
- Drawback 1: To understand the present system, one needs to read the artefacts of the original systems, then chronologically all the artefacts describing the successive set of changes. → reading a lot of unnecessary things which aren't true today anymore = waste & confusing
- Drawback 2: No clear view of the entire system! → Hindering the understanding → RISKS!
- Drawback 3: Think of many versions later: Chaos ! This is unsustainable.

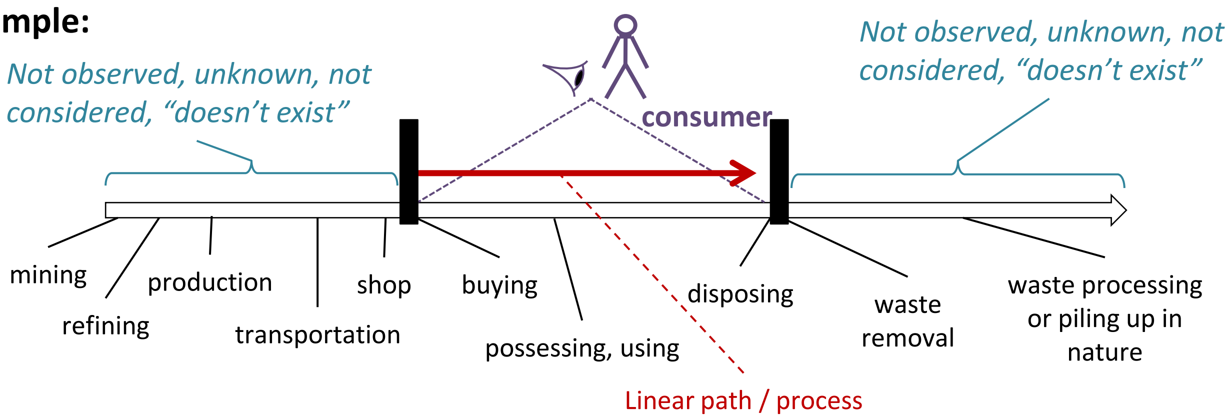
GOOD PRACTICE:
Document changes in the current system documentation/artefacts. This changed document becomes the new current system's documents.



Limited View



Example:

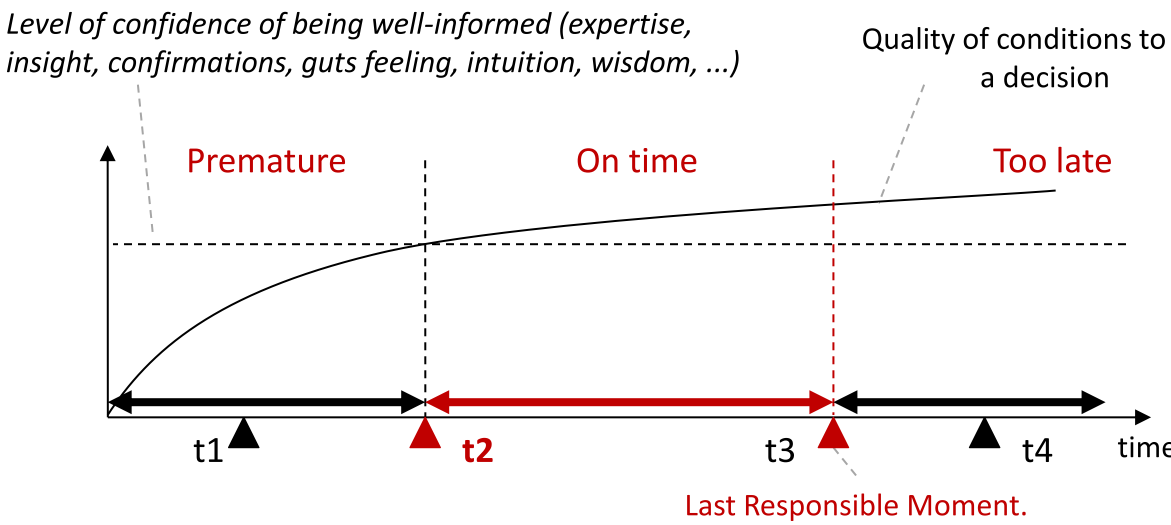


Notes:

The world we consider is often constrained within a defined zone. It often stops at some abstract or concrete borders (example SIPOC). We may consider a process until the perimeter of our own department, until the product is delivered to the client, until the information is delivered to the other organisation. Our mind thinks within the perimeter defined by a scope, a mission, a problem statement, a demand, a deadline, a month, a year or other limited period, a concept of action-reaction, our house, our street, our city, … our live. Our mind often limits our thoughts to a zone or timespan. Our thinking is not integrated into the larger world.

We consider our job and assume what we do integrates well into the larger picture, or, someone else will take care of it. Failing to consider and think outside our perimeter causes a huge amount of issues.

Last Responsible Moment



t1 : Insufficient information and insight; little certainty; closer to guessing; higher risks, ...

t3 : Last Responsible Moment. A decision taken here is still on time, but it can not be postponed. A decisions taken beyond the LRM is taken too late and will have more negative consequences. Question: How to determine the LRM ?

t2 : Decision is the ideal moment. Confidence of being well informed, of agreements and so on is fairly high or at acceptable level.

- Each decision not taken is an uncertainty. It may block work and other decisions.
- Each taken decision removes some uncertainty. It creates clarity and increases the stability. From the moment a decision is taken, it work can be based on it.
- A decision that is not taken can be a blocking factor.
- t3 – t2 = wasted time if decision is taken on t3

t4 : Decision is too late. Sometimes, it isn't even necessary anymore to take a decision.

Take decisions as early as possible, but not too early.

The curve is **illustrative** and depends of the specific situation. Factors for decision making can and have to be improved by actions:

- Information has to be gathered.
- Insight has to be acquired.
- Verifications are also useful.
- Agreements can be reached.
- Certainty can be increased.

Note: We may argue that taking a decision late leaves the options open. There is no guarantee that the decision will be changed. At one point a decision must be taken anyway. A taken decision can still be changed. So, there is no real reason to take decisions late.

BUSINESS-IT ALIGNMENT

Business-IT Alignment

Achieving perfect Alignment might be unrealistic.
The objective is to achieve the best possible alignment.

1. Alignment in the PRESENT – The Operational Level

Company’s Needs ⟷ IT Implementation

- Gap – Unsatisfied needs
- Limitations & Obstacles
- Complaints
- Issues
- Disappointing results

1. Detection and Identification of needs, obstacles, …
2. Diagnosis
3. Adaptation of the IT implementation

It is unlikely to achieve good results with demand-based reactive approaches. The lag is too important and too much time and resources are wasted.

It is possible to put in place mechanisms (early detection) and solution to reduce this lag and to facilitate adaptation (flexibility through structure).

With the alignment of the situation as it is today, companies also want to be aligned in the future.

Note:

Business-IT alignment is not a situation that can be reached and then forgotten. This state has to be maintained in time.

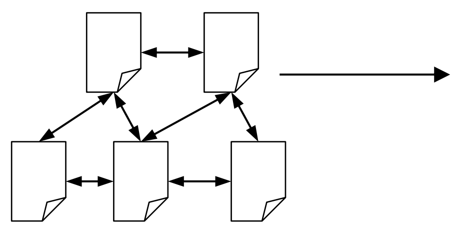
Business-IT Alignment

Maintaining the state of Alignment

With the alignment of the situation as it is today, companies also want to be aligned in the future.

2. Alignment in the FUTURE

A. PLANS



Plans are aligned

Gap with Implementation is Identified (known)

↓

Projects can be defined and start

Alignment of plans with

- Vision, Mission, Values
- Business Goals
- Business Drivers
- Business Priorities
- Business Timeline
- Business Budgets / Investments
- Business Functions
- Business Capabilities
- Business Model
- Business Operation Model

Important Note:
This is only a one-side set of targets to align with (the business perspective). Other targets are those related to the system's health and long term survival (see: System versus system Usage/Deployed Activity)

B. PROACTIVITY

The understanding of the environment, of people, of forces, of mechanisms, of evolutions help to align proactively (see subject "proactivity").

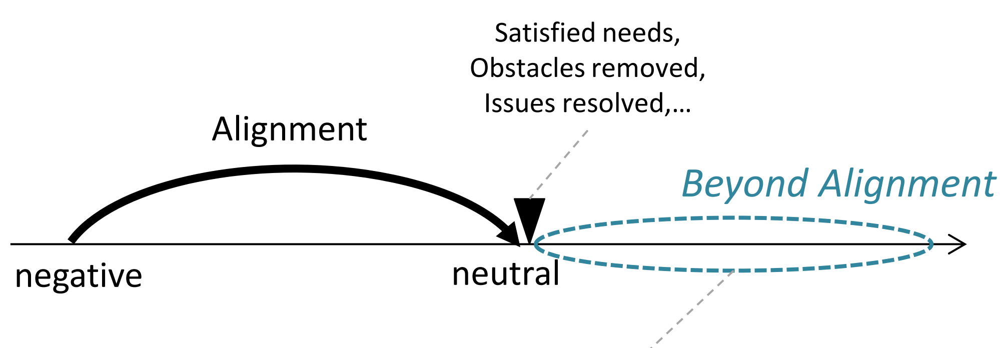
Business-IT Alignment

What do we want or need to Align? What can be Aligned ?

- Strategies, plans and priorities?
- Plans and allocated budgets?
- Overall capabilities with necessity and demand?
- Operational functioning and results?
- IT efforts and investments with business objectives?
- Systems features with the demands?
- Implemented logic with business logic?
- The limited and acceptable amount of submitted demands and a low rate of complaints
- …

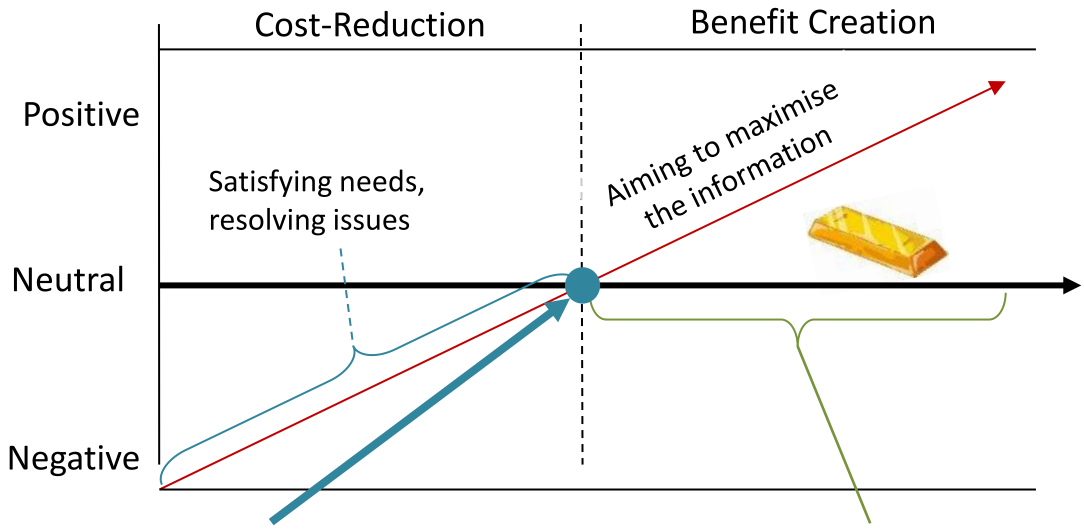
Alignment is about achieving a correspondence, a matching, conformance, an appropriateness, harmony, balance.

How about aiming BEYOND the state of ALIGNMENT?



DRIVING the Business
by
MAXIMISING INFORMATION EXPLOITATION

Beyond Business-IT Alignment



Business-IT Alignment Reached

Driving the Business

Business-IT Alignment =
"Successfully accomplishing what the business community asked for and what it needs"
= a single perspective (business perspective) based on limited insight in systems and in possibilities of Informatics

- Increasing business volumes and/or profit
- Supporting the business beyond the needs
- Lower the cost and risk beyond the demand
- Beyond the expectations and demand of the business
- INNOVATION

+

More information for strengthening and optimising the enterprise & for better management and guidance.

Impossible to be achieved by the business community

Hard to be achieved by 'IT'

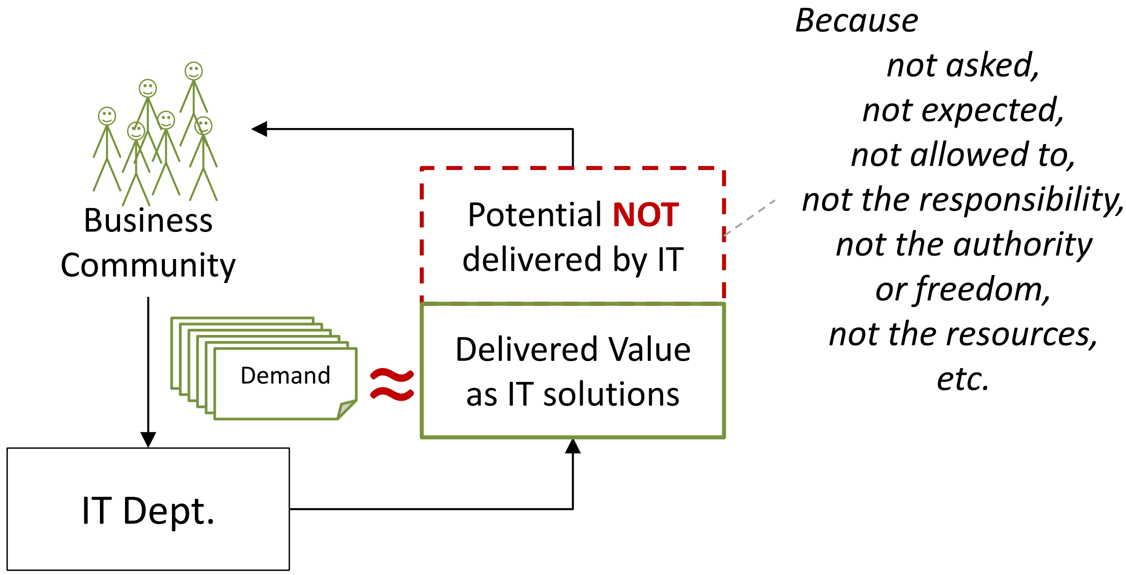
Can be achieved by Business Informatics

WARNING !
The quality of the enterprise as a system must not be ignored in this picture !!
(perspective of system vs activity)

Business-IT Alignment

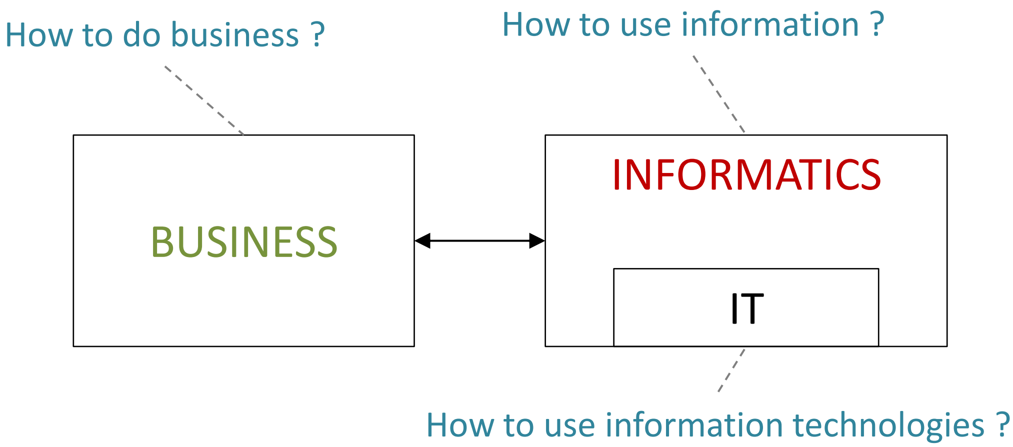
The IT implementation allows the business community to deploy and execute business activities in the way it intend to do it.

The IT implementation correspond to their demand and expectations and delivers the operational and financial expected results. It meets the business objectives.

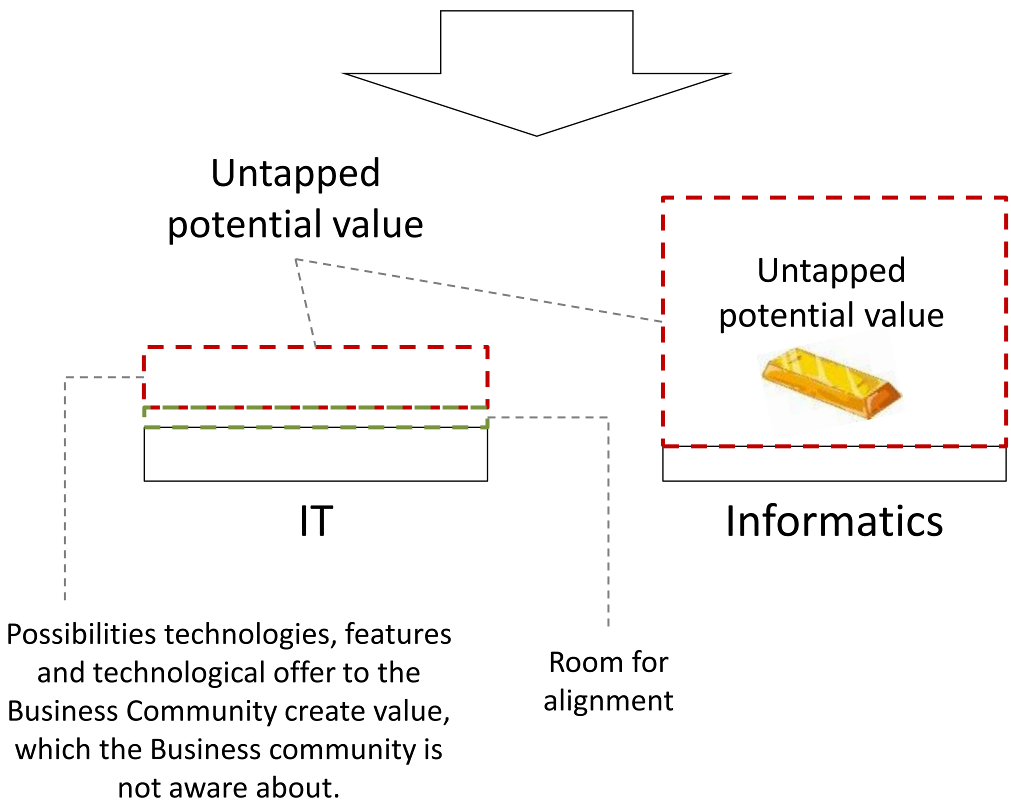


1. Business Community has a high level, general, business perspective and user's perspective, which is very shallow and narrow.
2. Business knowledge, responsibilities and goals can be siloed.
3. Business demands are oriented towards activity and results obtained trough activities and don't take the shape and health of the systems into account.
4. This approach can be lead to a piece-meal & stove-piped development.
5. What if the demands do not ask for the optimal (much better) solutions or even don't ask for the right problem to be solved ?
6. It is reactive.
7. Mostly operational (practical) or tactical demands (no big picture, no real or direct strategic contribution)
8. IT won't deliver (much) more than what the business asks for.
9. Creates pressure
10. Kills innovation

Untapped Potential in IT and Informatics



IT as sub-discipline of Informatics



Technology = Cost Saving

Informatics = Cost Saving + Business Driving

INFORMATION EXPLOITATION

Information in Companies

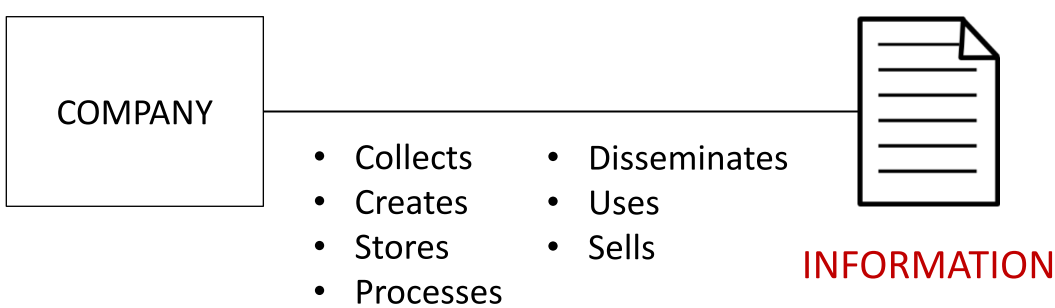
Page to be reviewed

Information is meaningful (valuable) to

- people
- companies and organisations

Information is a resources. It must be …

- Available → captured and stored
- Fit for usage → processable & processed
- Accessible
- Stored
- Organised
- Managed → manageable
- Exploited → exploitable, valuable, reliable
- Secured



Information is captured, created, processed, stored, disseminated and used by

1. People
2. Machines
3. Software/computer systems

Information is a Critical Resource

Page to be reviewed

Information is power. Information has value.

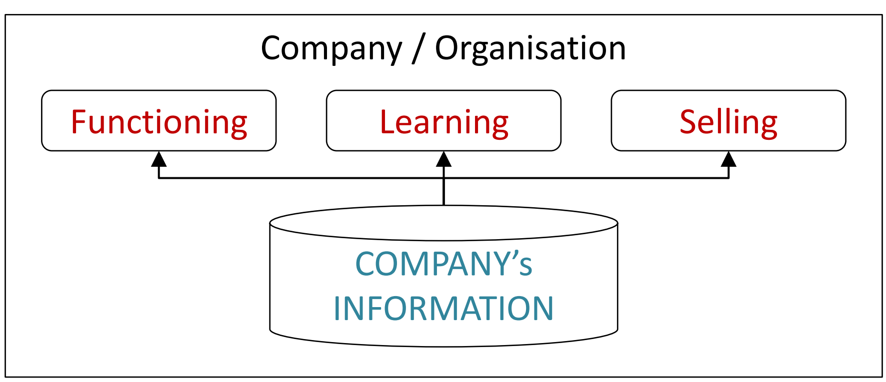
Information is key in decision making, choices, inventions, …

A company without information instantaneously stops functioning.

Information

- supports the functioning of the company
- supports the management of the company
- as product or service
- is knowledge / understanding
- is key to innovation

3 Ways to exploit information



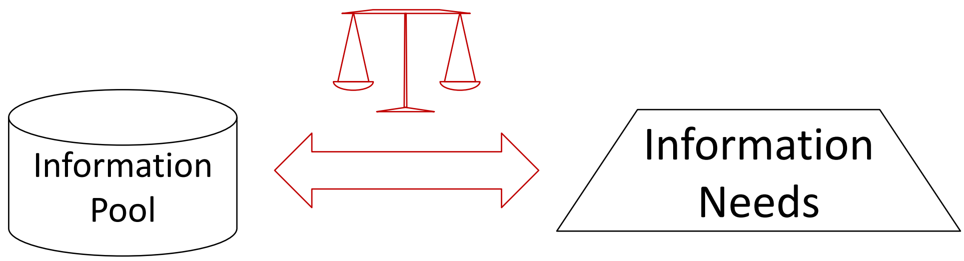
How to maximally exploit Information?

Information must be taken very seriously

Information Exploitation

Page to be reviewed

Value of Information is linked to the Needs and Usage



BALANCING
INFORMATION WITH INFORMATION "NEEDS"

Maximising

- the Quantity
  (of relevant information)
- the Value of Information
- the Exploitability of Information

Maximise the Usage

- Needs
  - Detected - Hidden ignored needs
  - Satisfied - Unsatisfied
- Opportunity

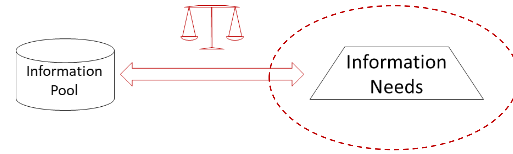
  "What can be done with an information that is valuable?"

Matching
Create correspondence

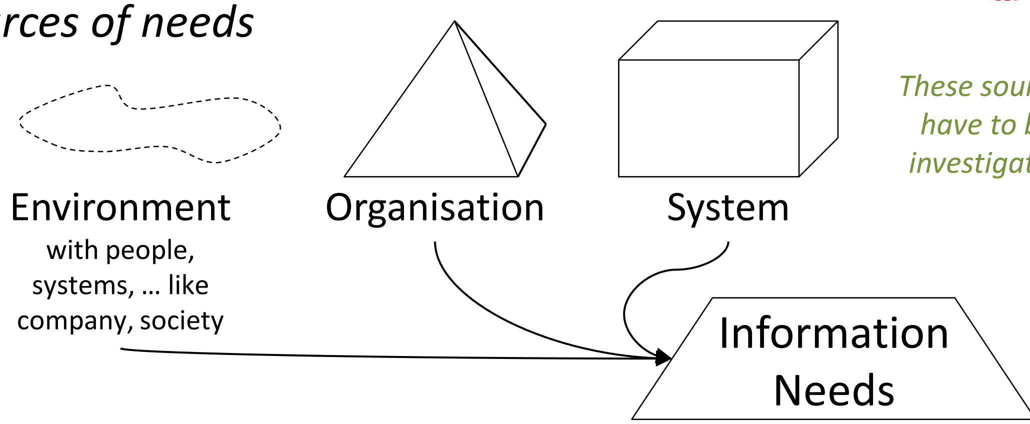
Note:
Information has also potential value. It can be needed later. The amount of information present is larger than what is necessary to satisfy the present needs.

Information Needs

Needs-side of the Balance



Sources of needs



These sources have to be investigated

	people are aware of / know	people are not aware of/ ignore / underestimate
Needs		
Improvements		
Opportunities		

Easy, at the surface, visible, small, local, obvious, concrete, experienced, …

Easy to detect

Much harder to detect ..

- *Can be important*
- *Can make the difference (innovation)*

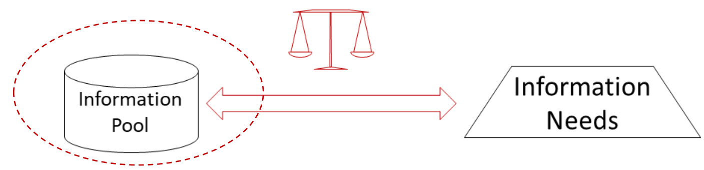
- Hidden
- Requires deeper understanding, special skills, attention and effort

for informatics experts

Often we aware something is wrong, but we don't really know wat, we can't pinpoint it or indicate it wrongly.

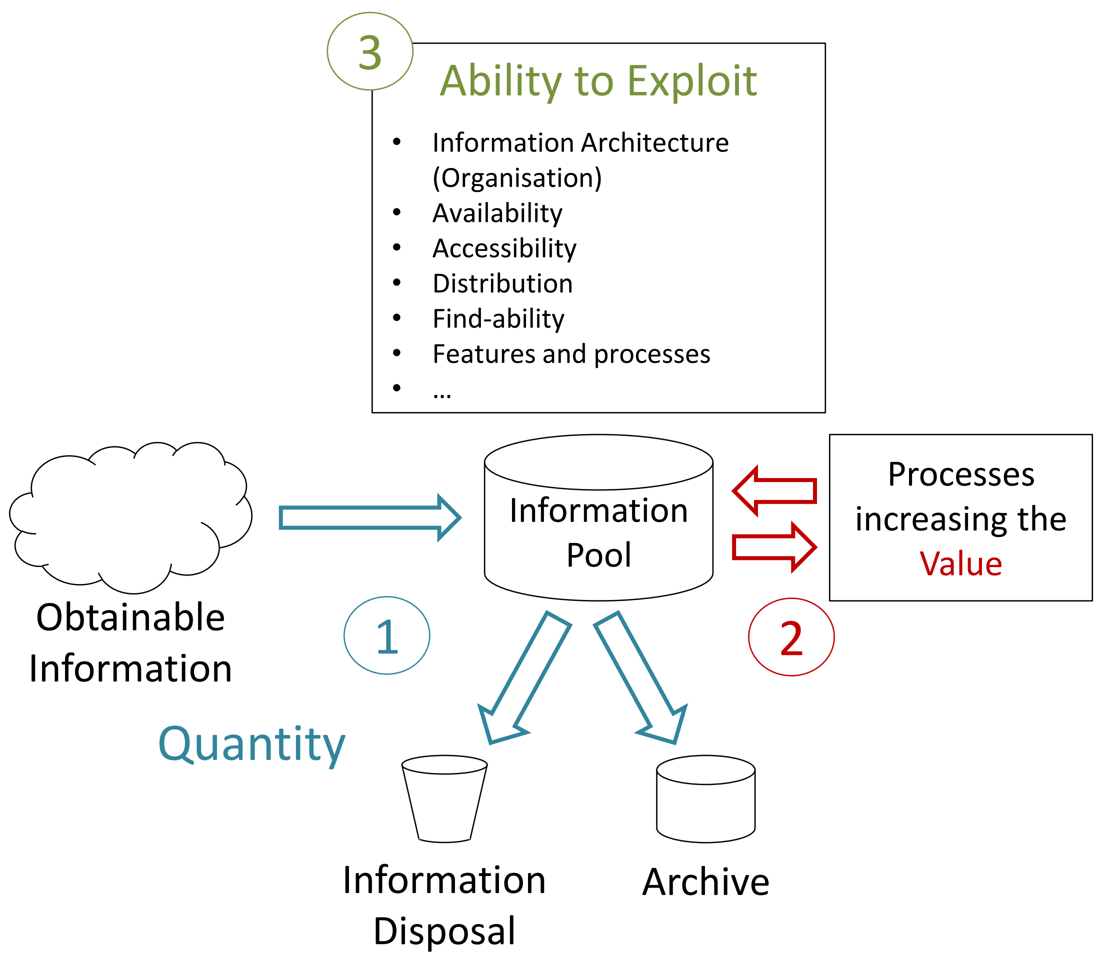
Information Exploitation

Information-side of the Balance



1. Increase Volume of useful information
2. Increase Value of information
3. Possibility & Ability to Exploit the Information

HOW ?



More about this on next pages

Why Keeping Information

Page to be reviewed

A) Need's Perspective

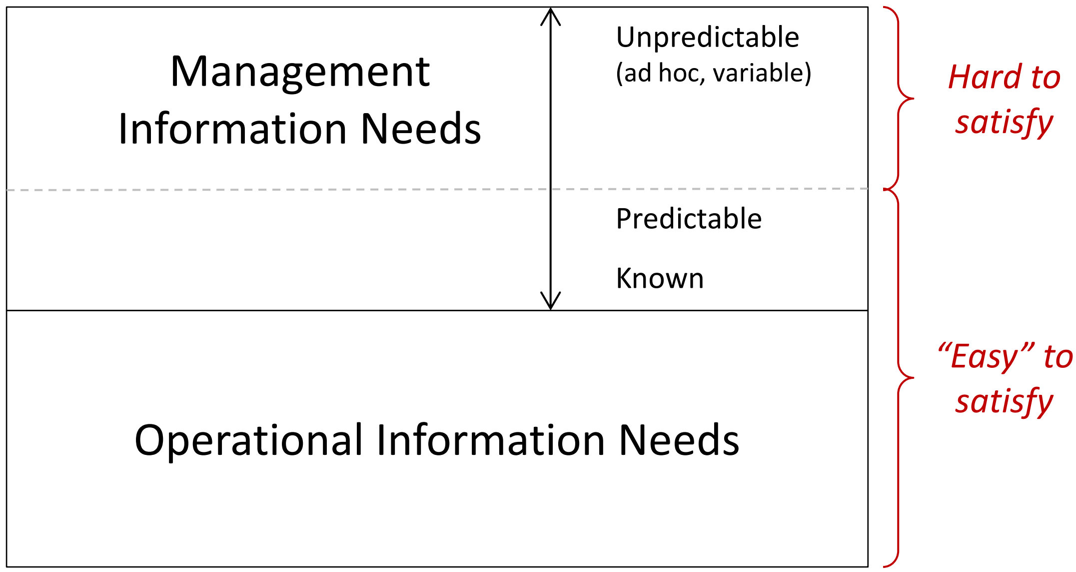
- **Company's** Information Need
  - Required for the company to function
  - Independent of what people wants, desire or decide
  - Ability to respond to usual information needs and to more unpredictable information needs
  - If considered broadly, rather stable, may change over longer period or a change is announced (decisions, plans, …)
- **People** Information Need
  - Ad hoc needs:
    - required by people to reach one-off goals
    - to perform, unique tasks
    - to increase their insight
  - Lesser predictable

B) Value Perspective

- Some information, through its meaning, has intrinsic value
  - Usage or potential usage
  - Curiosity & Interest
- Value is subjective and has to be estimated: criticality, likelihood, potential purpose, opportunity, value of decisions or actions made possible by the information
- Possibility to learn:

  about the organisation, its environment, its functioning, its results necessary for management, improvement, innovation, …
- Possibility to sell as product or service

Information Needs



- If the focus is only on responding to operational needs, it will be hard to respond to management information needs.
- If the focus is expanded to the known, evident or very predictable management information needs, then only these questions can be answered.
- If the information is considered more broadly, more of the unpredictable information needs can be answered. This allows to increase the insight of the management in the company and thus its control over the company.

Information Need

- Information needs can **only** be **solved by** having the **information** when needed and where needed.
  - Information will only fulfil needs if it has certain qualities (identifiable, linked (relations), reliable, complete, precise, consistent, up-to-date, accuracy, accessible, process-able, timely, …)
- **User dependency** (needs depend of **user and user group** (function, service, department, …))
- **Situation dependence** (needs may vary according to the situation)
- **Time** dependent (needs may vary over time)
- **Stability**
  - Information needs of the company → more permanent → more stable
  - Information needs of people → more temporary → more changes
- Some needs remain **undetected** or **badly understood** (not always easy to detect and understand real needs – symptoms of information issues)

ANALYST REQUIRED !!

Notes

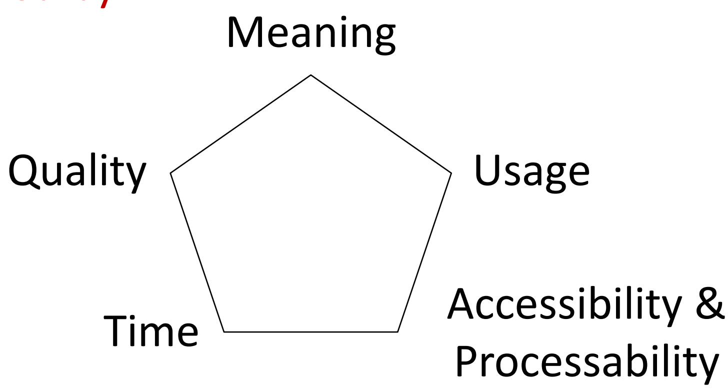
Important slide! Should actually be one of the first in the course.
It's all about "information needs", not about "technology needs"!!
Technology are only means to be better able to cope with information needs.

Information Value

30/10/2018

Page to be reviewed

Value determined by



Value of information is subjective. It's an estimation. It depends of the individual, circumstances, time (variable in time), place, …

Meaning

- What does it mean?
- Meaning is increased when the information is connected to other information.

Quality

- Reliability, clarity, unambiguity, precision, accuracy, completeness, up-to-date, recent, format, ...

Time

- Information has to be available on time or must pertain to meaningful period

Accessibility & Processability

- Inaccessible information is worthless
- Difficulty to process decreases the benefits of information (processing costs time and resources)
- In time, on the right place, in the right form increases the value (or doesn't decrease it).

Usage & Possible Usage

- What **is** it used for and what **can** it be used for?
- Is its usage essential, critical or optional?

Consider the maximal (or max. potential) value of information

Information Value in Time

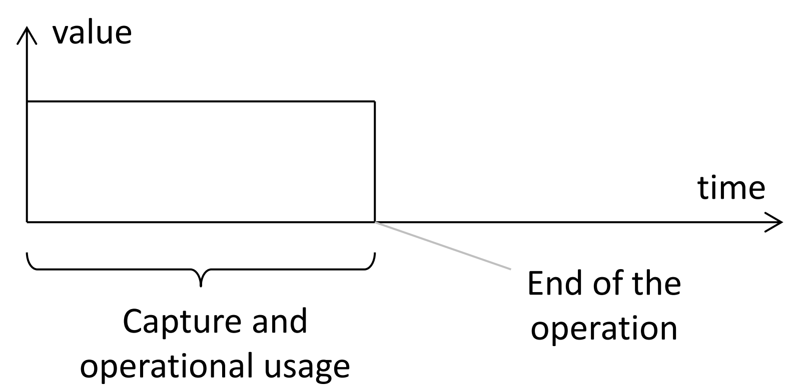
Practical value: Value by practical usage of information. Responding to an existing information need or to a predictable need that will occur in the short term.

Example: The address of the client where the product will be delivered within a week.

Estimated potential value: Subjective value assigned to information based on possible usages in the future.

Example: Names and addresses of former customers. They are still useful. Today, they have no practical value (no ongoing order). But these clients can put a new order in the future and this information can be useful for future mailings or marketing initiatives.

Operational value of an information element

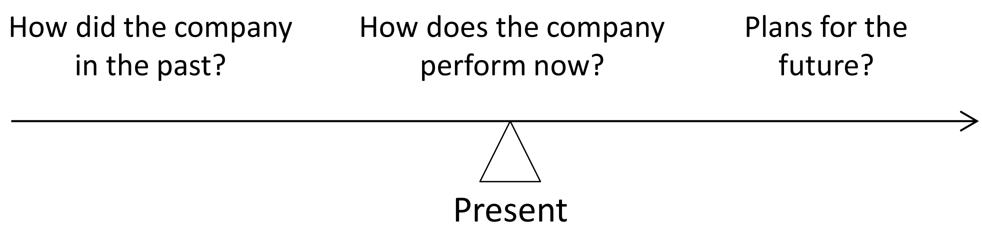


Usage is known. Relatively predictable.

Example: A customer order has operational value from the moment the order is placed until it is completed. Once completed the operational value falls back to nearly zero.

Information Value in Time

Management value of an information element



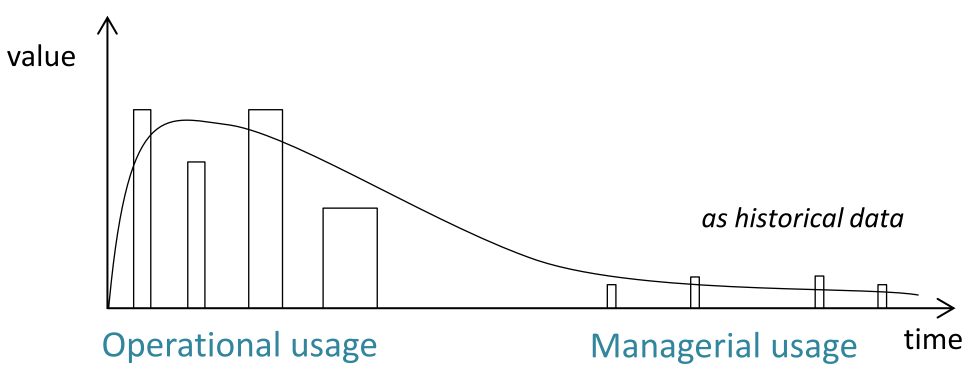
How does the company evolve?

Predictable

Habitual information about the functioning of the company (example: KPI's)

Unpredictable as a response to ad hoc investigations

- Detection of issues or opportunities
- Investigations
- Simulations



Management needs information, among others, to plan future operations, to monitor performances, to look for tendencies.

Operational data is often used as a selection. Aggregated data or lesser detailed data are used for management purposes. The value of historical data tend to decrease over time.

At some moments in time an information element may regain in value. The value curve is not as smooth, but rather irregular.

Information Value (1)

Page to be reviewed

Information Value is determined by following aspects:

1. Meaning - Relevance - Usefulness - Interest

Information can be interesting but not useful. Or it may be useful for decisions and actions.

2. Truthfulness - Up-to-date

Degree of truthfulness ranging from false to true.

3. Trustworthiness – Reliability

User's of information must be able to rely on information. For example, right information mixed with false information will undermine the trustworthiness of the right information.

4. Accuracy - Vagueness - Ambiguity - Coherency - Precision - Detailed - Clarity

Information has to be accurate enough for its intended and possible usage. Obtaining information that is 100% accurate might be (too) costly. Information that is not accurate enough may decrease its usability and its value. Degree from general or vague to precise.

5. Completeness

Information needs to be complete. Some operations, processes or decisions are more difficult, more risky or can not take place if some information is missing.

6. Context

Information without knowing and understanding the context my not be much worth.

7. Atomicity - Structured

Elementary, atomic pieces of information are generally more worth than aggregated information.

Information Value (2)

Page to be reviewed

8. Probability - Risk - Likelihood - Certainty

In general, the greater the probability, the more usable the information is. Lesser probable information can be very valuable as well.

9. Variability

Information can be true on one moment and lose its validity later in time.

10. Timeliness

Information is often related to time in 2 ways: It relates to a moment or period of time. It is useable at a certain moment or period of time and thus must then be accessible to the user. The information has to be presented to the employees on time. Information coming too late (too soon) is of no or lesser use.

11. Availability

Information that is inexistent can't be used. It must be recorded. It is worthwhile to look at the clients and to search in the company's environment for interesting information.

12. Accessibility

Information that is inaccessible is useless. Accessibility can be a matter of geographical localisation.

13. Awareness

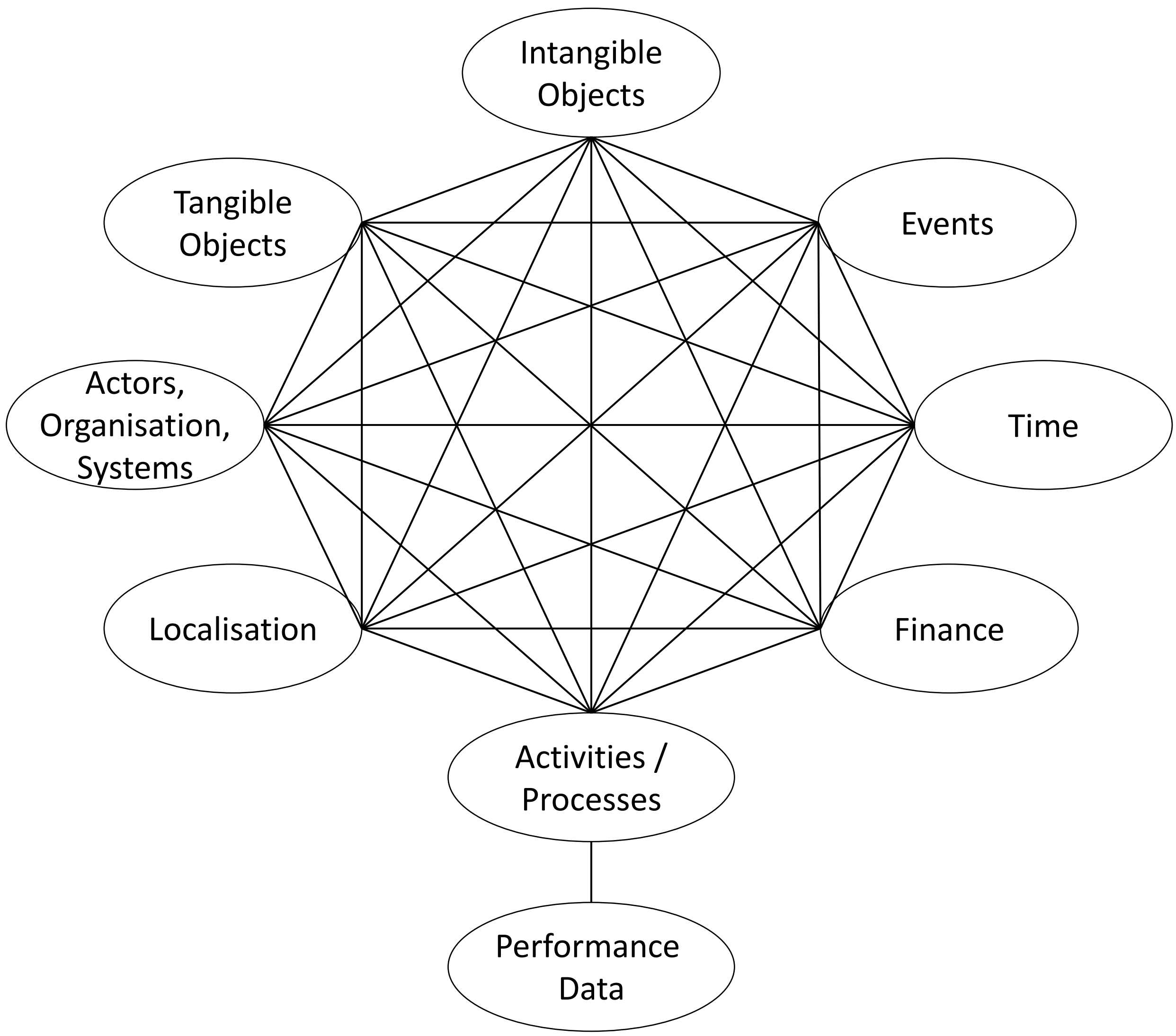
If users ignore the presence and availability of information, they are not likely to use it. Ensuring the existence of information is known is important.

14. Processability – Appropriateness for Processing

Atomicity, organisation, integration, standardisation, format, encoding and many other factors influence the processability of the information.

Operational Information

Basic model of Operational Information



This is a basic model that may help when investigating operational issues. It may help to come up with some questions. There might be lesser or more entities involved.

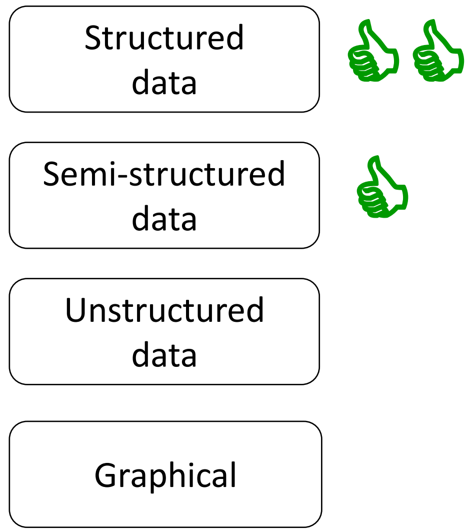
A right classification of these elements is crucial for later use by management.

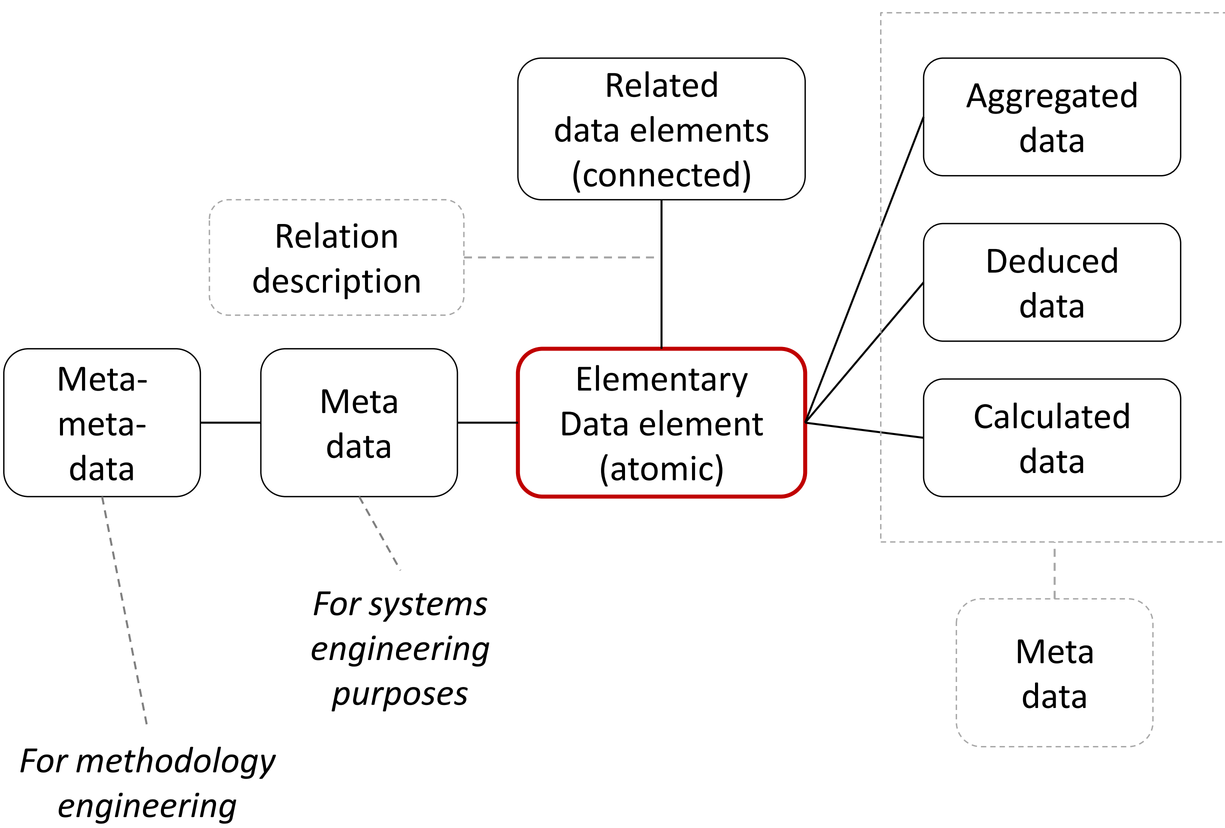
Degrees of Information Quality

continuum

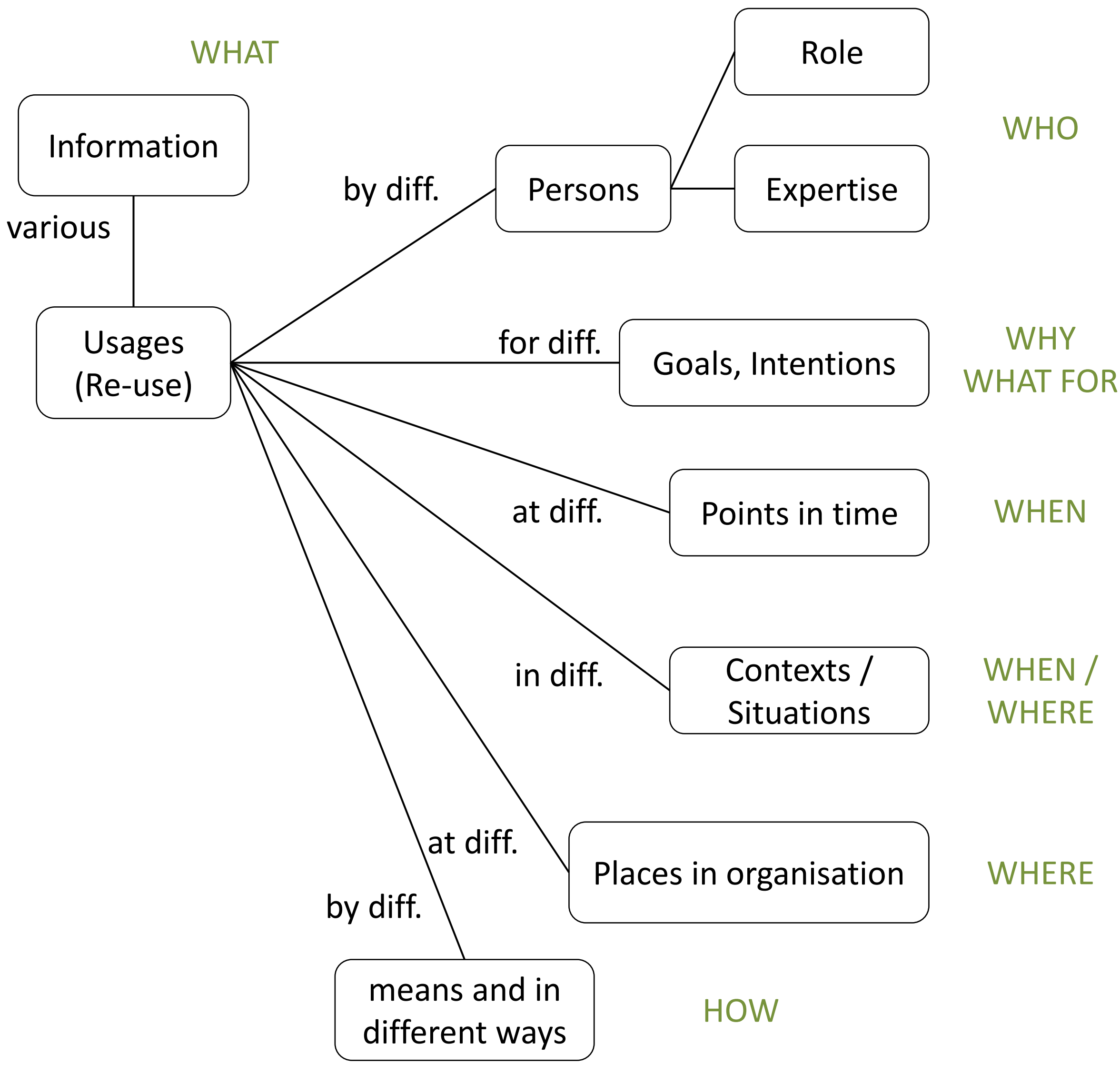
High-Level	↔	Detailed		
Coarse	↔	Fine		
Clarity, unequivocally	↔	Ambiguity		
Precise	↔	Vagueness		
Coherent	↔	Incoherent (conflicting, opposite)		
Up-to-date	↔	Outdated		
Past	↔	Present	↔	Future
Theoretical	↔	Practical, applicable		
True	↔	False		
Certain	↔	Unsure		
Complete	↔	Incomplete, partial		
Correct	↔	Distorted		

Information





Information Usage



Prepare information for multiple usages

Design information solution (information architecture/model) that allow multiple usages of information

Information Operations

Easy operations

- Capturing
- Transferring
- Duplicating
- Unconsidered dissemination
- Changing
- Aggregating
- Unstructured information
- Disconnecting
- Usage of freedom and flexibility to manipulate data

(End-users can do this)

⇩

- Inefficiencies
- Loss of meaning
- Loss of value of information
- Loss of reliability
- Difficulty to process
- Chaos
- Information Swamp/ Overload

⇩

Decrease of value of information

CHALLENGING OPERATIONS

- Identifying
- Meta-data (creating, describing)
- Decomposing
- Analysing
- Selecting
- Standardising
- Cleaning
- Modelling, structuring, organising, formalising
- Connecting
- Keeping up-to-date & reliable
- Maintaining consistency
- Managing information status
- Managing information throughout its life-cycle

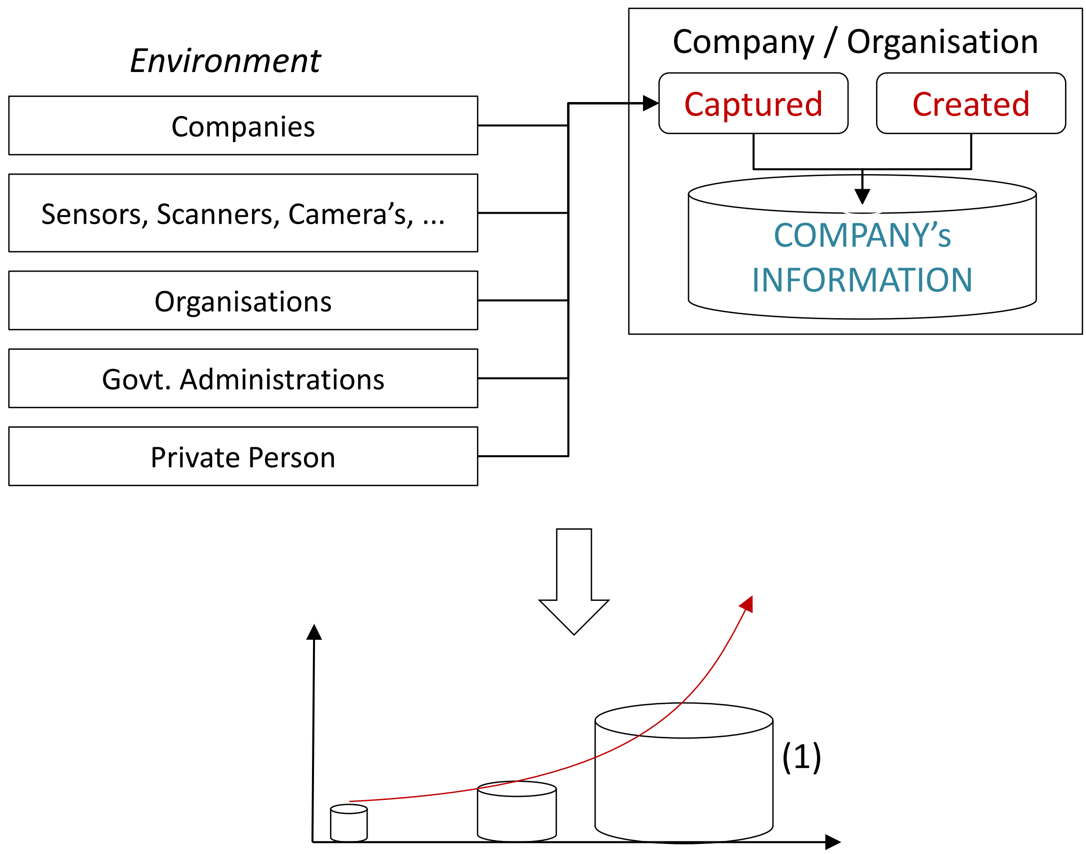
- Preserving and maximising the value of information
- Maximising its processability

⇩

BETTER EXPLOITATION of INFORMATION as a resource

Information in the Organisation

2 Ways to increase information



Capturing information is crucial

Missing information is a cost, a lost opportunity.
It may have far reaching consequences.

REFLECTIONS

(1) Endless growth of information? Good or bad? To be controlled? To be managed? How to deal with t? How to adapt systems to it?

Information Operations

Information tends to increase over time + **Information Entropy**

IF

- the nature of information is not understood

AND

- the principles of information engineering and information management *(including proper information usage)* are not respected

THEN

it's easy to create **INFORMATION OVERLOAD**
and **INFORMATION CHAOS**

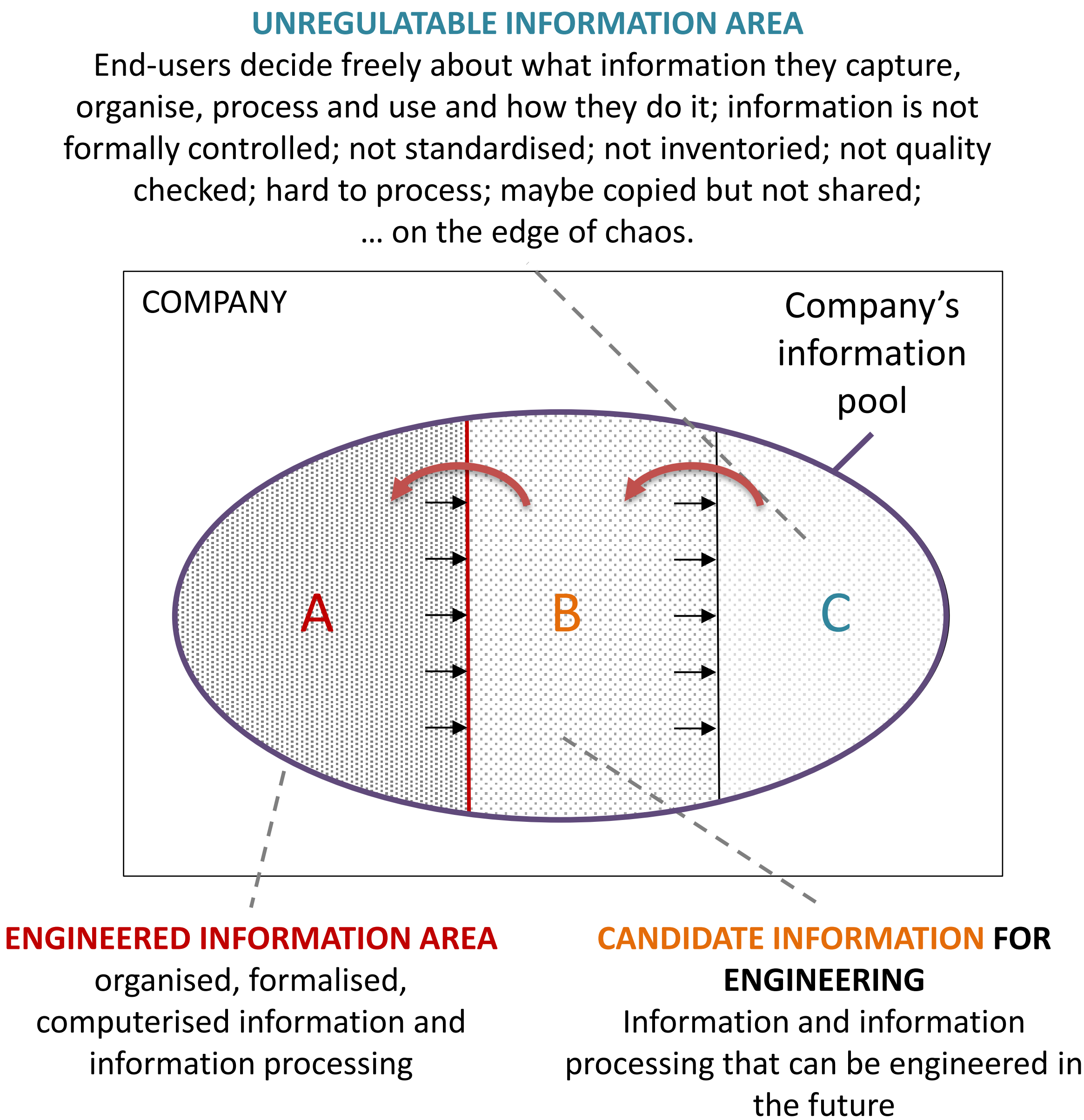
Losing control over information

=

Losing control over the company

Over time, quantity tend to increase
whilst quality tend to decrease

Information in the Organisation



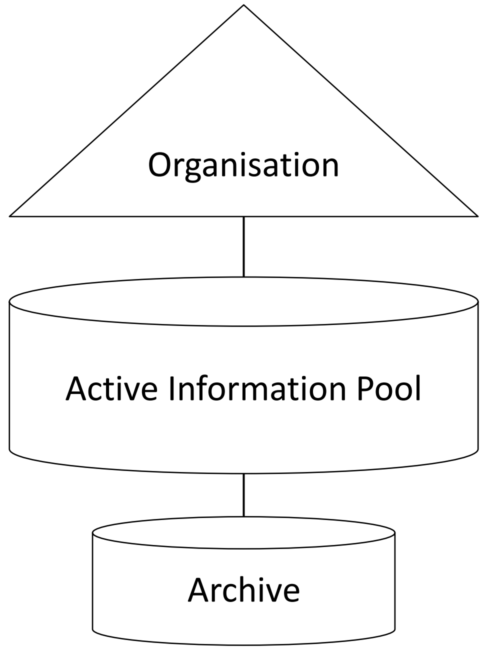
Notes:

Expand the *Engineered Information Area* (A) by engineering area B.

Expand the *Information Candidate for Engineering Area* (B) by detecting information and processes in area C that might be engineered. Overtime, area C will shrink.

Area C is difficult to formalise, to clean up, to maintain, to manage, to exploit, to engineer, etc., at least, for now. (OAS supports the exploitation of 'B' and 'C'-type information).

Information Pool

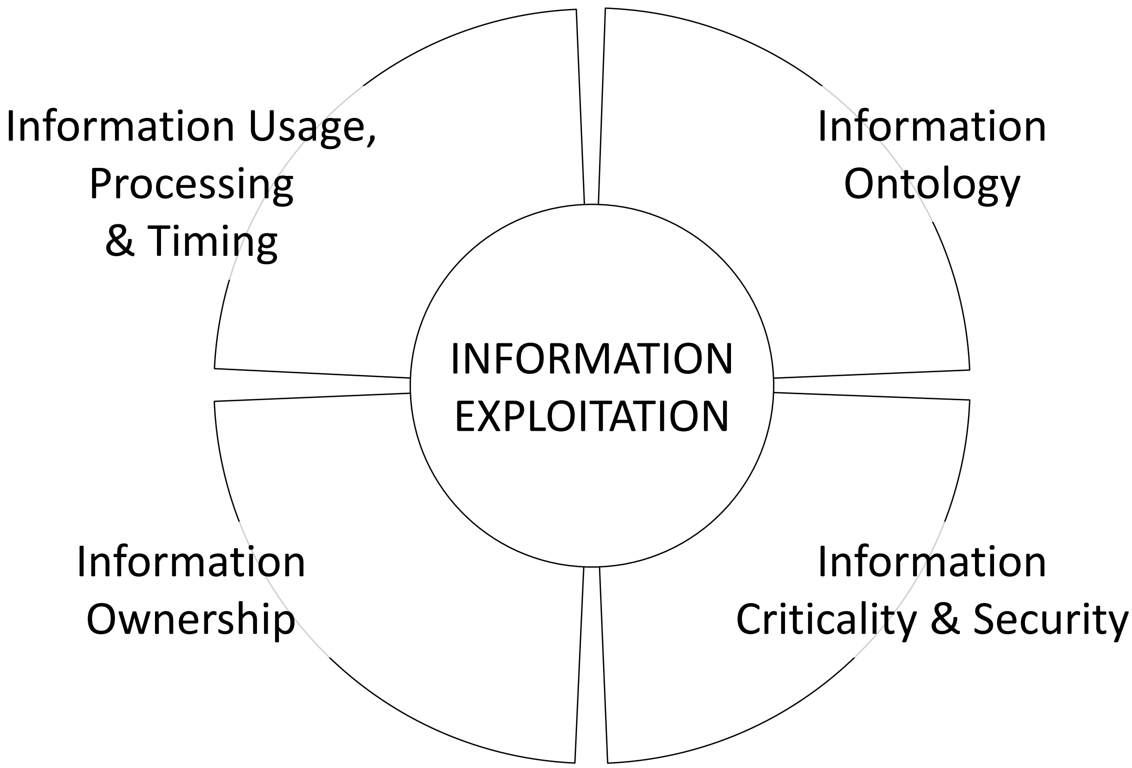


INFORMATION POOL

- Respect essential information qualities (below)
- Only valuable information
- Organise information
- Avoid information duplication
- Maximise information and information quality
- Maximise information value
- No useless information (remove, clean up, archive)

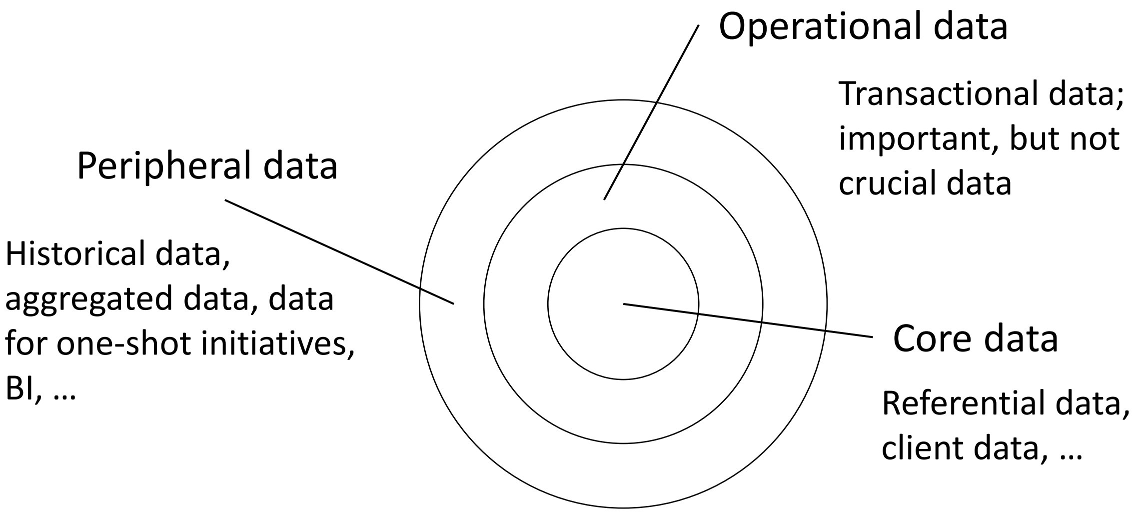
Information architecture brings stability. It is better to develop processes upon good information architecture than to develop an information architecture that suits the present processes.
Why better? The information structure is better which results in better exploitability, expandability and changes will have smaller impact.

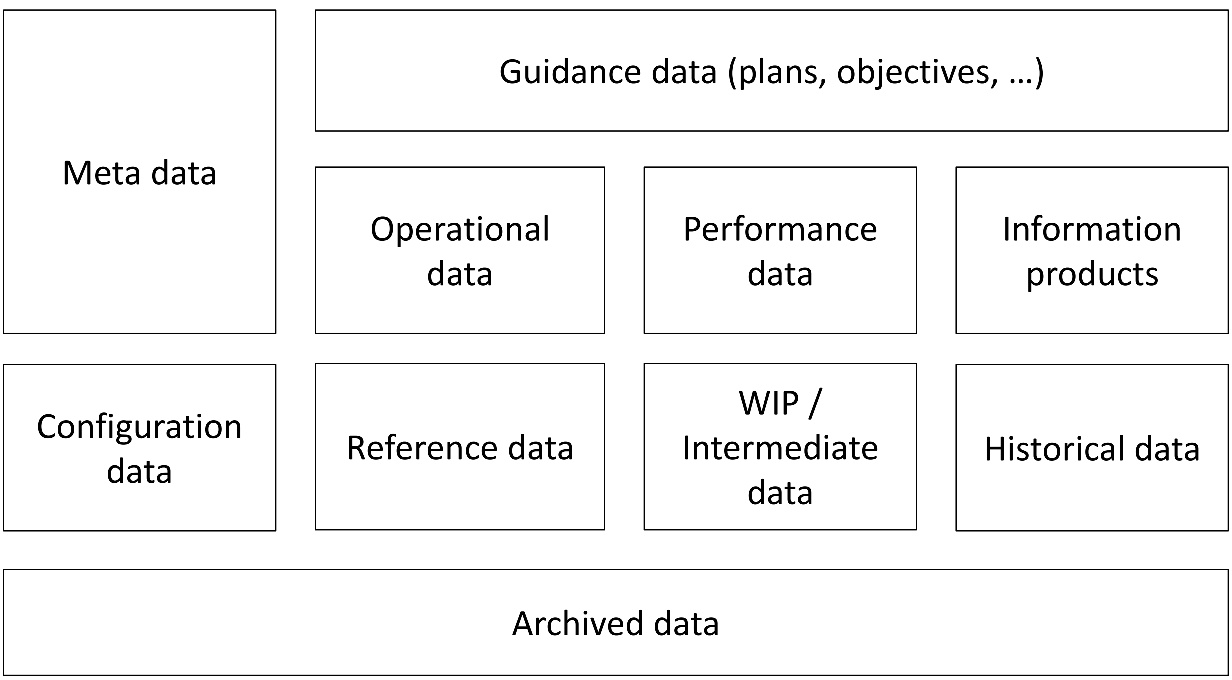
Four Perspectives to Organise and Exploit Information



These perspectives have to be combined intelligently.

Information Organisation





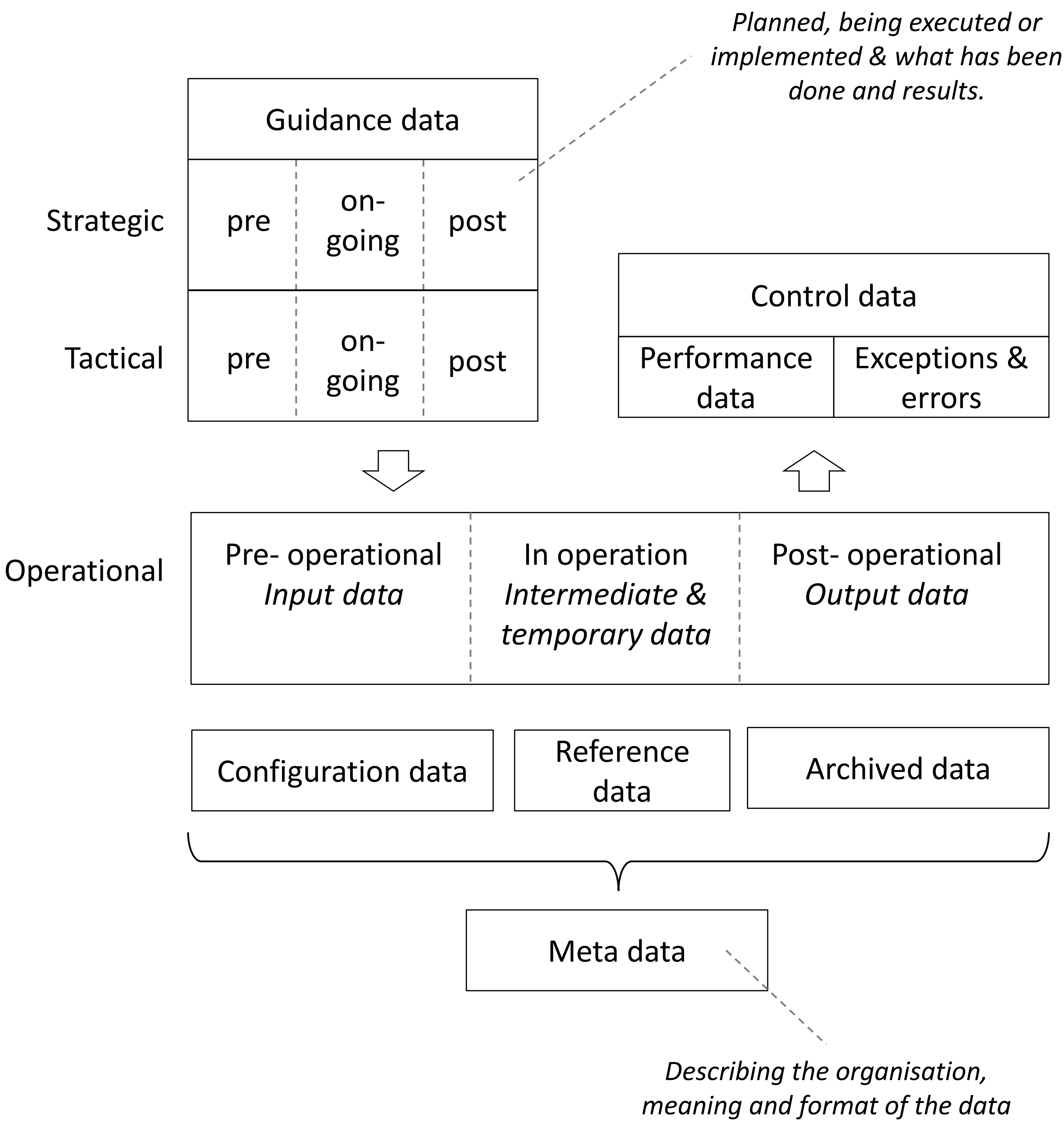
“information”

when emphasising the purpose, the usage and the value of data

“data”

when considering information as a matter that has to be captured, processed, stored, …

Information Organisation

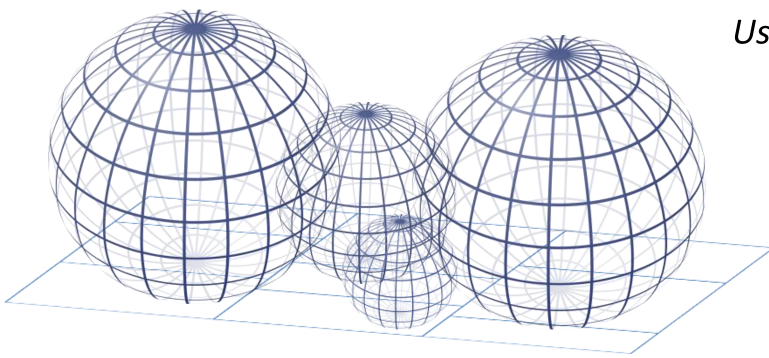


Methods to Organise information

- Per Concentric layers
  - Core: reference data
  - Operational: transactions, process
  - Peripheral: Managerial info, BI
- Per Business Domain
- Per activity, activity type or purpose
- Per nature
- Per availability

Usually, a mix of the perspectives is used

Information Domain and Information Sphere



Information Spheres

Usage oriented

Information Domains

Logic oriented

Information Sphere:

Whole set of information a user or users group uses, controls or might need to perform a job

Information Domain:

Information relating to a same subject, object, topic, issue, aspect, item (reflects the real world)

Notes

Business people may need to use information from different domains (like products, orders, financial,..) to perform their job.

These two concepts help to manage accesses and usage of information.

A user is inside a sphere together with all available and to him/her accessible information doing his work.

Information Exploitation

How to maximise the value and exploitability of information ?

1. Relevant, meaningful
2. Correct
3. Up-to-date
4. Precise, Clear, Unambiguous
5. Clean
6. Reliable (verified)
7. Standardised
8. Connected
9. Atomic (elementary, indivisible)
10. Logically organised in an architecture (reflecting real world, criticality, purpose, processing or usage)
11. Structured (avoiding aggregations, documents, …)
12. At the right place
13. On time
14. Available, being present → need to be captured, gathered, …
15. Accessible
16. Findable and retrievable
17. Quickly accessible
18. Easy to process
19. Meta-data (described with)
20. Captured, stored
21. Unique occurrences
    avoid having to update of multiple occurrences of same information
22. Shared and Re-used
23. Protected
24. Inventoried, Maintained and managed
25. Under control, under own control

Goal of the Analyst
striving to maximise these qualities in corporate information solutions.

These aspects have to be taken into account when conceiving information architecture, information systems and information treatment and usage

Information Exploitability

How to improve Information Exploitability

1. Capture as much relevant data, data with a true potential value, as possible
2. Use an Information Inventory
3. Keep control over the information
4. Keep information as atomic and structured as possible
5. Connect information elements as much as possible. It increases their value. A connection is also information.
6. Share information (avoid multiple instances. Though, in some cases multiple instances is advisable)
7. Make information accessible (but secure it as well)
8. Understand the meaning of the information (what precisely does it describe)
9. Use information formats which are easy to process
10. Avoid cryptic and confusing codes
11. Standardise information as much as possible. Limit the number of formats
12. Implement agents controlling data quality (respect of formats, missing information, incoherent information, …)
13. Clean up (delete, archive, ...) old data.
14. Have data policies and data governance
15. **Train People**

Notes:

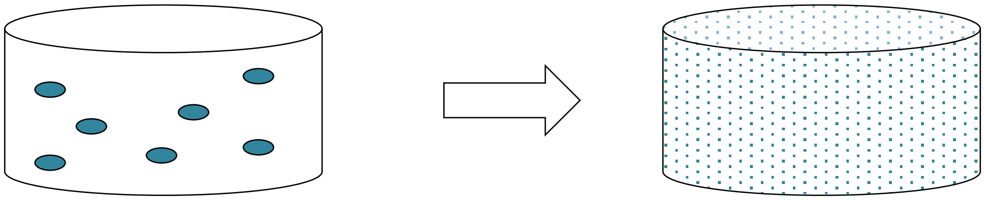
Some items are on the previous list as well.

Main Causes of Information Problems

- Lack of information
- Bad quality of information
- Unorganised or badly structured information
- Inappropriate “solutions”
- Bad information practices

Some wrong, imprecise or unreliable information in a database can destroy the trust in all the information in that database and thus destroying the value of the database.

Trust & Information Contamination

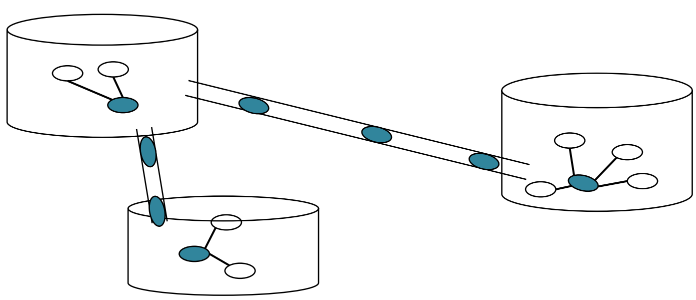


A few unreliable data, other data is OK.

Since we don't know what data is reliable and what isn't …

we suspect every data element to be unreliable.

The whole database is considered as unreliable & not trustable and not trusted.



- Contaminated data is transferred to other databases
- Data is connected to other data
- Data is used for different purposes, by different persons

Notes:

How to limit this? Automated data input; appropriate and facilitated data input; appropriate checks on input; Data Quality Checking software running through the DB; get employees verify data when using it (if possible)

V.I.P.: Vital Information Practices

- What information has **value**?
- How to **capture** information (easily, efficiently, early, reliably, …) ?
- How to **identify** information?
- How to **verify** information?
- How to **structure** information?
- How to **link** information (relations)?
- How to keep information **process-able**?
- How to keep information **up-to-date**?
- How to keep information **consistent** throughout the company?
- How to keep the information **useable**?
- How to **evaluate** information?
- How to **share** and **reuse** information?
- How to **control the usage** of information?
- What is the **lifecycle** of information?
- What **meta-data** should describe information? How to determine and manage meta-data?
- How to **preserve or increase the value** of information?
- How to **secure** information?
- How to **innovate** with information?
- How to **clean up** information?
- What information can be **erased**?
- …

We need to develop the practices that responds to these questions.

Conclusion

Information is a

1) Critical resource
2) Extremely valuable
3) Hard to manage

Think “INFORMATION”

- Be vigilant about any “information destroyers” and “information risks”
- Use your best information experts
- Sharpen information skills
- Avoid giving away control over (critical) information

ENTERPRISE ARCHITECTURE

Architectures

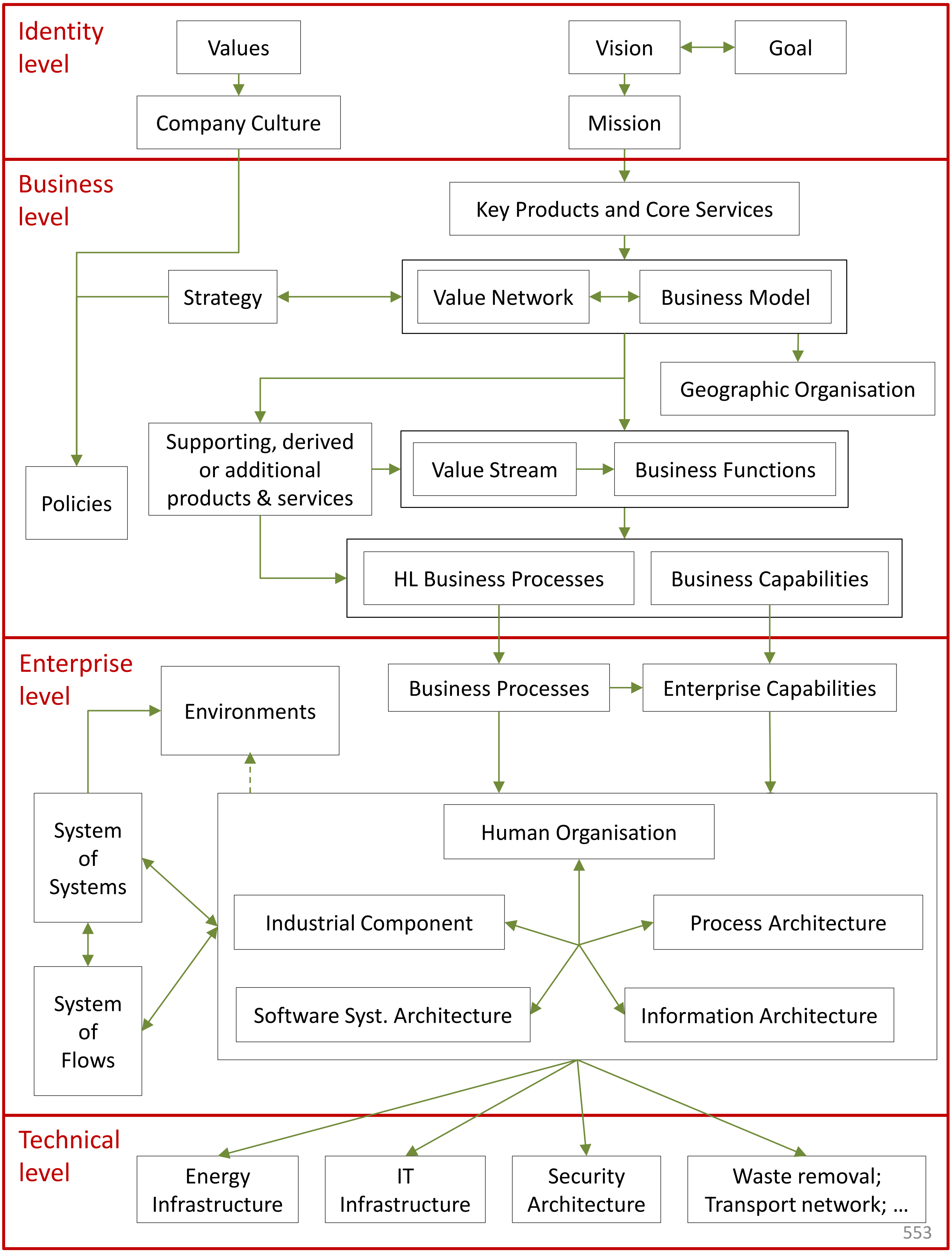
Some Major Structures / Architectures

- Goal Structure (Architecture, Model)
- System of Plan (organised and managed set of all/major plans)
- Decisions Hierarchy (?)
- Capability Structure
- Geographical organisation
- Organisation
- Process Architecture
- Information Architecture
- Production / Assembly Line Architecture
- Information Flows
- Communication Flows
- Transportation Infrastructure
- System of Information Systems
- System of Software Systems
- Functional Software Architecture (FSA)
- IT Architecture
- Security Architecture
- Network Architecture
- Energy Network
- Water Network
- Waste Network

Notes:

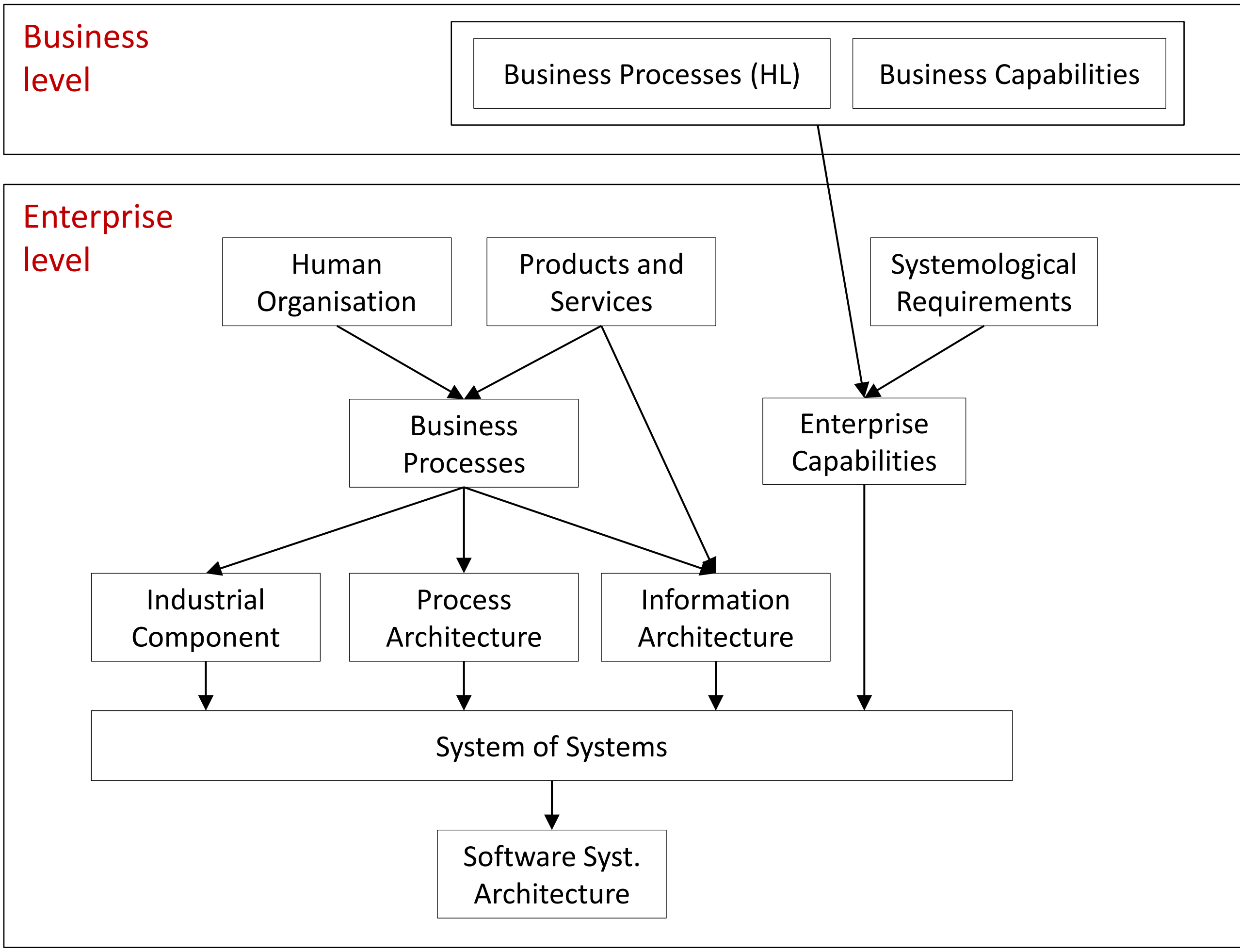
- This set of organisations, structures, architectures and systems gives an idea how things are entangled. It emphasises a holistic approach.
- Each architecture requires specific knowledge area specialisation and skills. Yet, they need to be aligned. All these engineers have to collaborate very closely.
- Some architectures may be not applicable to an organisation.
- There is more required to achieve alignment, balance and sustainability than aligning architectures.

Enterprise Engineering Framework



Variant

Adapted extract from the previous diagram:



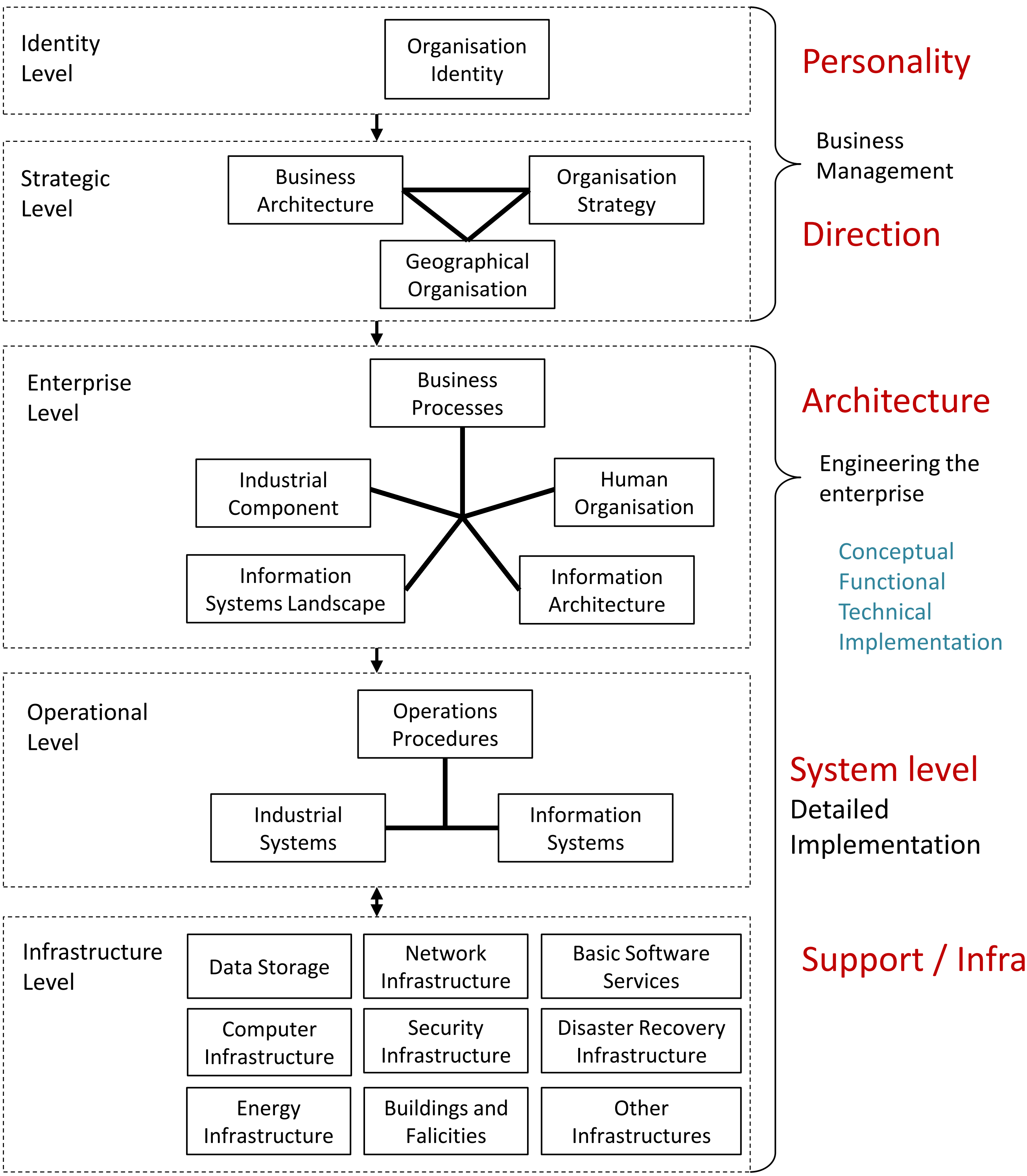
Notes

These diagrams present some important elements of a company and from where these elements can be derived. A model is always a reduced picture of the reality. And since every company and situation are different, the relations between these elements are specific to each case. They vary from case to case.

For example, the human organisation can be existing and be a given for an initiative.

It is the duty of practitioners to analyse and to understand the company and situation they deal with. These diagrams can serve as a basic template helping to understand and which then can be adapted to the particular situation.

Another Variant



Business Architecture

The Business Architecture is a business description of the system by which business activities are deployed, the way of executing the business activities and the way it will achieve the realisation of its vision, mission, purpose and objectives. The Business Architecture is a business perspective.

Principle: The business architecture has to be defined by

- Management
- Business Experts
- Business Consultants

Consequently, anything requiring non-business expertise to be established, doesn't belong in the Business Architecture. It is a part of another Architecture.

Content of the Business Architecture

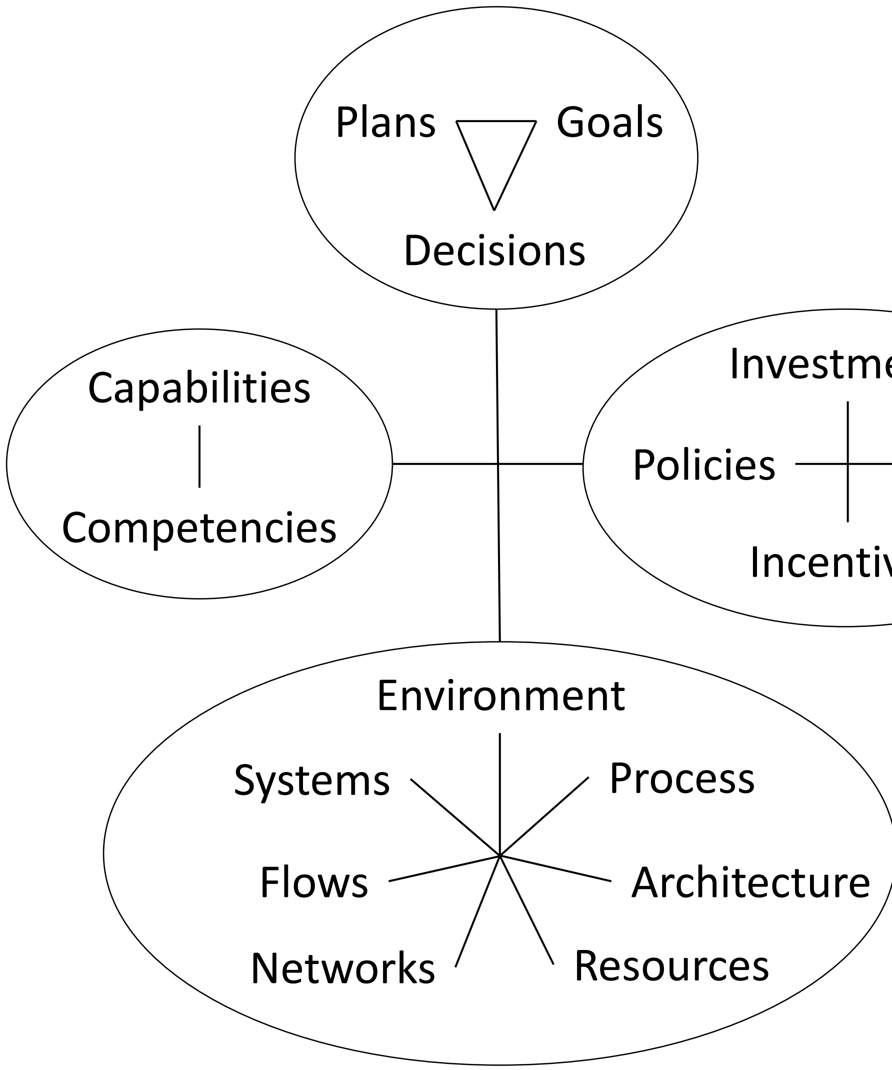
- Actors, Entities, Organisations
- Partners
- Suppliers
- Main Resources
- Sources of resources
- Key Products
- Core Services
- Key Business Capabilities
- Geographic Locations
- Geographic areas
- Customer Segments
- Interorganisational Flows
- Value Streams
- Business Functions
- Business Policies, Rules, Principles
- High Level Business Processes
- Financial Structure

Complementary to the Business Architecture

- Strategy
- Metrics and Measures
- Initiatives and Projects
- Decisions

Notes:
This definition of business architecture differ slightly from the mainstream definition.

Global Internal Alignment



Notes :

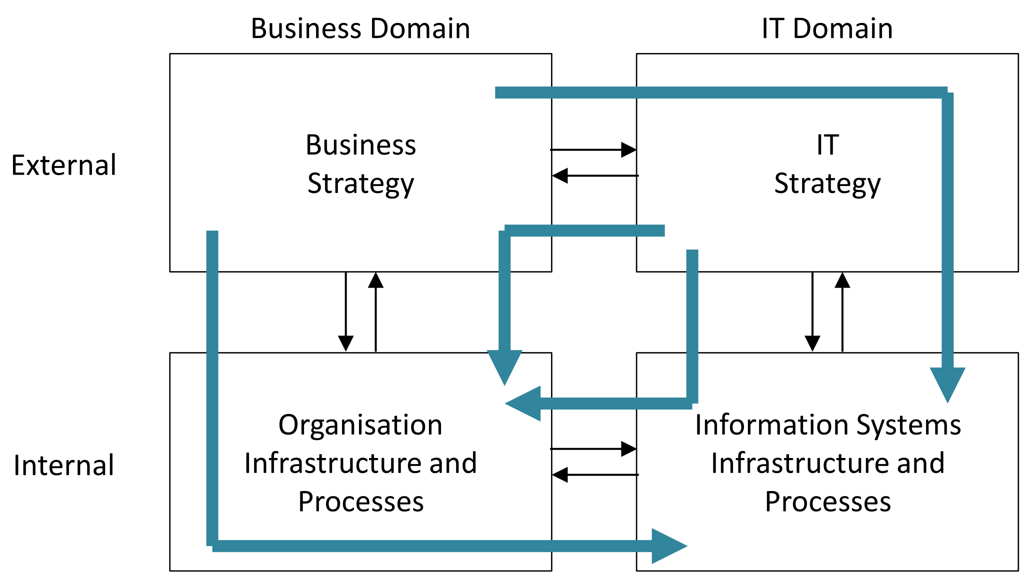
Why is this important?

1) All these aspects are expressed in information
2) They have to be supported with information
3) Information systems have to be aligned with this.

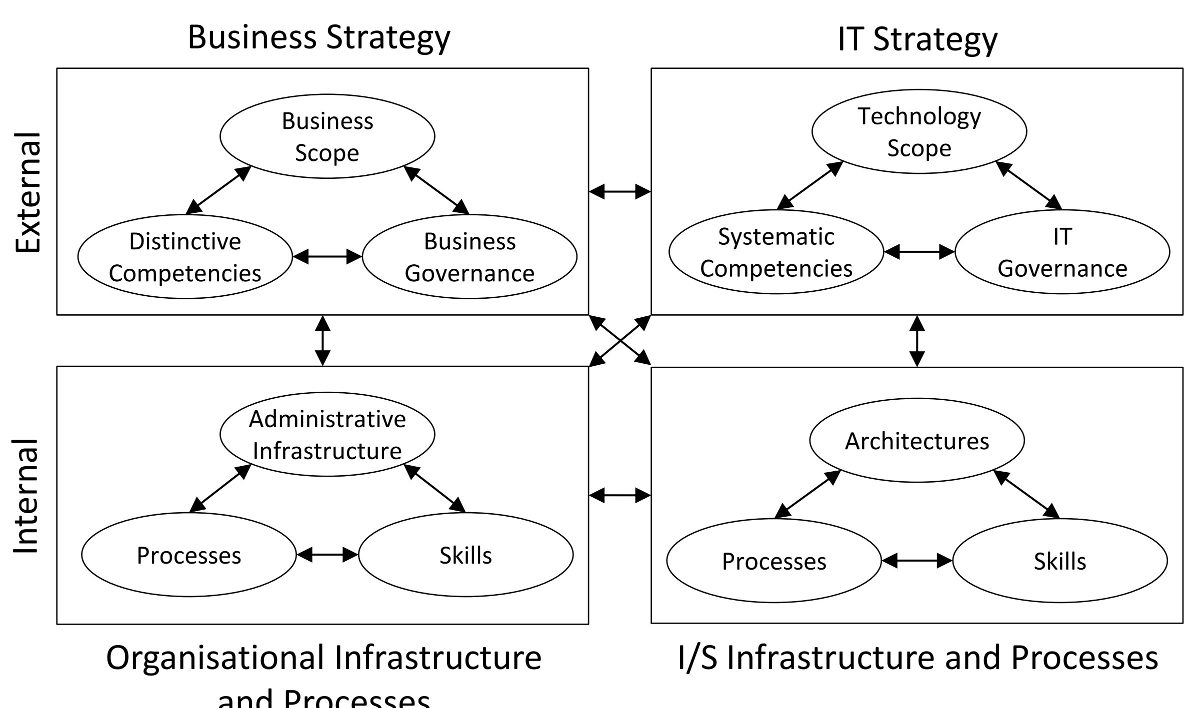
It is the Analyst's and architect's job to contribute to this alignment by identifying misalignments and conceiving aligned solutions.

Alignment
Henderson – Venkatraman

Strategic Alignment Model (SAM)

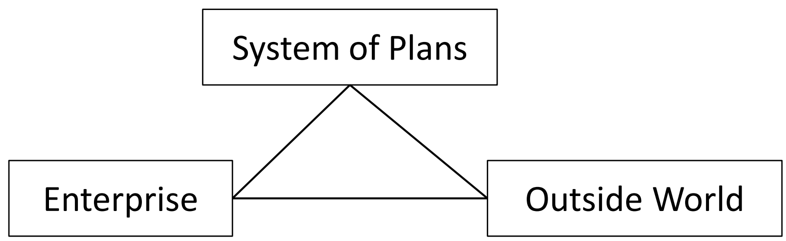


FUNCTIONAL INTEGRATION



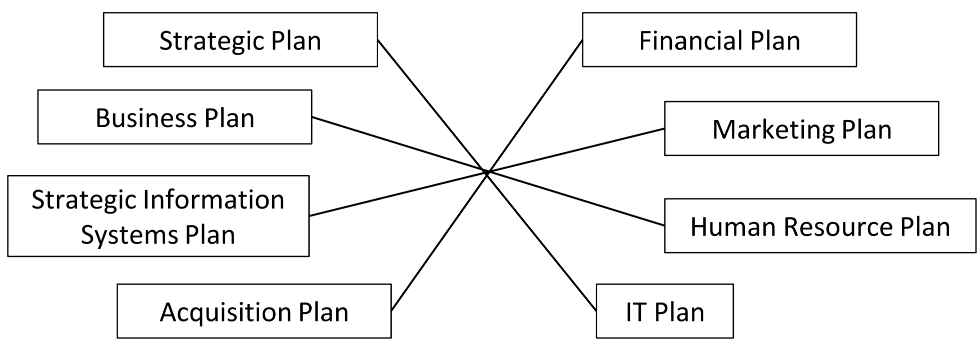
Other Alignments

Alignment of the Company

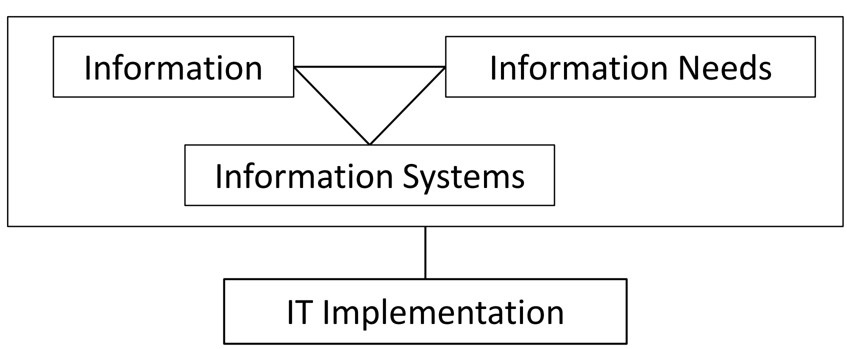


Alignment of Plans

Plan Architecture - System of Plans – Organised and managed Set of Plans – Hierarchical Network of Plans



Alignment of information and Information Needs

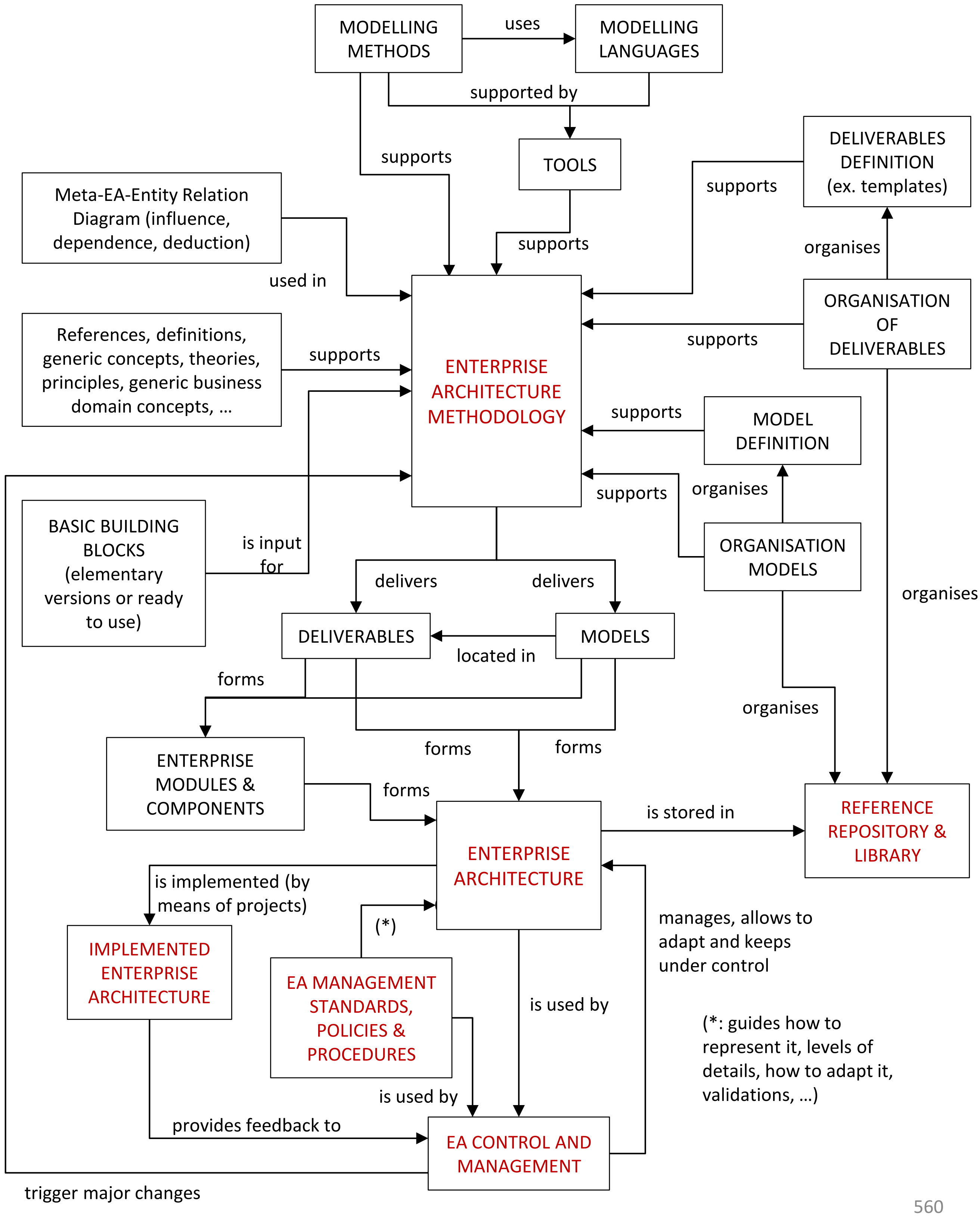


Notes:

Alignment is a momentary state. Because of variability, everything has to be kept in sync (aligned). They have to evolve together. (different speeds of adaptation!).

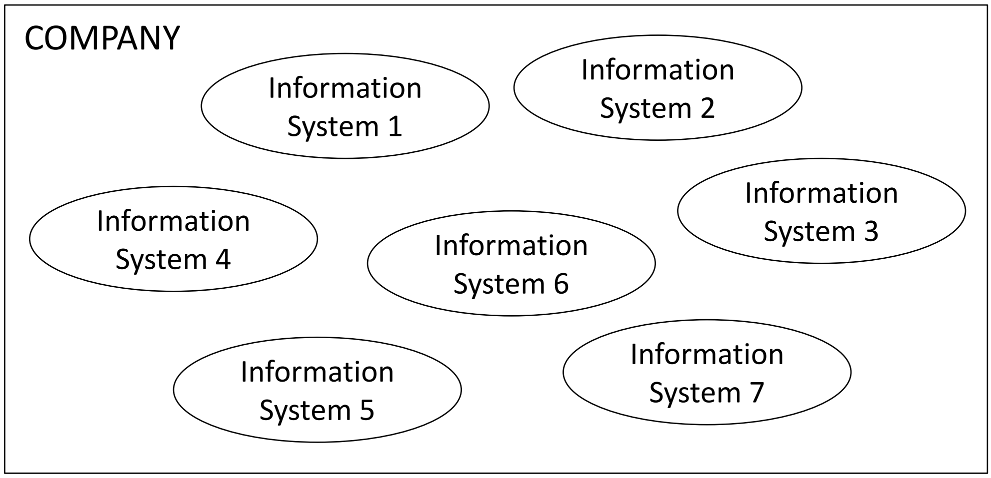
Alignment is a reactive process. It’s a minimal state Companies need to drive, to lead, to create, to innovate.

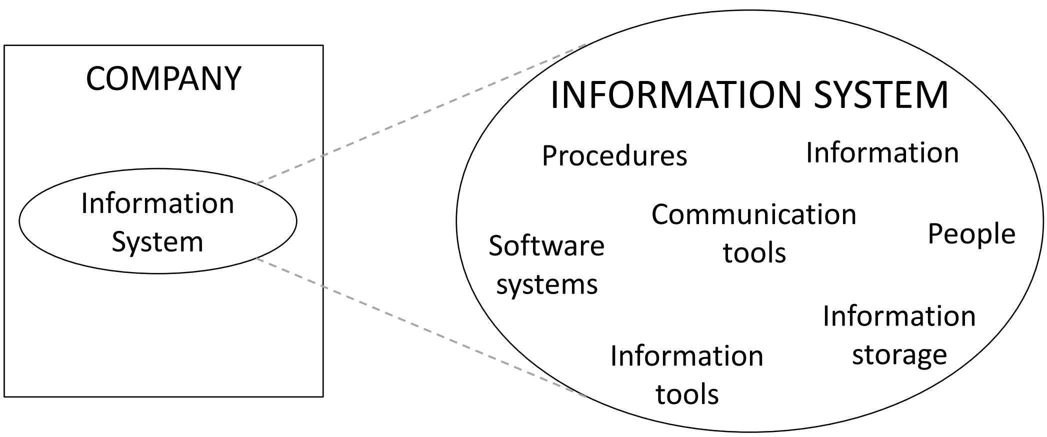
Enterprise Architecture Framework

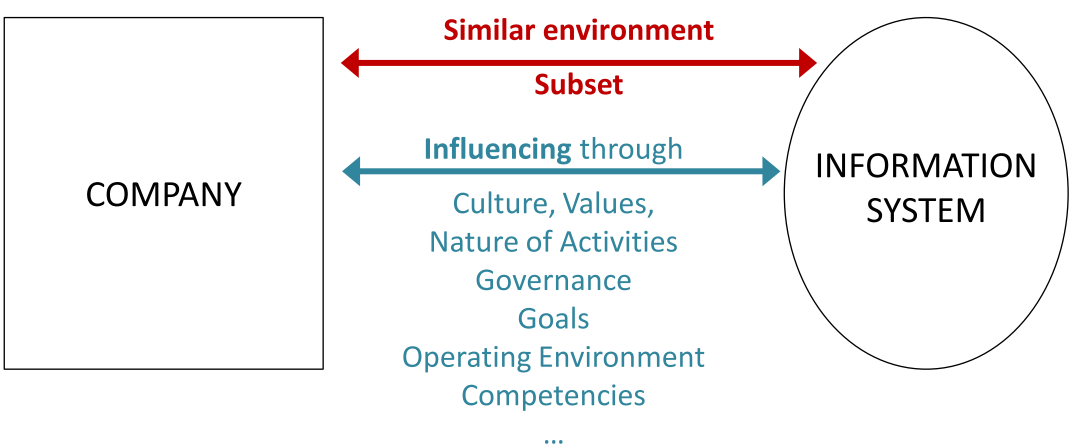


INFORMATION SYSTEMS

Company's Constituents

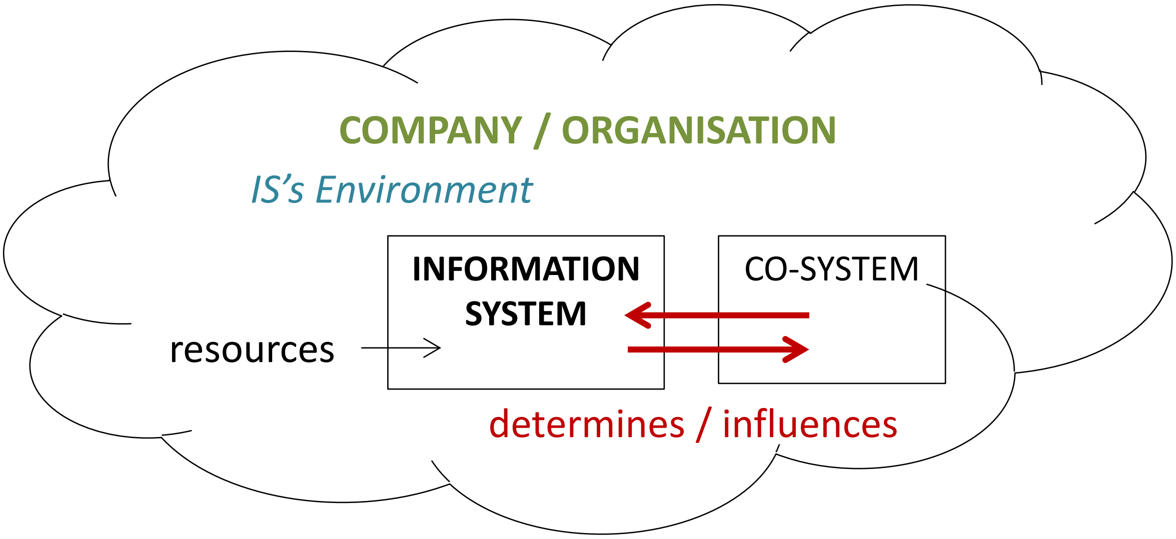


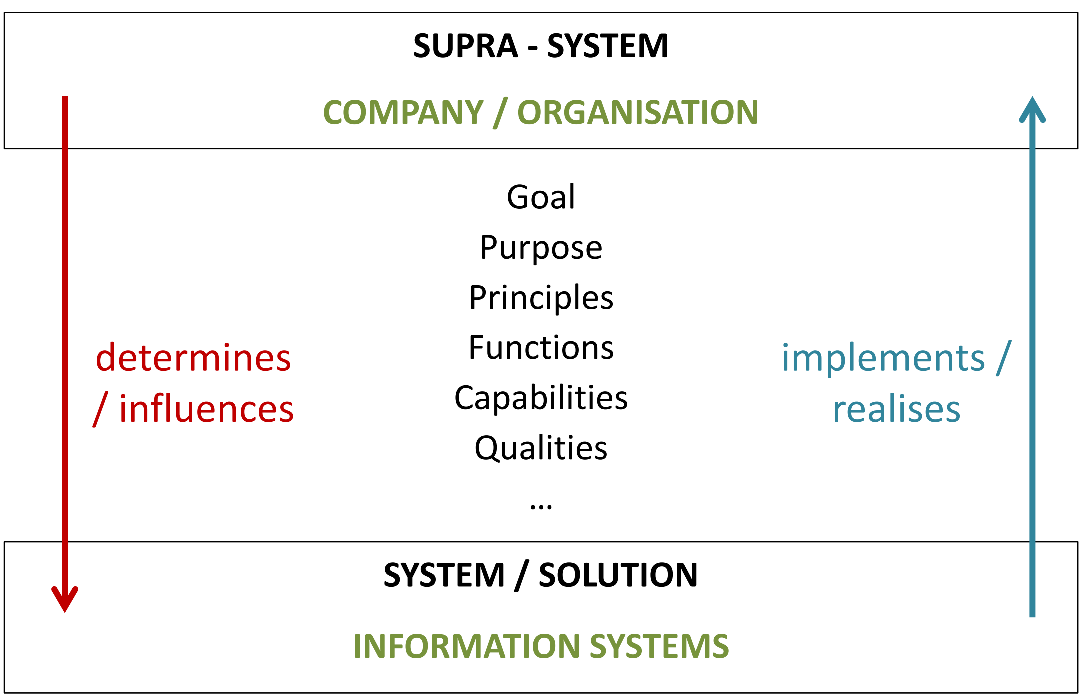




IS's are part of the company. They partly form the company. The company, its activities and the overall environment have to be taken into account when designing an IS. Therefore they should be understood.

COMPANY = SUPRA-SYSTEM & ENVIRONMENT



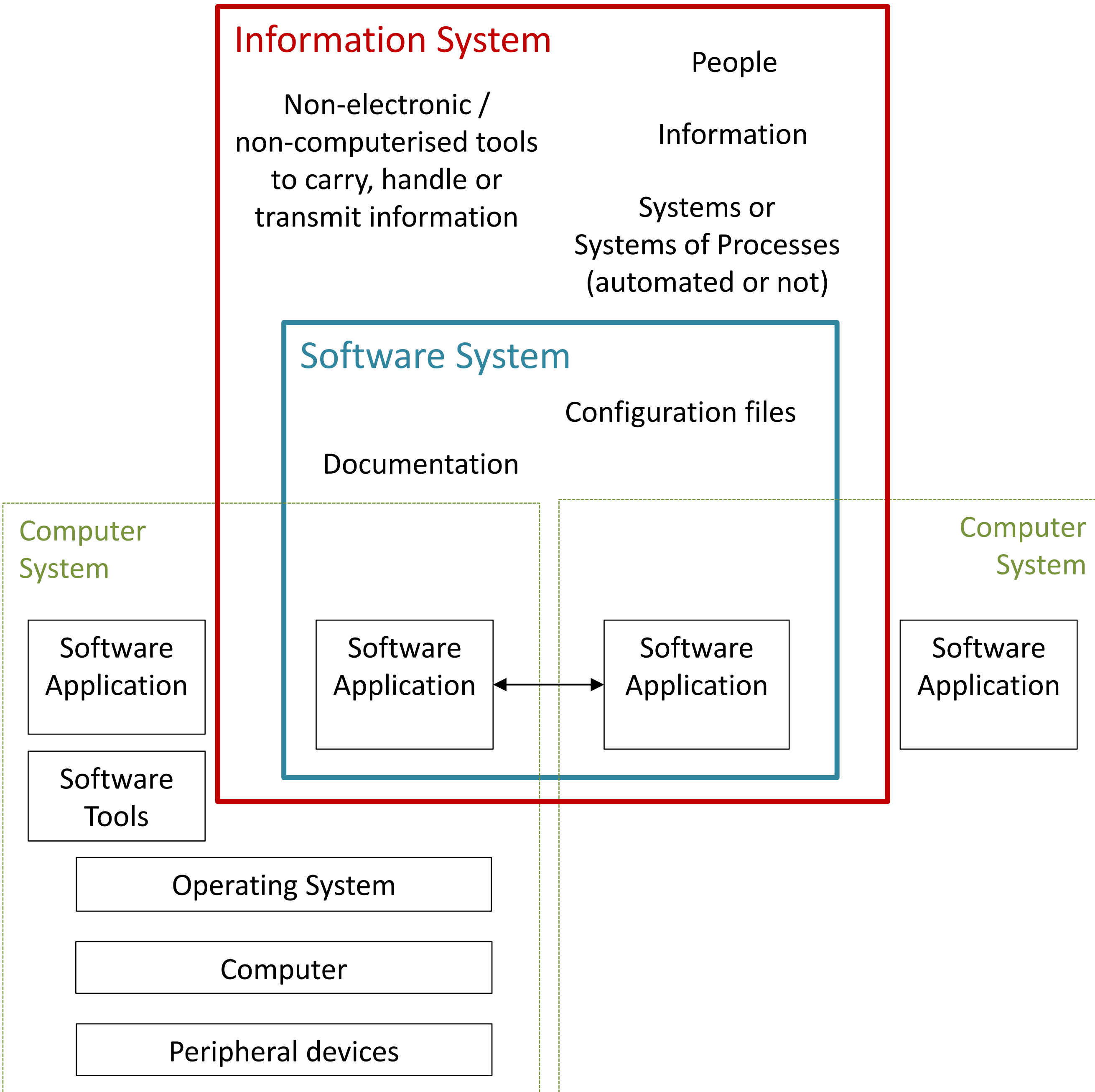


Supra-system determines or strongly influence the design of its parts

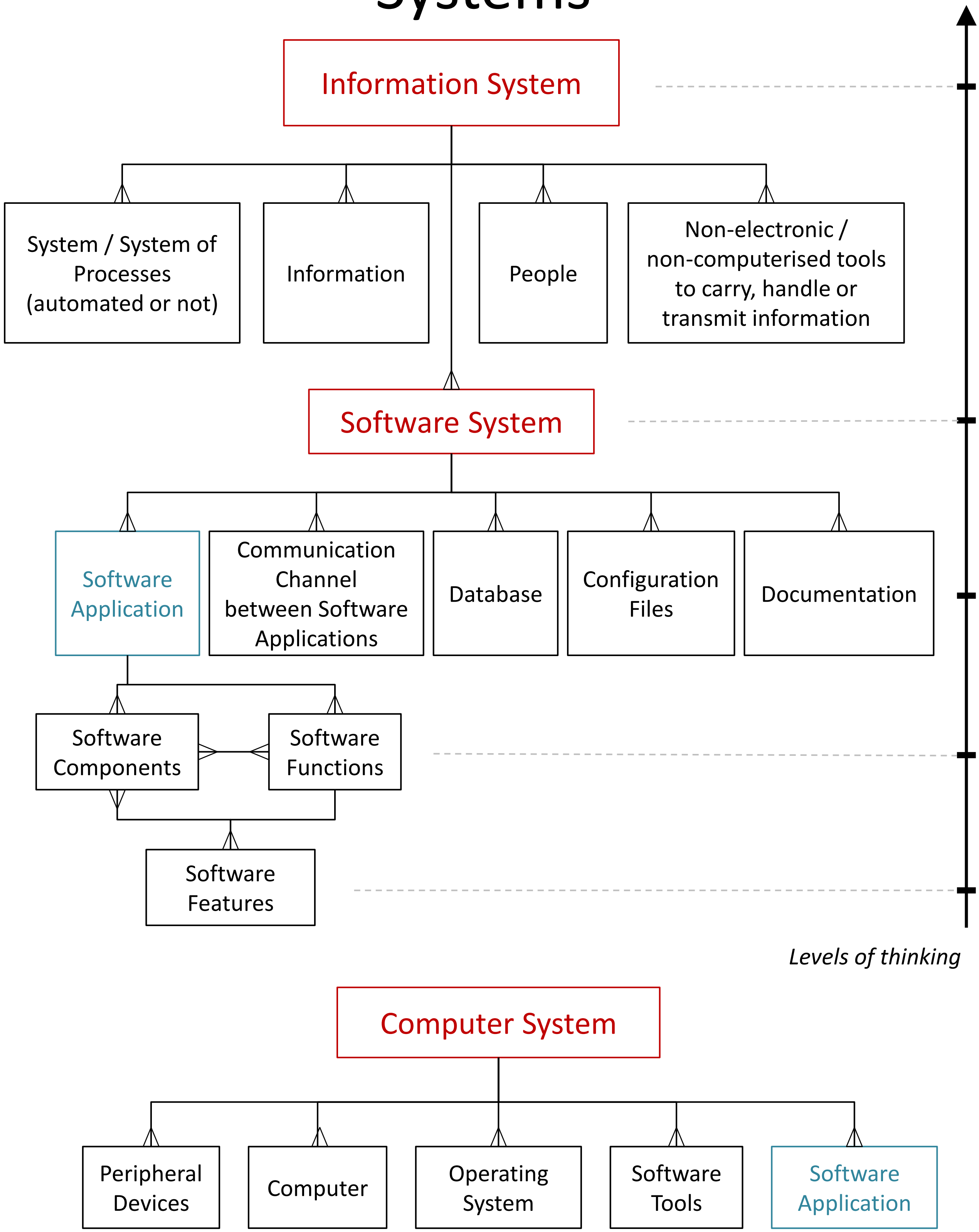
Reflection:

When designing a solution / IS, can we ignore the supra-system?
What is the relation between the company and the IS?
What is a company / organisation ?

Information / Software / Computer Systems



Information / Software / Computer Systems



Information Systems Mechanisms

1. Transformation mechanism
2. Queuing mechanism
3. Filters
4. Buffering mechanism
5. Finding mechanism
6. Selection mechanism
7. Sorting mechanism
8. Prioritisation mechanism
9. Decision making mechanism
10. Measuring mechanism
11. Conversion mechanism
12. (Re-)Formatting mechanism
13. Decomposing mechanism
14. Grouping or assembling mechanism
15. Matching mechanism
16. Identification mechanism
17. Connecting mechanism
18. Integrity checking
19. Balancing / Assignment mechanism
20. Evaluation mechanism
21. Messaging system
22. Routing mechanism
23. Push / Pull Mechanism
24. Transaction / rollback mechanism
25. Feedback mechanism
26. Pattern detection/recognition
27. AI mechanism
28. I/O management system
29. Encoding / decoding mechanism
30. Log-in system
31. Access Control mechanism
32. Alarm mechanism
33. Notification system
34. Control unit
35. Monitoring mechanism
36. Debugging mechanism
37. Tracing mechanism
38. Logging mechanism
39. Archiving/ Restoring mechanism
40. Deployment mechanism
41. Patching mechanism
42. Configuration mechanism
43. Version control mechanism
44. Deployment and activating mechanism
45. Start, Pause, Resume, Stop mechanism
46. Clean-up mechanism
47. Back-up/Restore mechanism
48. …

Software Systems Qualities

Functional Suitability

- Helpfulness: deals with most important and valuable issues, create most value
- Appropriateness: (solution is appropriate)
- Process / Feature Accuracy: (solution is accurate)
- Degree of automation
- Degree of control over the processes

Operability

- Technical accessibility
- Understandability / Recognisability
- Ease of use
- Attractiveness
- Learnability

Reliability

- Availability
- Fault Tolerance
- Recoverability

Performance Efficiency

- Time Behaviour
- Resource Utilisation

Security

- Authenticity
- Accountability
- Confidentiality
- Integrity
- Non-repudiation

Compatibility

- Standard compliancy
- Co-existence
- Interoperability

Data Suitability

- Data importance
- Data organisation
- Process-ability
- Reliability
  - Completeness
  - Accuracy
  - Consistency

Integrate-ability

- -

Maintainability

- Maturity
- Degree of control over the system
- Supportability
- Configurability

Adaptability / Evolve-ability

- Expandability / Extendibility
- Scalability
- Replaceability
- Documentation
- Source code organisation
- Analysability
- Changeability
- Modification Stability
- Modularity
- Reusability
- Testability

Transferability

- Installability
- Portability
- Adaptability

...

Sources:
ISO9126
ISO25010
SEI: Profiling Systems Using the Defining Characteristics of Systems of Systems (SoS) (CMU/SEI-2010-TN-001)

<u>Other qualities:</u>
Geographical spread
Cohesion, coherence, fragmentation of responsibilities
Cohesion, coherence, fragmentation of technologies
Degree of structured information
Matching between implemented concepts and reality
Degree of alignment
Degree of neatness and elegance of the source code
...

Needs of the Informatics Department

The responsibility for the administration and management of information systems creates needs:

- Deployment system (updating, activation, upgrading, ...)
- Release & Version Management
- Configuration tools
- User and Access Management
- Start-up, On-Hold, Stop (shut down) procedures
- Monitoring
- Logging Management (tracing bugs, errors, exceptions, ...)
- Alarms
- Data Quality Control (E.g. consistency checks)
- Data Synchronisation
- Queue Management
- Performance measurements
- Environment Management
- Configuration Management
- Resource Management
- Capacity Management
- Hardware Management
- Archiving & unarchiving
- Problem Analysis
- Back-up & Restore
- Data Recovery - Disaster Recovery
- Clean-up
- Security
- … ?

The Informatics Department
is a MAIN USER
of software application systems

ENGINEERING

Man-Made Systems

A man-made system is the creation of our brain

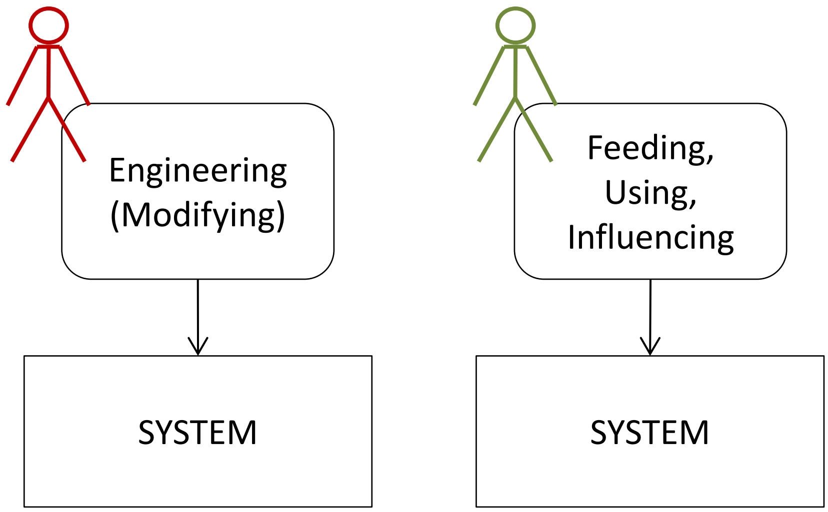
Therefore

- our understanding
- our vision
- our thinking patterns and habits
- our norms
- our mental flexibility
- the openness of our mind
- our creativity
- our knowledge
- our competences
- our experience
- our priorities
- our collaboration
- our emotions

but also our interpretations, assumptions, misunderstandings, distortions, unknowns and other weaknesses

are reflected in the design of the systems and solutions we create.

Acting Upon Systems



Why we need to learn and understand systems?

Each automated system has a purpose. It implements a mechanism based on principles. It has characteristics, limits and constraints.

A person, as a user, a manager or as a part of the system, feeds, uses and influences the system. Dealing in a wrong way with the system will create damage. The system will inevitably and indivertibly respond accordingly to its own logic, irrespectively of that person's knowledge, opinions or intentions. Even when it breaks, it will do it by obeying its own logic and to natural laws.

Systems always obey their nature, natural laws, embedded principles, built-in logic characteristics and limits. They have to be respected.

Engineering Systems

The design of systems must respect the laws and principles governing systems. Some of these laws and principles are essential to the survival and thriving of the system.

Information systems, as a specific type of systems, have to respect laws and principles governing a proper organisation, processing and use of information.

A system that doesn't fit into its environment, one that doesn't respect the nature and laws of its environment, can be destroyed by its environment or it can become irrelevant to this environment.

A system which doesn't respect laws and principles may also risk to die from within. A system dies or run into trouble, not so much because of external events, but much more because of its own bad design attacking the system from within. A good system should have a alerting mechanism warning that it is going to the end of its life.

Adapting such a system without understanding it fully is a very risky action. The system will always react and behave accordingly to its nature and logic.

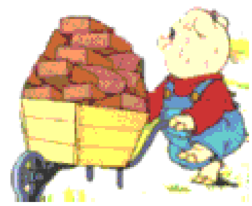
The understanding of systems and information, both as a knowledge domain, are critical in the conception of information systems.

This knowledge is neither to be found in the business domain knowledge nor in technological knowledge.

Tale of the 3 Little Pigs

Good Enough ?

Seemingly strong



Appropriate

Not (only) about materials (technology). It's also about

- Vision
- Mind set
- Norms
- Approach
- Skills
- Seriousness & Professionalism

Winchester Mystery House

LEARNING A LESSON

Owner: Sarah Winchester (widow of William Wirt Winchester (firearm magnate)

Approach

- From the ground-up
- Owner and Builders meet daily
- No architect (no analyst)
- No global plan
- Based on sketches

A few numbers about the building:

161 rooms, 40 bedrooms, 40 staircases, 47 fireplaces, 17 chimneys, 6 kitchens, 13 bathrooms, 2 ballrooms, 2 basements, 3 elevators, 10.000 window panes, one shower

Building Process

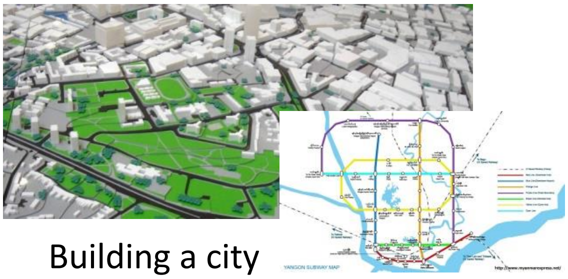
16 carpenters worked in shifts 24 hours a day, 7 days a week during 36 years (1886-1922). Sarah met the carpenters daily. She hastily sketched designs on paper to explain what the carpenters had to build. There was no architect. Sarah built, demolished and then rebuilt. Sarah ordered errors to be torn out, to be sealed, to be built over or around it, or sometimes simply to ignore it.

Oddities

The house is a labyrinth. Windows are overlooking other rooms. Cabinet and doors open onto walls. Small rooms are built within larger rooms. Some chimneys don't reach the ceiling. Stairs have odd-sized risers or leading to nowhere. A door opens out into nothing. Balconies are inside. Floors have skylights. This approach led to a chaotic architectural jumble. Rooms were hidden and lost behind new construction. Just to name a few.

Today, the mansion is a tourist attraction

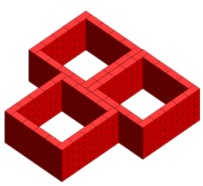
Hierarchy of Systems



Building a city

Road infrastructure, waste water, public transportation network, communication network, energy, emergency services, balance nature-housing-work-entertainment, …

Building a house



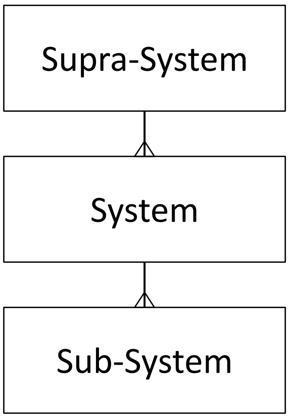
Building rooms

Building a wall

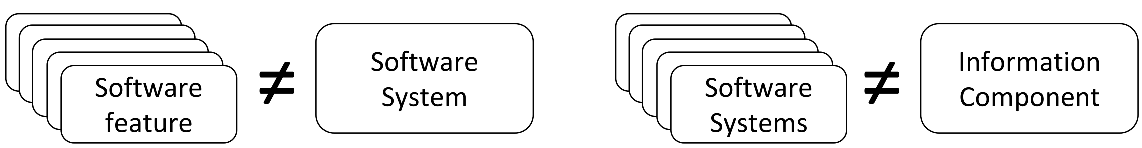
- Requiring different skills
- New aspects, questions, problems, priorities, principles, criteria, … appear at the different levels.
- Work and product are different in nature
- Requiring different expertise's

A higher level resolves specific questions, specific issues that don't exist at a lower level.

Hierarchy of Systems



1. A system solves a different problem from its sub-systems.
2. The purpose, function and goals of a system can differ from its sub-systems.
3. Sub-systems have to contribute to the purpose and goals of the system.
4. A system and its sub-systems can be of different nature.
5. A approach, methods and skills to conceive and build a sub-system may be inappropriate to conceive a higher system.
6. A system can not be conceived with the same level of thinking that is suitable to conceive a sub-system.



A Software Features is a mini-system. Software Systems and larger systems are not simply collections of Software Features. They are a different type of system. They are also a sub-system integrated in a heterogeneous supra-system.

Limits of Scalability!

Why are some approaches or methods not scalable?

A way of thinking (level of thinking, world view), an approach, methods and insights suitable for a lower level, may not be appropriate for a higher-level system.
A philosophy, an approach or methodology designed with one level of thinking (maturity) may not be appropriate for a higher-level problem/system (supra-system).

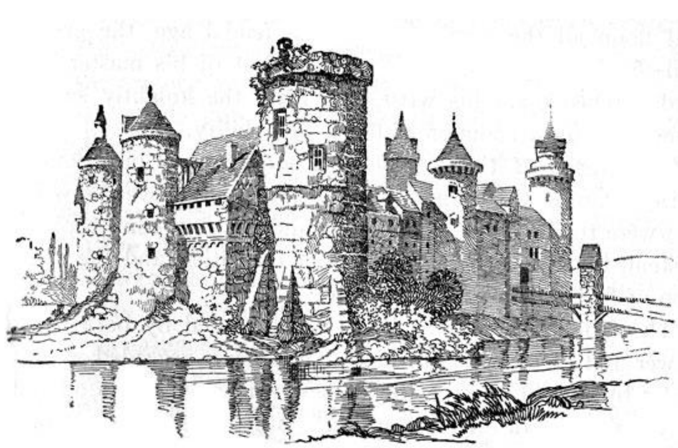
MODERN MIND-SET

- Easy
- Quick
- Not much thinking
- Little effort
- Instant gratification

Little short-term successes

OK for little things that don't matter.

Are we still able to build things that do matter and which last?



Notes:

The castle is a system that is vital, well-thought, functional, practical, lasting, operating as one system, … and critical for thriving. (It's not about being outdated or monolithic). It is about the focus and mind-set to build great systems.

Metaphor: Restaurant

This metaphor helps thinking about what corporate IT is required.

Customers may find it long to wait for their meal. They want it quick, cheap and tasty. They want a great experience. The restaurant may deliver that.

To deliver a decently cooked meal, it takes some time. The customer has to have some patience. If he can't wait, either he will have a badly cooked meal.

The restaurant may also try to look for simpler meals taking lesser time to cook. Possibly, it may end up transforming itself into a fast food. Fast food restaurants are "restaurants" without chefs.

The restaurant may seek to offer a great experience or to offer them nice looking and very tasty meals.

The restaurant may seek to solve the hunger of their customers. And customers may be glad not to have hunger anymore. However, since hunger is just a symptom, it ends up solving symptoms.

Resolving the desires of experience, taste and hunger can be fine. However, in the long run, it may have devastating effects. The human body needs a healthy diet to be healthy and to live long. It needs specific nutritive elements on regular basis.

Patience and decent meal is maybe not what the customer may ask for, but it is what he or she needs, particularly when we consider the broader picture.

Decisions made based on pleasing or on short term may undermine the system, the foundation and the long term, particularly if they are made frequently.

A chef needs to understand cooking tools, cooking techniques and taste. He or she needs to understand what (s)he creates and the materials (s)he deals with. (S)He has to understand food and nutritive elements, their value, their nature, what happens when they are processed, and so on.

A good restaurant can not be satisfied with a chef that knows only his tools and techniques or one who can only cook by using recipes. Recipes are fine. But they are only the basic process. It has always need to be adapted to the specific situation. Being able to follow a recipe doesn't make a great chef. Recipes don't replace the knowledge of the chef or the cooking skills.

Mind-Set : Driving Beliefs

MEDIOCRE DRIVING IDEAS

Fill the gap

Get the problem solved

Get the job done

Follow the flow

Respecting standards

How does anyone else do it

What do you want me to do?

Analogy, Copy, Buying, “this is similar to”

“Having it working is just fine”

Local, short term

SUPERIOR DRIVING IDEAS

Higher goals

Purpose-based

Root causes-based

Holistic

Innovation, New ideas

First Principles

Natural laws

Multi-dimensional

Sustainability

Long-term

Evolution

Driving Goal of Initiatives

OR

		Goal : Customer Satisfaction	
		Dissatisfied	Satisfied
Goal: Company / System Design	Excellent	**Dissatisfaction** is possible, probably fixable	
	Inappropriate	**Undermines** the Org./System Hard to fix	**Undermines** the Org./System Hard to fix

Excellent System Design

Everything that shapes systems,
affecting the Structural Design and Core Mechanisms

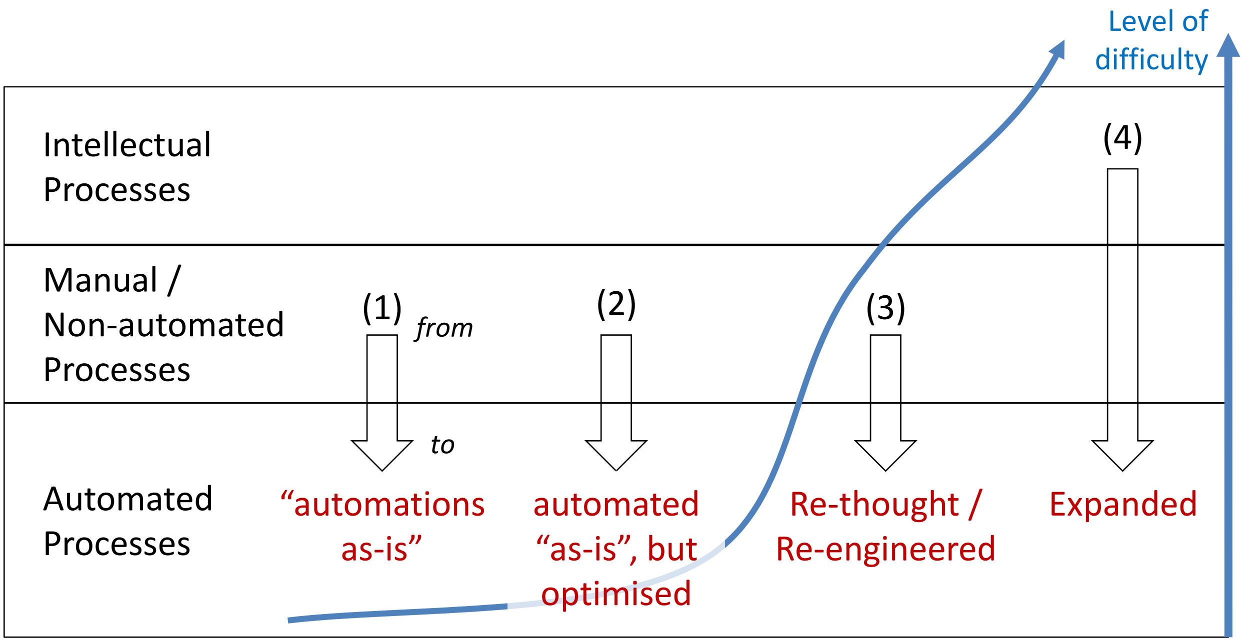
- Core logic of processes
- Core information concepts
- Organisation of the core of information,
- Landscape of systems (roles of systems, areas, interactions and collaboration between systems, (business) functions per (sub-)system)
- Systems solving wrong problems
- Integration, fragmentation, separation, duplication, interoperability, scalability, …
- Missing sub-system and mechanisms necessary for the control, management, evolvability and survival of the system
- Architecture

It does not include: issues with features, adjustments of processes, missing information, end-user interface issues, … they can create dissatisfaction, but does not require rethinking and reengineering core aspects of the system to be solved.

Inappropriate design

The core of the system is inelegant, weak, creating imbalances, internally chaotic, …

Computerisation



1. Automation of the existing non-automated processes. "Show me how you work, I will computerise it." Same processes, but faster execution. Risky. Computers aren't people. These sets of processes may have grew organically. They can be very inefficient.

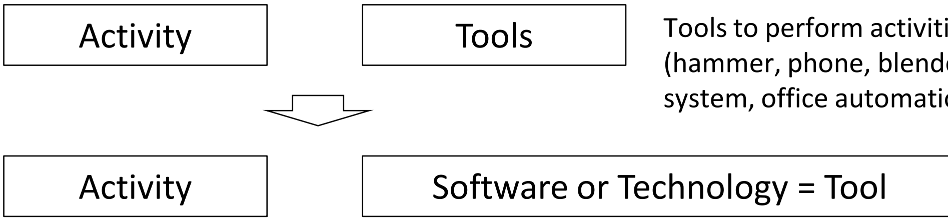
2. Automation of the existing manual processes, but introducing optimisations, such as faster information transfers to other organisational units, removing unnecessary manipulations, etc.. Some processes can be added, but they don't revolutionise the system.

3. The whole system and processes are reviewed, re-thought and re-engineered. Great gains can be obtained.

4. Implementation of the intellectual processes of people. This requires the analyses of how they use information, how they interpret it and how they think based on that information.

5. Conception of NEW system (*not in diagram*)

Thinking Pattern: Activity + Tools



Tools to perform activities (hammer, phone, blender, e-mail system, office automation software, …)

Traditional Salesman's View / Consumer's View of IT:

"Buy, build or provide tools, be it software applications or technologies, to support or perform our activities."

"I sell what you need" – "I buy what I need"

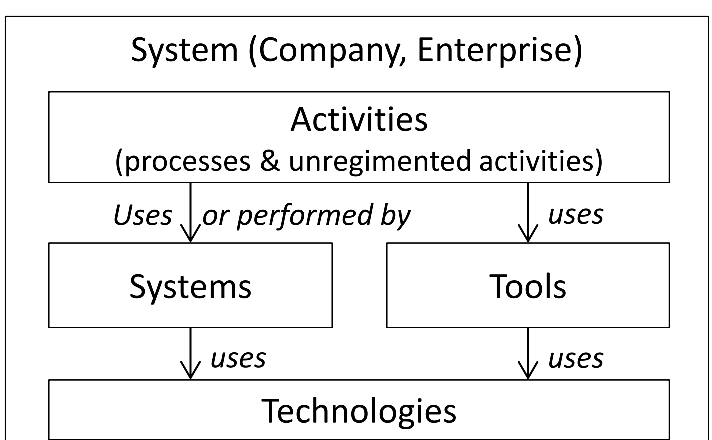
"Adding (what is needed) allows a better functioning"

("IT is about delivering tools & technologies")

This thinking is applied in a household. A company's budget is much larger than an household's budget. A company is not a household.

This way of thinking, in a business setting, is linked to local & operational level, users level. Compartmentalisation at lowest level, Fragmentation, stovepipe-thinking, sub-optimisation, …

The company's situation is a bit different:



Small & Large Projects

Small Projects

Usually :
- Simple, easy and short
- Can be done with limited understanding of the discipline, limited skills
- Can be done with little organisation, simple environment, little management
- No or little incentive to learn about the discipline and to improve
- Everybody can do it
- Easy to be successful (small success after a few days)
- Small, unimportant, superficial things can be achieved

Large Projects

Usually :
- Complex, difficult, long
- They really **test** our capabilities, understanding, …
  (*one can't pretend to be skilled or expert and do only basic, small, easy, basic work*)
- Requires great insight in the discipline, advanced skills
- Requires a more developed, formal and managed organisation and environment
- Obliges people to learn and to improve their skills
- Not everybody can do it
- Is <u>NOT</u> synonym of / does <u>NOT</u> imply “big bang” development/implementation !!!
- Serious stuff, things that do matter, sizeable challenges, …
- Not necessarily harder to be successful (much greater result over longer period)
- People built great things to show their skills. Societies built great things to show how advanced they are.

Reflection: Should large project be avoided because

- We can't do it?
- We want to be successful? Fear of “Failure” ???
  (What if success is defined by tangible results instead of by “meeting estimations”?)
- Impatience & quick wins
- Development of solid skills, practices, insight, … ???

Or, on the contrary, are there good reasons to learn doing sizeable and larger projects?

Some Major Engineering Approaches

Analytical, Methodical, Logical, Structured, Critical → Systems Analysis, Systems Thinking, …

Creative, Explorative, Experience → Design Thinking, Brainstorming, Trial & Error, …

Plan-driven, holistic, top-down, long-term based, shaping the future, …

Opportunistic, local, ad hoc, problem or need driven, Bottom-up, Explorative

Continuous Analysis

Continuously study of objectives, plans, changes, systems leading to projects

Mission-driven

can well be combined

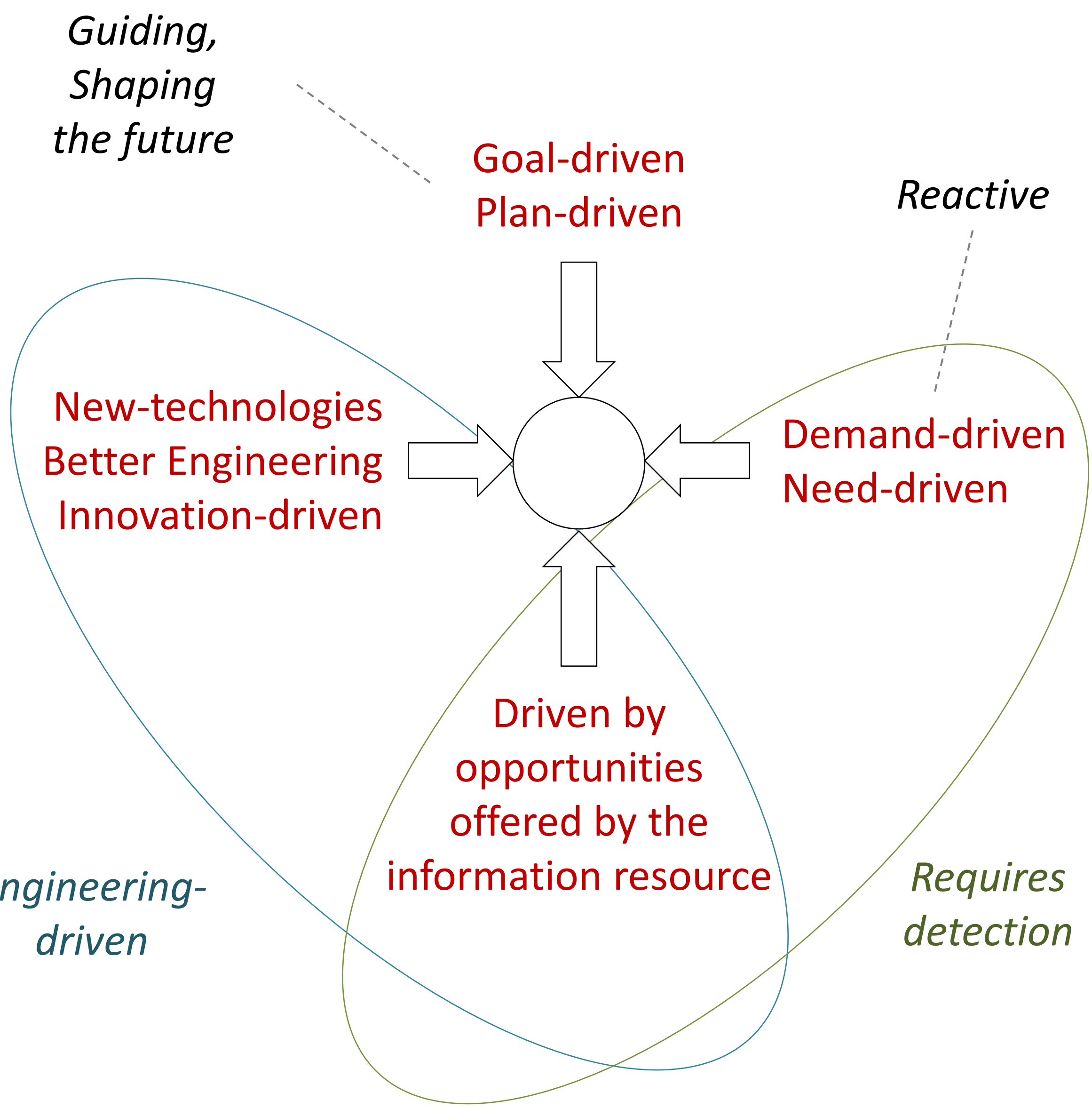
Initiative-driven

local, ad hoc, free or authorised (sudden idea, local need, problem or opportunity)

Notes

- Some approaches can be combined in one.
- A company may need to have or allow different types of approaches. It’s not about choosing one single approach for the whole company. Usually, one main approach can make sense.

Types of Approaches



Notes:

Companies needs three, and preferably the four types of approaches.

Reactive Approaches

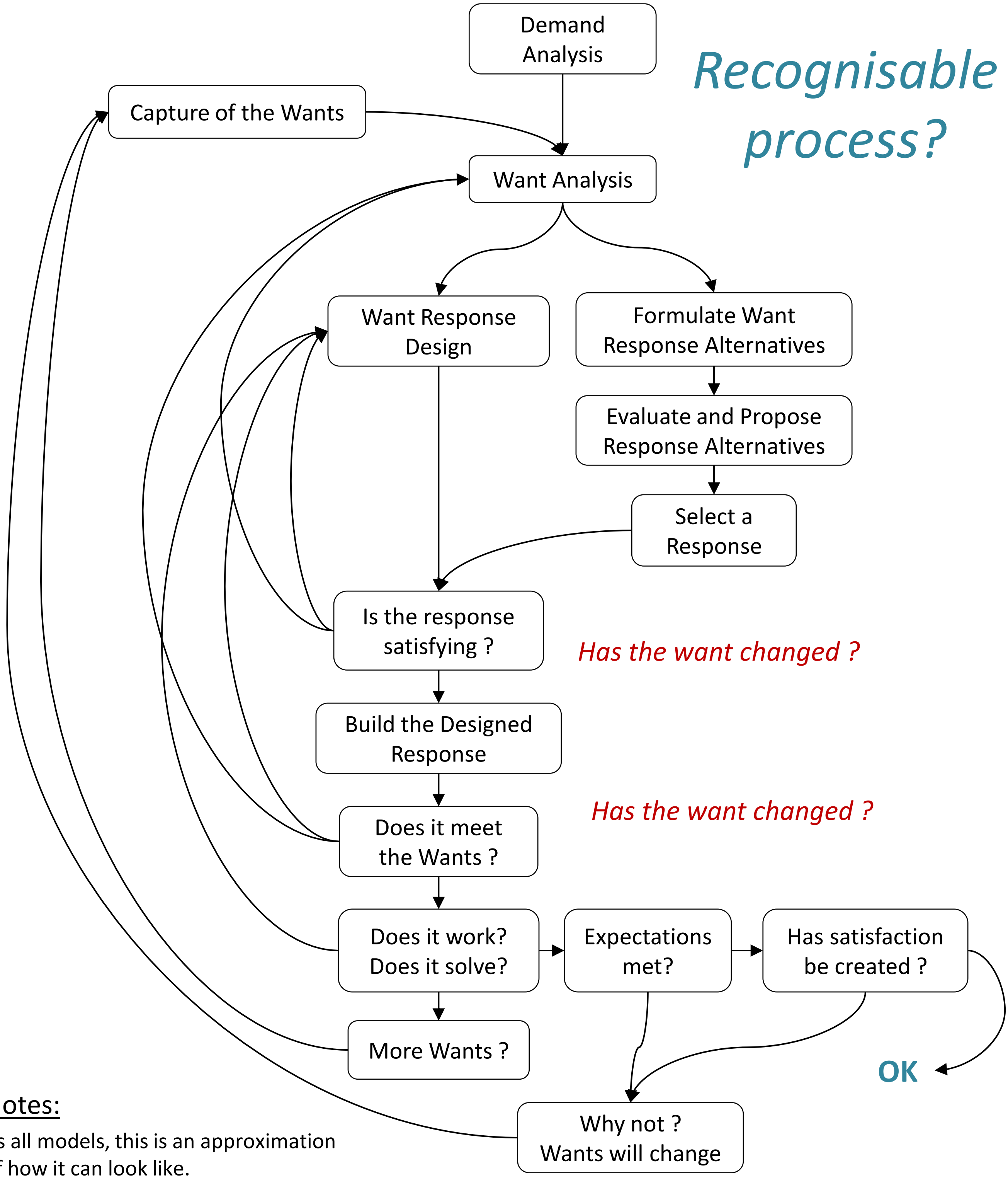
All approaches based on existing needs, existing problems or on demands

- Problem exists and creates already damage.
- Need exists and is already a missed opportunity (cost)
- No control over when what problem, need or opportunity will pop-up
- No control over the direction
- Following, not leading or shaping the future
- Always lagging, always gap between problem, issue, need or opportunity and solution
- Existing problem and opportunity creates frustration and impatience
- Creates pressure
- Assuming received information is reliable and true. No verifications.
- Pressure, assumptions, lack of verifications lead to mistakes, bad solutions, misunderstandings, conflicts, stress, exhaustion, …
- Focused on solution design, instead of on (understanding) the problem (understanding the demand or symptoms ≠ understanding the problem)
- The less time is spent on verifying, learning, thinking and testing, the more time can be spent on building and the quicker something can be delivered.
- Focus on building without understanding. Building based on assumptions.
- Limited to translating the demand into design of ‘something’ to be built.
- Less competencies are used.
- Not proper for innovation

Is a reactive approach appropriate as main stream type of approach?

Demand and Want - Based Development Cycle

15/03/2019



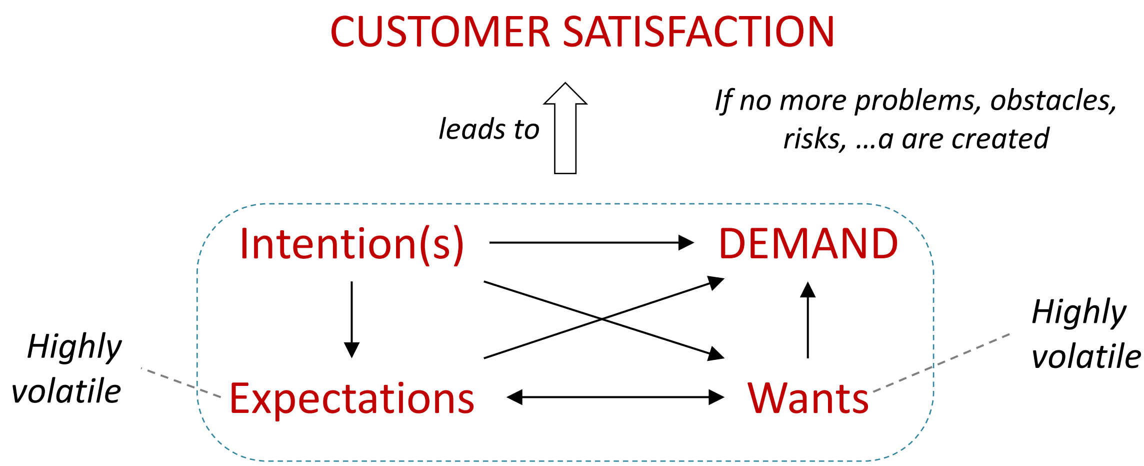
Notes:

As all models, this is an approximation of how it can look like.

Or, software development w/o analysis and without methodology.

Does this approach match the needs of efficient and effective software development?

Demand and Want Analysis



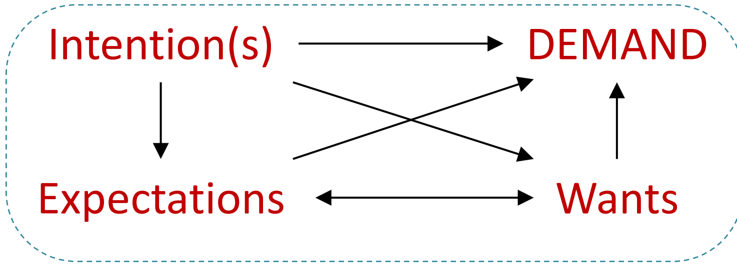
Intention, wants, expectations and demands
of business stakeholder*, customer, end-users, sponsor*

What is the QUALITY of the Intentions, Wants, Demands and Expectations ?

MUST be:

Justified	Stable
Possible	Reliable
Coherent	Good / Optimal
Complete	…

Demand and Want Analysis



The average analyst has no (or little) clue
on what this is based.

He/She doesn't know the reasoning behind it.

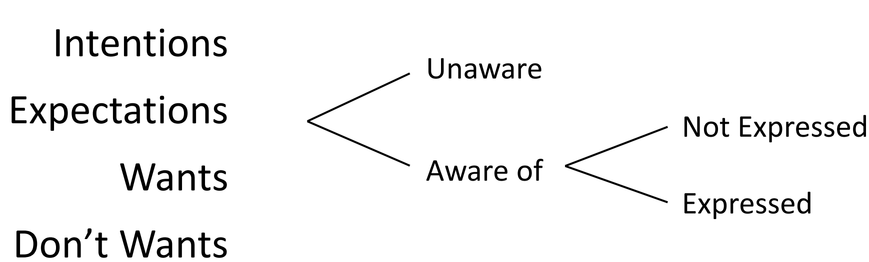
How much is this in line with reality ? (cfr practical versus choice problems)

What changes these expectations and wants?

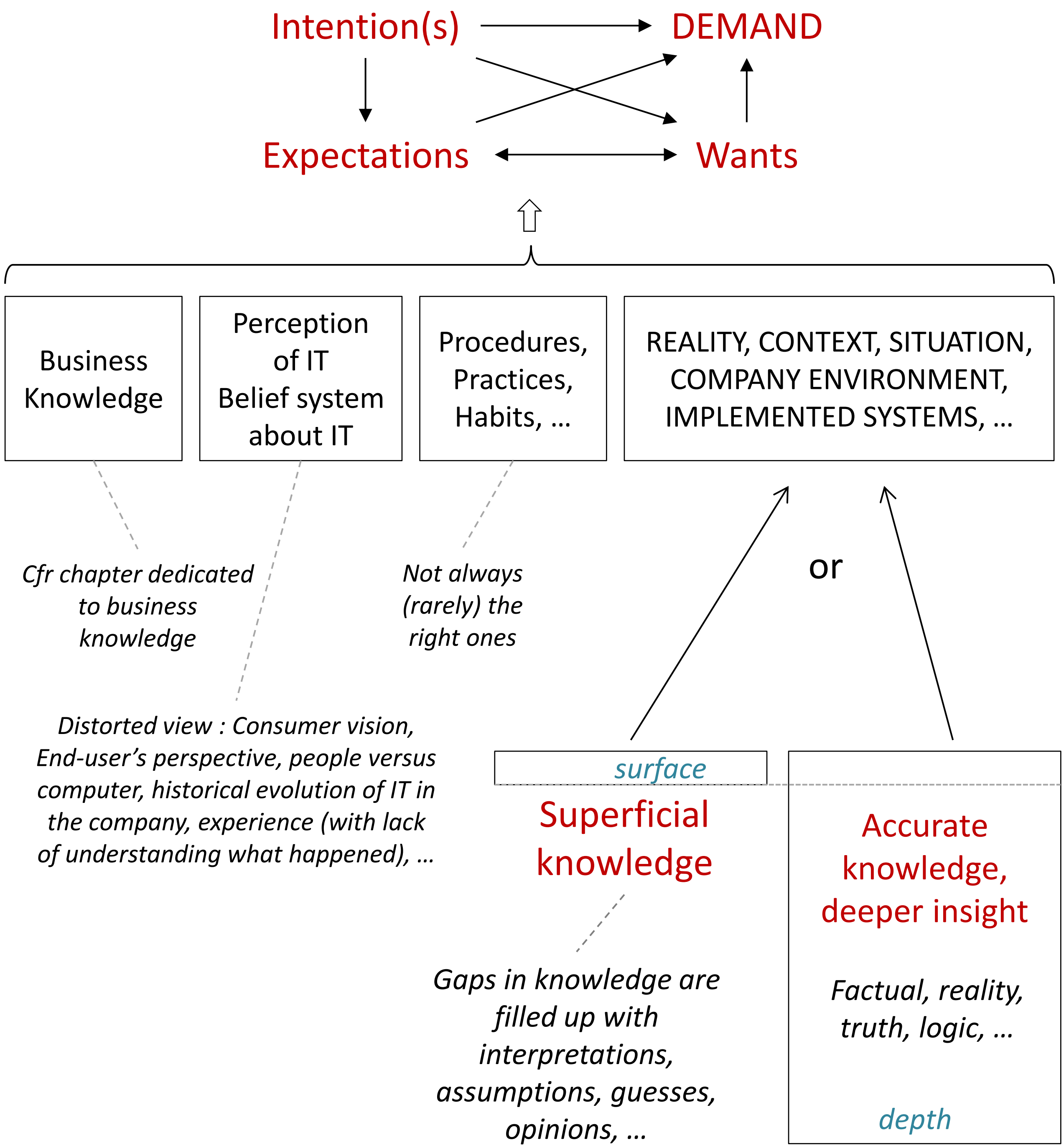
- New information
- New insights, deeper insight
- Detection of contradictions
- Uncertainty, hesitation

We don't know …

- whether the demand, the wants, the expectations fit with the intentions
- whether it solves the problem,
- we don't know if responding to the demand, expectations, wants that customer satisfaction is created. We simply assume this. Projects and actions based on assumption … ???

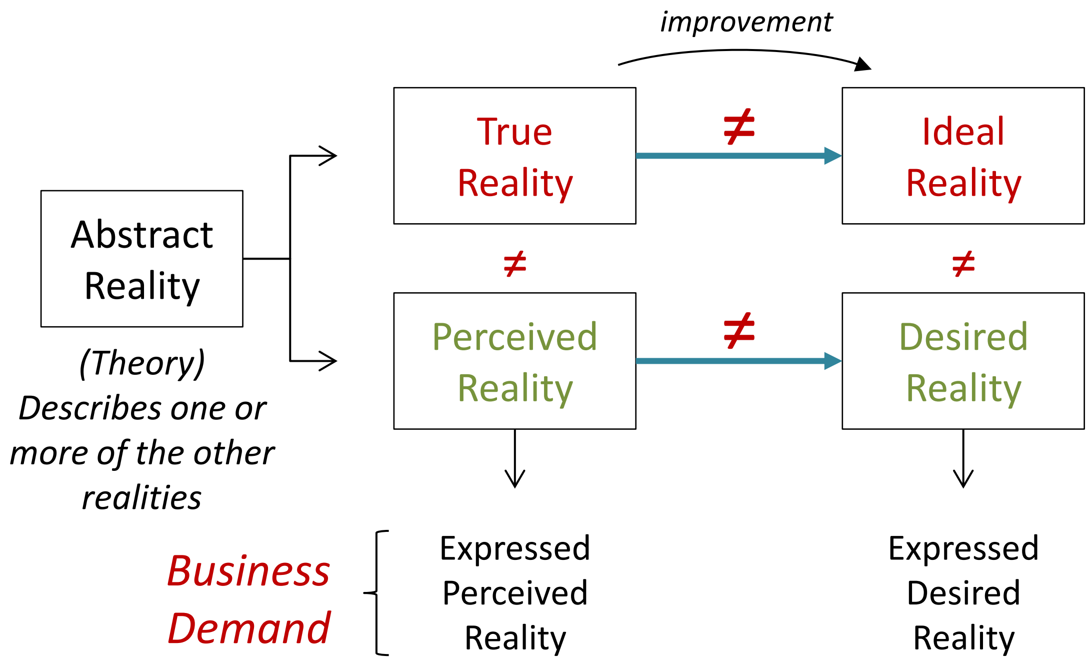


Demand and Want Analysis



Much Work for the Analyst

Building upon Realities



It is problematic when

- the perceived reality (subjective reality) doesn’t match the or true (objective) reality.
- the desired reality is based upon a distorted perceived reality
- the desired reality is too different from an ideal reality

The Analyst has to

- Study the true objective reality.
- Identify the
- Align perceived reality with the true reality and the desired reality with the ideal reality
- Identify the path between the present objective (true) reality to a more ideal reality

Do not rely and build upon distorted, incomplete or disadvantageous reality.

Some False Beliefs

Beliefs based on the ASSUMPTION:

The demand is correct, complete, reliable and stable.

- The demand describes the needs.
- The demand describes what is required.
- Responding to a demand = solving the problem
- Responding to a demand creates satisfaction.
- Understanding the demands = understanding the problem
- Understanding the demands = understanding the situation
- Understanding the demands = sufficient to create a solution
- The demand takes the situation and all aspects and parameters fully (sufficiently, reliably) into account.
- If the demanded solution is built, value is created.
- Projects (always) produce solutions.
- Business community can diagnose its information problems and conceive information solutions.
- Business community knows what software and computer systems can do and can’t do. They understand their power, constraints and impossibilities.

Engineering Systems

Information is critical for the company.
Information systems, and their automation, constitute a huge benefit especially for larger companies.

Building Software Systems is …

- very Complex
- very Slow
- very Demanding

Techniques to speed up development:

HARDER

- Tackling the right problem rightly from the first time
- Planning
- Creating an appropriate environment: relational environment, appropriate work atmosphere and physical environment
- Availability of people and competencies
- Smooth decision making processes
- Project team support
- Organisation of artefacts
- Sound architecture and concepts
- Internal organisation of source code
- Parallel development
- Good choice of standards, tools, technologies
- Modular software components and Reuse

Other techniques:

EASY

- Increasing pressure (shorter deadlines)
- Increasing the number of people
- Taking all kinds of shortcuts
- Leaving out intermediate steps and work

- *Higher risks*
- *Lowers the quality*
- *Defers costs to the future, which may turn out to be much higher and/or <u>hidden</u>*

<u>Notes:</u>

Shortcuts: ignoring complexity; ignoring the purpose, the value and the importance; pretexting "it has no value", "it's faster", "we can already start" (leaving unsettled questions for later), …
These decisions require understanding of projects and of ISE/SE.

Causes of Hidden Costs

- Delivering well after the need or problem exists
- Not fully exploiting the conceptual possibilities
- Not fully exploiting the information
- Solved consequences leaving true causes unresolved
- Exaggerated and unnecessary complexity
- Oversimplifications
- Built-in obstacles and limitations (to be circumvented)
- Fragmentation
- Ballast, unnecessary and unused source code
- Confusing explanation and logic (documents, source code, …)
- Loss of knowledge and insight
- Unreliability, vagueness, contradictory information
- Information glut
  information chaos, duplication, not inventoried information, various formats, lack of connections, lack of meta-data, unreliability, bad information organisation, unnecessary and outdated information, ignored information, inaccessible info, …
- Chaotic documentation, information, source code, systems architecture, …
- Lack of alignment
  with needs, with objectives, with business knowledge, functional alignment, conceptual alignment, rules, technological alignment, misalignment in standards, …
- Unappropriated and limiting concepts, processes and architectures
- Systems, software applications and source code that are hard to change
- Unnecessary processes (like data transformations)
- …

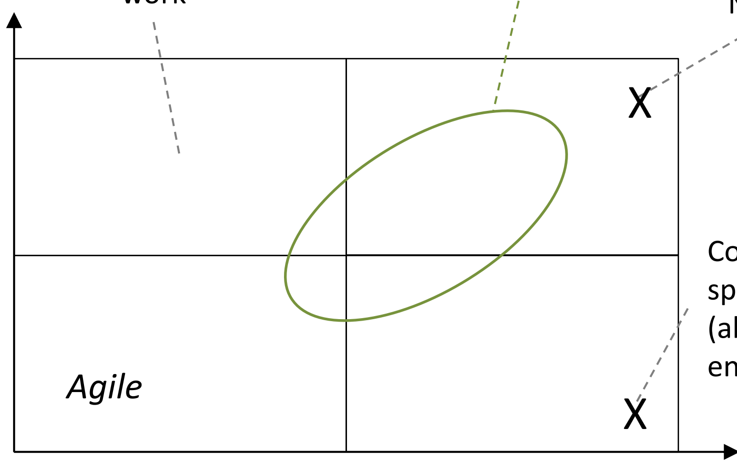
Note:
A lot of hindrances are not about programming or technological
These “causes” are consequences in their own right.

Art vs Engineering

- Mainly an engineering discipline, partly also an art.
- Building the IC of the company, when possible also please end-users

Not sure this will work

Not every thing can be fully engineered



Build the IC of the company

Please business community (end-users and stakeholders)

Common wide-spread way of (ab)using software engineering

Software Development is an ART

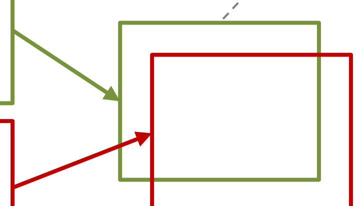
Software Development is an ENGINEERING discipline

Two System Building Processes

More likely to be a system that is badly tied together

Process 1
Simply doing anything that seems to be necessary

Process 2
Engineering Process
(well above 50% is engineering)



More likely to be a better system

Not every system development process can be called an “engineering process”

Two Major Engineering Approaches

Analytical, Methodical, Logical, Structured, Critical

↓

Systems Analysis, Systems Thinking, …

Analysts deal essentially with systems, processes, structures, …

Creative, Explorative, Experience

↓

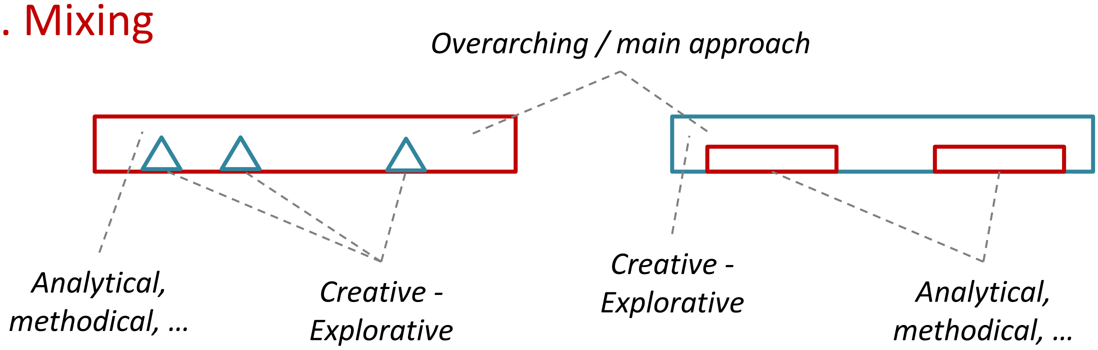
Design Thinking, Brainstorming, Trial & Error, …

1. Continuum of possibilities

Analytical, methodical, .. ⟷ Creative - Explorative

The extremes (or pure forms) are clearly different. However, there is a continuum of possibilities between these two extremes.

2. Mixing



Two Major Engineering Approaches

LOGIC - driven

- Rational, based on logical thinking, reasoning
- Product, result is more important than taste
- System-oriented
- Architecture-centric, component based
- Requires understanding, holistic, knowledge-based
- Top-down, integration
- Plans and models
- Some more control
- Rigorous, methodical, structured
- Longer iterations (short iterations is possible)
- Examples: Systems Design, Systems Thinking

CREATIVITY - driven

- Experimental, trial and error, experience
- Usage-centric, people-oriented
- Can be matter of taste
- Creativity, idea generation
- Ad hoc, unpredictable
- Short iterations, fast feedback
- Lesser structured approaches
- Requires lesser understanding
- Lesser (supra-)architectural
- Bottom / Bottom-up
- Integration is lesser important
- Examples: prototyping, design thinking, user-centred design, …

Creativity-driven gets more attention these days increasing the uncertainty, unpredictability and amount of changes.

Logical ⟵ *Gradation* ⟶ Creative

Each type of design approach uses the other, but to a lesser degree (more locally, sporadic, for a specific usage, as subordinated approach, …)

Logical	Creative
Creative	Logical

Notes:

It is the nature of the challenge; the nature of the system, its purpose and usage that determines which type of engineering is required.

Two Major Engineering Approaches

BALANCE

70% (+ or - 15%)	**30%** (+ or - 15%)

70% (+ or - 15%)

- Value-driven
- Plan-driven & plan-based
- Holistic
- Learning by analysing & thinking
- Top-down
- Collaborative
- Adaptive

Defining overall objectives, long term, main lines, overall architecture, …

30% (+ or - 15%)

- Opportunity-, demand-, problem, need-driven
- Local
- Do and Learn
- Bottom-up
- Exploration

Adjust, fine tune, adapt, improve, seize local opportunities, …

Notes

This depends largely on the industry, on the type of system (core vs peripheral) and on the customer (example: operations vs marketing)

Types of Approaches

1. Mission-driven

- **How:** The Analyst receives missions to execute. These missions define the work of the Analyst, the work to be done by a project, and so on.
- **Advantage:** The work is more likely to be inline with the overall evolution and objectives of the company.
- **Drawbacks:**
    1. It relies on the knowledge and understanding of people other than the analyst. The mission may not be defined correctly.
    2. Weaknesses and flaws may remain undetected. Important corrections, improvements and opportunities may never be applied leaving the company inefficient and weak.

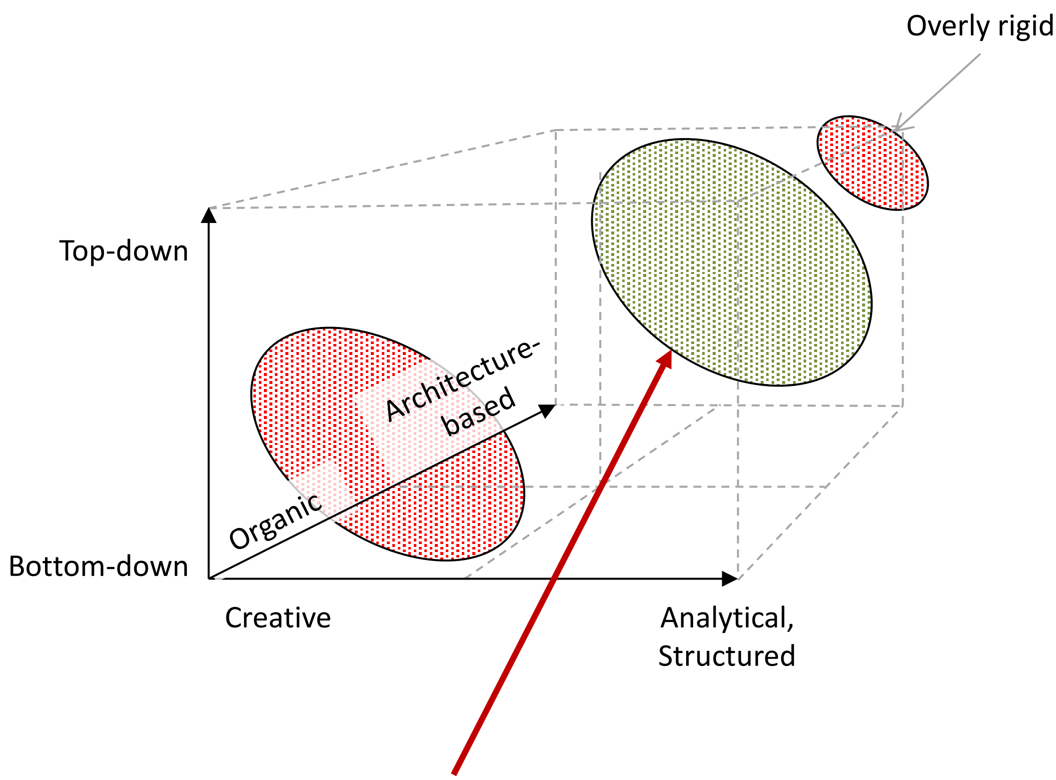
2. Based on Continuous Investigation (Continuous Analysis)

- **How:** The Analyst does continuously investigation to find issues, weaknesses, opportunities. The Analyst also study plans and architectures to see what impact they have on the present implementations and ongoing initiatives. He or she either has the authority to take initiatives of (some) changes. Or, he or she report detected issues and proposes initiatives and solutions.
- **Advantages:** The implemented systems can be improved in ways the management isn't aware of. Bottom-up improvements are possible. Systems and processes are better understood because they are under continue investigation.
- **Drawback:** Alignment with plans and priorities might be somewhat more difficult (but not impossible).

Notes:

Both approaches are indispensable. However, missions should be adjustable to the situation in order to get the most out of it.

Different Types of Approaches in Man-made Larger Complex Systems Conception

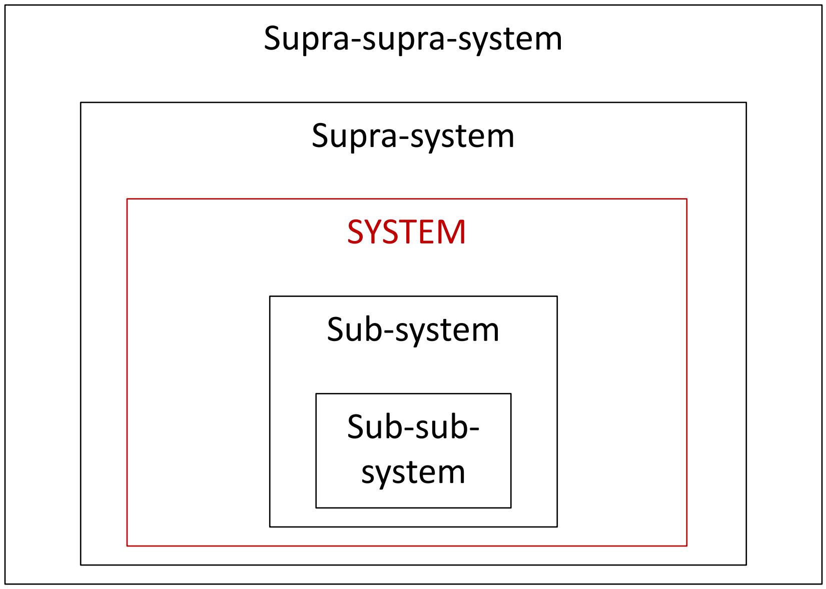


For this type of systems, the approaches should be in this area.

It is mainly top-down, analytical and architecture-based.
It make also possible to have creativity, some bottom-up and some organic growth.

This combines the strengths of all tendencies.

System Levels and Thinking Level



THINK "HIGH LEVEL"

The mind has to be focussed on, to be driven, inspired and guided **by the higher systems** and their environment.

- **Goals** are deduced from the goals of the higher systems (supra, supra-supra-, …)
- **Requirements**, **Design** and **Functional Integration** are deduced from these higher systems, their goals and purposes and from their environments.
- **Technological Integration** takes the supra-system into account.

The supra-systems may be of a different nature than the system and can be heterogeneous. Same is true for the sub-systems.

A mind driven by and focussed only on the change, the features, the system or the solution to be delivered is likely to create inefficiencies and, through repetition, over time, chaos.

Also important for methodology development

PRINCIPLE: SEPARATION OF CONCEPTUAL SOLUTION and CONCRETE SOLUTION

KEY PRINCIPLE: Conceptual thinking precedes and must be separated from concrete thinking.

The brain has first to think about how to solve a problem conceptually. Once this is done, it has to think how to realise it with technologies, with matter, with concrete pieces.

Process:

1) Define the conceptual solution
2) Define the technological solution, the technologies, the materials

Implication:

It is way better to separate the conceptual/functional/non-technological roles from technical/technological roles of architects, analysts, engineers.

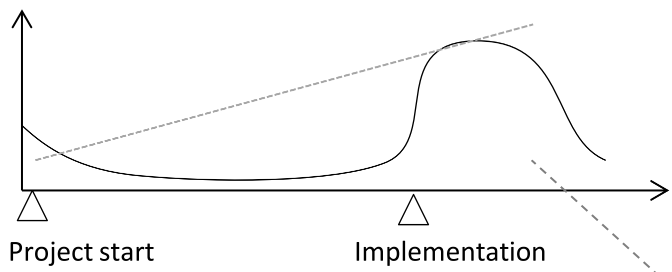
Note:

It is favourable for the conceptual thinker to know (or to have a good idea) of what technology can do and what it can't do.

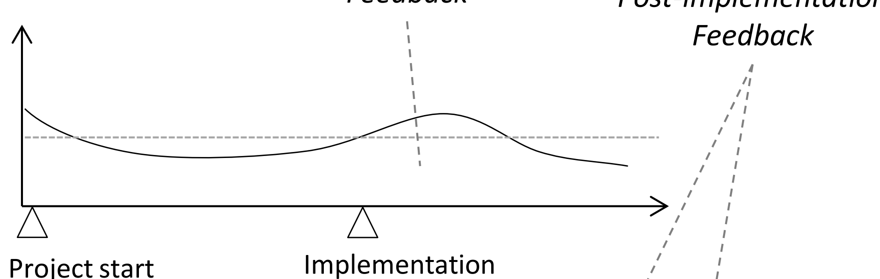
The way business is ran and how information is used in the business activities and how it is organised, stored and processed in the company should be separated as well.

Learning in the Process

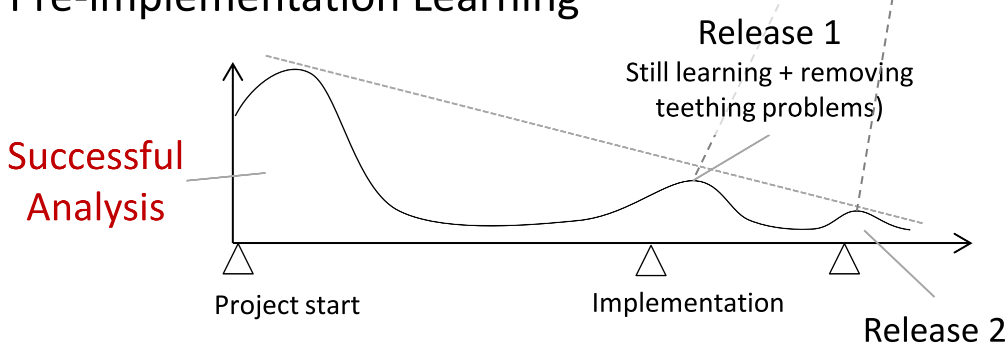
Post-implementation Learning



Continuous Learning



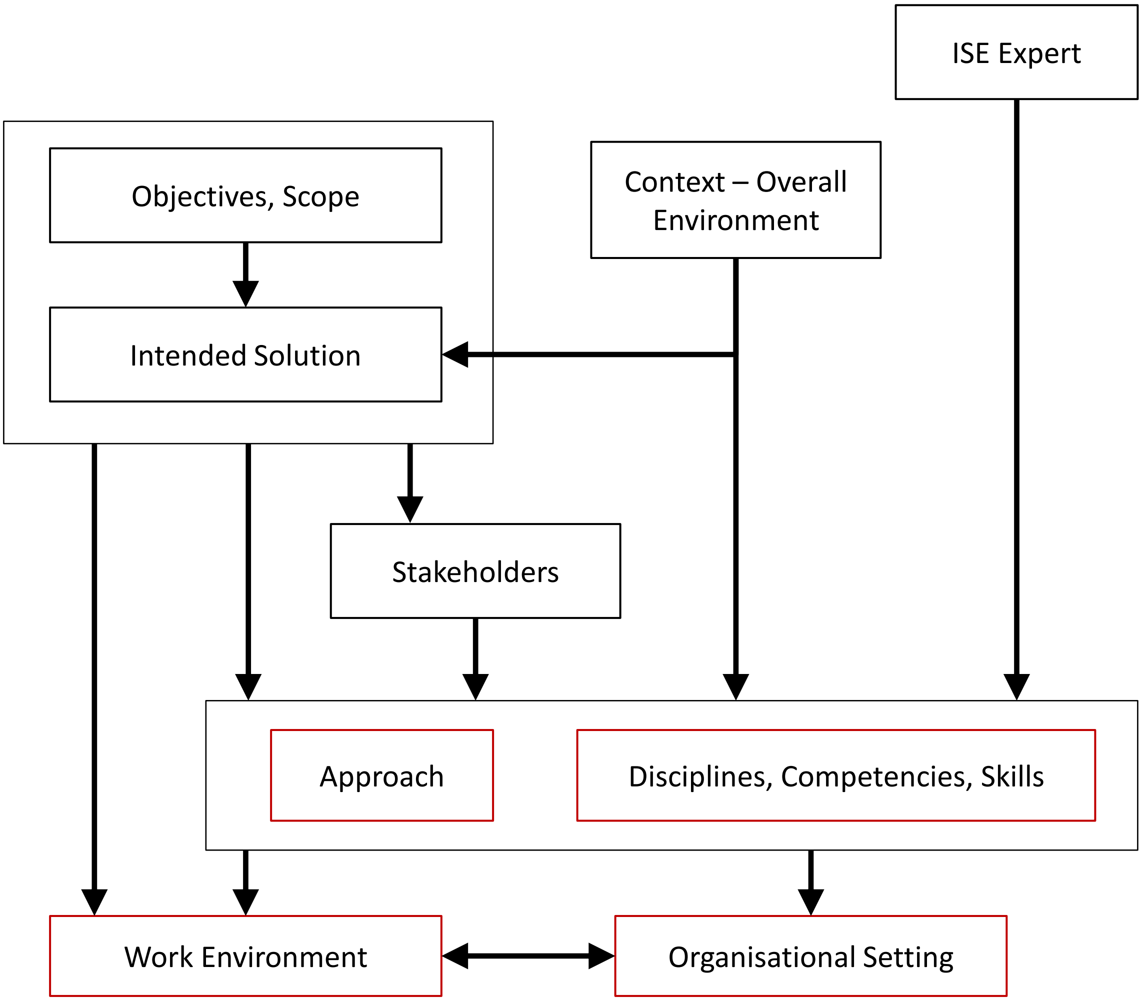
Pre-implementation Learning



Notes:

There is always some pre-implementation analysis (learning), continuous learning and post implementation learning.

Setting up for IS Development



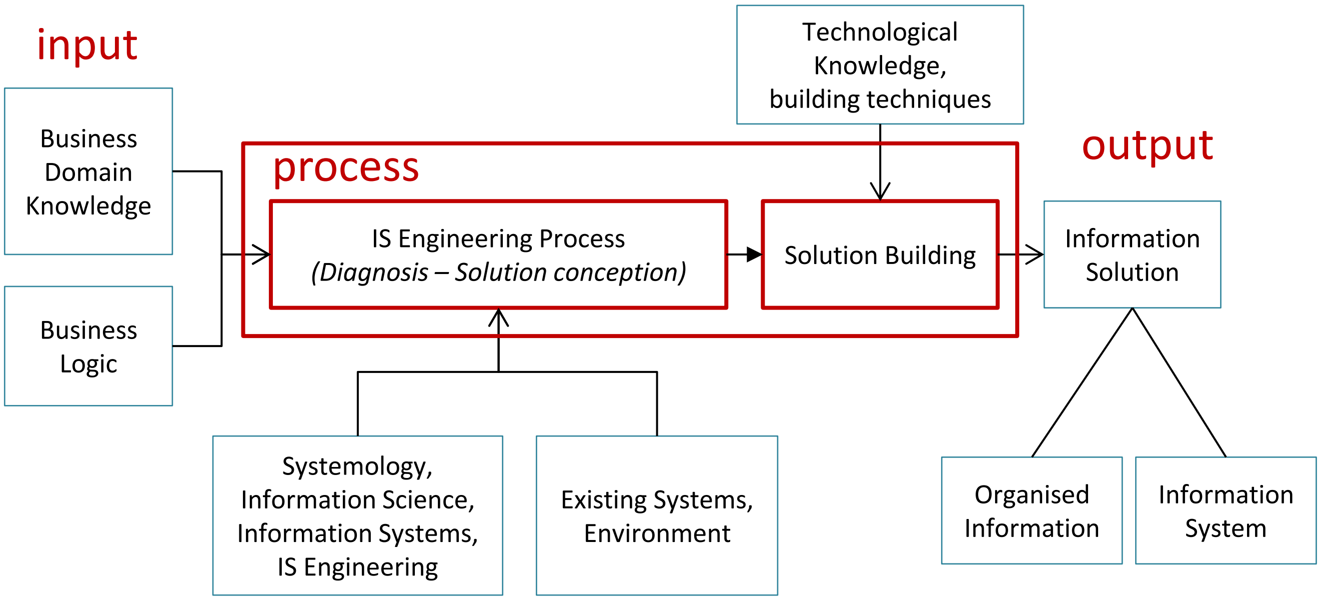
The objective, the scope, the intended solution (if present), the stakeholders, the global context and overall situation and the ISE experts and/or project team determine the approach required to achieve the objective or required to produce the intended product. They also define the required discipline, competencies and skills.

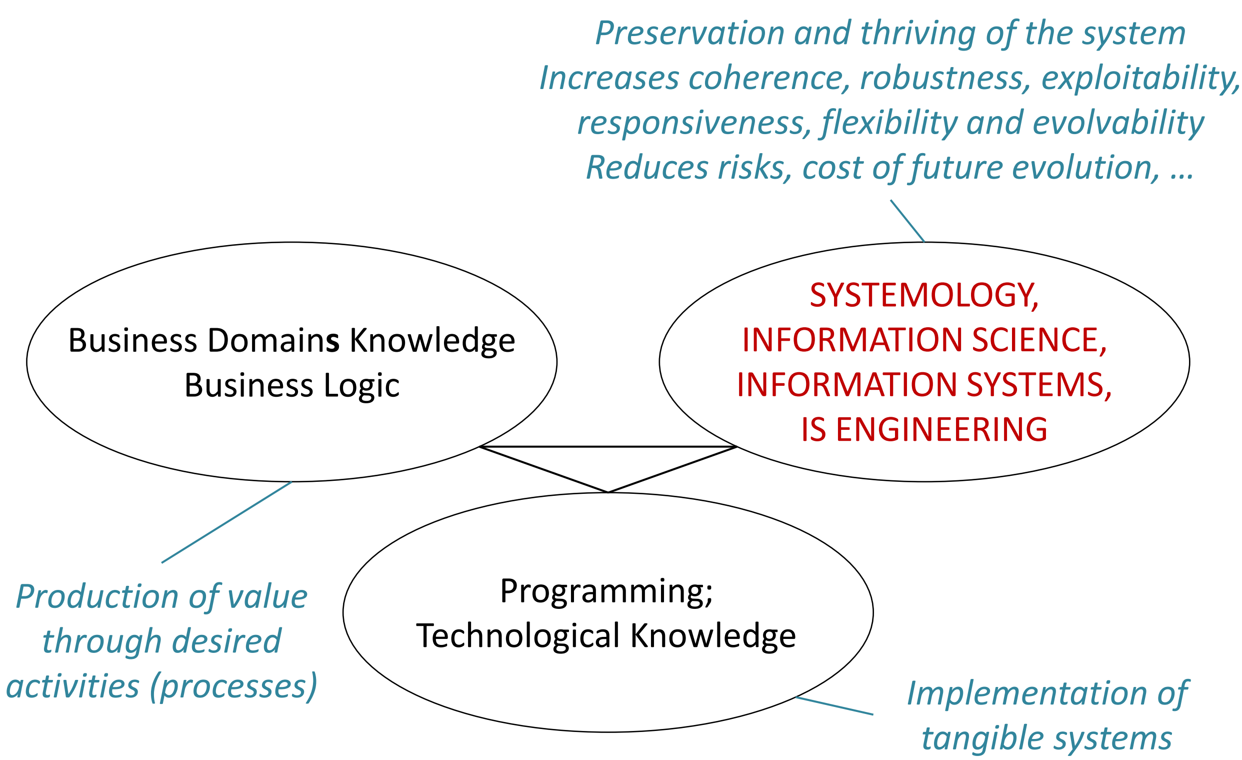
The approach defines the required work environment (room, space, tools, processes, schedules, …) and the organisational setting (roles, responsibilities, collaboration, …).

Performing jobs like sculpting a statue, writing a book, repairing cars, conceiving an advertisement or managing accounts or business information, trading, require a specific environment and work atmosphere.

It is up to the project team to define what work environment is required. This is not an easy task. For now, a lot assumptions are made about this topic.

Engineering Process and Knowledge





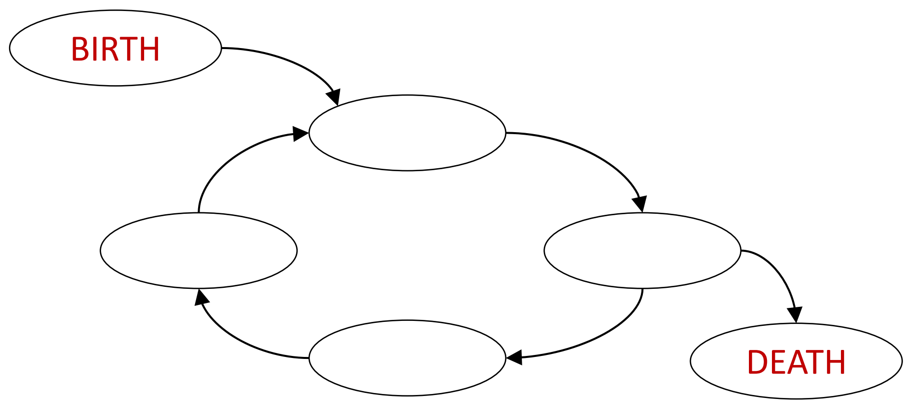
Notes:

“Systemology” is the disciplinary field studying systems.

Building ≠ Solution Conception; Using / Executing ≠ Solution Conception

Life Cycle – Development Cycle

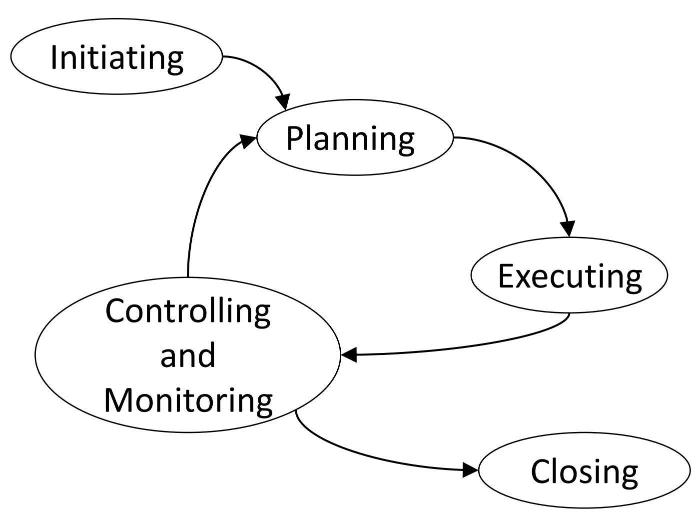
Life Cycle



Life Cycle

Describes the evolution, the phases and major events that may happen during the lifetime of an entity.

Project Life Cycle (example of PMI's PMBoK)

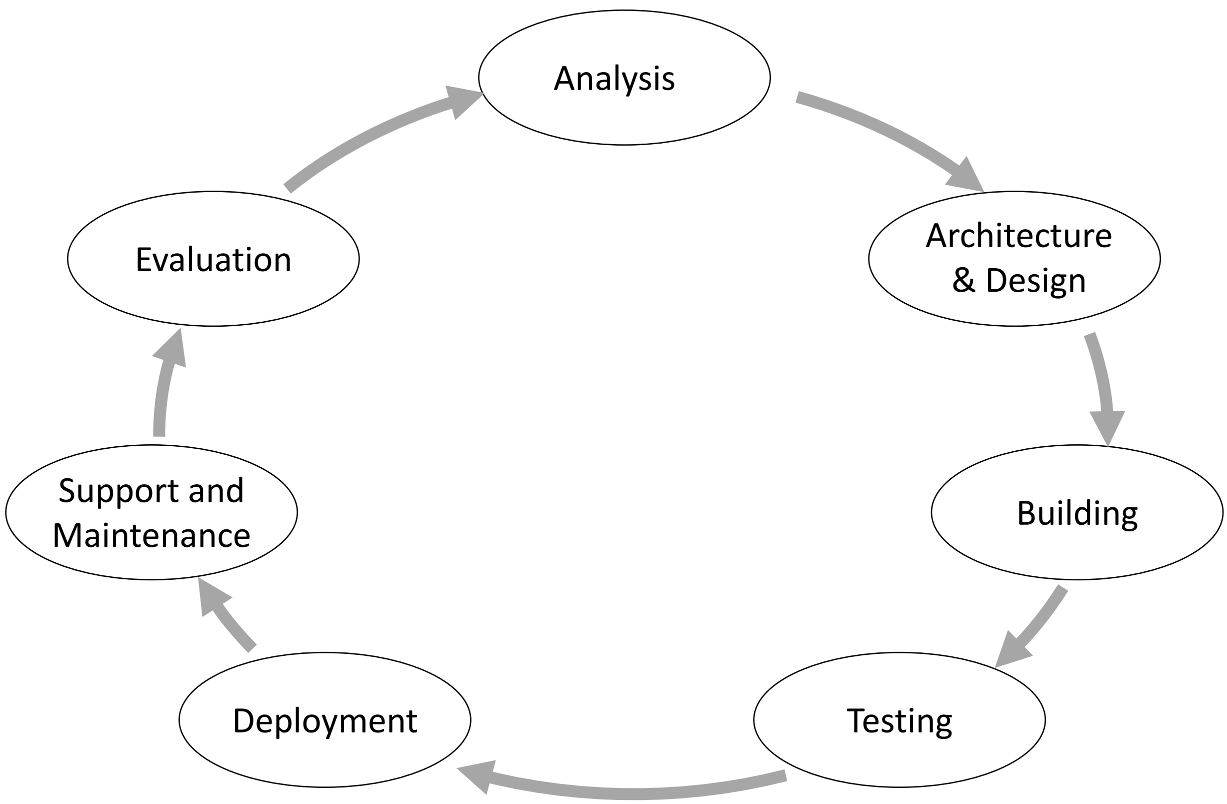


Life Cycle – Project Cycle

Development (Life) Cycle (example)

Development (Life) Cycle

Describes the phases, stages of a development of an entity.



NO SINGLE BEST?

SOLUTION - SYSTEM

- Not always a single best solution

  (≠ No (/never a) single best solution)
  Sometimes, but not always, there is a single best solution.
  We may neither assume there is a single best solution or that there is no single best solution. Often we don't know and can't know.

- If there are several solutions then
  - Those solutions **differ** from each other
  - Have their own **specific strengths and weaknesses**
  - Some **are better** than other
- Try to find better solutions and select the best of the known solutions
- Continuing to find alternatives and improvements

SIMILARILY

PROCESS – APPROACH – METHODOLOGY - FRAMEWORK

- Not always a single best APPROACH

  (≠ Never a single best way)
  Sometimes, but not always, there is a single best way.
  We may neither assume there is a single best way or that there is no single best way. Often we don't know and can't know.

- If there are several approaches then
  - Those approaches **differ** from each other
  - Have their own **specific strengths and weaknesses**
  - Some **are better** than other
- Try to find better approach and select the best of the known approaches
- Continuing to find alternatives and improvements

Structural Quality – vs – Added Quality

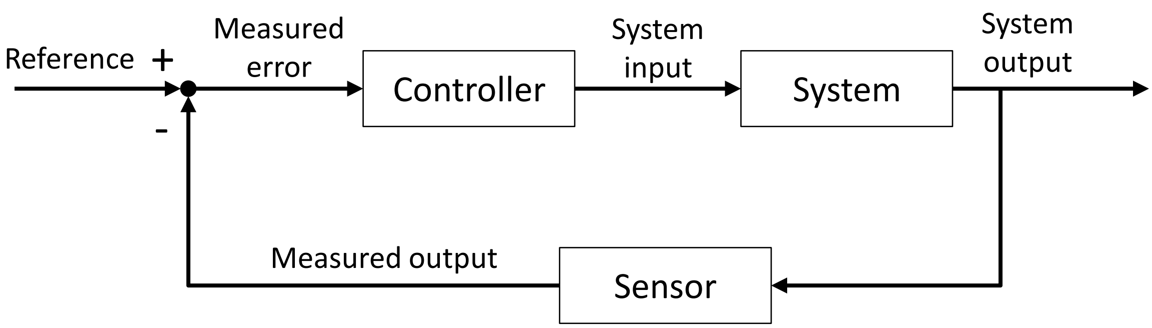
1. Implementing qualities by design vs adding it

- Not about features. Some can be added easily to a system
- Adding qualities like integration, quality, control, security, flexibility, connectivity, scalability, as a post-design (or late-design) activity is very hard. Rarely good results.
- Much better results (more powerful and lesser complex) when added from the beginning.

2. Change of purpose, function, role

- “Designing a screwdriver and trying to make a hammer from it.” Never as powerful as when it was designed from the ground up for that purpose, function and role.
- Like using a spreadsheet as DB

Control Theory



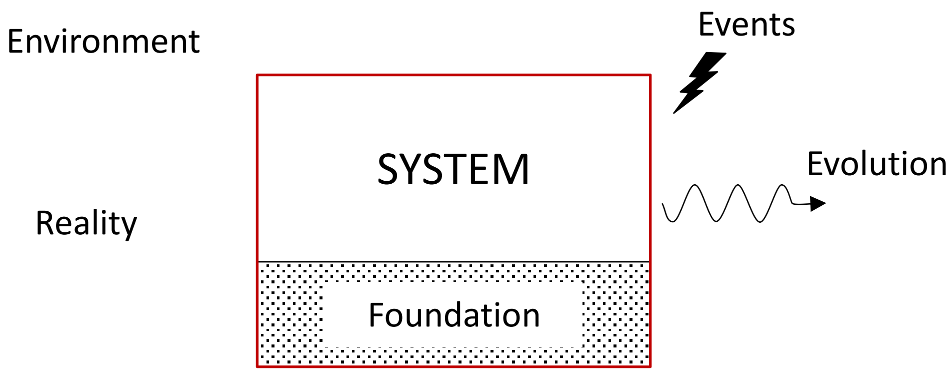
The concept of feedback loop to adjust the behaviour of a dynamic system.

Any dynamic system must have one or more feedback loops

- Company
- Project
- Development Methodology
- Information Systems
- Individual
- …

This theory answers the question why we need control in dynamic systems.

Robustness



GOOD SYSTEMS ENGINEERING

Foundation

Based on solid foundation. Systems built upon weak foundations are weak. Solid foundation: TERMS (based on right definitions; already a huge problem in IT), natural laws, first principles, based on understanding of nature of things, atomic elements, building blocks, … Business demands are useful, but commonly, they are not a solid foundation.

Reality

Reflects reality. Critical to understand nature of things, relations between things, nature of these relations, abstractions of reality, …

Fitness for Use (Quality)

Obvious

Environment

Respecting the rules of the environment and respecting the environment

Events

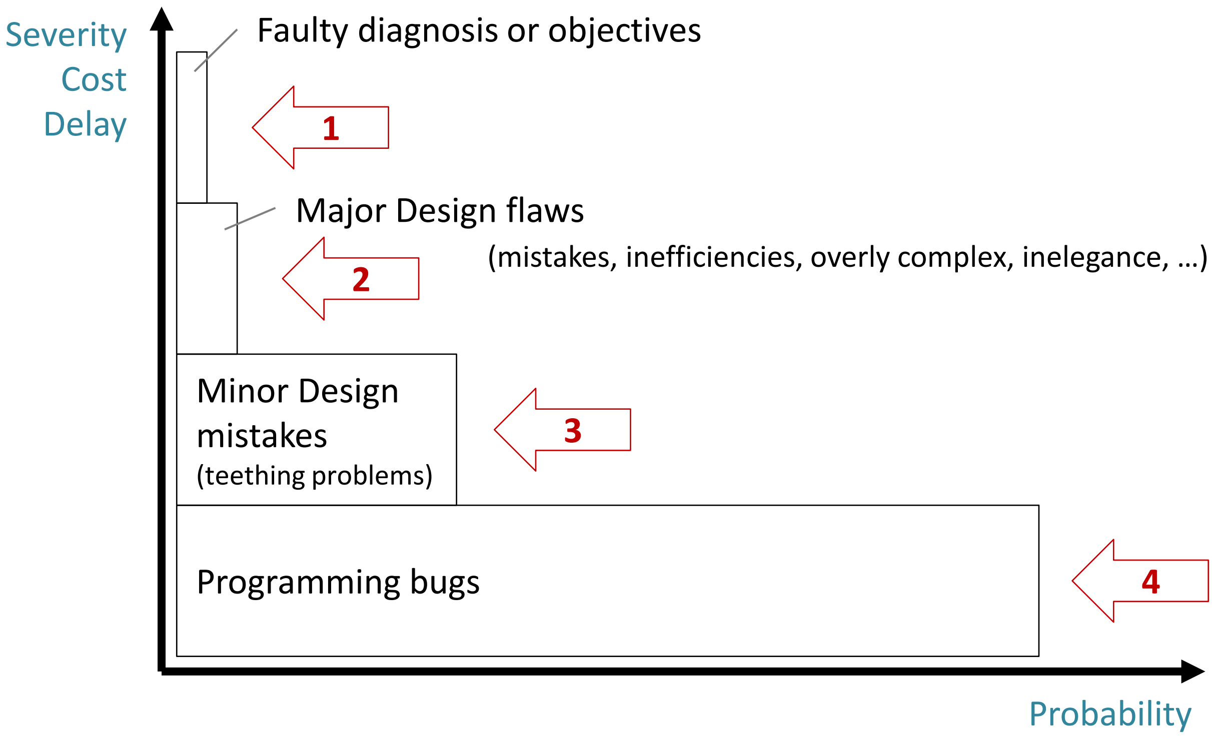
Able to respond and to cope with events

Evolution

Able to evolve. Adaptability doesn’t come by its own. It is engineered in the system. The development environment has continuously to capture the needs and opportunities to evolve.

These are areas/sources for requirements

Engineering Flaws



Force aimed at reducing the probability (and the severity of impact) of flaws:
Approach, Norms, Techniques, Skills, Resources and Time used to reduce the probability of flaws and impact. These 'forces' are not equal. Their 'size' and nature depends of what quality (or flaws) is acceptable for the project. This depends of the project, its environment, its stakeholders, …
Example: a technique aimed at reducing design flaws will not eliminate a faulty diagnosis

1 ≠ 2 ≠ 3 ≠ 4

Requires different perspectives, different measures, different methods and skills, different knowledge (thus often by different persons) … at different levels, at different moments in de development lifecycle !

Notes:

These types of mistakes form actually a continuum. These categories are not strictly defined.

Major Design flaws implicate keeping the objective and (mainly) the scope, but need to review the architecture and overall design.

Faulty diagnosis, objective implicate the halt of the project. A brand new project has to be started.

A methodology and project process have to take this into account and implement a maximum of ways to prevent these fault to happen.

Integration

When talking about Integration – 3 Questions

1) **What** is integrated?
2) **In what** is it integrated?
3) Which **aspect** is integrated? From which perspective?

Integrated Information Flow

The most basic form of integration, through automation, is to add some technologies to ensure exports and imports of data. It limits the integration between the systems it communicates with. A more advanced form consists of a deliberate and purposely engineering of the entire set of information flows.

Technological Integration

Technological integration is realised by using same technologies as those already present in the company or by using technologies allowing interoperability among the existing systems and technologies.

Architectural Integration

Architectural Integration integrates the new system, components, interfaces and changes in the landscape of systems or in the system of systems. The thinking about integration happened deliberately during architecture activities.

Functional Integration

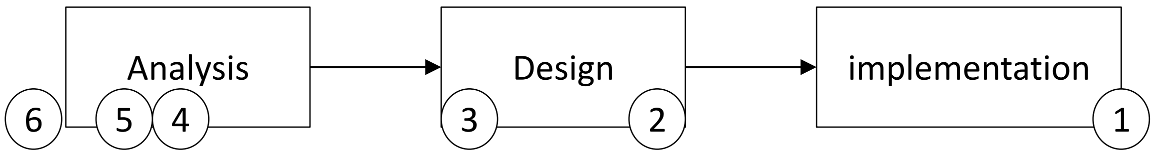
Functional integration is based on domain knowledge, functions and purpose. Functionalities are logically organised. There is no duplication of features, functions, processes, … All functions are well-thought.

Holistic Integration

Holistic integration combine all previous integrations. It also includes the integration in supra-systems and in their environments. All perspectives are taken into account and everything is aligned, including all the purposes and goals.

Integration

When do we start thinking about integration ?



No integration

System is in isolation. Information is exchanged manually.

1) Post-implementation (basic integration)

Once the system is operational: "How can we automate information exchange?" This may bring in new technologies (middleware or other technology allowing information exchange).

2) Post-design integration

After the solution itself has been designed, the concern is raised of the <u>exchange</u> of information.

3) Integration as part of design

During the conception of the solution, the question of sharing or exchanging information is raised. This may influence the choice of technologies.

4) Architectural integration

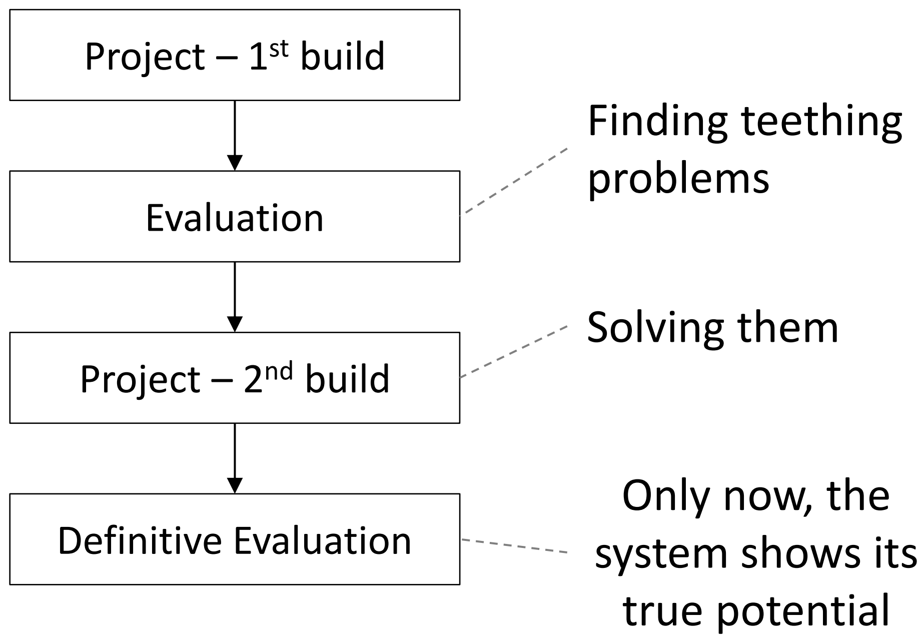
5) Functional integration

Architectural and functional integration happen essentially during the analysis phase.

6) Holistic Integration

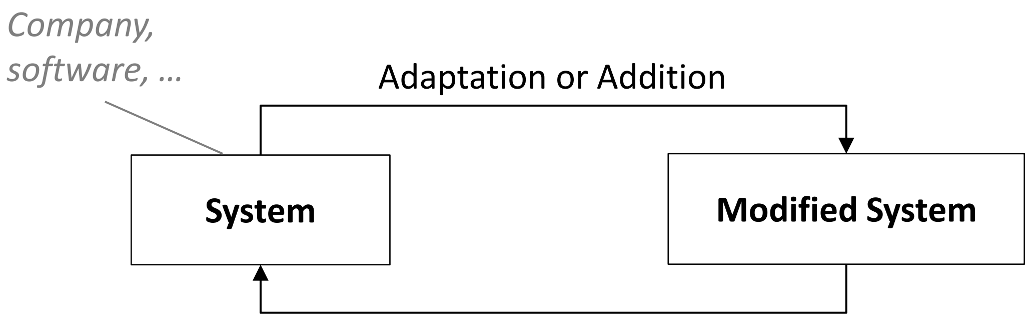
Holistic integration happens during the whole engineering process. However, it starts with the definition of the objective, the mission and the scope. It has to start as early as possible.

Teething Problems



Teething problems are problems due to a lack of insight, additional information surfaced, imperfect solution logic, unexpected system's behaviour or unexpected ways of using the system, missing features, and so on.
It is better to make a difference between teething problems and programming bugs. Teething problems require additional analysis or design activities.

Changes Eroding Systems



Eroding System

- Oversimplification
- Overly complex
- Unnecessary elements
- Inelegant internal organisation
- Lack of clarity

Per iteration:

Increased size
Increased complexity

↓

Decreased Manageability
Decreased Adaptability

↓

For future changes:

Increased risks
Increased time and effort (→ paralysis)
Increased cost

Benefit/cost (ROI) tend to decreases
Tendency to entropy

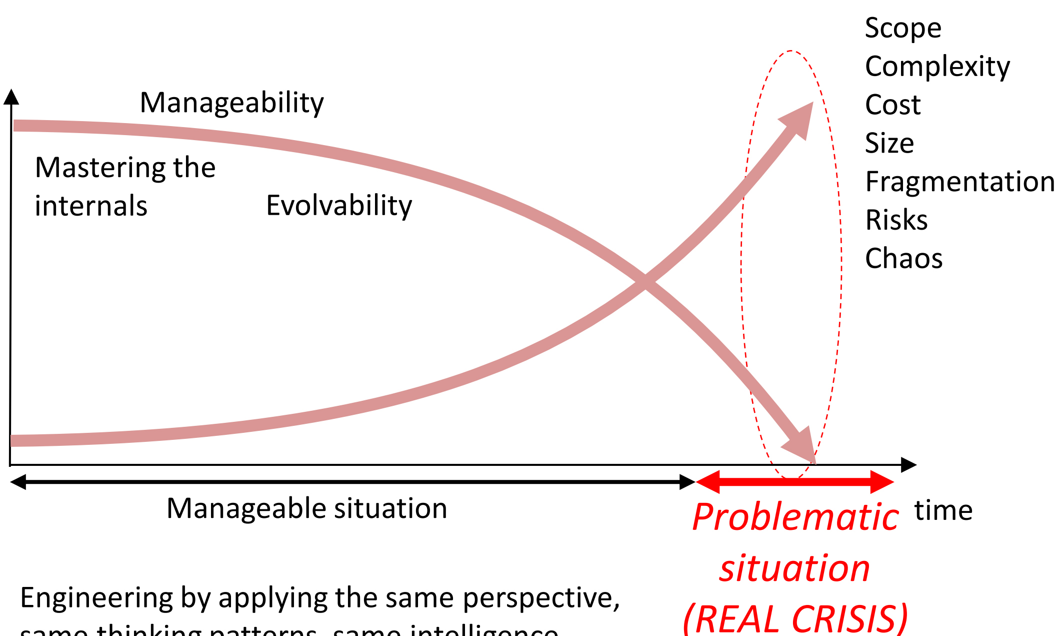
⇨ CRISIS

Common Causes:

- Time pressure
- Lower norms ("if it works, it is good enough" ☠)
- Unawareness of decreasing quality of the system
- Adaptions are made with the same perception, same assumptions, same priorities, same skills, same level of thinking, same beliefs and assumptions.

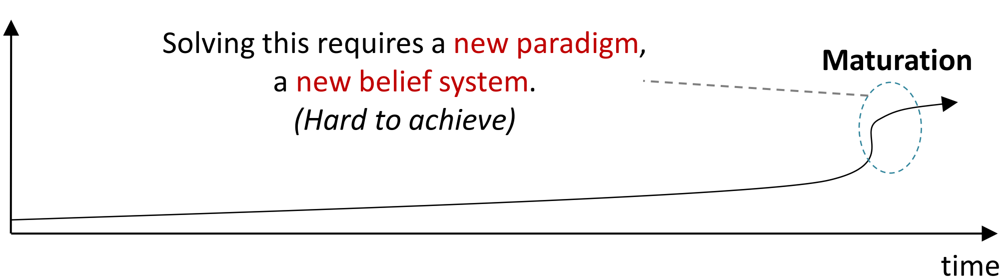
Evolving Systems and Crisis

- A company has usually many systems in different stages of their lifecycle.
- Over decades the nature of developed systems evolved as well.



Engineering by applying the same perspective, same thinking patterns, same intelligence, same insight, same belief system

Time for reengineering, paradigm shift or other radical measures and shift



Writing vs Adaptation

Assumption: Adaptation is faster than the first writing of source code or than recoding from scratch

Adapting source code	more time	First writing
Adapting source code	approx. same time	First writing
Adapting source code	lesser time	First writing

Depends of change, source code organisation, spread, …
Implications: Softw. Dev. Approach, Estimations

Similarly, bug correction can be hard to estimate.

A bug may require small change in code, or larger or many changes of the code.

Depends also of the type of bugs:

- Programming bug
- Design bug
- Analysis bug

Trial and Error

Synonyms

- trial and failure
- trial and practice
- generate and test
- guess and check

Characteristics

- Every trial teaches something
- No upfront knowledge or insight can be acquired
- Plenty of time and resources
- Attempts can be done safely
- Limited number of cases to test or some options have better chances of succeeding
- Only 'a solution' is required, and no deeper understanding, …

Trade-off between 1) number of possibilities; 2) effort, duration and cost of each attempt and 3) importance of the problem being solved.

Weaknesses and risks

- No alternatives or optimal solution. Aim to find "a solution", not all or "the best solution".
- Delivers single solution to single problem. No attempt is made to generalise the solution.
- Does not do a diagnosis. No cause/problem identification. Assumes the diagnosis is right.
- A solution may appear after a few attempts, only after many attempts, or not at all.
- May be time consuming (for example, due to many attempts)
- May consume a lot of resources
- May turn out to be costly
- Making an error may be very detrimental. Only one or very few attempts are possible (think of surgery)
- Doesn't search to explain "why" it works and no attempt is made to get this understanding. Maintaining superficial insight or ignorance. (Learning lessons?; Control and management of the broader whole?; Evolvability?)
- Found solution can be hard to optimise
- Quality? Reliability? Strength? Scalability? Behaviour in variable circumstances?

Frameworks

- BizBoK
- OMBoK
- EABoK
- TOGAF, Zachman, TEAF, FEAF, PERA, GERAM, …
- BABoK
- DAMA
- CobIT
- ITIL
- PMBoK
- Prince2
- SE BoK
- DA BoK

Bad Engineering Practices

Knowing bad practices help to recognise and to avoid them

- Throw it over the wall (limited collaboration)
- Accept anything at face value.
- Don't question earlier findings, decisions, …
- Don't explain the higher goals, intentions
- Retain information (filtering)
- Freeze everything made or validated by the business stakeholders
- Apply principles, rules, methods because they are 'prescribed' or because of habits
- Build upon understanding of business demand and/or requirements as only insight.
- Be positive. Be a "YES"-(wo-)man. Everything is fine. Everything is possible.
- Do only the work you prefer. Work you don't like is not necessary anyway.
- Perform unnecessary work
- Ignore the purpose, reason, value, right usage of concepts, tools, …
- Do not collaborate or collaborate as little as possible
- Decisions can be taken without knowledge and understanding. Either the decisions is pretended to be right regardless of the cost and consequences, or it doesn't matter because any decision can be changed anyway later on.
- Don't do what is necessary. Instead, do whatever is asked hoping to meet the expectations
- Do not disagree. Avoid disagreeing with the chief, with the group or with the majority.
- Let others take decisions and responsibilities, that should be yours.
- Don't review made decisions. Don't ever backtrack.
- Be reactive and follow.
- Don't doubt, even if the world is complex, dynamic and unpredictable.
- Pretend to know everything.

Note:

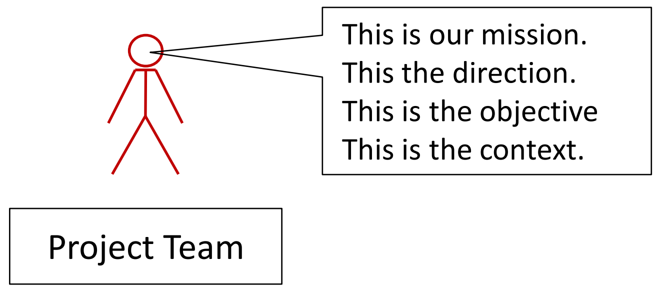
Regardless of the project approach, these practices are neither prescribed nor advised.

MANAGEMENT

Leadership

LEADING

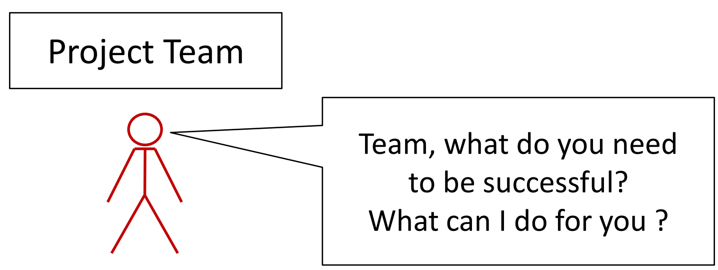
Leader above the team



Guiding by setting the objective, Organising, Guiding by defining the process, …

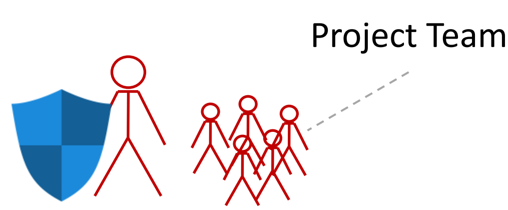
SERVING

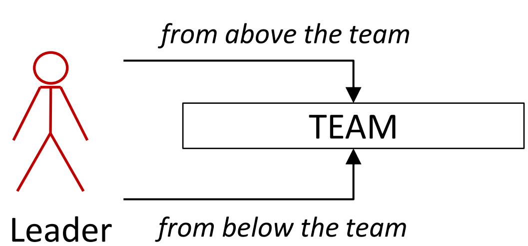
Leader under the team



Providing, resolving, …

PROTECTING (*)





*: interferences, conflicts, pressure, risks, disturbances, politics, …
Management ≠ Leadership

WORK EVIRONMENT

Work Environment

Work of Architects, Analysts and Engineers consists mainly of learning, analytical thinking, critical thinking, logical thinking, systemic thinking and creative thinking.

The work environment greatly influence this intellectual work. If it is not suitable, it will hinder it leading to disappointing results. Or, often people won't even be aware of the missed opportunities and benefits that could have been obtained.

Some principles and ideas:

- Think doesn't happen linearly.
- Creativity is spontaneous. It doesn't work on command. It can't be managed. But circumstances may be more favourable to creativity and techniques may support it.
- Creativity leads to innovation. Everything that hinders the mind hinders innovation.
- Stress, fears, uncertainties and other negative feelings and emotions hinder the mind. Drive out fear.
- Conflicts, uncertainty, firefighting, urgencies, pressures and chaotic environments should be avoided.
- Eliminate elements that distract.
- Eliminate or avoid interruptions.
- Administrative workers can work easily perform an amount of work in 1 hour or lesser. Therefore, a common day in and administrative environment is divided into slices of 1 hour. Architects, Analysts and Engineers may need 15 minutes to an hour or more simply to get into the matter. Depending on the work, they may really need to be able to work without interruption for half of a day, a working day or even more.
- Ideas may come while walking through a park, when watching through the window, when sitting on the toilet, when being alone in a calm, quiet and secure place.
- Very flexible hours.

ORGANISATION

Managers - Engineer

A Manager is not an Engineer

- A manager manages
- An engineer engineers

Managing and engineering

- have to different goals
- require two completely different mind-sets
- and require different ways of thinking

Exceptions: Some engineers may become managers and some managers have engineering degrees.

Leading the Conception of an IS

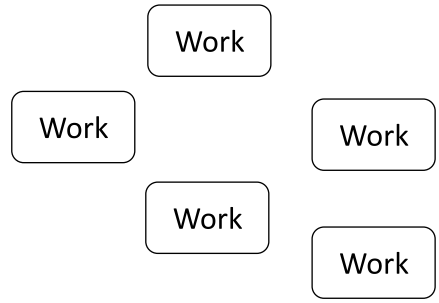
Conceiving a solution requires understanding

- how to maximally exploit information
- what is possible, difficult and impossible in IT
- what is necessary for an information system to survive and to strive
- what undermines an information solution
- what architecture fits the endeavour and environment
- understanding how to preserve or increase the value of information
- understanding information risks
- etc.

Who possesses this insight? Or, who is the most likely to possess this insight?

Group or Team

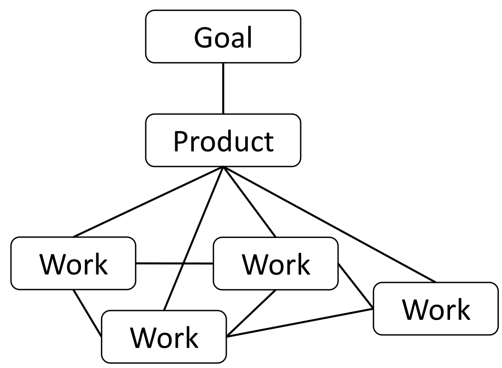
Group



- Unrelated work
- No collaboration and little interactions are required

→ No team is required. A group is fine

Team



- Working towards a same goal
- Working on a same product
- Work is related
- Each other's disciplines and qualities help or are necessary to achieve something in common

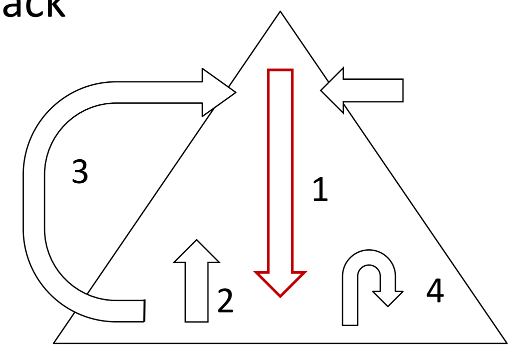
→ A TEAM is required

Hierarchical Structure

Creative with hierarchy – a few ideas

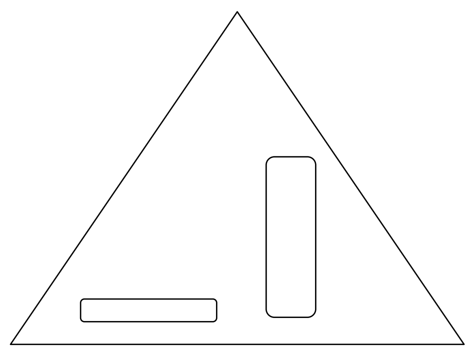
Top-Down – Bottom-Up Feedback

1. Top-Down
2. Bottom-up
3. Bottom to high top-down
4. Bottom to low top-down

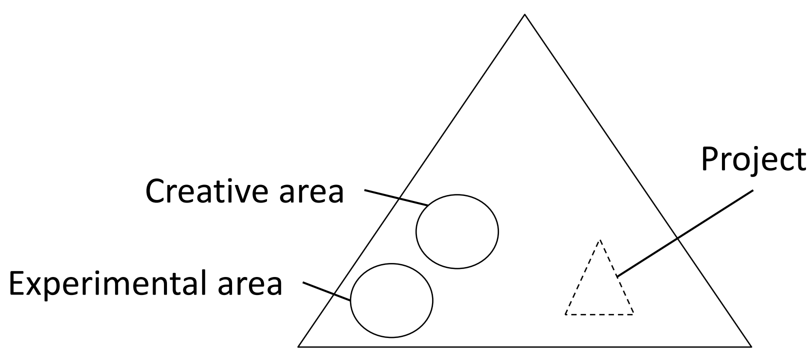


Cross-border collaboration

- Horizontal and/or vertical
- Persistent, temporary or ad hoc



Area's, Zones

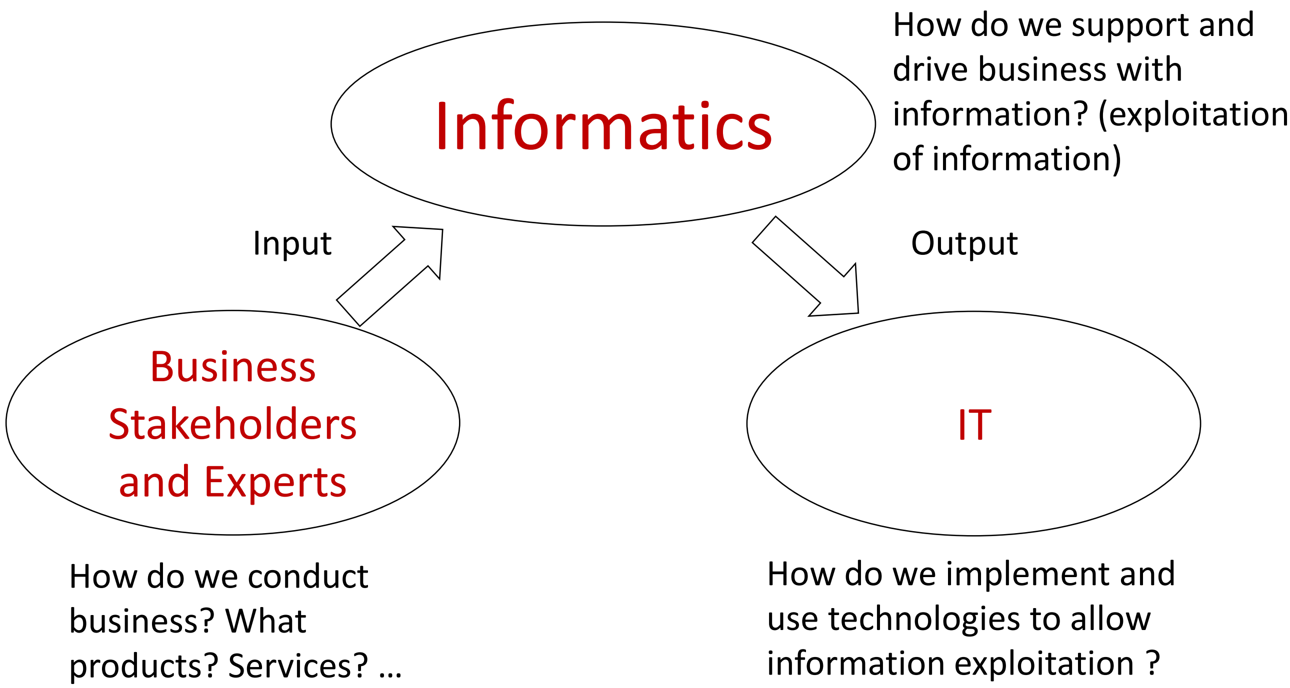


Notes:

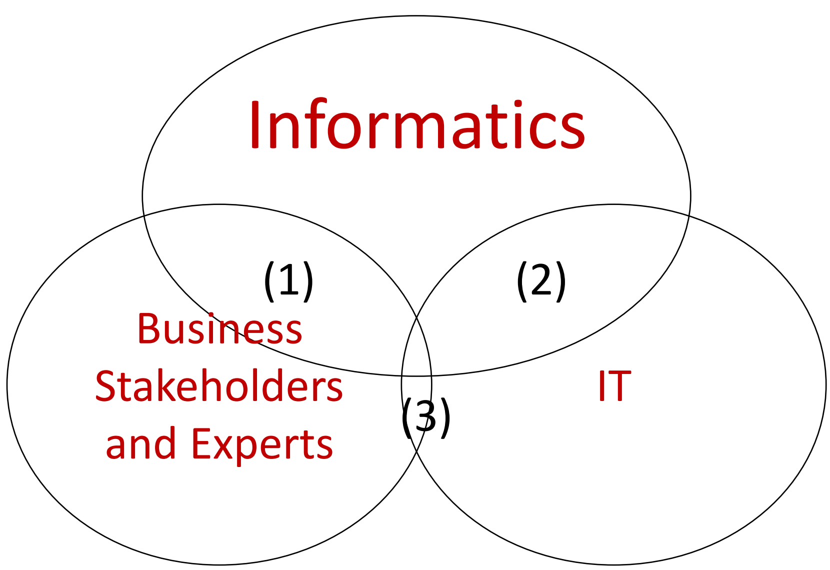
Can be vertical, horizontal or both. Permanent, temporary or ad hoc, guided or free, measured or not, controlled or not, …

ROLES
&
COLLABORATION

Basic Information Flow



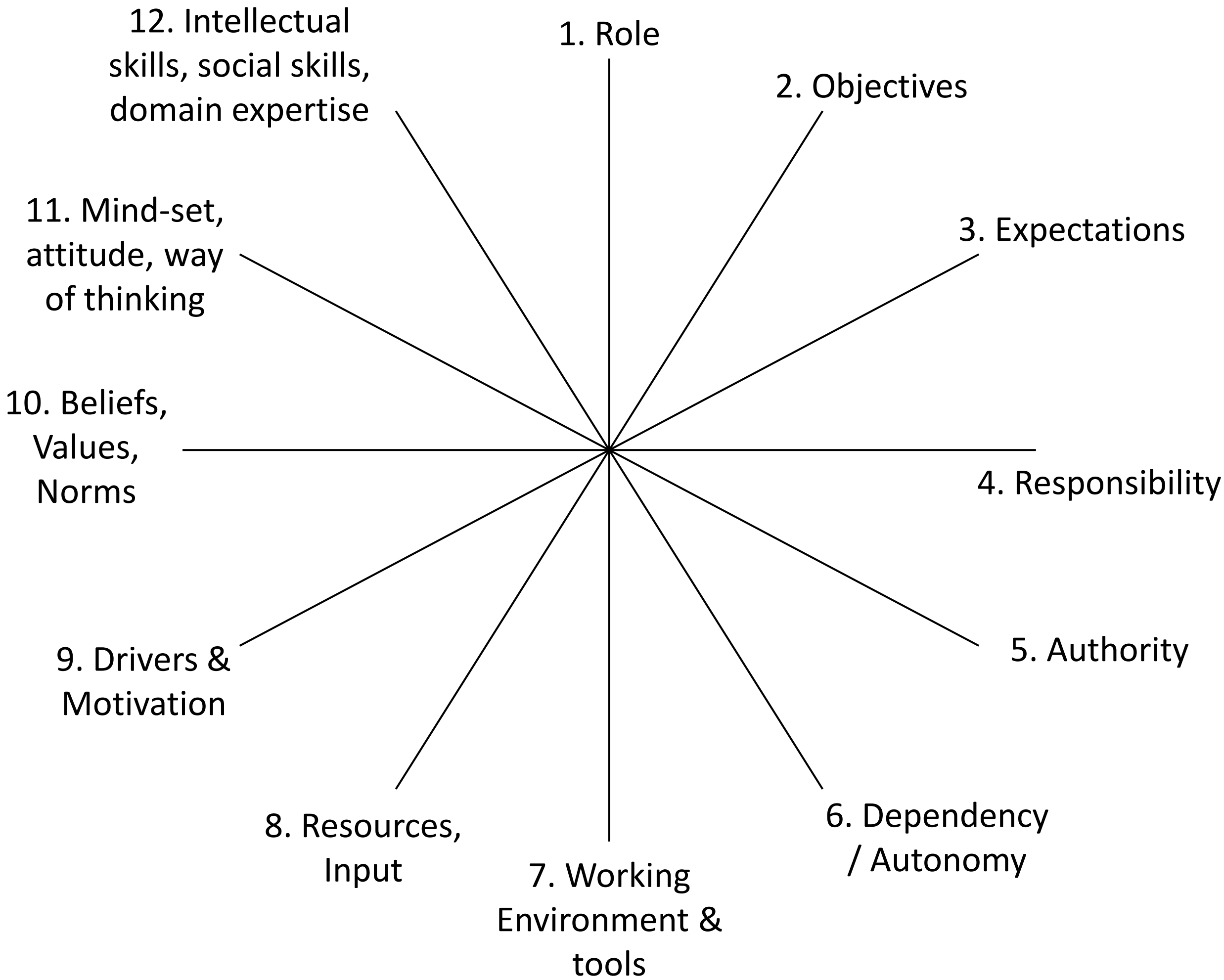
Suggested Collaboration Model



Notes:

Collaboration (1) and (2) are extensive. Collaboration between (3) is useful, though somewhat lesser (when business-informatics issues are settled: reviews, wrap-ups, feedbacks, …).

Operational Role Alignment Model



These factors have to be aligned in order to successfully perform a work. They are operational prerequisites for a job.

More alignments:

Cultural alignment

Alignment with "the boss"

Alignment with the group

Alignment of the evaluation criteria, evaluation system, reward system, ...

Functional vs Technological Role

KEY PRINCIPLE

Conceptual, functional, logical roles
and
the technical and technological roles
should be assigned and performed
by different persons

The brain has to be able to focus freely on the global solution, on the big picture, on the higher goals, on the purpose.
The attention of the brain is easily directed on what technologies to use and how to use them, on how to build the product, on what to do now, on the short term. These are very practically matters. When the brain is busy with these matters, the attention is diverted from the overall conceptual and global thinking, higher goals and long term. Great opportunity to get real or much better solutions can be missed. The risk of building non-solutions increases.

Also important for innovation !!

Positions, functions, job titles, job definitions should either concern conceptual work or technical work, but not both.

Collaboration is the Key to Project Success

1. Clear Common Goals
2. Motivation: Wanting the project to succeed
3. Mutual Understanding (communication, listening)
4. Availability / Time
5. Agreements
6. Knowing and respecting the **roles** (responsibility, authority, action)
7. Respecting the principles of the different **disciplines**

The project's success and the created business value depend of
every stakeholder and of every **project team member** !!

Note:

Not all definitions of '*stakeholder*' include the project manager and project team members. Frequently the terms is used in statements to indicate business stakeholders, clients, … but not the project manager and project team. This definition is more practical.

Hindrances in Collaboration (1)

Consumer IT	Corporate IT
Oriented towards consumer (selling and end-user experience)	Oriented to groups of end-users and serves the company's interests
Solves personal needs, responds to personal tastes, personal choice	Solves various needs, primarily company's needs, within a broader heterogeneous system of systems
Single product (except cloud, social media,…)	Set of complex interconnected systems part of the enterprise around an architecture, using an infrastructure
Focus on end-user features, appearance, ease of use, preferences and taste, experience, fun	Focus on value, processes, services, ROI, …
Same product developed for many consumers	Developed for limited number of end-users
Usage: individually, accordingly to own taste	Usage: used by community of people, with different roles, but as part of a same organisation with a same objective. Shared, regulated, standardised
Easy, fast, cheap, flexible & powerful	Slow to build, expensive, more rigid, powerful in a different way
Fuzzy, approximation, guessing end-user's wishes	Abstract, detailed, consistent, complete, clear
A problem usually impacts individuals	Problem has impacts on the company
Easy to acquire and replace (buy and dispose)	Difficult to acquire. Requires customisation, tests, integration, courses, maintenance, security, recovery, …
lifespan: 1 to 5 years	Has to evolve – lifespan: sometimes decades
More use of unstructured data and multimedia	Uses preferably structured data

Consumer IT are the IT products and services developed for personal consumption (usage). These products and services can be bought, downloaded or online accessed by consumers.

One can not confuse Consumer IT and Corporate IT (enterprise IT). The users and goals are different. There are different expectations, priorities and selection criteria. It is not wise to deal with Corporate IT as if it was Consumer IT (not black & white. It is a matter of balance)

Hindrances in Collaboration (2)

IT Literacy

What do end-users/consumers capture of IT ?

- Philosophy: Intuitive, explore and discover, guessing, trial & error, experiencing, ad hoc
- Ideas: Quick and easy acquisition of technologies, “The sky is the limit”, “One click”
- Plenty of software: office automation, multimedia, games, tools, ...
- Software characteristics: attractive, intuitive, fancy graphical user interface, flexible software, rich features
- Installation: easy, automatic configuration, Plug-n-play, immediately usable
- Usage: Drag-n-drop, Cut-n-paste, Copy-Paste-Delete, Do-redo/ undo, wizards, templates, WYSIWYG, install-uninstall, problem? Ctrl-Alt-Del-solutions, …
- Data dissemination: extensive use of unstructured data and individual data packets (documents), ad hoc copying and data transfers, seamless connections, invisible data exchanges
- Development: presentations, social media, blog, macros, websites, small software
- Other: IT magazines; unrealistic IT in Movies;
- Assumptions: Consumer IT = similar to Corporate IT; User’s Knowledge = IT Literacy; …

THIS PICTURE REFLECTS A VERY DISTORTED PICTURE OF CORPORATE IT

Not a good base for expectations, decision making, collaboration, …

Hindrances in Collaboration (3)

Difference Between Human World and IT World

- Specific Capabilities in Information Processing
- Capabilities of doing what humans can't do and vice versa
- Ability to perform a huge amount of work very quickly
- Omnipresence in the entire company
- Entanglement with the human organisation
- Speed of execution (huge numbers, small differences may have a huge impact)
- Connectedness, Interoperability
- Largest part is invisible to human's world (only computers, GUI, appliances, cables, printers, …)
- Abstraction of virtual concepts and daily life elements
- Degree of formalism, precision of language and of instructions (process description) versus interpretation
- Range of details from very high-level to extremely detailed and precise
- Complexity (real complexity is hidden from the end-user by the GUI)
- Required consistency, repeatability
- Need to foresee 'everything' → number of individual cases
- Higher norms are required
- Required level of thinking/planning ahead
- Effort required and speed of change – estimations !!
- Effects of changes
- Possible impacts (hidden parts of logic, connectedness, level of details, entanglement, …)
- Internal tendencies creating risks or leading to chaos
- ….

Hard to imagine, particularly for non-IT people

Gaps of ignorance is closed with assumptions

Lack of ability to detect the opportunities, to define better solutions, to define the right way of working, right norms, limitations, implications, to anticipate risks, …

Role of the Business Community in Information Initiatives

INPUT of the business experts, business stakeholders

1. The existing situation (how does the business works now)
2. Objectives, complaints, limitations, expectations, intentions, plans, … related to business results, work and information
3. Business Expertise, Business domain Knowledge
4. Answers to Analyst's requests
5. Disagreement or confirmation of the proposed solution

What they must not provide as a given:

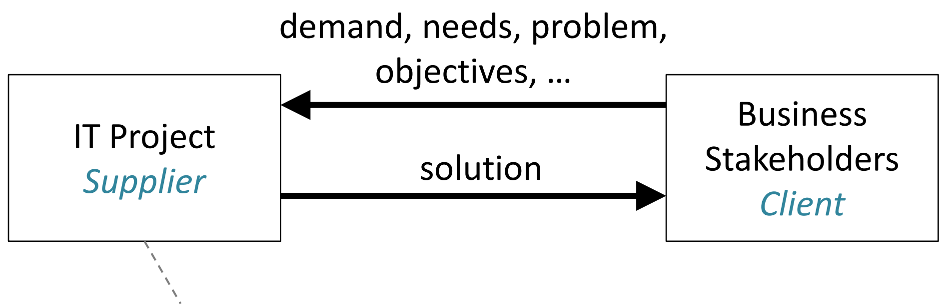
- Identification, definition and description of the (information) problem
- The (information) solution they want

But business specialists may <u>suggest</u> it as a possibility to the Analyst.

Why not? This requires "Systems Analysis" skills.

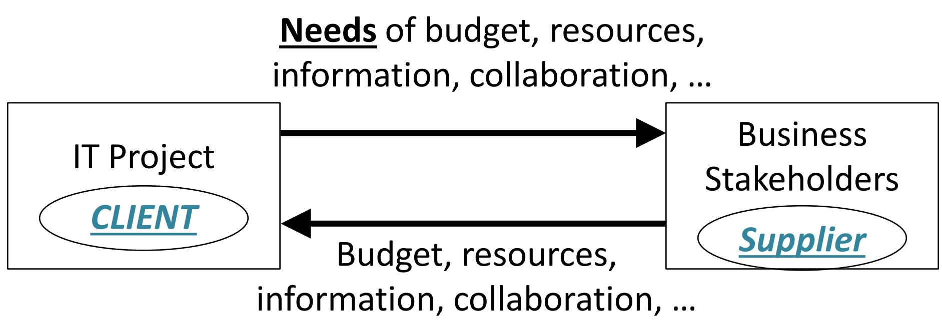
It is <u>related to</u>, <u>applied on</u> the business domain, but it <u>is not</u> business domain.

Dual Client-Supplier Relationship



The mission creates needs on the project side: resources, time, information, budget, tools, work environment, collaboration, ...

So, <u>to start</u> the project …



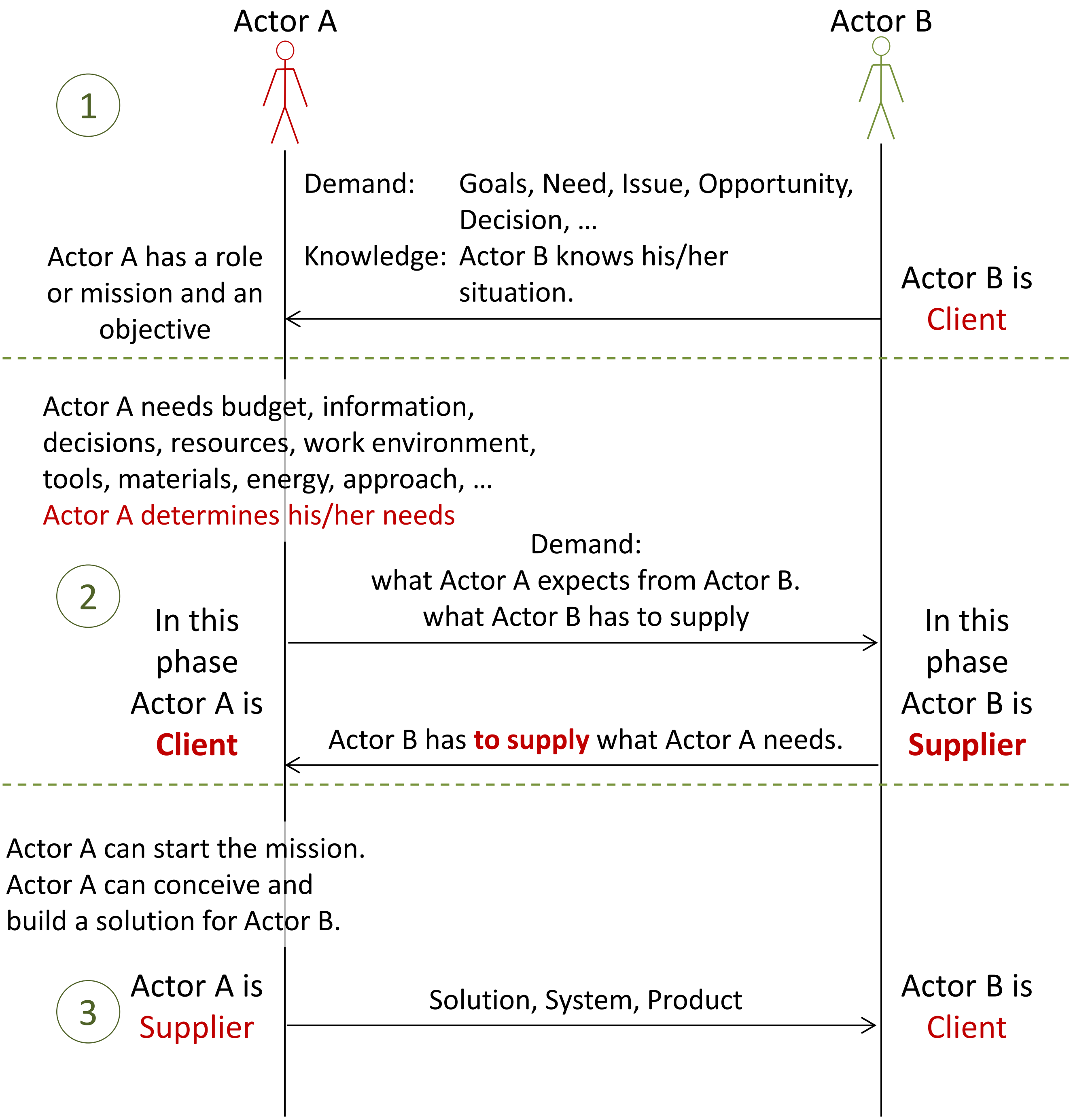
IT experts need to identify their needs: time, budget, resource, knowledge, collaboration, work environment, tools, time schedules, level of autonomy, … to be able to work in ideal conditions. They become a 'client' as well.

If this is ignored, they can't do their job properly and the final client can't be served well

<u>Note:</u>

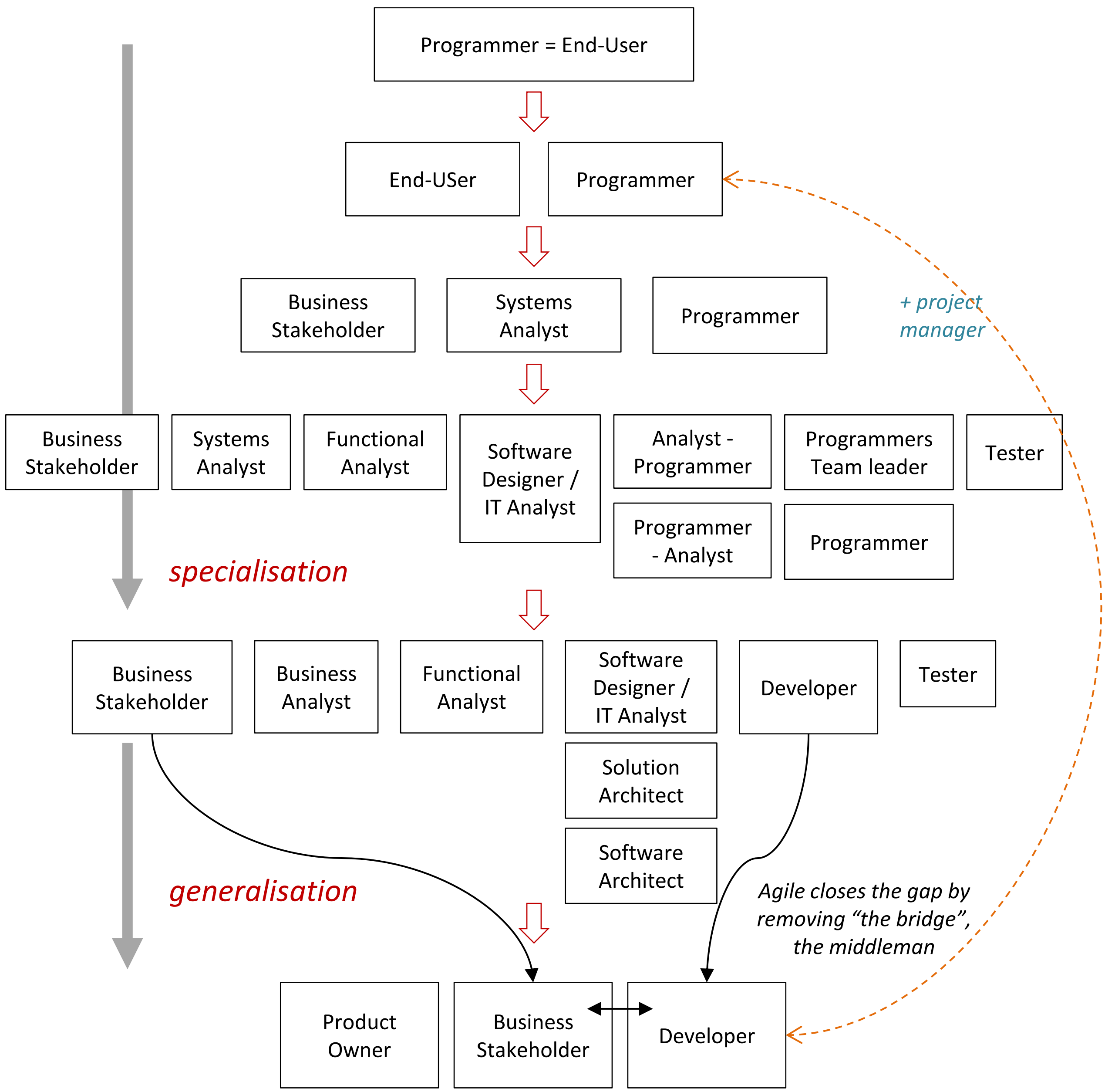
The Business Stakeholders are sources of expertise, "guiders" or parts of the system. The main client is (from a systems perspective) the company (organisation) and, from an activity-perspective, the final external client is the real client.

Client – Supplier Relation



- If (1) fails, then (2) and (3) will fail as well. If (2) fails, then (3) will also fail.
- (2) Gets often not the right attention. Frequently, the Actor B decides of what Actor A will need and what not, and when (s)he will need it. This is a recipe for failure.

Evolution of Roles in SW Dev. Projects

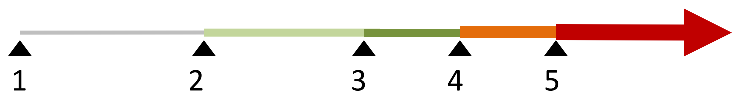


Separation and specialisations of functions (roles) emerged as from the necessity to cope with complexity, scope, span, diversity and scale in the evolving software development initiatives.

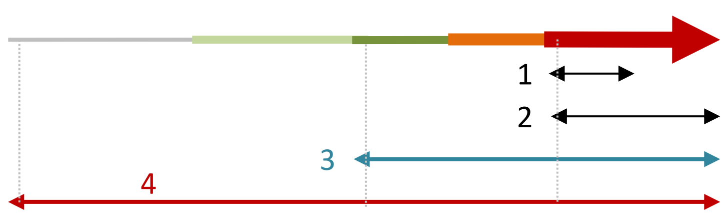
This is an approximate evolution of the appearance of different functions. Each organisation has its own functions and function titles.

Functions like process analyst, information analyst, information architect, solution architect, application architect, IT architect, enterprise architect and many others are not represented.

Application of Informatics in a Traditional Approach



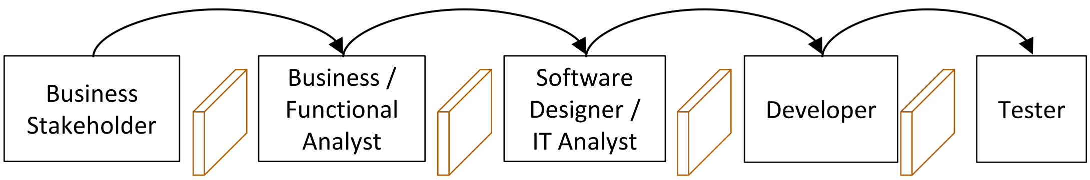
1. Birth of the problem or need.
   (hidden, not yet discovered)
2. Business people face the problem or need. Attempts to deal with it. Attempts to solve it.
3. There is awareness about the existence of the problem or need. It is recognised. The decision is taken to submit it to the IT department.
4. Business demand is submitted.
5. Project is executed.



1. Systems Analysis (*approx.*)
2. Official application of informatics
3. Actual application of informatics
4. Possible application of informatics
   (Systems Analyse)

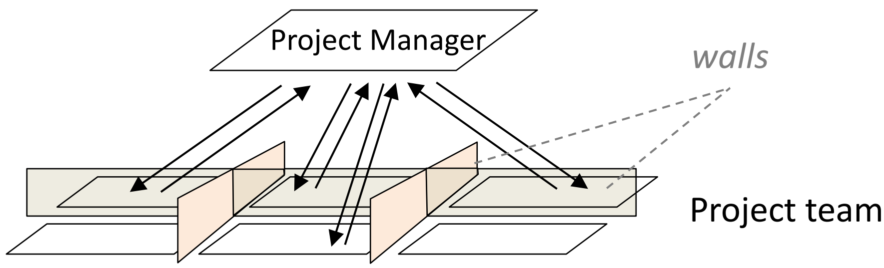
Collaboration

1) Throw it over the wall



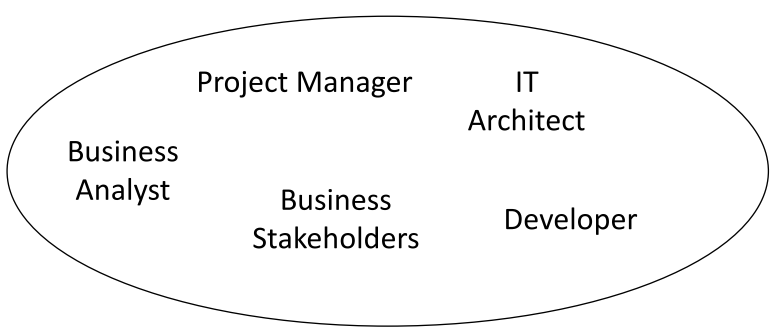
Some collaboration exists between two actors adjacent in the process.

2) Compartmentalisation of the project team and their work



Walls exists between the different roles in the project. The work is subdivided by the project manager and assigned to the individuals or sub-teams. This is all managed from above. Team has no or a vague global overview of the project and there is little collaboration among them.

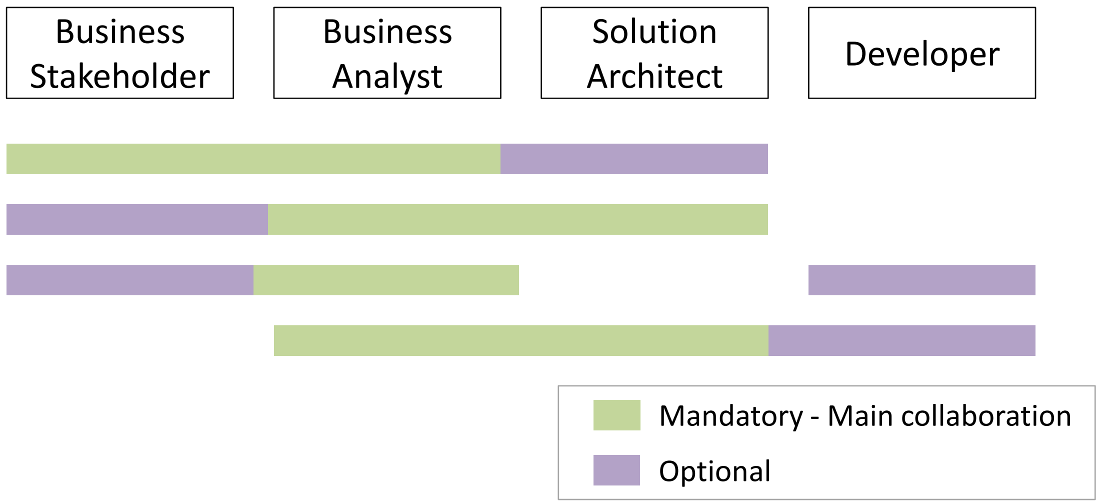
3) Full & free collaboration



This form of collaboration has drawbacks and poses risks. Which ones? And why?

Collaboration

4) Suggested collaboration



To perform a work or to obtain a result, some parties are mandatory.

In some occasions (meetings discussing settled (global) issues, not unsettled details), the presence of other upstream or downstream parties is useful

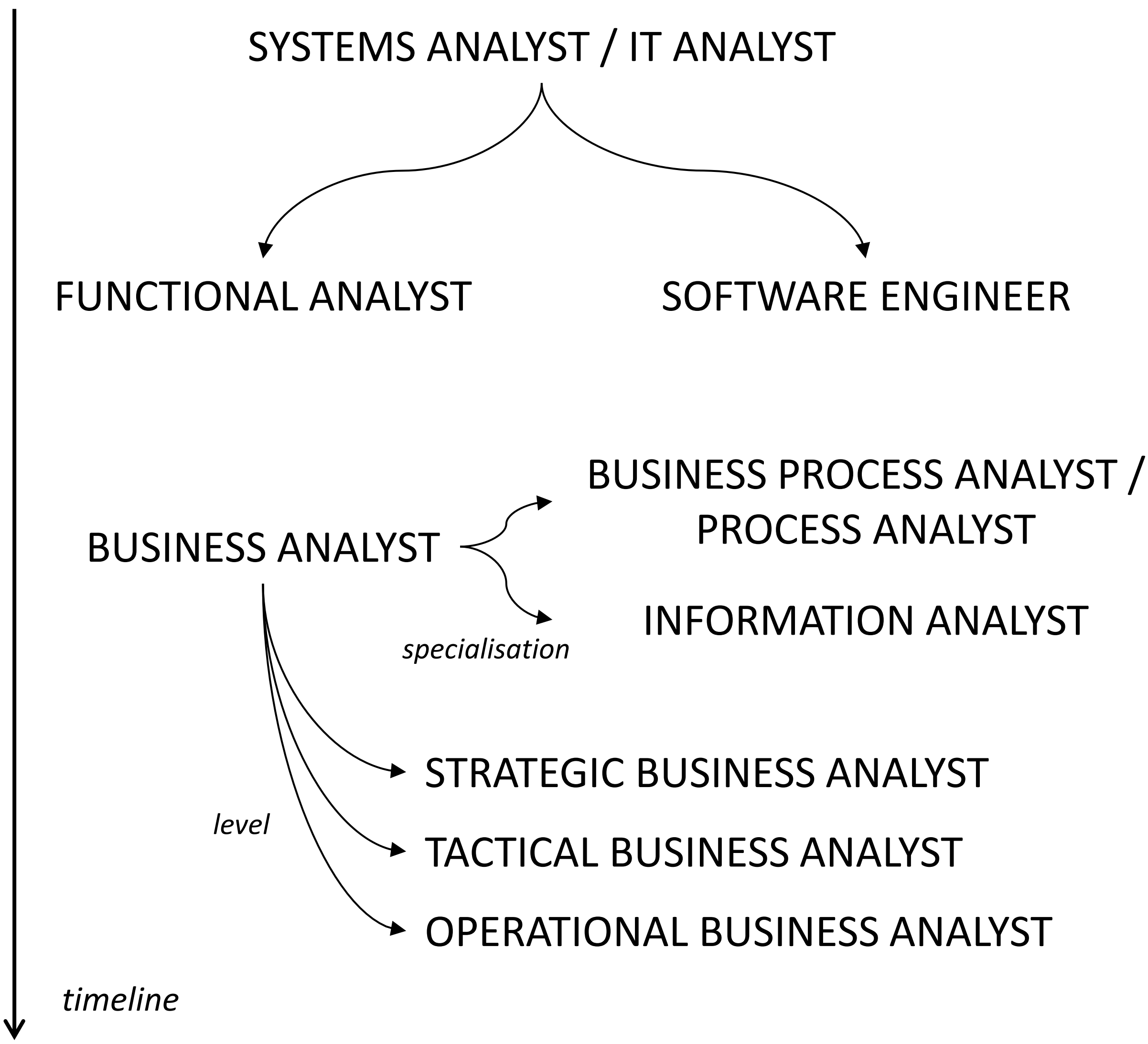
- to familiarise with the broader subject
- to learn from wrap ups and conclusions
- to solve specific issues
- or as a matter of training

Key question: Who can contribute significantly to a meeting/workshop or who can learn a lot of it?

- Avoid absences of people that can contribute or who could learn from it.
- Avoid the presence of people who can’t contribute or who has little benefit from knowing what is/will be discussed. (Possibly, they may be informed by a conclusion or overview that will soon be given).

THE ANALYST

SPECIALISATIONS



Notes:

The role of "Systems Analyst" emerged from a need. It evolved as needs were better understood and the awareness grew of better ways to use this discipline in different areas. Different areas lead to specialisations of the function.

Goals and Guiding Principles

Goals, beliefs and principles guiding the analyst:

- to “satisfy the business demand”
- to work within the scope
- to have the requirements to be implemented
- to deliver a product that “meets the requirements”
- to “build and deliver the product, solution, software features as defined in the project”
- to “implement a set of needed software features”
- to build a software solution
- to create customer/stakeholder satisfaction
- to meet or exceed the customer/stakeholder expectations

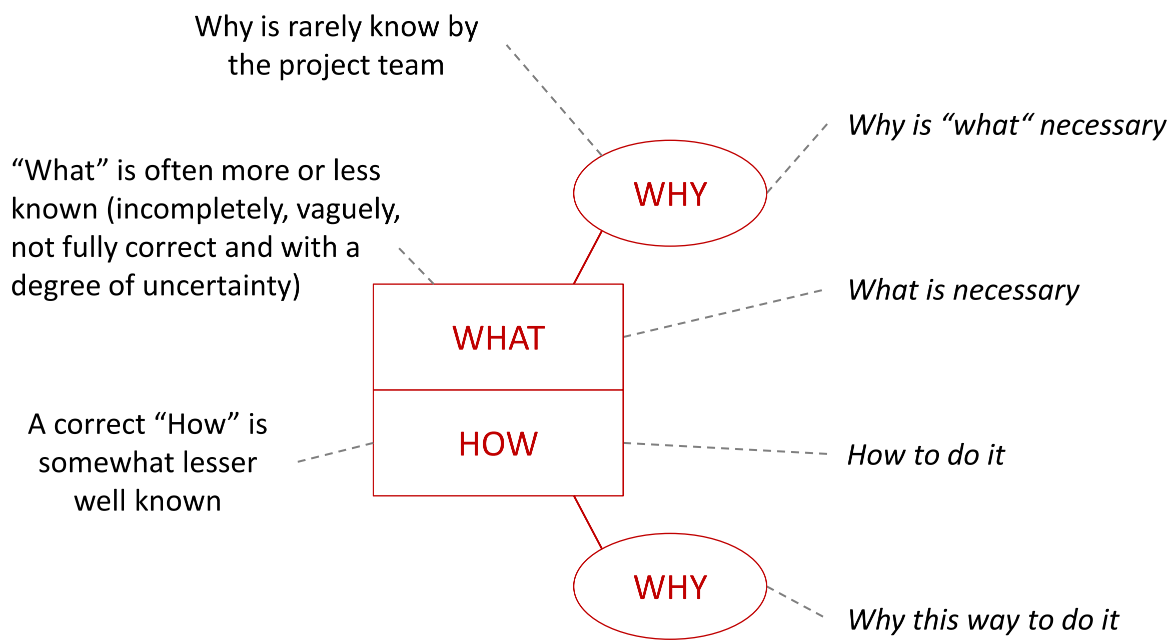
These goals, beliefs and principles LIMIT the Analyst. They LIMIT the thinking and CONTRIBUTION.

Business objectives, enterprise objectives (survival of the system) and broader outcomes are the drivers and objectives of initiatives.

Notes:

The analyst is often reduced to order taking. Then: The potential of systems analysis not exploited. And the analyst has little responsibility. The role of Order Taking Analyst makes real and good analysts to run away.

Professional vs Layperson



The WHY something is necessary and WHY a certain approach, techniques, activities, steps and techniques are rarely known.

A professional differ from a layperson in that the professional knows the right answer to the WHAT, HOW and WHY's.

Avoid blindly rely on
WHAT PEOPLE ASK, WANT OR EXPECT

INSTEAD

DO WHAT IS
RIGHT, WHAT IS NECESSARY, WHAT MATTERS AND HAS VALUE, WHAT IS REQUIRED TO REACH GOALS

and what contributes to

the company's LONGEVITY and THRIVING

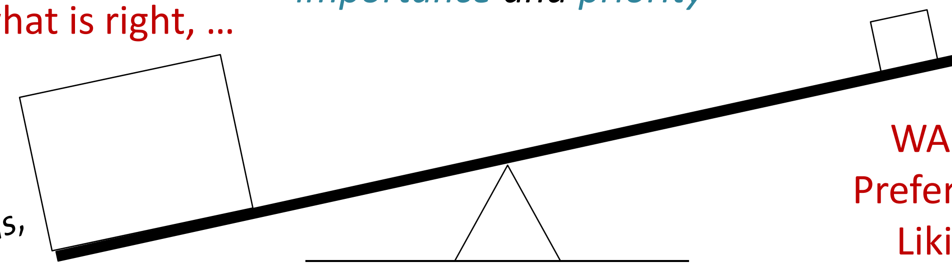
FIND OUT *WHAT IS NECESSARY !!!*

What the client says he wants is not always what is necessary.

"The client doesn't know what (s)he wants."

We may not base approaches on "what people want"

Necessity or Wants



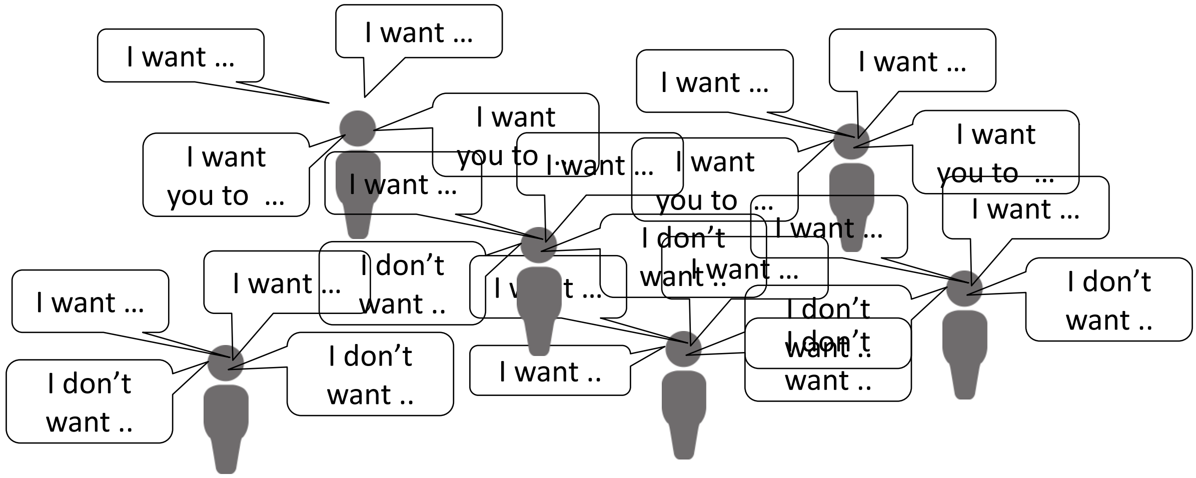
Holistic	Personal
Based on reality	Based on subjectivity
Lesser variable	Variable
Higher values and ethics	Short term, superficial
"Building"-mind set and values	"Consumption"-mind set and values
Responsible, accountable	Limited responsibility
Oriented towards survival of the whole, of the supra-system, of the environment	Oriented towards benefits and/or survival of the individual (or few individuals)
Understanding the reality	Understanding the demand
Investigation, finding out, analysing	Listening and doing, order taking, pleasing

THE COMPONENT, THE SYSTEM, THE INDIVIDUAL ARE PART OF A GREATER WHOLE. THEY ARE PART OF AN ENVIRONMENT. THEY DEPEND OF THEIR ENVIRONMENT. EVEN THEIR OWN SURVIVAL DEPENDS OF IT.

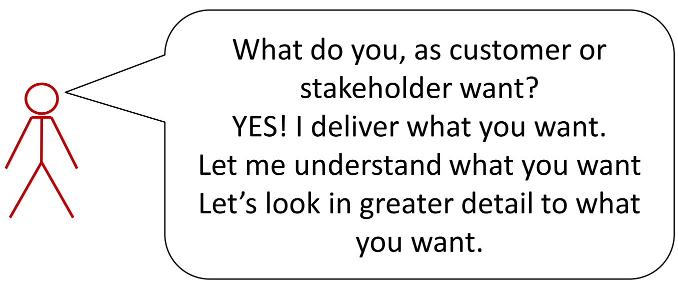
Examples

- In consumer: Delivering what the consumer wants may endanger the consumer (the consumer is not always aware of dangers of some products, like unsafe cars, fast food, chemical products, ...)
- In ecology: Doing what we wants, destroys "the planet" (nature, our life environment)
- In politics: Even doing what the majority wants, may destroy the system.

The Wants of the Stakeholders



Motto: "What the Customer Wants" "Order Taking" – Solving Wants



- Customer doesn't know what he wants
- What he wants doesn't solve the problem or doesn't allow him to reach the objective
- What he wants has changed
- Although he received what he wants, he is still not satisfied.
- Unaware of the missed opportunity of creating so much better solutions
- No innovation possible (or unlikely, only minor innovations, …)
- Wrong problem or wrong solution and find out that much time and resources have been wasted.

⇩

People ASSUME they know what they want

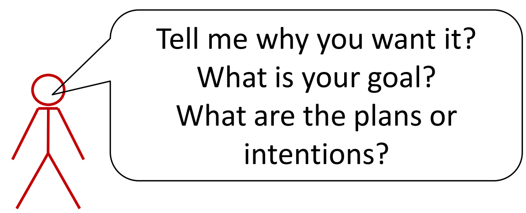
⇩

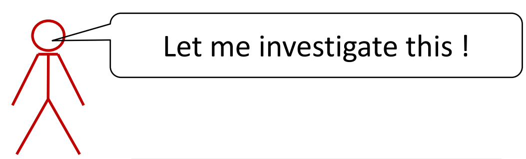
Customer Satisfaction ???

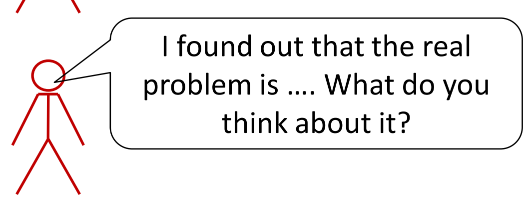
The key to failure is trying to please everybody

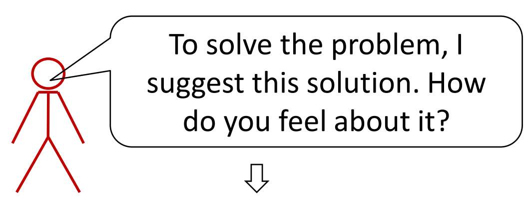
The Real Analyst

Solving Problems, Achieving Goals









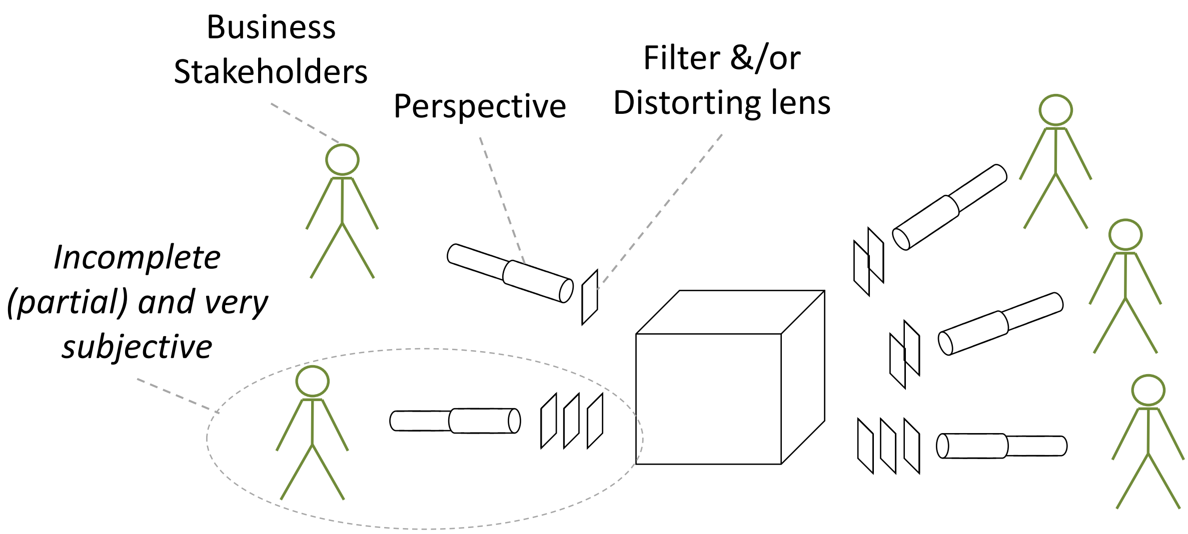
⇩

Building the right solution solving the right problem; well-designed; using best possible concepts of software; w/o creating new problems; possibly innovative;

⇩

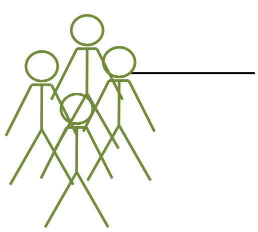
Customer Satisfaction

Perspectives and Filters

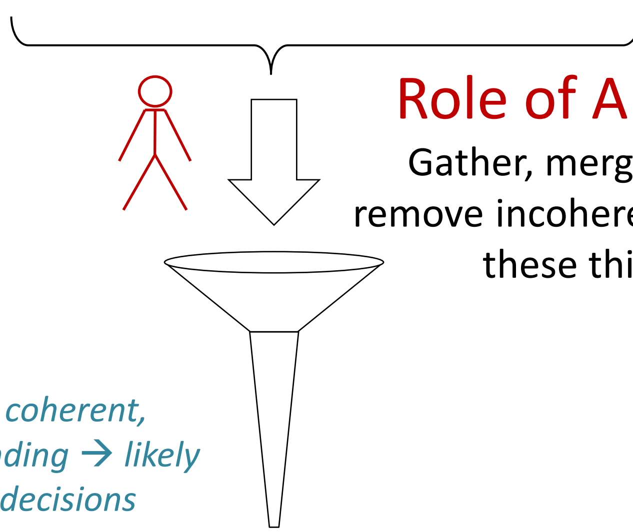


Fragmented, distorted, partial, incoherent & superficial understanding → More prone to bad decisions

The way to a MORE objective understanding



Knowledge	Desires
Insight	Preferences
Vision	Needs
Ideas	Priorities
Drivers	Expectations
Skills	Norms
Experience	Success criteria
Intentions	…

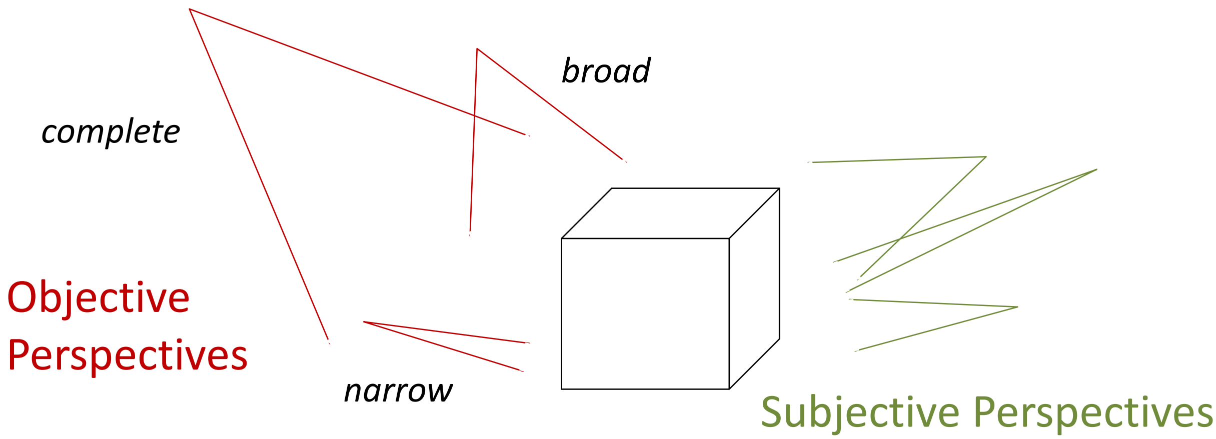


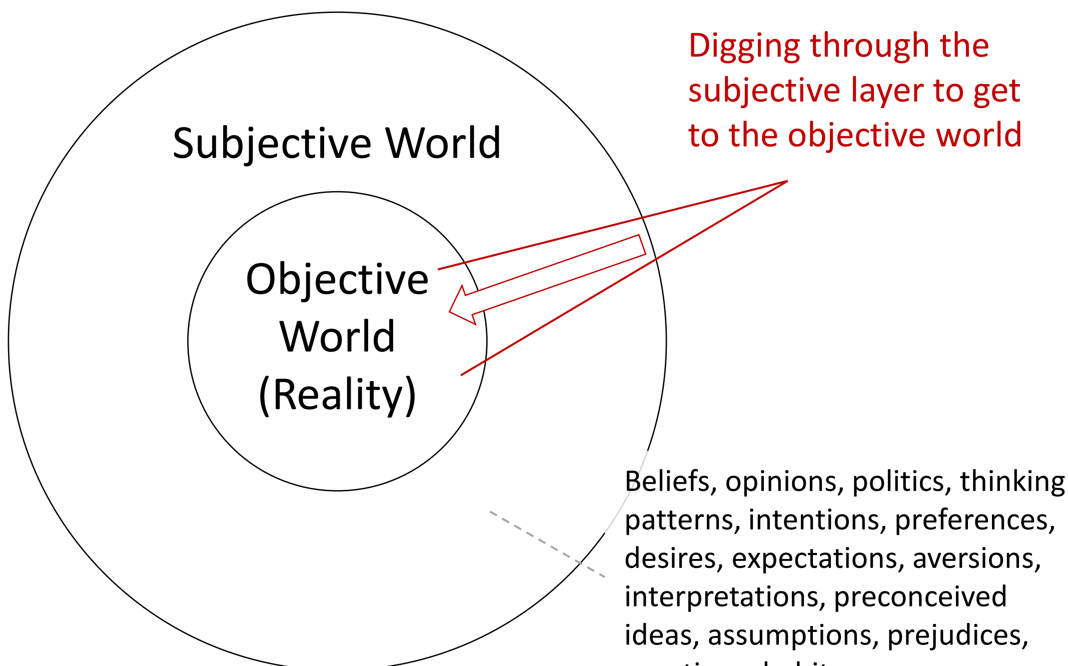
Role of Analyst

Gather, merge, align, remove incoherence, share these things

More complete, coherent, objective understanding → likely to obtain good decisions

Objective and Subjective World





Often the analyst needs to get through the subjective world to perceive the objective world, the reality, the real situation, as it is.
The analyst has to be able to make the difference between the objective world and subjective aspects.
(S)He has to take the subjective aspects into account and deal with it (manage it).

THE PERFECT ANALYST

ANALYST

Social Skills

Emotional Intelligence
Relationship Building
Empathy
Diplomacy
Listening skills
Leading skills
Group facilitation skills
Collaboration skills
Negotiations skills
Interviewing skills
Communication skills
Writing skills
Presentation skills
Persuasion skills
...

Attitude / Character

Respect
Curiosity
Autonomous
Driving
Goal Oriented
Proactive
Maturity
Responsible
Open minded
Objective
Depth
Tenacity
Flexible
...

Intellectual Skills

"Thinking like an Engineer"
Problem Solving
Critical Thinking
Systemic Thinking
Synthesising
Abstract thinking
Methodical thinking
Analytical thinking
Creativity
Sound judgement / Common sense
Engineering skills
Strategic thinking
Thinking at different levels of detail, from different perspectives, dynamic and evolutive thinking
Organisational skills
Autonomous thinking
...

Professional Skills

Information science
Information Engineering
Systems science
Computer Science
Software / Computer systems
Software projects
Companies, organisations, business
Project management
Stakeholder Management
Information Research & Management

Techniques
Use Cases
...

Standards
UML
BPMN
BABOK
...

Ability to find out what really matters and ability to make the difference between what doesn't matter and what does in any domain and the ability to keep focussing on what matters.
Ability to learn what matters.
Ability to envision the future.
Ability to lay out paths

Critical for Recruitment and Professional Development

Single Most Critical Skill

“Problem Solving”

Including all sub-skills like

- Critical thinking
- Abstract thinking,
- Systems thinking
- Holistic & Systemic thinking
- Sound judgment
- …

Must be super-developed

>1000 x stronger than average problem solving skills

Critical !!

One can’t be a (competent) analyst, engineer, architect, modeller, designer without this skill. (S)He may do more harm than good.

KEY TECHNIQUE: **QUESTIONING**

Analysts to Avoid

- Seeking to please people
- Expecting to be told what to do
- Liking to be told what to do
- Seeking to comply
- Doing what is expected
- Accepting everything at face value
- Thinking in terms of black or white, all or nothing, 0 or 100%, yes or no
- Having very quickly make up their mind
- Making a lot of assumptions and being unaware of them (it’s fine to make assumptions deliberately)
- Believing the majority is always right
- Confusing knowledge with understanding
- Seeing what is happening, not why things happen
- Thinking locally, short-term
- Interpreting and confusing terms and statements
- Following the rules, procedures, methodology (That’s safe. Avoiding being blamed)
- Copying colleagues and habits (spread of ignorance and bad habits)
- 9-to-5 mentality
- Not caring about the product and result. Low norms: “It’s fine if it works”.
- Not seeking to understand the discipline
- ‘Doing’ is more important than ‘Thinking’
- Can’t work autonomously, need continuous help
- Fearing problems and complexity
- Fearing too big change
- Lacking of focus and direction
- Unable to take decisions (some hesitation is certainly fine!)
- Systematically consulting others for their opinions about problems. Fully relying on them for solutions.
- Spending a greater importance on opinions rather than on facts
- Going along with the simple but wrong answers
- Being glad with the first answer or solution that comes to the mind
- Systematically buying or copying solutions as approach to solve problems
- Calling everything that is related a ‘solution’ even if it doesn’t solve anything or creates more other problems
- Solving symptoms
- Preferring simple or quick ‘solution’ (design debt)
- Doing more of the same, give up or throw away the ‘old’ and replace it (don’t fix it, don’t change the thinking, let alone the beliefs)
- Not having all the necessary social AND thinking skills

Competency Development

	Theoretical	Practical
KNOWLEDGE – level "How-to"	Frameworks Standards BoK's Methodologies Techniques Languages Tools manuals Courses	Experience, habits

Ability to perform activities rightly

INSIGHT - level

- Meta-thinking
- Critical thinking
- Questioning and investigating the assumptions, beliefs
- Questioning
  - Why …?
  - Is it true that …. ?
  - What if … ?
  - What is the nature of…?
  - What is the relation ...?
  - What is the relative importance …?
  - What is the true purpose of …?
  - …

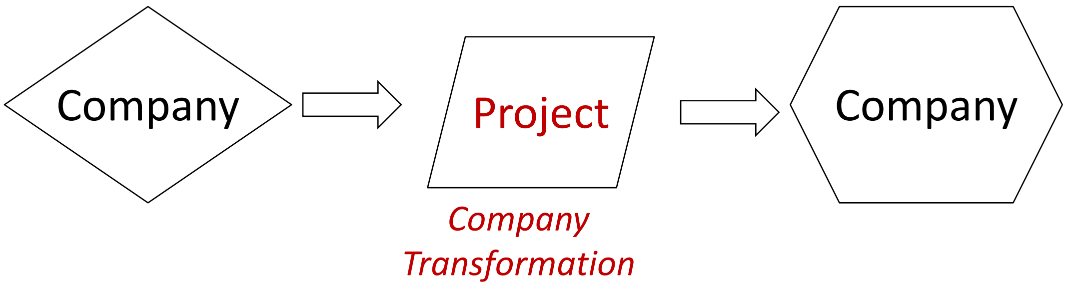
Ability to adapt, to do the right things right and get higher results

The development of the "insight"-level is the most difficult but also the most critical

Most of the standards, frameworks, … majorly are how-to-guides.
"Follow the guide / the majority / the present tendency !" – mentality.
Knowledge level only doesn't suffice. It leads to "cargo-cult".

PROJECTS

Projects



Projects are a way to build and to transform the company.
Projects are a way to execute strategies.

Projects are COMPLEX, UNCERTAIN & RISKY
Projects are CRITICAL to the COMPANY

Projects skills and/or engineering skills are critical

A project is not an activity that can be done by just any group of employees. Neither is it a social gathering of nice people. It is a group of collaborating experts … at least if experts have been recruited and/or assigned to the project.

Skills, insights, Methods and Actions help to deal with complexity and to decrease uncertainty and risks.

A Project ?

PROJECT MANAGEMENT's PERSPECTIVE

General definition

- Endeavour, A process
- Producing a unique product
- Progressive elaboration
- Executed by people
- Temporary (has begin and end)
- Uncertainty and Risks are inherent

A project is more than a process. A project is :

- **a temporary organisation**
- functioning in an (work) **environment**
- a **process** to produce a **unique agreed outcome**
- using **resources**
- **as efficient** and **effective** as possible and **limiting risks**
- **maximising the benefits**
- an initiative that must be **set up**, **planned**, **guided** and **managed**.

COMPANY's PERSPECTIVE

(IT) Projects are

- A mean to execute (parts of) a **strategy**
- A way to **develop** new **products and services**
- A way to **create assets**
- A way to **innovate**
- A way to **build (a part of) the company / organisation**
  - to strengthen, improve and transform / adapt / change the company/organisation.
- An **INVESTMENT!!**

Conclusion:
The capability of managing and executing projects is **VITAL**, a matter of life and death; a matter of disappearing, surviving or flourishing for the company.

Stakeholders

Stakeholders have

- Intentions, Objectives and Plans
- Needs
- Issues, problems, obstacles, complaints, opportunities
- Necessities
- Information, knowledge and insight (information sources)
- Expectations
- Limitations
- Resources

- They affect or are affected by the project, product or by the product's outcome.
- They provide input to the project
- They may bring opportunities and solutions.
- Trust and the right(!) relation has to be created.
- Collaboration must be put in place.
- Decision power: They will have to take decisions.
- They will evaluate the project, project's product or the realised outcome.
- They constitute risks. (They may make a project to fail!)

MAIN Stakeholders

STAKEHOLDER	POSSIBLE OBJECTIVES
Company	To survive, to grow, to evolve, to live accordingly to its purpose and mission, to serve the society, ...
Management	Reaching its objectives, increasing benefits, lowering the costs, executing a plan, ...
Business community	Conducting business, reaching objectives, ...
Informatics Department	Providing information solutions to the business, creating value for the business, responsibility and capability to manage and maintain the implemented Informatics solutions and to make them evolve, implementing a strategy, innovating, ...
End-Users	Reaching his/her objectives, having a good evaluation, avoid annoying work, offering a better service to the clients, release pressure on his/her own work, ...
Sponsor	Financial benefit, business objectives, …

Project Success

Criteria

Criteria		Criteria	
On Scope	☐	According to requirements	☐
On Time	☐	According to specifications	☐
On Budget	☐	Passed the Acceptance Test	☐
According to plan	☐		

Taking into account : Taken risks, leaving a deteriorated situation behind (e.g. technical debt, documentation debt, chaos, burn-out, people leaving, …), …

Does a project fails when it misses one criteria ? Can the same criteria be used to define failure? (not success = failure?)

Duration of Satisfaction: Project closure, acceptance of product, longer period?

But….

QUESTIONS

Is a project executed to deliver on time; within budget; respecting the scope, demand and specifications and meeting expectations?

or

Is it executed because the product, solution or change will be beneficial to the company and to its clients? (investment to build < value produced by the product, solution or change)

Is delivering within the iron triangle more important than having a product creating a maximum of value and limiting risks?

TIP: Criteria to be agreed upon and to be recorded in the Project Charter.

Product Success

CRITERIA

A PRODUCT / SOLUTION is SUCCESFULL if …

- Working software
- Meeting the business demand
- Meeting the business stakeholders expectations

  Which ones? Have the expectations (not requirements, but real expectations) been recorded and validated before the project started?
- Improving the activities of the business/organisation

  Seamlessness, flexibility, efficiency, effectiveness, safety, respect of rules and laws, … and a decent quality.
- Allowing the department to reach its objectives
- Allowing the company to reach its objectives
- Improving the value and exploitability of information
- Creating value for the company
- Creating value for the company's client
- Fully exploiting the opportunity
- Strengthening the company

Meeting the different criteria require a different level of thinking, mind-set, norms and values, skills, collaboration, approach, methodology, set of objectives, …

Notes:

Can the same criteria be used to define product failure?

Does it solve a problem or need? Does it contribute to the sustainability of the company?

Project & Product Success

PROJECT success

- According to scope, time, budget and quality
- According to plan
- Project executed without (big / unacceptable amount of) problems
- Improves competencies (learning)

Measured in duration: several months, few years

Measured at the end of the project, sometimes based on estimates made early in the project

PRODUCT success

- Maximum Practical value
- Maximum benefit
- Cost < Benefit
- Strengthens the company
- Opens up new opportunities
- Improves competencies (learning)

Measured in duration: over several years

Measured over a long period of time (once operational)

Notes:

Defining the right success criteria is important. Measuring correctly.

Learn the right lessons. Put it in perspective: project success = more important than product success? On what type of success does the company/stakeholder focus most?

Investment, Cost, Benefit of Product

Product Success

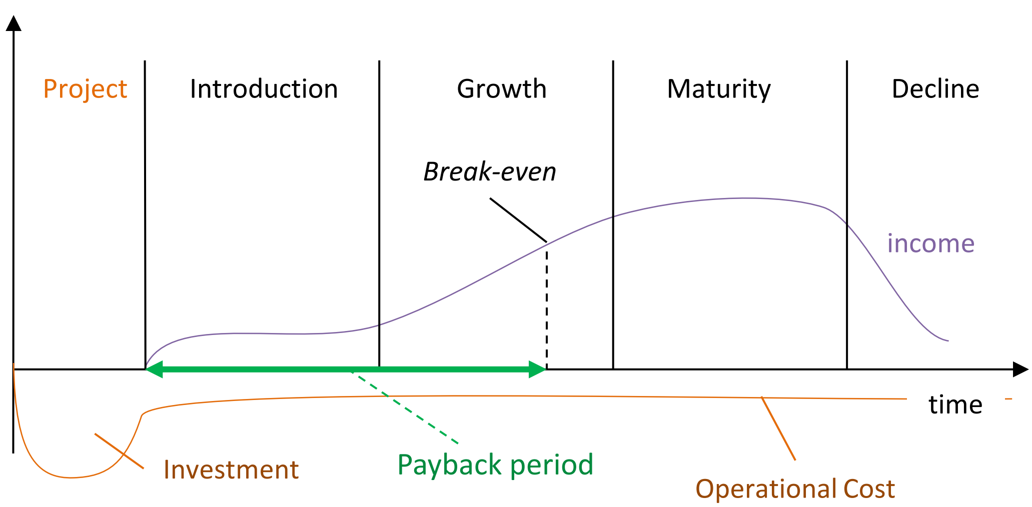
Project → *produced by the project* → System in Operations

Cost (Investment)

Producing benefits; takes time; income is variable; cost of operations

Product is Profitable? Total Cost < Produced Benefits

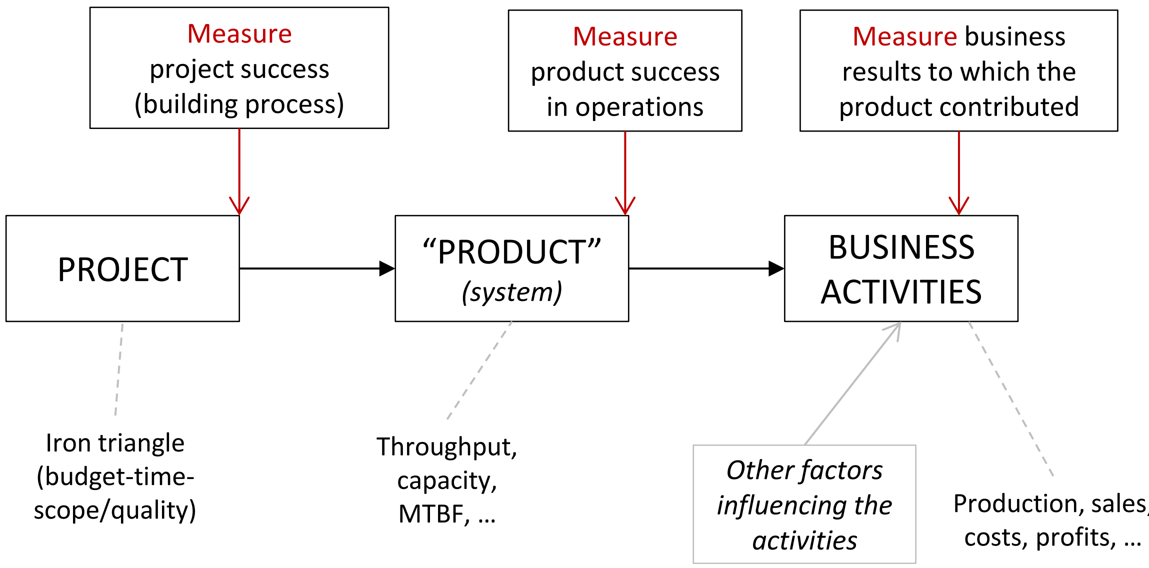
Simplified System's Lifecycle (financial perspective)



<u>Remarks:</u>

1) During the life changes may be implemented. Changes have a cost, an increase of benefits (or lowering of cost) and a payback period
2) Each innovation may bring in an increase of income in diagram of the system, or, for example postpone its decline.

Overall Success Evaluation



"Product": A project produces a product, which is a part of the enterprise, such as a capability, a solution, a system, an adaptation of an existing system, a set of processes, …

This "product" allows to execute business activities.

The success of each (Project, Product, Activities) can be influenced by other, sometimes external, factors, such as

- Project: decisions to be taken by business, quality of received, …
- Product (System) : Training of discipline of the users, pressure
- Business Activities: Products, Services and actions of competitors, …

Notes

When evaluating the contribution of the solution/system, other factors that influenced the business results have to be taken into account

Project Intentions → Project Driver

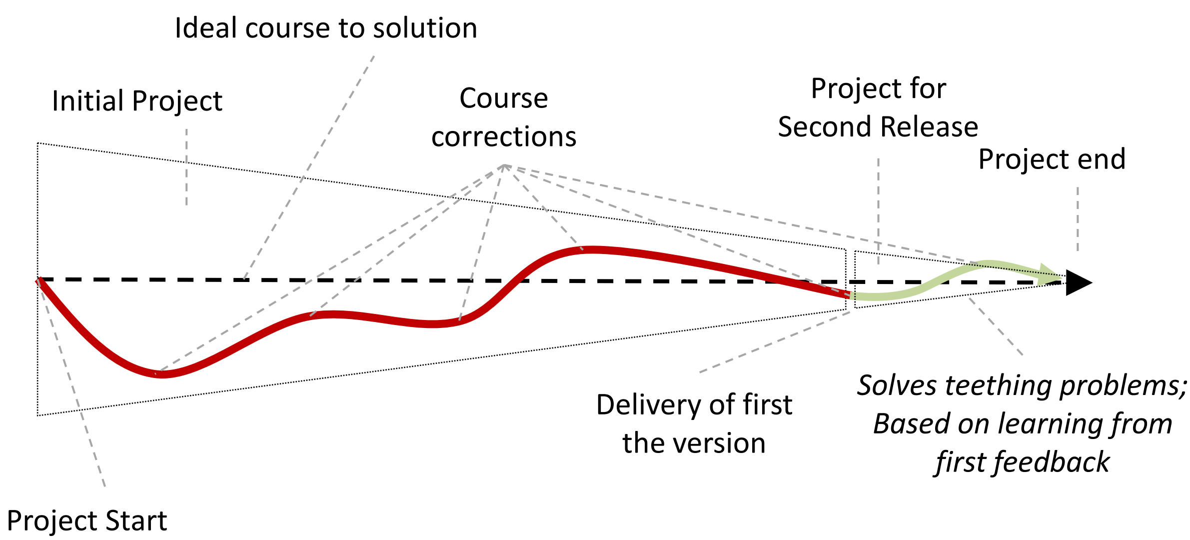
What are common intentions for informatics projects ?

1. [ ] A Vision to implement
2. [ ] A Strategy or Plan to execute
3. [ ] Legal constraints to respect
4. [ ] An Architecture to implement
5. [ ] An Objective to meet
6. [ ] New products and services to launch
7. [ ] New capabilities to develop
8. [ ] An amount of additions and improvements to implement
9. [ ] To keep workers busy
10. [ ] Abundance of Time
11. [ ] Excess of money. It has to be spent.

Answer is 1 to 8 :	Objective ("Scope"-related)	
Answer 9 :	Budget, Cost (& Resource)	unlikely
Answer 10, 11 :	Time (& Resources)	

- Commonly, a projects is started and systems are built in order to obtain a result, to achieve a goal.
- The Scope is the main natural driver of projects, and time and budget are dependent.
- Without profitable scope or goal, there would a time and budget.
- Budget and resource allocations are assigned based on a justification of a beneficial product, outcome or goal.
- A deadline can be established and scope can be adapted to meet the deadline. But without scope there wouldn't be a deadline.

Project Course



- Course corrections may imply scope changes, adaptations of project plans, budgets, schedule, delivery date, …
- Analysis reduces the likelihood and the amplitude of deviations from the ideal course.
- Course corrections shouldn't be caused by "changes of mind" or preferences.
- After Analysis the likelihood on changes should be severely reduced. It should be even more reduced after the design.

Projects

are

Semi-structured / CASE-based Processes

Initiatives

Implications:

It is senseless to deal with a project as if it was a strongly structured process that can be defined fully upfront and then executed as written.

A process or plan devised upfront can not be considered as prescriptive. (see page about un-/semi-/structured processes)

Any Project Plan
defined upfront
will have to be adapted
during the execution

Mastery of the Discipline,
in-depth understanding
and common sense
are critical

Project Objectives

1. Produce the product described in the customer's demand
2. Meet the requirements
3. Meet the expectations
4. Produce a specific product

Allowing only a specific or a limited way to contribute

5. Improve company's KPI's or other measures
6. Contribute to a pre-determined business objective and allow to reach it
7. Drive business trough optimisation, improvement, innovation, new ways of working and new products and services

Allowing to contribute in a broader range of ways;
Offering more freedom;
better use of possibilities and skills;
More can be learned

ASSIGN/LINK HIGHER OBJECTIVES TO PROJECTS

RESULT DELIVERY rather than **PRODUCT** DELIVERY

(organisation, human resources and collaboration have to be adapted)

Project Objectives

OBJECTIVE "mission"		RESULT "what you will produce/get"
Develop the demanded software application	*leads to* → *produces* *delivers*	demanded software application
Solve a stated information problem/need	→	Solves the stated information problem/need
Contribute to a specific department's goal	→	A contribution to the department's goal
Consolidate the enterprise's systems	→	Consolidation of the enterprise's systems
Innovate and Drive Business	→	Innovation and improved business

Low objectives leads to low results

High objectives leads to higher results

The objective assigned to the project
determines
the result produced by the project.

The stated objective is habitually the <u>maximum</u> that the project will deliver.

<u>Notes:</u>

It is better to turn Software Development projects at least into Information Systems Development Projects.

ASSIGN

COMPANY’s GOALS

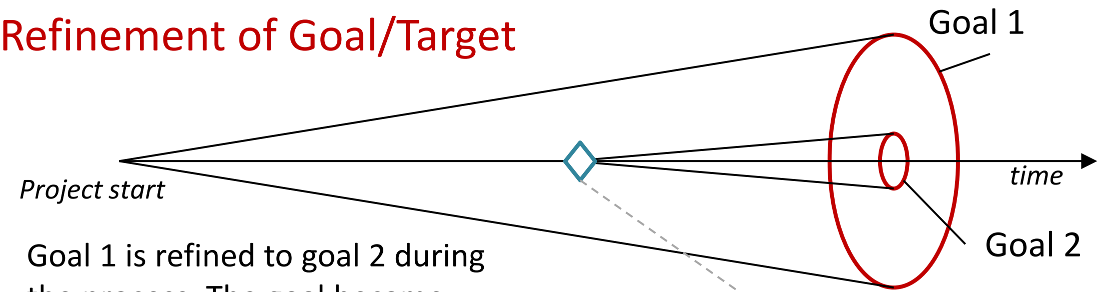
To ISE/IT PROJECTS,
and also
to ARCHITECT’s jobs,
to ANALYSTS’s jobs,

In order to get more creativity,
more innovation
and much better solutions and benefits

Give target and context and let people do their job.

Goal-Oriented & Direction

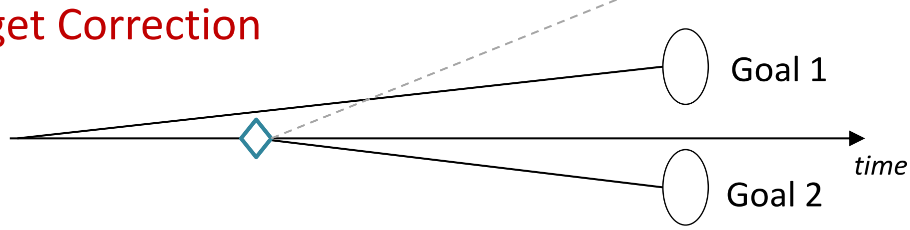
Refinement of Goal/Target



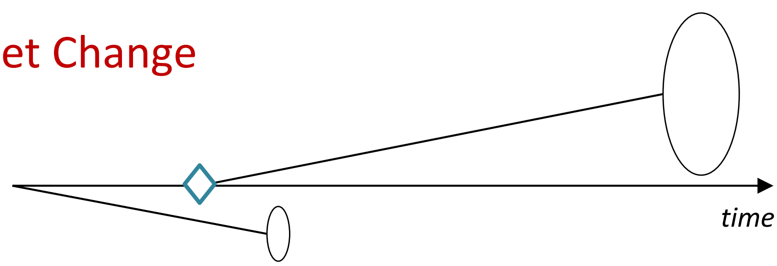
Goal 1 is refined to goal 2 during the process. The goal became more clear and precise.

Goal change
= preferably a consciously well-considered decision

Goal/Target Correction



Goal/Target Change



Goals are tight to Purpose

Know the (real) purpose(s) and you know the goal

Notes:

A goal provides either an objective, the idea of the pursued final desired outcome, or a direction. It brings focus. It allows to align all the means and efforts in one direction. It brings focus, stability, effectiveness and allows efficiency.

A goal avoids wasting resources and efforts in different and/or opposite directions or on opportunities of lower interest. Frequently changing the goal(and the direction) is the same as having no goal.

However, fixing the goal, cutting it in stone, is also a misuse of the concept. It makes no sense to continue to pursue a goal that has been found being useless. Small goal changes or goal refinements are normal. Frequent important goal changes are a symptom on an underlying problem. 180° change of objective can sometimes be necessary, but should happen very rarely.

Goal and strategy (or other plan) shouldn't be confused.

A Project – A Few Reflections

Objective

- Reaching a Business Objective
- Implementing a part of the Strategy or tactic
- or Strengthening or improving the Enterprise

Purpose

- Adapting the company or the company's product and services

Investment

- Intent to have a favourable return on investment
- A company doesn't invest in initiatives, blindly, without knowing what they hope, expect or will get. It is not a carte blanche.

Difficult, Complex and Critical

- Since it strengthens and transforms the company, the most skilled people should be assigned on projects.

Risky

- Implies the project may be lesser successful or even failing. We have to accept this eventuality.
- Need to minimise (mitigate) risks

Life after the Project goes on

- When the project is done, we need to leave the company in a better state (people's morale, servers, documentation, technical debt, …)
- Product of the Project has a Lifecycle

This has to be respected when defining the objectives, norms, approaches, products, when taking decisions, …

Concepts Defining the Project

Project Mission

General statement describing what the project aims to achieve.

Project Goals / Objective(s)

Objectives the project seeks to achieve. Note that the project's product has also a goal or objective.

Project Drivers

Reasons, motives, why the project is undertaken.

Project Boundaries

Boundary delineating the domain/area that can be investigated and/or which can potentially be adapted or directly impacted by the project.

Project Dependencies

Projects are dependent of external factors of which the project depends. They rely on them. Therefore, they affect the project execution and their outcome. They may pose a risk to the project.

Project Assumptions

Hypothesis upon which the project is based and which may significantly affect the project execution, its outcome or the value of the outcome. They have to be clarified if possible and when possible. Vigilance is required.

Project Constraints

Project constraints are restrictions or obligations imposed on the project. (Similar to Product Constraints).

Product Scope, Project Scope, Project Boundaries

PROJECT BOUNDARIES
What part of the environment will be studied, may be changed, and/or will/can be directly impacted by the product

PROJECT SCOPE
What WORK will be performed to define and build the product, to make the environment in which the product will operate ready, ...

PRODUCT SCOPE
What functions, features, components, deliverables, … will be built and delivered.

These elements define limits of the project. They DELIMIT !

However …

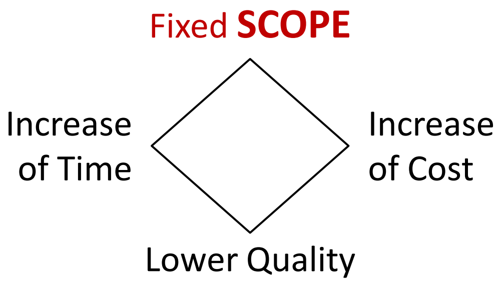
1. The business environment may change during the course of the project.
2. New insights, issues and ideas may surface at any time.

Therefore

When it makes sense, when it is beneficial, they should be able to be adapted.

Plans are adaptable and dynamic artefacts

Constraints

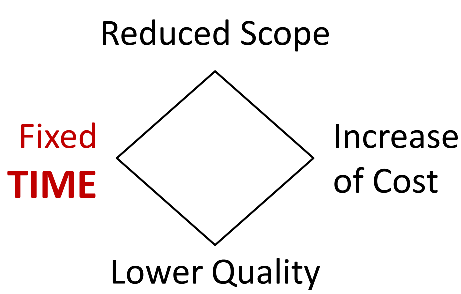


Companies work based on a vision, on strategy, on goals and targets, on production of value, on limiting risks and costs, on increase of benefits and on regulations.
In a natural way, this leads to the submission of project proposals. The product or outcome is the primary reason why projects are executed.

It is obvious that scopes define the missions of projects. Time and cost are deduced from the product scope.

What happens if a project is running late and the scope is fixed?

Time will increase. Cost will increase. The quality can be lowered, sometimes in an hidden way. This creates debt. Or it can be a combination of these.



Time is never the trigger and driver for the start of a project. It can be an imposed criteria (legal obligation, celebration day, …). A client is rarely ready to invest in a project of which (s)he doesn't know what (s)he will get, and thus what will be the return. Making some vague estimations is always possible. (see predictability of constraints)

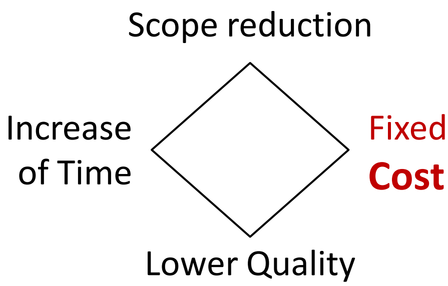
What happens if a project is running late and the delivery date is fixed?

The scope can be reduced. The cost may increase. The quality can be lowered, sometimes in an hidden way. Consequences of a lower quality will come later. Or it can be a combination of these.

Note:

- When something is "fixed", this means that it is the main constraint. It is the last one that should be adapted. And in some case, it won't be possible to adapt it, although those cases are rare.
- In most cases, adaptations of the constraints is not desirable unless it is really beneficial.

Constraints

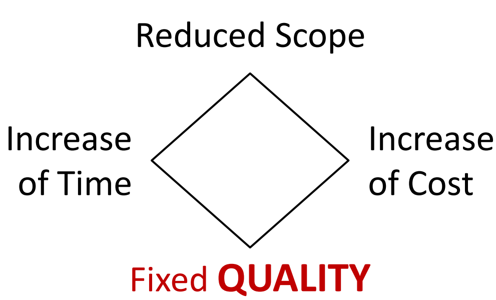


Cost is never the trigger and driver for the start of a project. Sometimes it is possible to find additional budget. This depends of the expected benefits of the project. A client is rarely ready to invest in a project of which (s)he doesn't know what (s)he will get. Making some vague estimations is always possible. (see predictability of constraints)

It is obvious that scopes define the missions of projects. Time and cost are deduced from the product scope.

What happens if a project is running late and the COST is fixed?

Scope can be reduced. Time may increase. The quality can be lowered, sometimes in an hidden way. This creates debt. Consequences will come later. Or it can be a combination of these.

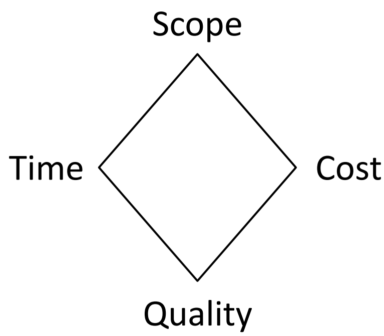


Quality is never the trigger and driver for the start of a project. However, quality can be a non-negotiable constraint. A client is rarely ready to invest in a project of which (s)he doesn't know what (s)he will get, and thus what will be the return.

What happens if a project is running late and the quality is fixed?

The scope can be reduced. The cost or time may increase. Or it can be a combination of these.

Constraints



We can negotiate on 5 aspects.

So, there are SIX questions

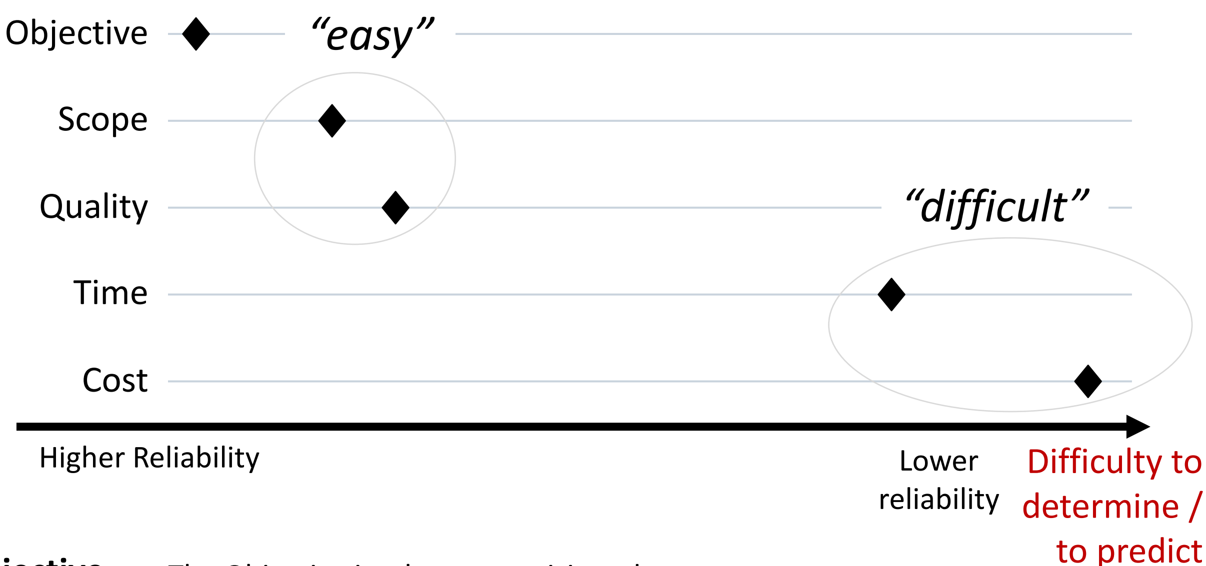
1. Can we adapt the scope? For example, by postponing some parts.
2. Can we simplify the solution while keeping the scope?
3. Can we reduce the project duration?
4. Can the cost be reduced?
5. Can we be satisfied with reduced quality and where can the quality be lowered and until what point?
6. Or can any of the answers to the question above be combined to have a satisfactory result?

- It is advisable to try to do a good analysis and to estimate better in the first place and to reduce everything that may pose delays.
- A project runs out of scope, time or budget for a reason: inefficient analysis, bad estimations, bad leadership, bad planning, work environment, insufficient collaboration, received information, slow or bad decision making, …

Maybe first find and deal with the causes rather than trying to solve the consequences. Only then we can learn valuable lessons !!

- What if we could assign lesser importance to the iron triangle and more focussing on the product?

Difficulty of Predictability of Project's 5 Main Parameters



Objective The Objective is what we envisioned.

Scope The Scope can be determined (if we focus on what is necessary, rather than on wants and if SASD is done decently)

Quality Required Quality is relatively easy to be determined.

Time Time = mainly f(Scope, Quality) + non-linearity + uncertainties + quality of organisation, collaboration, information, ...

Cost Cost = mainly f(Scope, Quality, Time)

The product, as defined by the objective, the scope and the quality create satisfaction. They create the value.
Time and Cost can be constraints. They are inherent parameters of the execution of the initiative.
General principle: Time and Cost are always dependent of the Scope and Quality.

Scope and Quality may be adapted during the project execution. Still then Time and Cost are a function of Scope and Quality.

Project Dependencies

Factors influencing the progress and success of a project:

(some are external to the project):

- Availability of stakeholders
- Conflicting goals and/or visions among stakeholders
- Time to align visions and get agreements among the stakeholders
- Pace of decision making and quality of decisions
- Frequently changing priorities and changes
- Hidden agenda's
- Collaboration with stakeholders
- Pace of receiving information & quality of received information
- Size of the problem area & solution
- Skeletons in the closets
- Degree of knowledge of systems and organisation/company
- Quality of existing source code
- Collaboration within the project team
- Work environment
- Skills of the team
- …

"Six Factors Model+1" Contributing to Project's Success

IT Project

1. **Business Community & Input**
- Objectives, intentions
- Realistic expectations
- Issues
- Constraints
- Business knowledge & Info
- Accountability & Commitment

2. **Project Management**
- Clear vision & scope
- Hierarchy of objectives: clear, same for everybody
- Manage stakeholders (expectations)
- Management against success criteria linked to business value
- Real authority of PM and specialists
- Structure the initiative
- Plan & review plans
- Organise project, team, work environment
- Resolve problems
- Risk Management
- Communication

3. **Process**
- Approach, methodology
- Methods
- Reviews & Validation
- Feedback

4. **People**
- Skills
- Motivation
- Understanding
- Collaboration
- Communication
- Common sense
- Analytical thinking
- Critical thinking
- Creativity
- Flexibility
- ...
- Hard work

5. **Resources**
Workforce
Time
Budget

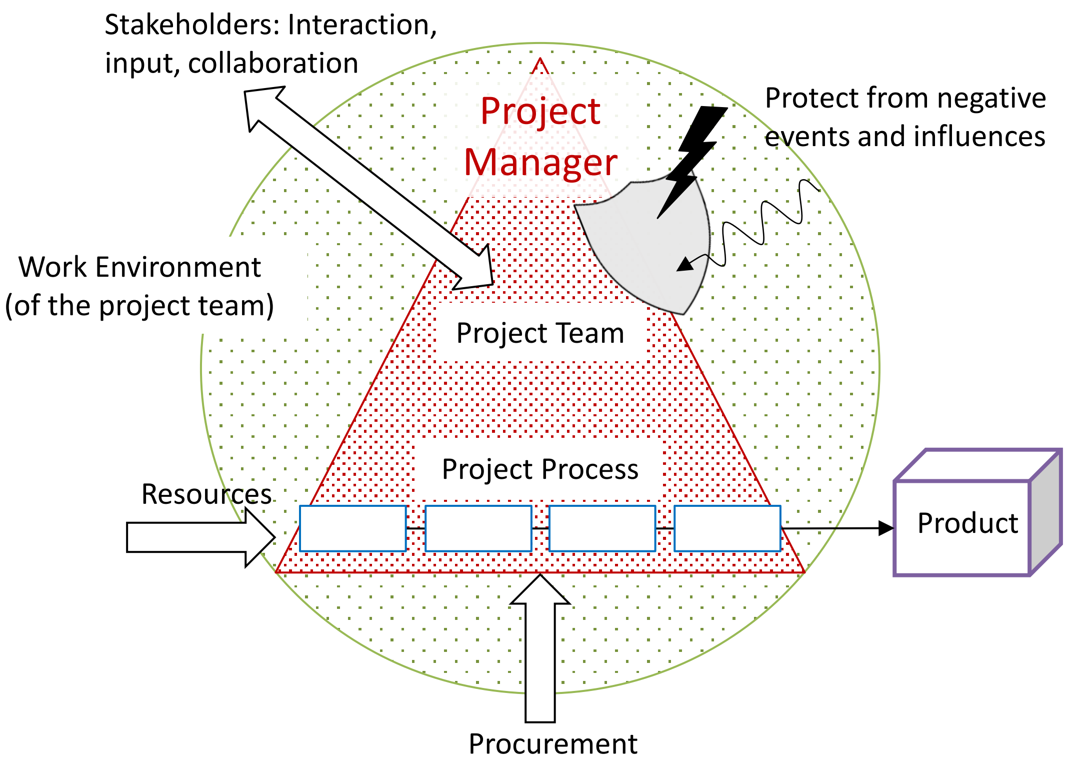
6. **Work Environment**
- Office space, meeting rooms, creativity room, ...
- Software tools
- IT environments
- Hardware and software
- Company rules, policies, company culture, …

The "+1"

The project MUST respect the FUNDAMENTAL PRINCIPLES

of the involved disciplines like
- information systems engineering,
- Information management,
- project management,
- change management, …

Main Aspects Managed by the Project Manager



The Project Manager

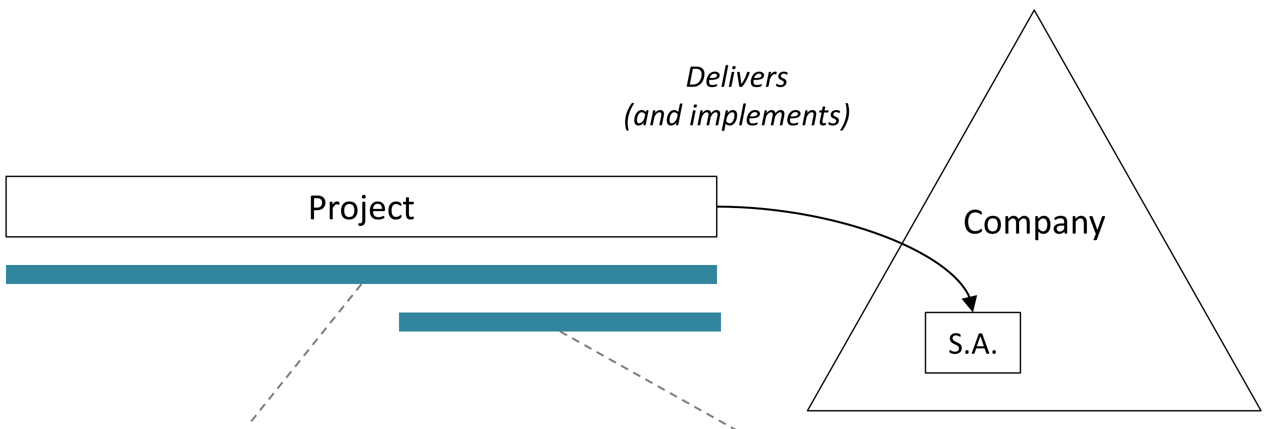
1) sets up this **temporary organisation** and **work environment**
2) ensures the project fulfils the **mission** by reaching the **objectives** (within certain conditions).
3) obtains, creates, organises, plans and manages the initiative
4) manages Risks, Stakeholders, Communication, Budget and Resources.
5) protects the initiative (shield, filter, …) and remove all negativity in it

Probably, one of the most important responsibilities and tasks of the Project Manager is to create an organised and safe work environment that suits the project team to work and that allow them to work efficiently.

"What do you (team) need to be able to work ? And what hinders you?"

Organisational Change Management

Software Development Projects should be more than implementing and delivering a software application.



Organisational Change Management (OCM) to ensure a better collaboration between “IT” and the business community

OCM to prepare the organisation to accept, and to adopt project’s product/solution.
This contributes to a better integration in the human organisation and to ensure feedback of the product/solution/system.
Training might also be useful (about the product and about information usage) to ensure a good integration.

Notes:

This view should influence the way the project mission and scope are defined. It may also influence the role of the Project Manager and of the Analysts, Architects, …

Planning & Managing Projects

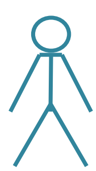
PLAN THIS	PREPARE FOR THIS	
KNOWN & STABLE *(Unlikely to Change)*	UNCERTAINTIES	UNKOWNS
INCREASE THIS	LIMIT THIS	BE VIGILANT FOR THIS

Can be planned

Identify
- Assumptions
- Risks
- Unanswered questions
- Hesitations
- …

may require adaptations (of plans, models, project, …)

Try to turn Unknowns and Uncertainties into Known and Stable elements and then to take the best possible decisions.



Project Manager

Eliminates uncertainties about …

PROJECT ENVIRONMENT
PROJECT ORGANISATION
PROJECT PROCESS
PROJECT RESOURES

Transmit findings about problem, problem area & solution (Increasing the "knowns" and decreasing the "unknowns")

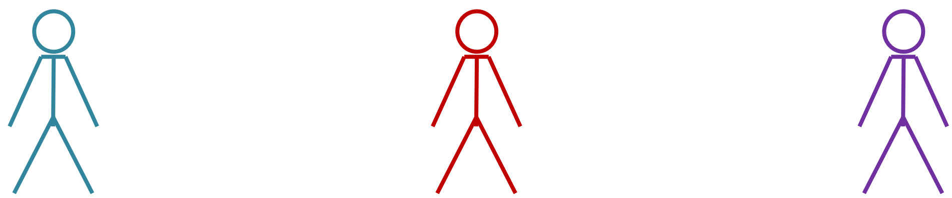
Analyst
(Systems Analysis)

Eliminates uncertainties about …

PROBLEM or GOAL
PRODUCT or
SOLUTION

Project Team

Three Main Profiles



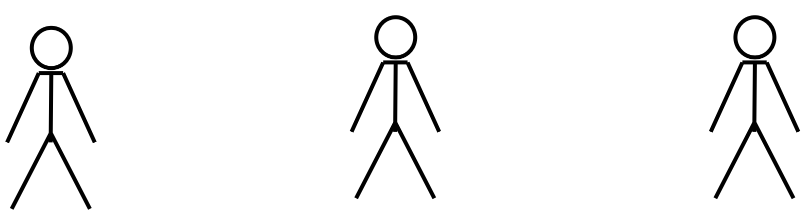
Business Leader(s)
Responsible for the goals, for the business vision, for the business logic, …
Can be manager(s), business architects, SME's,

Solution/System Leader(s)
for the solution and/or system for the product. (perspective of information exploitation)

Project Manager
Responsible for the project as a temporary organisation, work environment, work and resources.

They must defend the goal and mission; have the motivation, the authority and competencies to ensure intended solution will solve the problem or need or will produce benefits inline with the goals; and they must be very present and accessible.

Other Key Profiles



Security Expert

Technology Expert

….

Note:
This does not imply that these persons must take all the decisions. They may guide, coach and support. They may give freedom to a team or to a few persons. They may ensure a democratic process in a team. Etc.
In the end, they are responsible for the final outcome.

Leadership – Team Management

	Project Manager	Analysts / Architects
1. Visionary Leadership 2. Transformational Leadership 3. Servant Leadership 4. Coaching Leadership 5. Pacesetter Leadership 6. Transactional Leadership 7. Laissez-faire / Hands-off Leadership 8. Bureaucratic Leadership 9. Democratic Leadership 10. Autocratic Leadership or Authoritarian Style of Leadership		

Style of leadership of the Project Manager can be different of that of an Analyst/Architect since both have a fundamentally different role.

Styles of leadership can be combined depending of the situation.

Leadership – Team Management

Manager-led Team ≠ Self-managed Team ≠ Self-organised Team ≠ Self-governing Team

	Manager-led Team	Self - managing Team	Self - organising Team	Self - governing Team
Setting overall direction, purpose & composition of team members				
Defining or modifying work processes and policies				
Monitoring and evaluating the work process & monitoring progress				
Executing discrete tasks that make up the delivery of some valuable product / service				

Manager

Team

What if …

- a manager delegates decision making to the team and coaches and guides the team in their decision making process ?
- the team defines the work process (approach, methodology) and policies but a manager manages its execution ?
- the composition of the team is defined by the team, but the team is managed by a manager ?
- some important directions and purposes can be defined by a team, but not all ?
- etc …

PM – Analyst Collaboration

PROJECT MANAGER		ANALYSTS - ARCHITECTS
Process, Resources, Work Environment - oriented		**Product - oriented**
Work Conditions Authorisations (obtention) Authority (obtention) Accesses (obtention) Stakeholders availability Stakeholders collaboration Project structuring Process planning Process guidance Budget Risk Resource Estimations Resources Resource Usage Communication Tools Conflict Resolution Issue Escalation Negotiation Project Termination …	← **What** **When** **Who** → How ← **Progress** **Results** **Issues (*)** **Risk** **…**	Goal Scope Feasibility Stakeholders Expectations Diagnose Approach elaboration (*Methodology*) Solution Quality – centric Long term - oriented

Diagram represents the general idea

Notes:

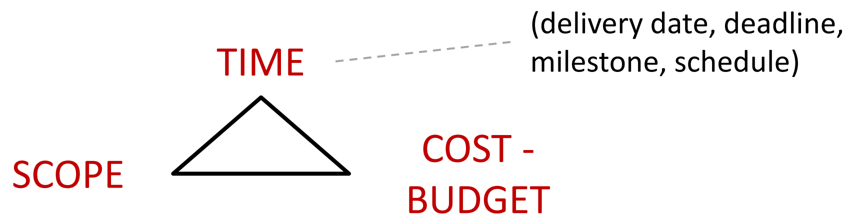
Some tasks, like Scope definition, may, originally been defined prior to the project start.

Examples: The Analyst notices that a scope change might be advantageous. This affects the agreements, plans, required resources, … The Analyst has to discuss this with the PM. The stakeholders will also be involved in a discussion.

The Analyst detects a risk. This has to be discussed with the PM to see what measures can be taken.

*: The issues the Analyst discusses with the PM are essentially those which impacts project management. The Analyst may inform the PM about some problems related to the logic and product, yet they have to be solved by the Analyst. A PM doesn't solve an issue in process modelling or information modelling.

Iron Triangle



MEANING:

- A project delivers a product/solution accordingly to the scope. To produce this product/solution time and budget (cost) is required.
- These 3 constraints are related to each other
- A change in one of the three changes, affects the other two parameters.

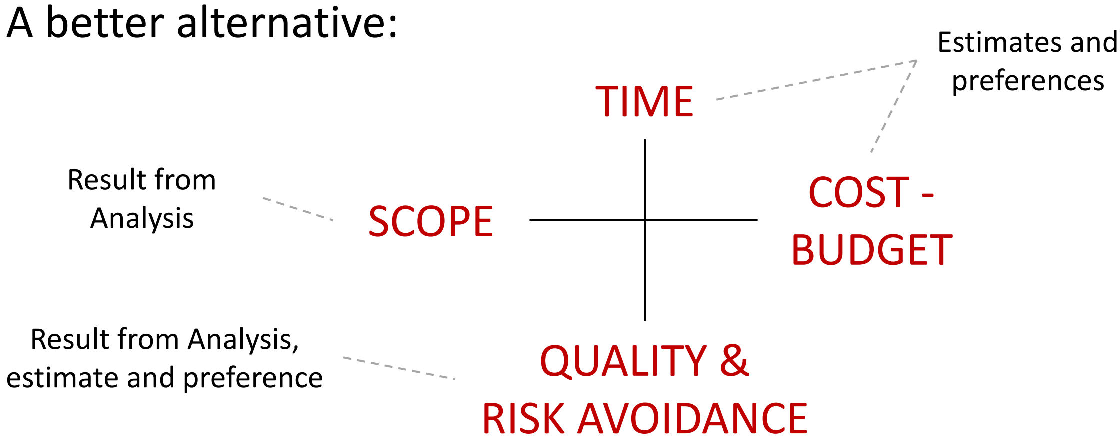
It does

- not imply that the scope is fixed
- not define the priority among the constraints
- not imply that all three constraints are fixed (frozen, can't be changed)
- Not imply that delivering accordingly to these constraints a solution is delivered that solves the problem, that this solution is beneficial or that the best solution has been delivered.

CRITIC:

The aspect of created quality and risk avoidance are not included.

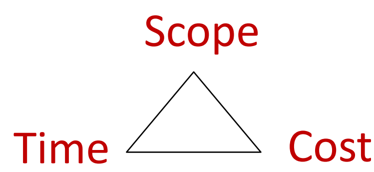
A better alternative:



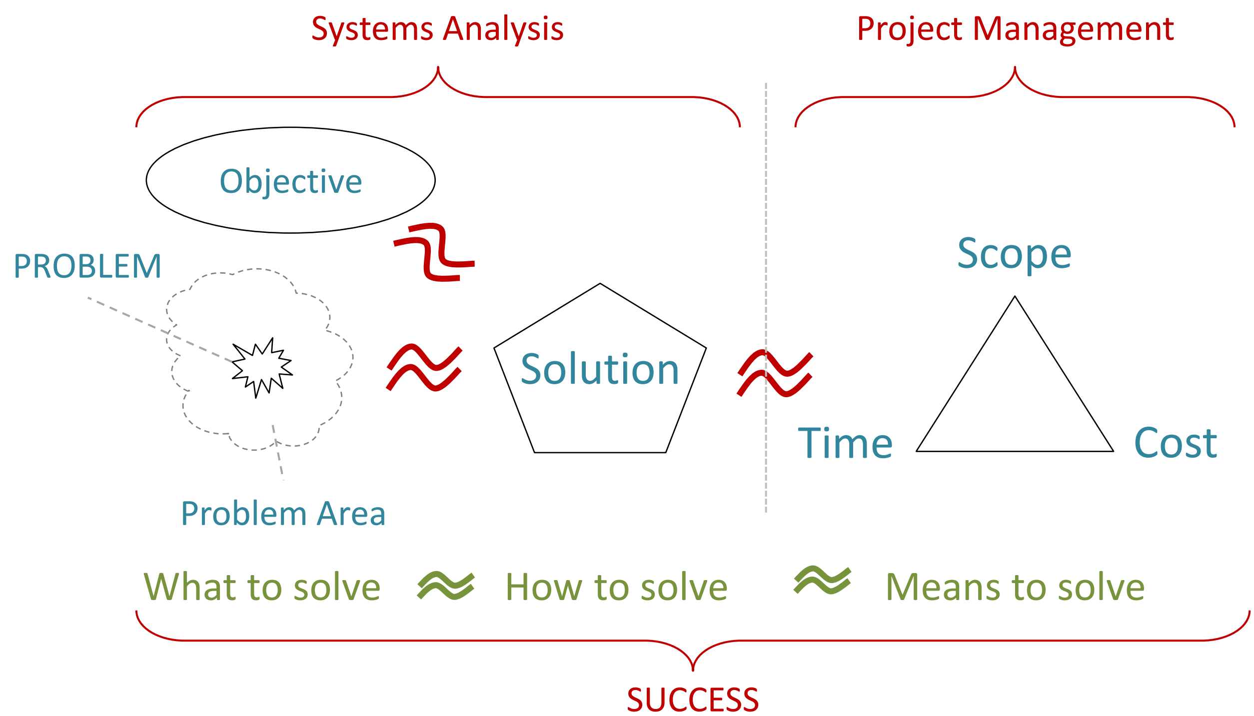
A deadline can be the result of an agreement based on estimations, on preferences
Or it can be an imposed date.

Iron Triangle

10/01/2020



Broader Picture



- The Objective and/or Problem (including the Problem Area),
- the Solution
- and the Iron Triangle

must be

- correct and/or feasible
- and have to correspond with each other

during the WHOLE COURSE of the project.

if Objective/Problem and Solution are wrong → Iron Triangle = worthless

Notes:

Note that the scope is not the solution or the demand. The Scope only delimits the problem and the solution.

Iron Triangle

Project 1

System (product) at delivery 2

System's Lifecycle 3

Iron triangle gives only a partial view on this

1) How well has the project been executed?

Delivering according to scope and within time and budget.
Other criteria/indicators can be found.

2) How well is the product at delivery?

Does it matches the expectations?
Does it meet the demand?
Does it correspond with the requirements and specifications?
Does it integrates well?
Does it work ?
…

3) How well is system performing during its lifecycle (lifetime)?

Does it create value?
Is it able to deal easily with many unforeseen events?
Is it flexible?
Is it reliable?
Is it manageable?
Is the quality maintained?
Are the performances stable, irregular or declining?
Is the system under control?
Is the system easily adaptable?
What is the Total Cost of Ownership?
What is the created value ?
…

Iron Triangle

Priorities among the constraints of triangle depend of the product and situation.

The priorities are INDEPENDENT of the chosen approach.

ALWAYS Prioritise the Triangle

Always have at least 1 adaptable constraint

Highest Priority	Explanation
Value - driven Goal, Quality	Minimal value to be delivered (at least this or more) Creating value has the highest priority. Cost and time are adjustable to create the maximum of value. If critical applications, long term, sustainable, has to evolve, to be built on top, to be integrated, …
Time-driven	Delivery at deadline or earlier. For events, one shot
Cost-driven	Deliver accordingly to budget (or cheaper). One shot, (really) temporary, “cheap” is expensive.

Project Manager, Business Stakeholders, Architects and Analysts should always decide together at the start of the project :

- What are the priorities? What is the most important?
- If one had to change, which one would it be?

- Main stakeholder may need advice about the priorities.
- The stakeholder’s perspective is only one perspective. (S)he may not understand all the factors, aspects, risks and implications of a choice.
- If an opportunity or issue occur, decisions will always be taken against these four aspects.
- Although constraints and their priorities should be defined as well as possible to avoid changes, if it appears that it is advantageous to bring in change, then this should be done (being awareness of the benefits and consequences and adapting the project to it).

Fix all Three (or Four) constraints is a Recipe for Failure !!!

Iron Triangle

QUESTION 1: Heart surgery is necessary. The patient is offered for the **SAME** operation two options:

a) operation of 30’ and Cost 500 €

b) operation of 1h30’ and Cost 1000 €

Difference: in (a) the surgeon works very fast. In (b) (s)he has the time to verify, to do things right, …

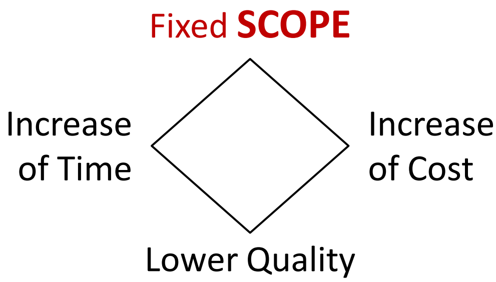
What would you chose if you were the patient (provided you can afford the 1000€)? Why? What is the lesson?

QUESTION 2: A team gets a software development mission.

1. It delivered a valuable, high quality, innovative, software system after 10 months.
2. It built an awkward system with questionable purpose and value, delivered on time and on budget but with a reduced scope.
3. The team could, together, overcome unexpected challenges, had the opportunity to do things they didn’t think they could do, to learn and to conceive and create a valuable good system without having to worry too much on scope, time and budget.

In which case would the team have the most satisfaction and pride? Why? In what order? Why? What is the lesson?

Constraints

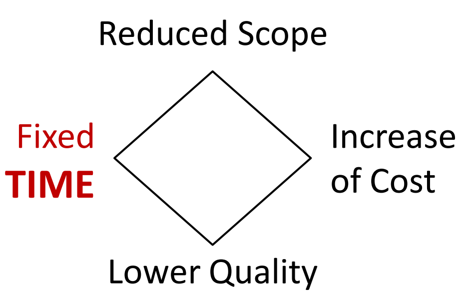


Companies work based on a vision, on strategy, on goals and targets, on production of value, on limiting risks and costs, on increase of benefits and on regulations.
In a natural way, this leads to the submission of project proposals. The product or outcome is the primary reason why projects are executed.

It is obvious that scopes define the missions of projects. Time and cost are deduced from the product scope.

What happens if a project is running late and the scope is fixed?

Time will increase. Cost will increase. The quality can be lowered, sometimes in an hidden way. This creates debt. Or it can be a combination of these.



Time is never the trigger and driver for the start of a project. It can be an imposed criteria (legal obligation, celebration day, …). A client is rarely ready to invest in a project of which (s)he doesn't know what (s)he will get, and thus what will be the return. Making some vague estimations is always possible. (see predictability of constraints)

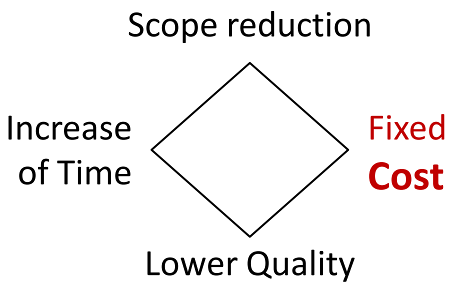
What happens if a project is running late and the delivery date is fixed?

The scope can be reduced. The cost may increase. The quality can be lowered, sometimes in an hidden way. Consequences of a lower quality will come later. Or it can be a combination of these.

Note:

- When something is "fixed", this means that it is the main constraint. It is the last one that should be adapted. And in some case, it won't be possible to adapt it, although those cases are rare.
- In most cases, adaptations of the constraints is not desirable unless it is really beneficial.

Constraints

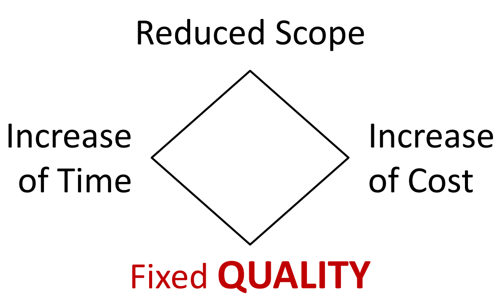


Cost is never the trigger and driver for the start of a project. Sometimes it is possible to find additional budget. This depends of the expected benefits of the project. A client is rarely ready to invest in a project of which (s)he doesn't know what (s)he will get. Making some vague estimations is always possible. (see predictability of constraints)

It is obvious that scopes define the missions of projects. Time and cost are deduced from the product scope.

What happens if a project is running late and the COST is fixed?

Scope can be reduced. Time may increase. The quality can be lowered, sometimes in an hidden way. This creates debt. Consequences will come later. Or it can be a combination of these.

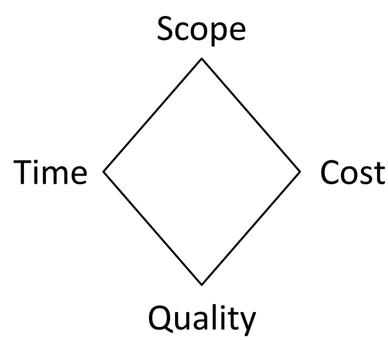


Quality is never the trigger and driver for the start of a project. However, quality can be a non-negotiable constraint. A client is rarely ready to invest in a project of which (s)he doesn't know what (s)he will get, and thus what will be the return.

What happens if a project is running late and the quality is fixed?

The scope can be reduced. The cost or time may increase. Or it can be a combination of these.

Constraints



We can negotiate on 5 aspects.

So, there are SIX questions

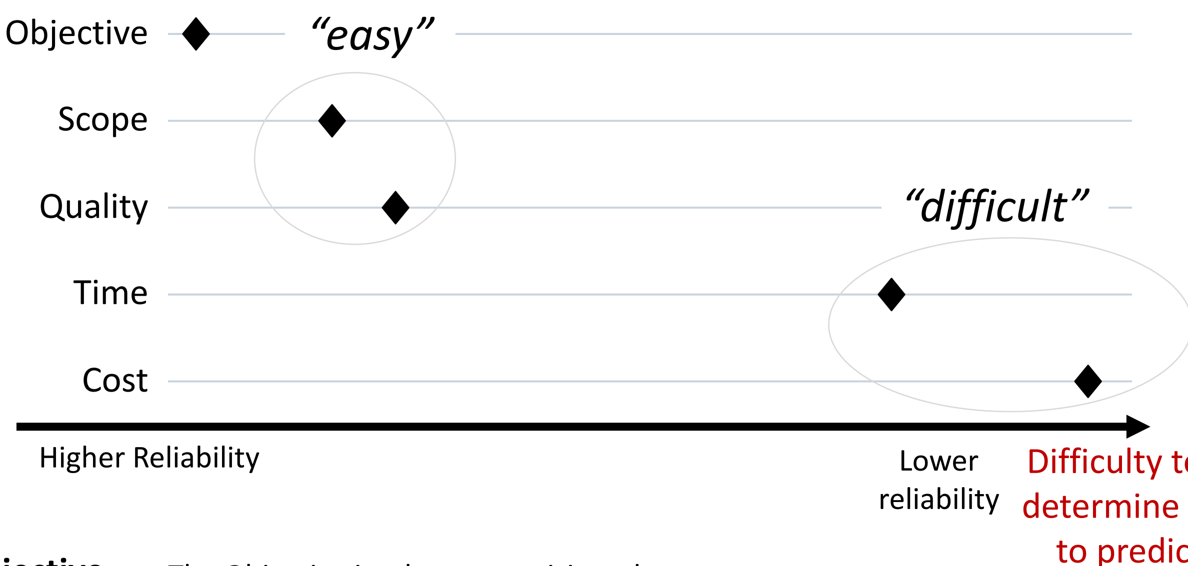
1. Can we adapt the scope? For example, by postponing some parts.
2. Can we simplify the solution while keeping the scope?
3. Can we reduce the project duration?
4. Can the cost be reduced?
5. Can we be satisfied with reduced quality and where can the quality be lowered and until what point?
6. Or can any of the answers to the question above be combined to have a satisfactory result?

- It is advisable to try to do a good analysis and to estimate better in the first place and to reduce everything that may pose delays.
- A project runs out of scope, time or budget for a reason: inefficient analysis, bad estimations, bad leadership, bad planning, work environment, insufficient collaboration, received information, slow or bad decision making, …

  Maybe first find and deal with the causes rather than trying to solve the consequences. Only then we can learn valuable lessons !!

- What if we could assign lesser importance to the iron triangle and more focussing on the product?

Difficulty of Predictability of Project's 5 Main Parameters



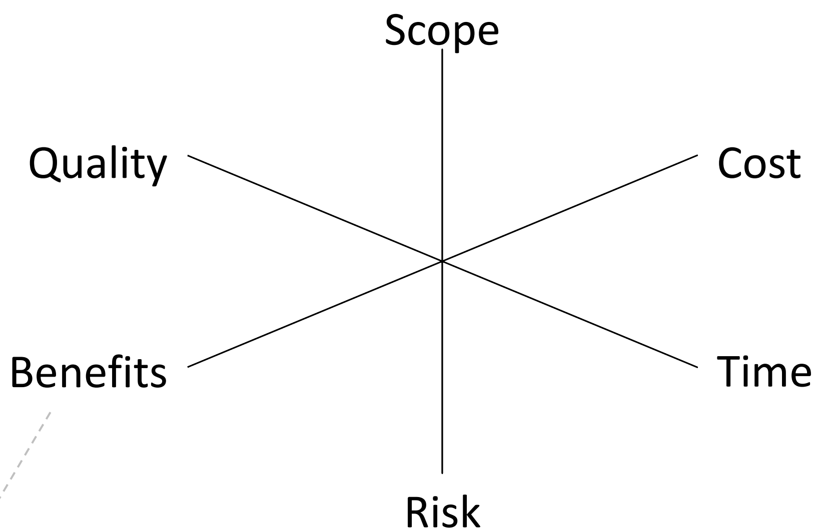
Objective	The Objective is what we envisioned.
Scope	The Scope can be determined (if we focus on what is necessary, rather than on wants and if SASD is done decently)
Quality	Required Quality is relatively easy to be determined.
Time	Time = mainly f(Scope, Quality) + non-linearity + uncertainties + quality of organisation, collaboration, information, ...
Cost	Cost = mainly f(Scope, Quality, Time)

The product, as defined by the objective, the scope and the quality create satisfaction. They create the value.
Time and Cost can be constraints. They are inherent parameters of the execution of the initiative.
General principle: Time and Cost are always dependent of the Scope and Quality.

Scope and Quality may be adapted during the project execution. Still then Time and Cost are a function of Scope and Quality.

Project Constraints

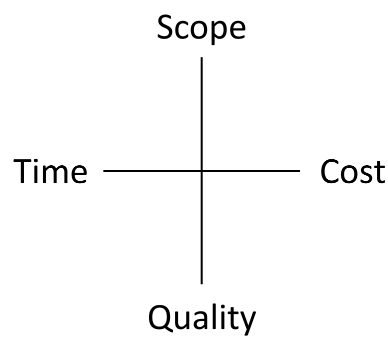
Actually, A project continuously, from before it begins until it ends, balances 6 main constraints.



Benefits:

- What is the alignment with goals and strategies?
- What value does the product or outcome create?
- What advantages and new opportunities are created?
- What new hindrances and limitations are created?

Iron Triangle



We can negotiate on 5 aspects.

So, there are SIX questions

1. Can we adapt the scope? For example, by postponing some parts.
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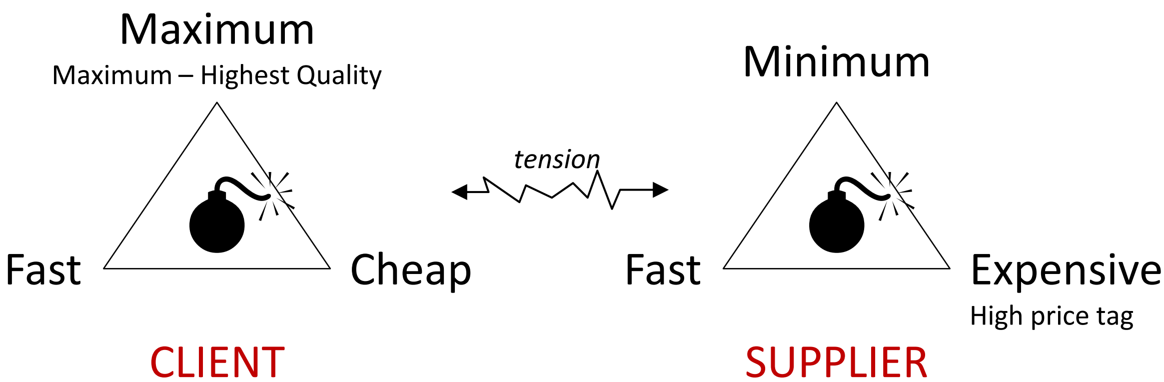
5. Can we be satisfied with reduced quality and where can the quality be lowered and until what point?
6. Or can any of the answers to the question above be combined to have a satisfactory result?

- Better is to try to do a good analysis, better estimations in the first place and to reduce everything that may poses delays.
- A project runs out of scope, time or budget for a reason: inefficient analysis, bad estimations, bad leadership, bad planning, work environment, insufficient collaboration, received information, slow or bad decision making, …

  Maybe first find and deal with the causes rather than trying to solve the consequences. Then we can learn valuable lessons !!

- What if we assigned lesser importance to the iron triangle and more focussing on the product?

Tensions between Triangles



Client's Triangle (drivers)

Clients desire appropriate, effective and efficient well-designed systems. They desires solutions that solve their problems and which creates benefit for their organisation.

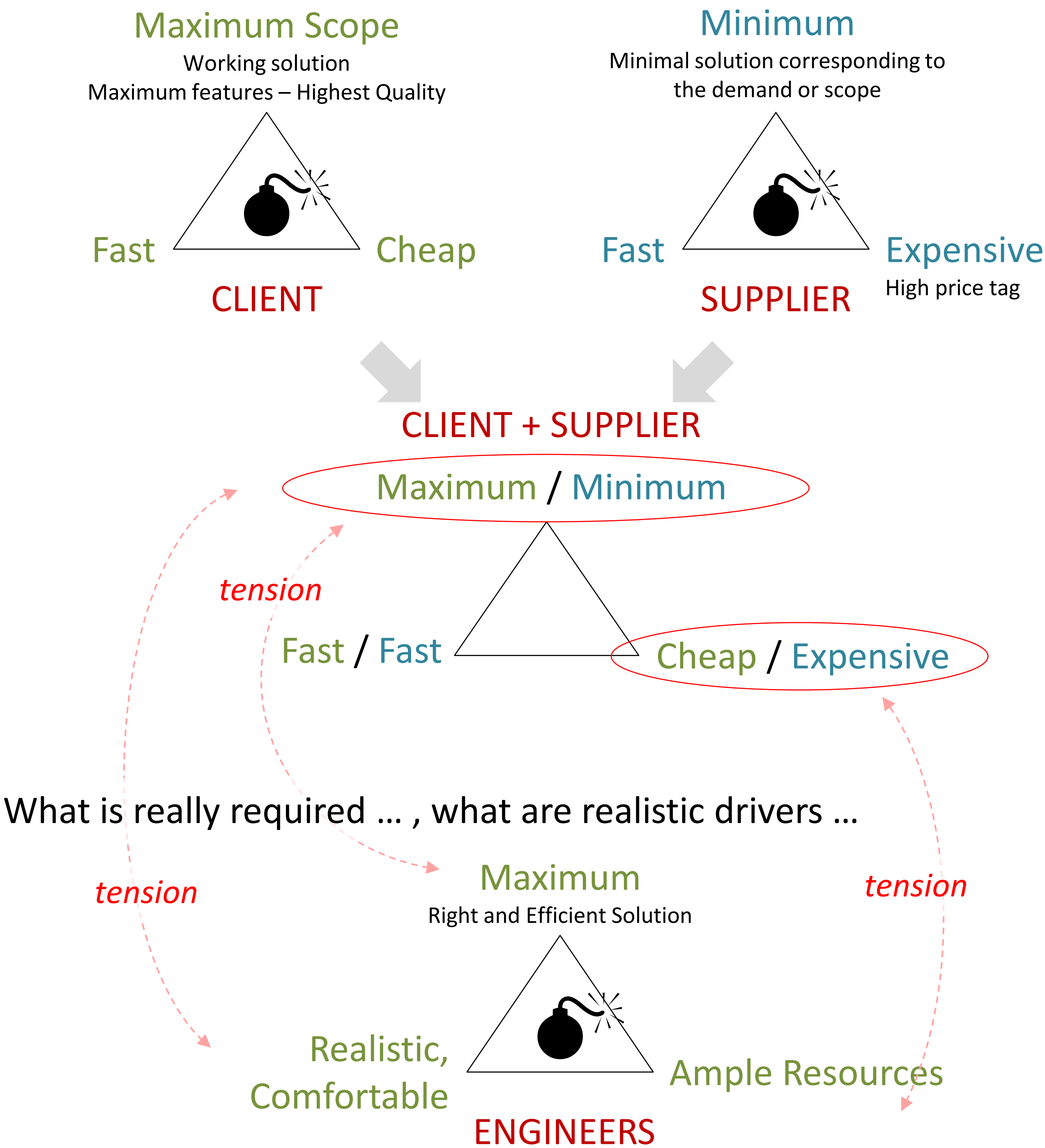
But they want it fast and cheap. Clients usually don't have solid competencies in software engineering. They are unable to estimate what a near optimum solution is and what it takes to build it. As a result, they may easily underestimate it.

The desire to have a result quickly and at low price will then undermine the conditions required to build a good system and a real advantageous solution. This is particularly true when they see the project as a cost.

Supplier's Triangle

Suppliers seek to sell a project at the highest price. They will seek to minimise cost and delay. A shorter delay means that more projects can be executed. As a consequence, they may be tempted to deliver the minimum that still complies with the demand. Some suppliers may genuinely want to help the client and deliver better and truly valuable solutions.

Tensions between Triangles



The Client's differences between the Supplier's objectives create obvious tensions. But even if they agree, their agreement may still differ from the objectives and needs of the systems analysts, engineers and builders. This agreement then constitute a threat. It is not favourable to create the right work conditions (pressure, lack of resources, feasibility, ...) and constitute a risk for the engineers and for the whole project.

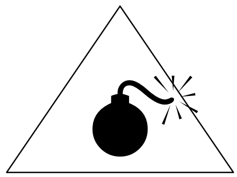
Tensions between Triangles

10/01/2020

Page to be reviewed

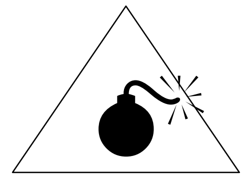
Maximum

Maximum – Highest Quality

Fast  Cheap

CLIENT

Minimum

Fast  Expensive

SUPPLIER

Delivering a maximum at a cheap price won't satisfy the supplier and the engineers. Supplying a minimum at a high price may lead to a product that doesn't solve the problem and the client may not be glad about the price.

Both, client and supplier, may agree to execute the project quickly ("FAST")

Reduction

Reduction of cost, effort, time is a receipt for disasters. In a short time, it may seem to save money or time. Soon this may turn out to be much more expensive.

Short-cuts

Looking for short-cuts to speed up the development process is a losing strategy

Diluted version

Faking, imitating, cargo cult, pretending: Often artefacts, products, documents are produced without doing the real work, without understanding the true purpose of it, its meaning and value, without the real substance.

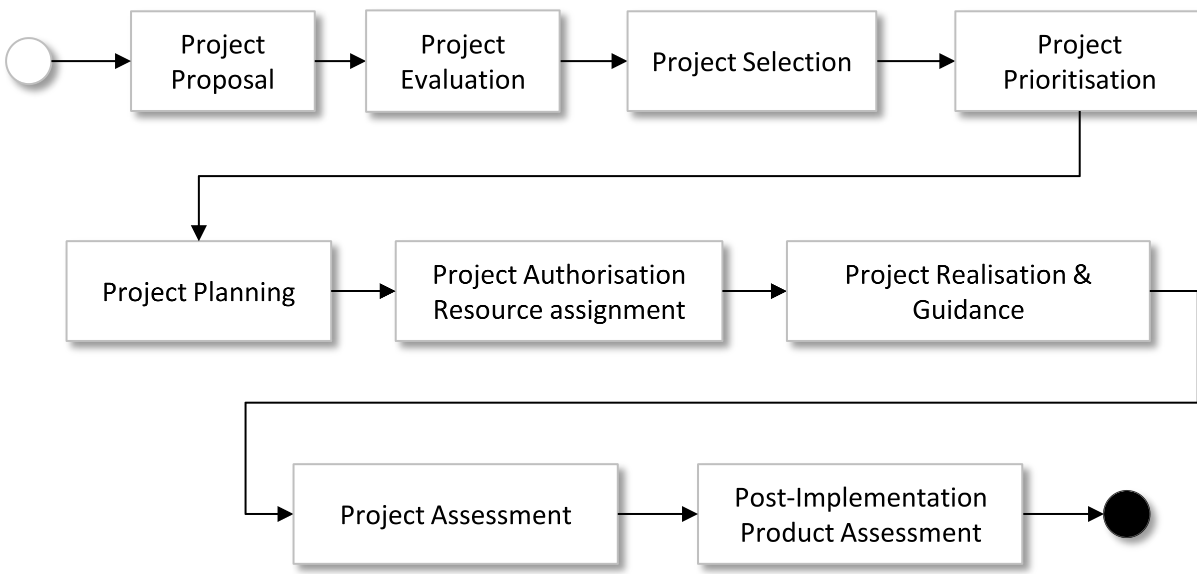
Low Quality

The required level of quality is often underestimated. High quality is not wanted because it is expensive and because it is confused with luxury.

Notes:

There are true techniques that facilitate or increase development speed. Some ways, like CBD, increase the speed in the longer term. Real professionals can make a difference between short-cuts and true techniques.

Project Overall Process



Executing a Project?

Objective – Goals
Goal structure/model

⇩

What must we do?
During execution: Provides focus

Cost / Benefits	Feasibility	Risks	Preconditions

⇩

Is it worth to do it?
Execution: Should we continue?

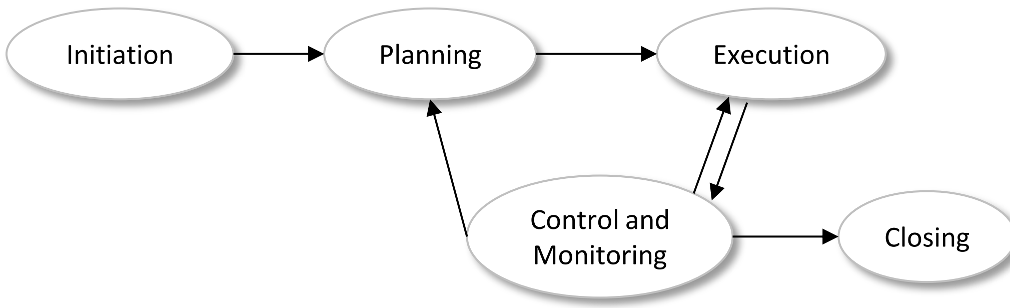
Resources	Work Environment	Process

Let's do it!
Execution: plan, organise, execute, control

Notes:

Other aspects to be considered: strategic fit, criticality, priority related to other projects

PMI - PMBoK



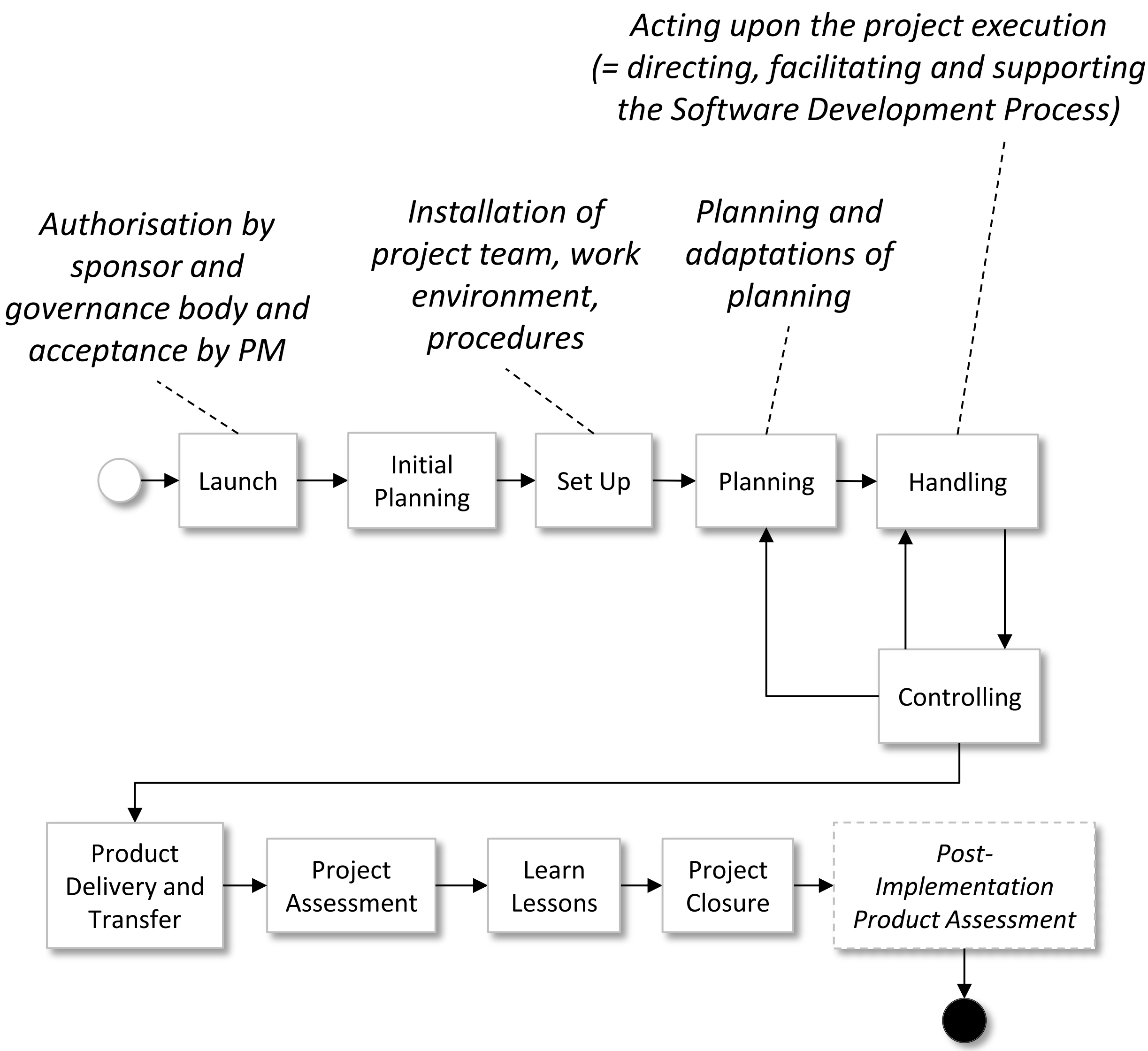
1. Project Management **Integration**
2. Project **Scope** Management
3. Project **Risk** Management
4. Project **Time** Management
5. Project **Human Resource** Management
6. Project **Procurement** Management
7. Project **Cost** Management
8. Project **Quality** Management
9. Project **Communication** Management

Source: Project Management Institute : Guide to the Project Management Body of Knowledge

Project Management in a Nutshell

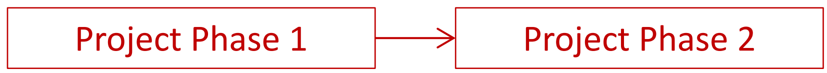
Initiation	Check mission, objectives Check management support Check feasibility and risks Identify stakeholders (role, alignment of objectives, ...) Obtain authority and resources Develop the Project Charter
Planning	Structure the project Define the WBS Develop a schedule Estimate resources Estimate costs and plan budget Plan quality Plan human resources Plan communication Plan risk management Plan procurement Review and adapt plans Align plans
Execution	Acquire, develop and manage project team Direct the set up of the work environment Conduct procurements Manage the work environment Manage stakeholders and their expectations Perform quality assurance activities Manage changes (eg inspect and negotiate changes) Execute the project (analysis, design, software development, testing, migration, implementation)
Monitoring	Control scope and progress Monitor and control resource usage Monitor the work environment and the project team Identify, monitor and control risks Identify need for change Perform quality control
Closing	Learn lessons Close the project

Project Management Process

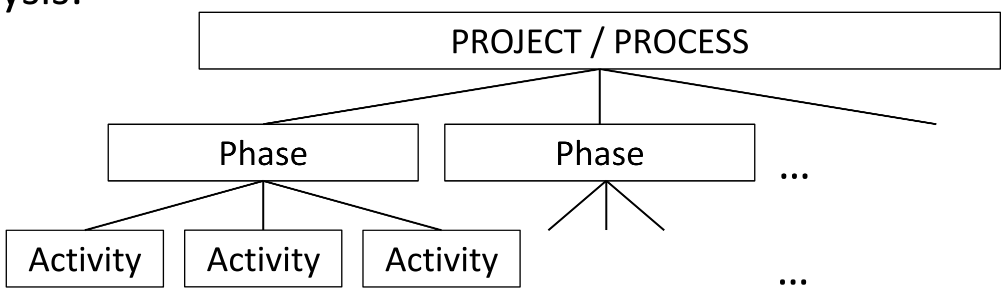


Project Phase & Activities

Traditional Representation in Methodologies

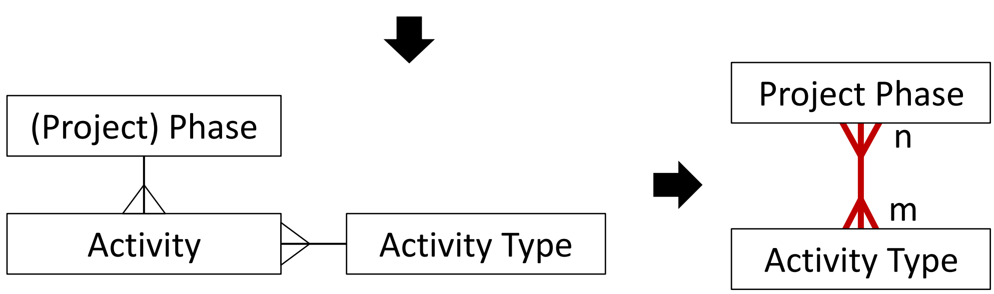


Analysis:



In Software Development …

Project Phases		**Activity Types**
Analysis		Analysis
Design	?	Design
Programming	=	Programming
Testing		Testing
Implementing		Implementing



- Design activities can be performed during an Analysis phase
- Analysis activities can be performed during a Design phase
- Programming can be done during a testing phase (for example, to correct bugs)
- Analysis can be done during a Testing phase to know how to correct a bug in the higher logic.
- And so on …

Project Phases

Project Phases do / are

- Indication of the main FOCUS and LEVEL of THINKING now required
- Indication of the MAIN TYPE of ACTIVITIES currently being executed
- Indication of TYPE of OUTPUT to be expected soon
- Indication of the PROGRESS: WORK (and TYPE of WORK) that has been done and what is being done
- Facilitate the MANAGEMENT of projects
- Result from a Project Management Decisions

Project phases do NOT/ are NOT

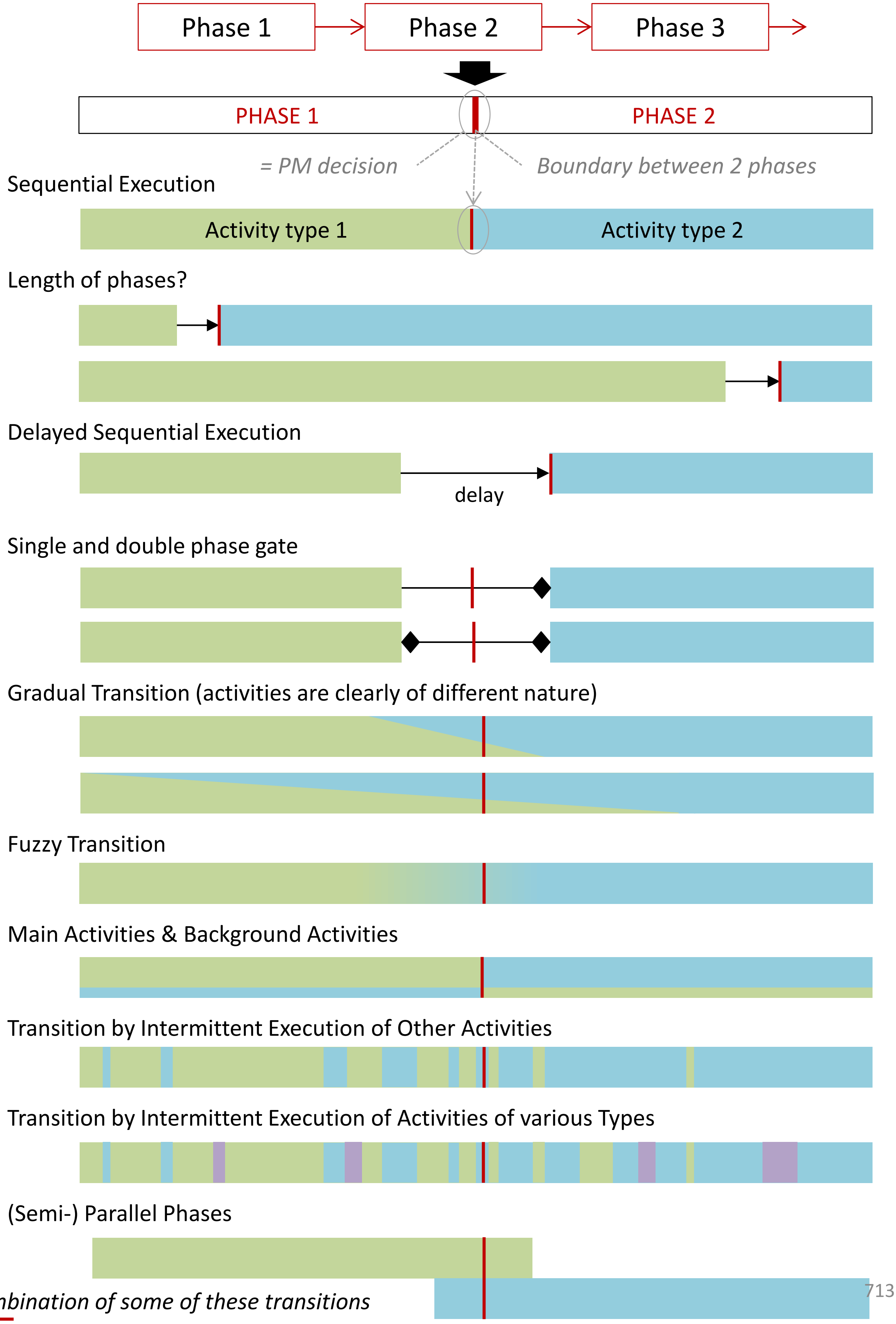
- Do not limit the type of activities being done
- Not meant to provide a precise measure of progress (in time, cost or effort). Other measures do.

A PHASE is also a **BUILDING BLOCK** that helps to structure the software development approach. Each phase has its purpose and goal and can be applied on a subject, component, issue. A phase can also be executed at a certain level of detail or from a certain perspective. The phases can be defined and assembled in many ways.

Phases offer flexibility and scalability to projects

Phase Transitions & Activities

30/10/2018



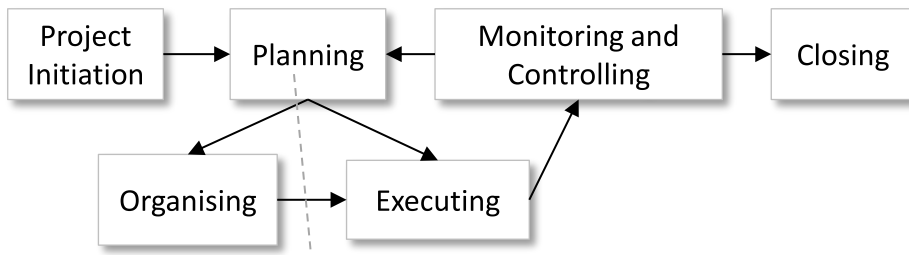
Or a combination of some of these transitions

Project Phases ?

Project Management Methodology

(simplified framework)

"How to manage a project?"



Project Management Vision on the Project's Process

How PM sees, organises and plan the project. (example: Deciding to move the project to next project phase)

Project Phases (as defined in the plan)

Analysis	Design	Building	Testing	Deployment

PM Perspective: PM Purpose, PM decisions, PM Needs

IS / SW Dev. Perspective

= some correspondence

Software Development Perspective on the development process

What project members do. Nature of activities, focus,

Phases defined as Activities Types

Analysis	Design	Building	Testing	Deployment

Project team's perspective:
What is necessary to be done, what types of activities are executed now.

Standard Methodology

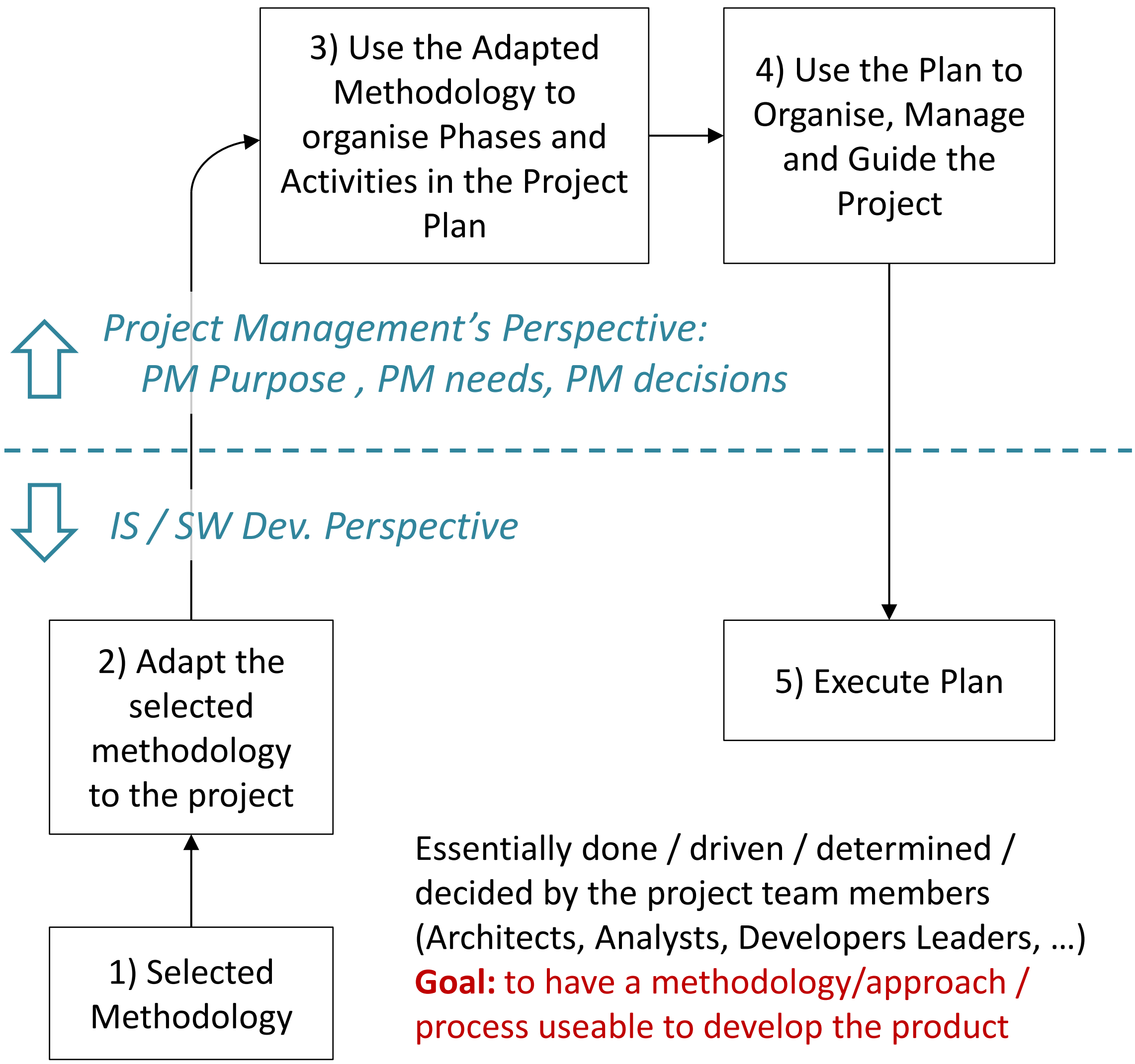
Methodology

Analysis	Design	Building	Testing	Deployment

The standard, the template, the theory, the whole set of artefacts proposed as a basis for IS/software development endeavours

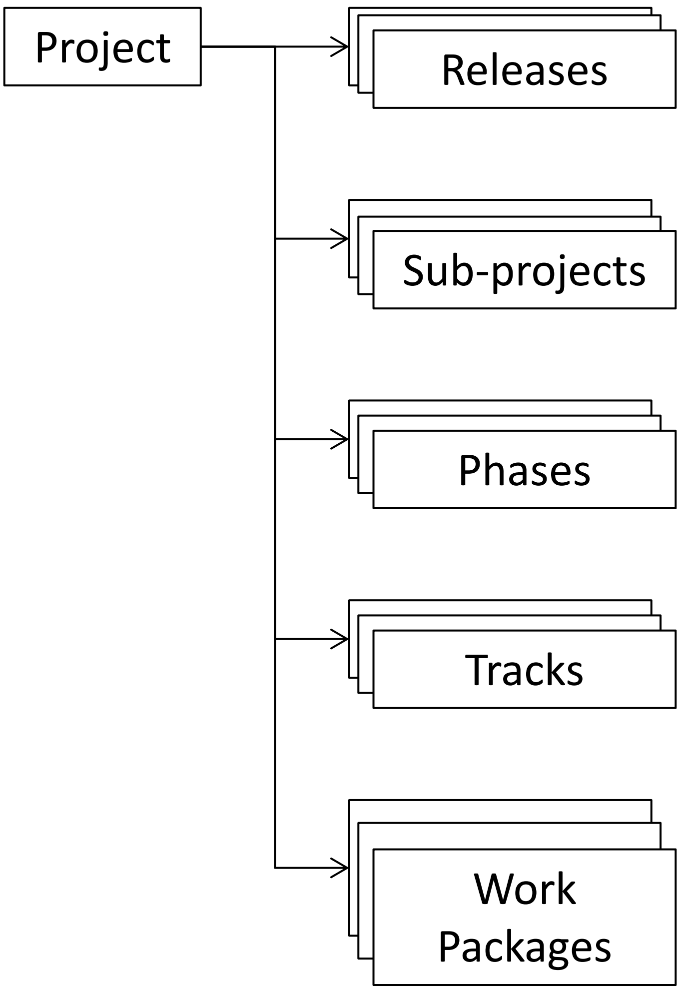
Project Phases ?

Lead by the Project Manager
(with team input and collaboration)
Goal: to have a plan useable to manage the project



Essentially done / driven / determined / decided by the project team members (Architects, Analysts, Developers Leaders, …)
Goal: to have a methodology/approach / process useable to develop the product

Structuring the Project



Subsequent projects on same product.

Small projects within larger project. Each has independent project documentation, planning, …

Subsequent deliveries within a same project.

Tasks are grouped by nature. A track can have an (internal or external) delivery (E.g. a component).

Smaller set of tasks planned together assigned to a specific person or group.

STRUCTURING A PROJECT
MAKES
THE PROJECT SCALABLE

Notes:

Structure is the key to scalability.

Without clear structure, no scalability is possible.

Structuring the Project - WBS

The WBS (Work Break-down Structure) is a decomposition of all the work to be done by the project. It is used to estimate the necessary resources and time and then to schedule and staff it.

The WBS can be organised in different ways:

- per sub-project, track, …
- component-based
- by development phase
- by nature of work – output / deliverable-based

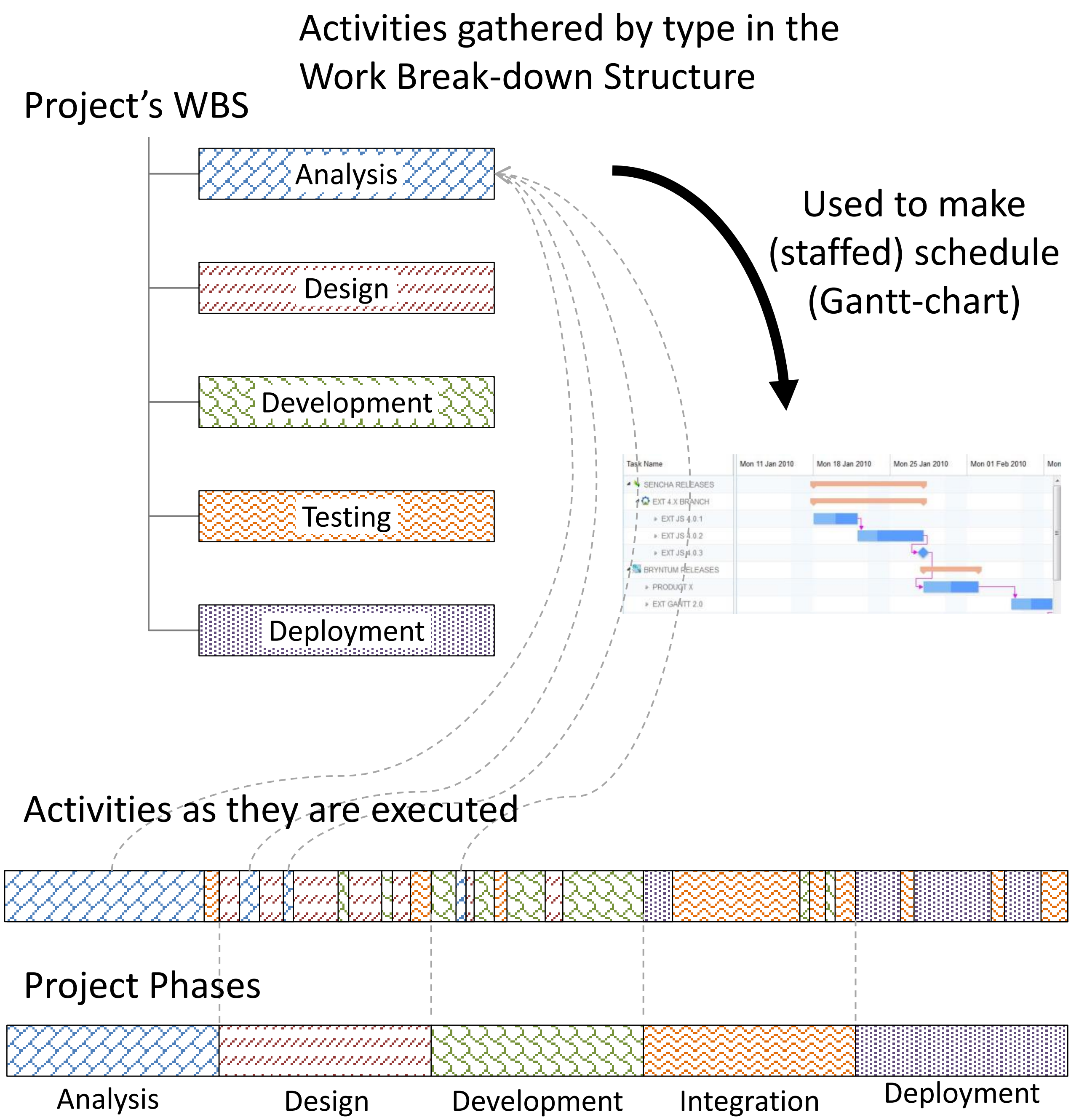
  Example: All test activities are gathered together in one branch of the WBS. All Analysis activities are gathered in another branch. All this, regardless of the phase in which the work is executed.
- by executor
- …
- Or a mix

Remark:
The WBS may or may not reflect the work really executed in a project phase.
An alternative is a structure formed by the decomposition of the product into components.

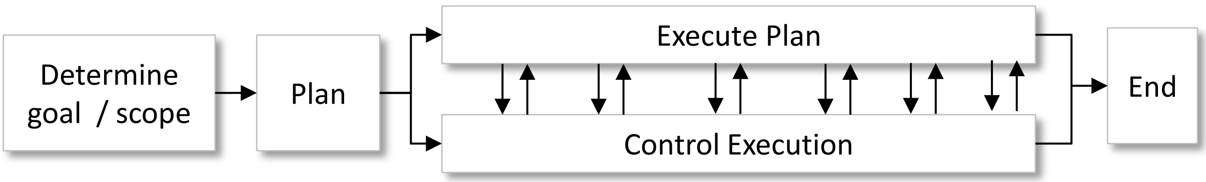
<u>Choice to be discussed:</u>

- What suits the project the best ?
- What is the easiest to manage the project?
- Impact reporting !

WBS – Gantt - Phases - Execution



Traditional Planning



Why this doesn't work ?

Assumes :

- All information necessary for planning can be gathered and taken into account
- The planner excels in planning
- Plan is always right
- The execution of the project (the reality) can and has to be adapted to the plan.
- People's mind (thinking, creativity, ….) works at a linear pace
- People work and collaborate at a linear pace
- No skeleton in the closet or other difficulties, obstacles, setbacks
- The objective (or obligation) is to follow the plan
- Executing "as planned" leads to the achievement of the objective

Ignores :

- Uncertainties and risks are greatest at the beginning of the project (exactly when the project plan is defined)
- Limited understanding of the initiative in the beginning of the project
- Limited skills of the planner
- Unforeseen events may happen

REAL Cause of Death March

How to prevent this?

Traditional Planning

Why do Planning Fail?

- We underestimate the work to be done (size, complexity, ..)
- We overestimate ourselves (competencies, knowledge, insight, abilities, …)

How to execute a project successfully?

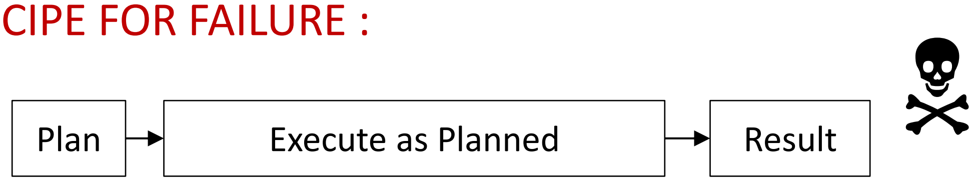
Multiply the estimates by 10 (or by 2)

Then ..

- Why to make a plan?
- Will it solve the estimation abilities, the abilities to manager buffers and the project management skills ?
- = symptomatic problem solving

Wrong ways of using a plan:

- Not using a plan. Leave it on the disk or in the drawer.
- Freeze the plan and stick to the plan.
  RECIPE FOR FAILURE :



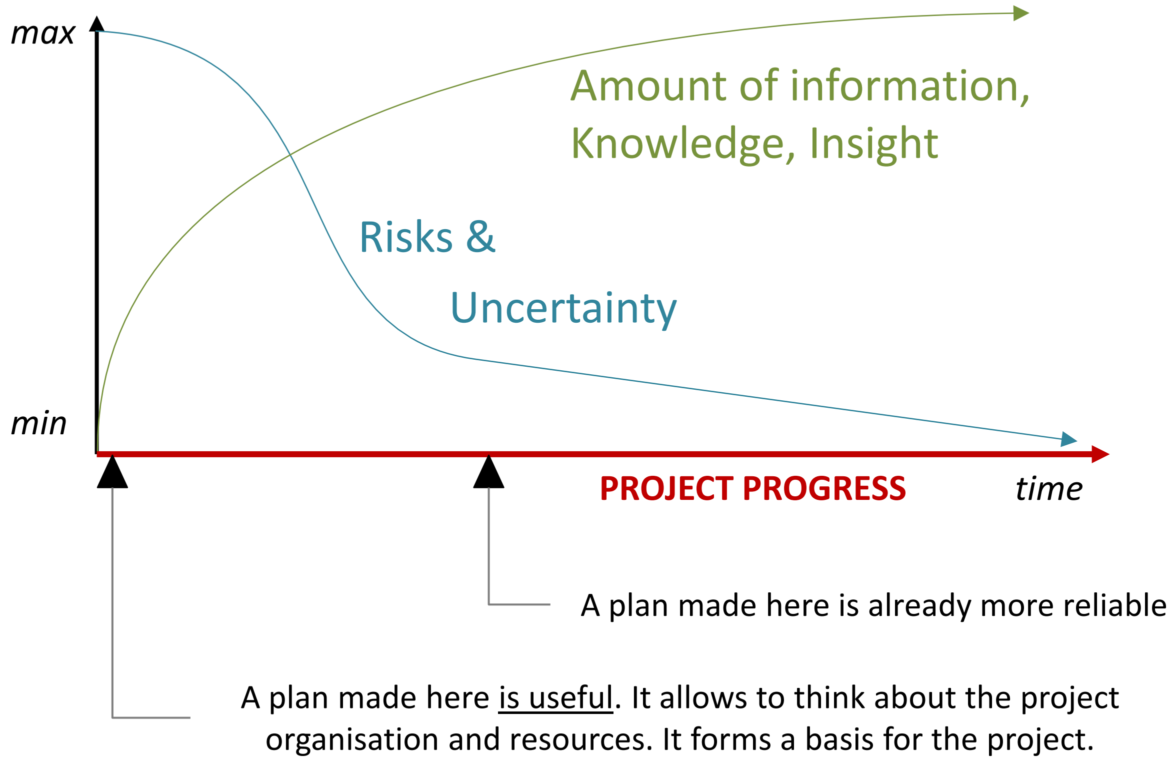
based on a lack of understanding the fundamentals and essentials of planning.

"An idiot with a plan can beat a genius without a plan" (Warren Buffett)

provided the idiot's plan isn't too bad and (s)he knows how to use plan correctly

Traditional Planning

Why NOT FREEZING a plan made early in the project?



A Plan is **PREDICTIVE** AND **ADAPTIVE**

Any plan made in a situation with reduced information; a lot of uncertainties, unknowns, risks, unsettled issues and/or for an endeavour and environment that isn't under full control, is <u>very likely to change</u>. It will have to be adapted as more is known, as more is being settled, as the situation unfolds. It has to evolve to continue to be as realistic, feasible as possible and suitable to the situation.

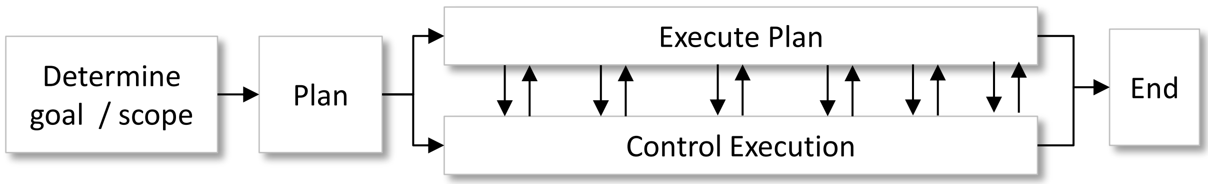
!

<u>Notes:</u>

Re-emphasising: "Validation" is different from "Freezing" and does not imply it.

A plan can be validated. However, a plan is a **dynamic, adaptive, evolving** tool.

Traditional Planning

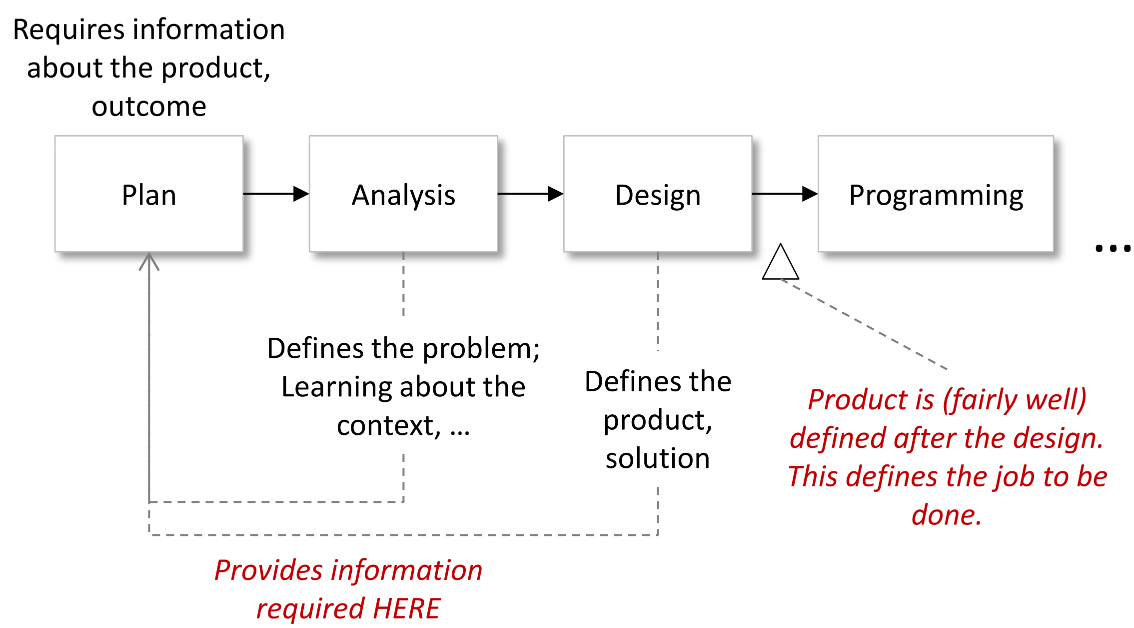


Why this doesn't work ?

1. RIGID Planning of hard to estimate activities in dynamic environment

2. Intellectual activities and collaboration are absolutely non-linear activities.

3.



Analysis and design provide information required for planning. But these activities happen **after the planning phase**.

How to solve this?

A part of the solution is to do a HL pre-analysis & HL pre-design (before planning). Then a HL-plan can be established (coarse-grained) and a more low level-plan for the analysis activities. As the project progress, more HL-planned activities are planned in greater detail. (Rolling Wave) Uncertainty is decreased, but a lot of it still remains.
A plan is not static. It has to evolve, to be corrected, to be refined, to be adapted in order to converge to the goal. Plan Dynamically.

Planning

A projects is a one-time (unique), uncertain and risky initiatives producing a unique product usually using scarce resources. There is no established approach for them.

Need:

- To achieve the goal of the project
- To be effective and efficient
- To reduce risks
- To organise and control the project

How? Establishing a plan

The **purpose of planning** is to execute the project effectively and efficiently while controlling and/or reducing the risks and to move swiftly and steadily towards the goal. It increases the chance for success to achieve the goal.

The plan is right. The reality has to prove the plan was right regardless of the reality. The goal of planning is NOT just to have a plan.

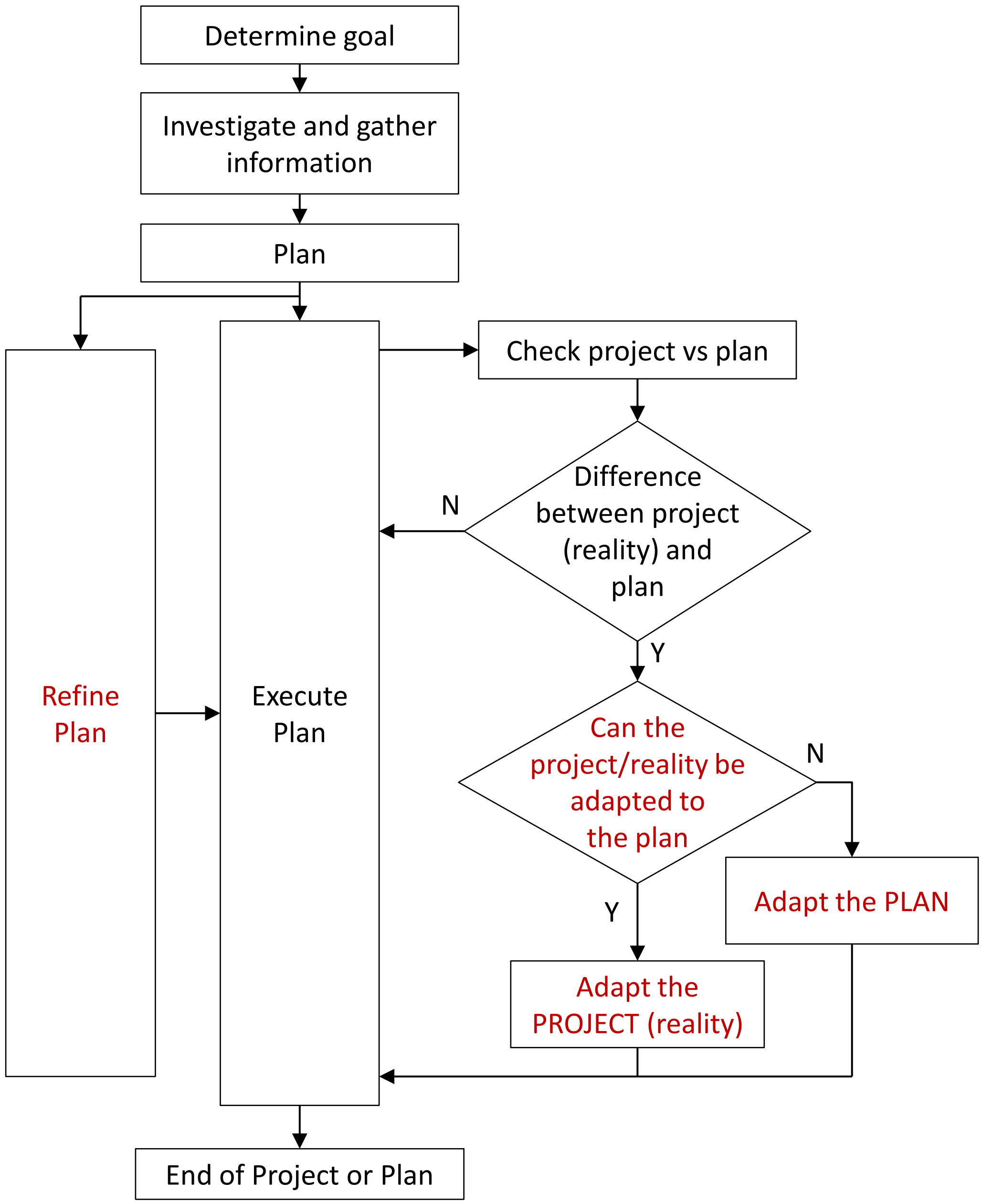
It's all about the activity of planning. Establishing the plan forces the planner to investigate, to think, to foresee, to structure and to organise.

Therefore we need to know things like:

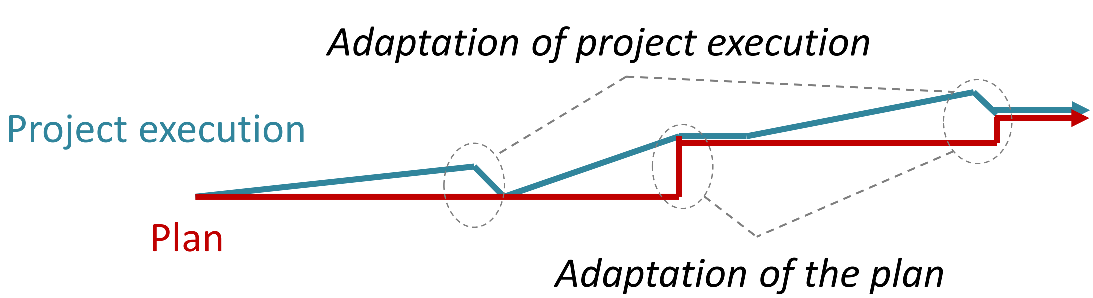
- What process is required to execute the project
- What and how much resources are needed
- When are these resources needed
- We need estimates (we need estimate skills)

Warning: Planning aims to save time and resources. But planning takes time. The value of the plan and planning should be greater than the effort spent in planning. Spending too much effort in planning may kill the benefits.

DYNAMIC Planning



Plan versus execution

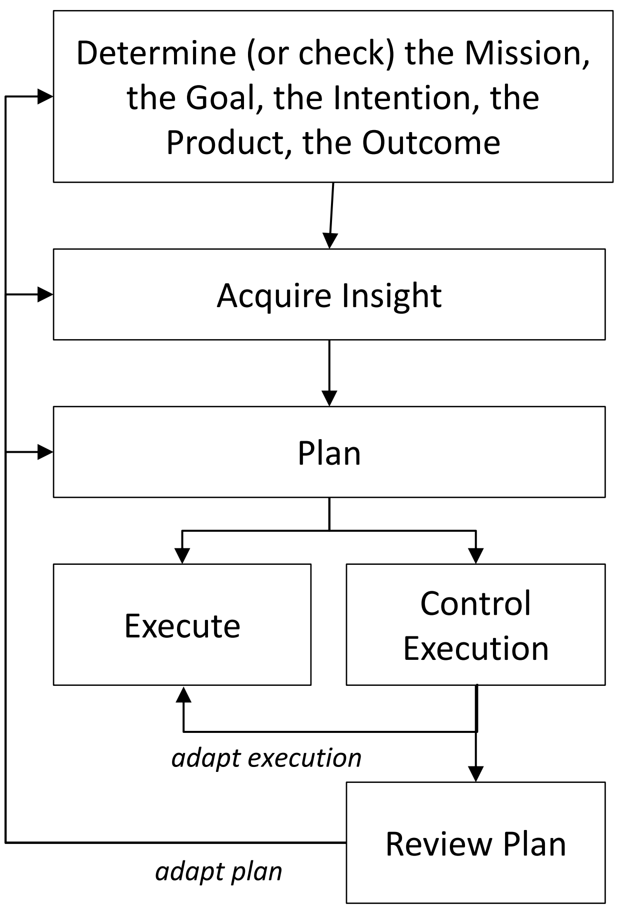


Basic Planning Mistakes

Mistake 1: Ignoring the purpose of planning

The goal of planning is to think about how an initiative can be organised, what it requires and other aspects necessary to obtain an efficient and effective execution; and thinking about critical aspect that may undermine the project. The aim of planning is to INCREASE the chances of success.

All action must contribute to this goal. Their execution must be based on the circumstances and in line with the goal.



Mistakes

- Wrong mission, goal, intention or product (often partial problems, local problems or consequences are solved)

- Acquiring insufficient or unreliable knowledge and insight. Worse: guessing or decreeing based on ignorance.

- Planning in too great details
- Planning for all eventualities
- All kinds of underestimations (time, resources, cost, knowledge, skills, norms, difficulty, …)
- Critical aspects are missing in the plan (and haven't been considered)

- Plan is not used (in a drawer, not communicated, not followed)
- Plan and estimates are never questioned
- Plan is never reviewed and adapted.

Notes:

The described planning process provides a general idea. In practice, the process is NOT as strict as in the model.

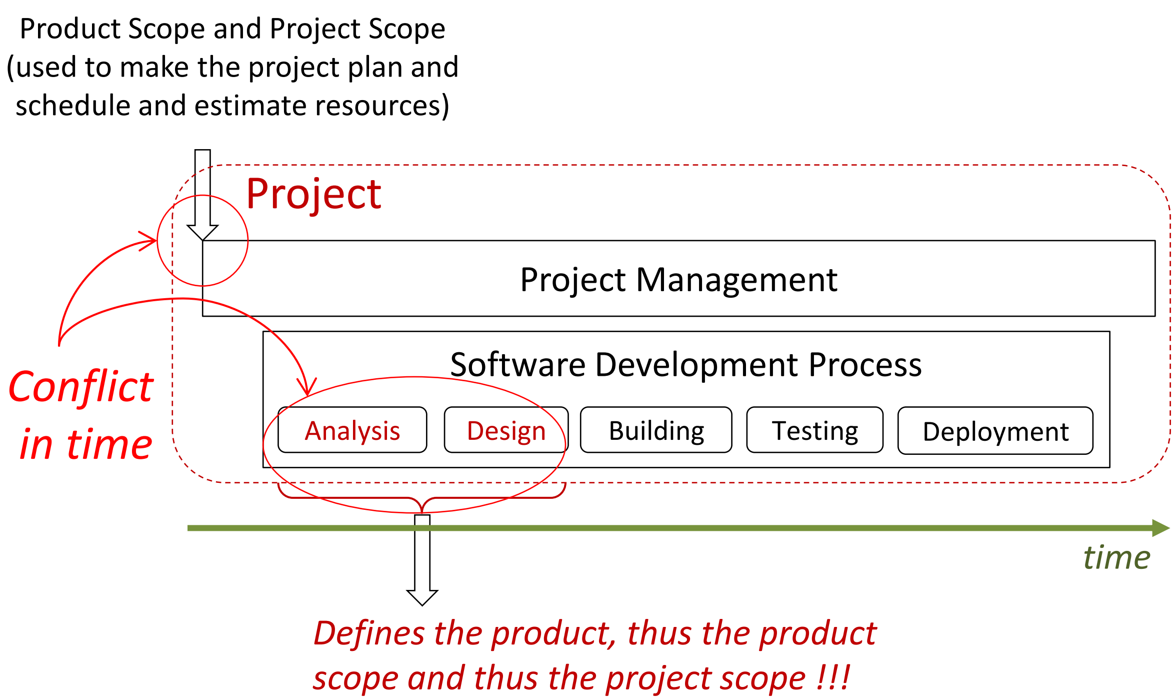
Product Scope & Project Scope

Traditionally,

- the product scope is defined as

  the list of functions, features, interfaces and components of a product.
- the project scope is defined as

  the work to be done by the project



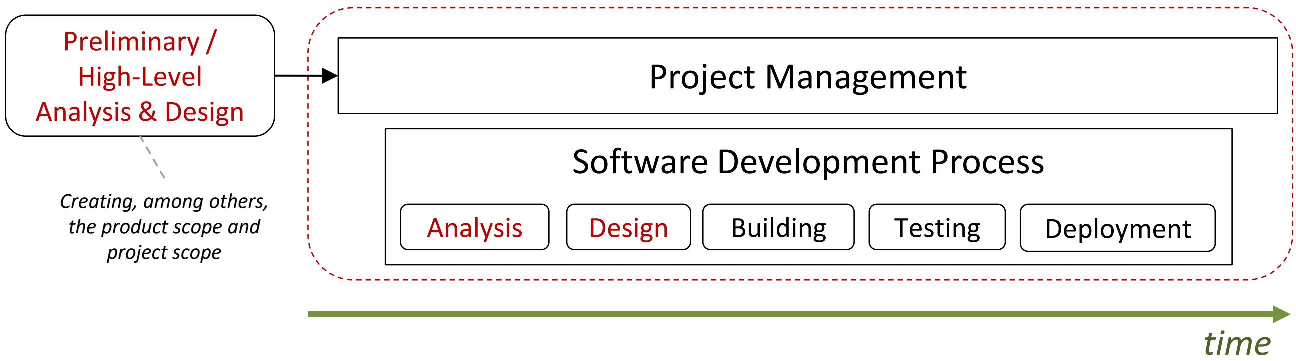
The Product Scope and the Project Scope have to be known at the start of the project. But they are the result of the Analysis and Design. The Analysis and Design are done during the project (after the project start).

We can not have and use something before it is created.

Product Scope & Project Scope

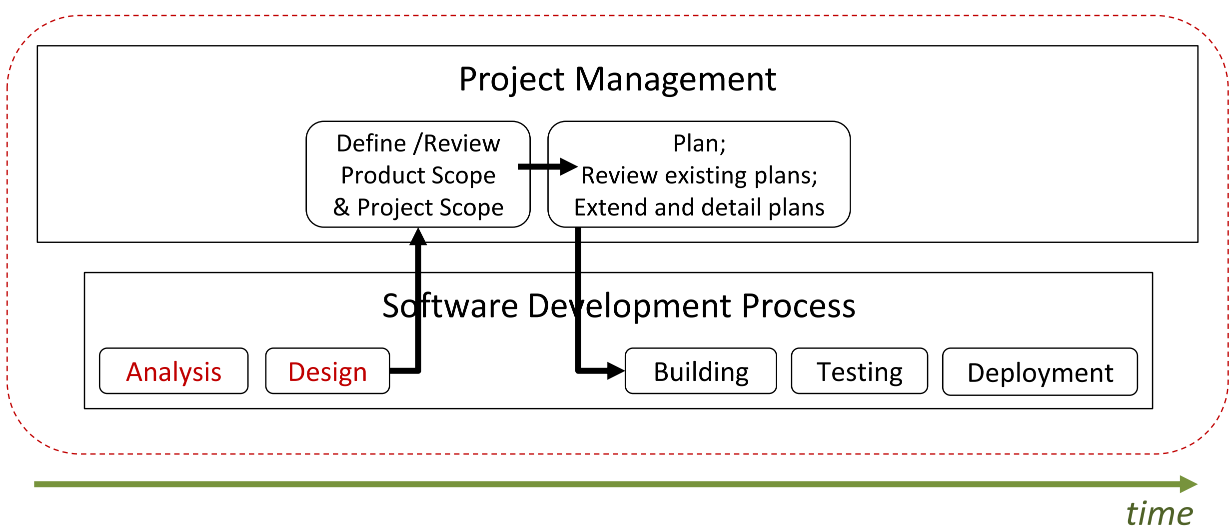
The Product Scope and Project Scope are the result of Systems Analysis and Design (in a broad sense; it includes Architecture).

A solution can be:



Product Scope and Project Scope are subject to revision during the project.

Another solution can be:



- General (undetailed) project plans can be made at the project start
- Or, only Analysis can be (loosely) planned. Later Design can be (loosely) planned. Only then the project can be planned a bit more in detail.

Changes in a Project

An Opportunity of a Change occurs during the project

- Is it obligatory ?
- Is it feasible ?
- Is it beneficial (Cost / Benefit / Risks / New Opportunities / New Limitations) ?
- What is the impact on the project ?

Possible Decisions

- Accept the Proposed Change
    - Implement as it is defined
    - Postpose the change
    - Adapt the change

      a simplified or adapted version
    - Phased Implementation

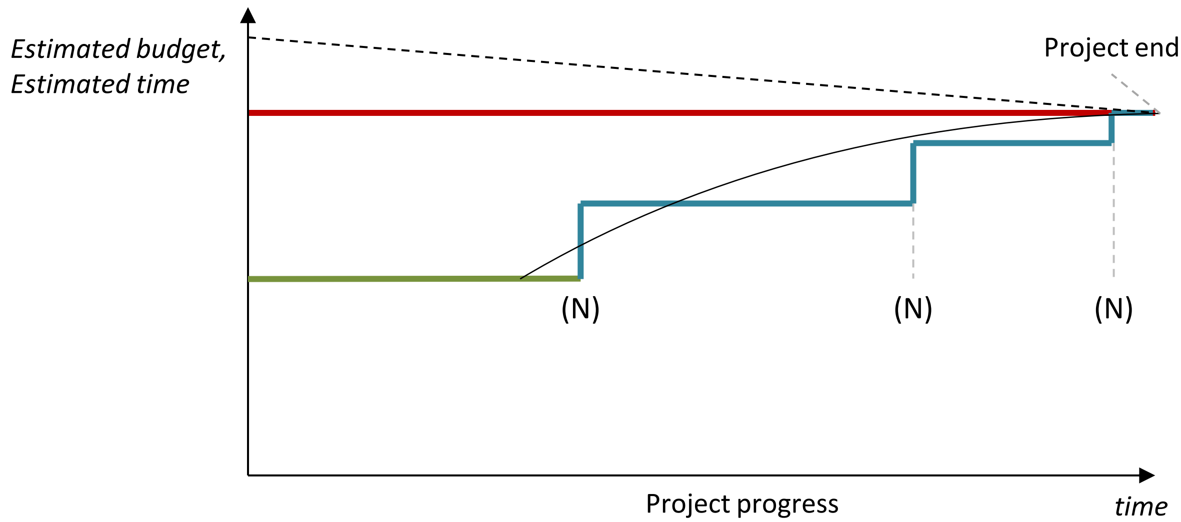
      Implementing the change partially now, other parts later.
    - Prepare the present solution to allow an easier implementation later
    - Let another party implement the change
    - A mix of the above
- Refuse the Change

Distribution of Effort

Phase / Types of Activities	Effort
Pre-Analysis (Requirements)	5-10%
Analysis	15%
Design	10%
Construction + Unit Testing	25-30%
Integration + Integration Tests	10%
Systems Tests	15-20%
Acceptance Tests	5%
Deployment	5%
Documentation	5%
Training	

- Limiting the early phases will reduce the insight. A part of the learning shifts then downstream to later phases causing late investigation additional rework due to changes (corrections due to bad decisions).
- Project estimations are often too optimistic or too many impediments will appeared. Therefore the global estimate is often multiplied by a factor of 1.5 to 2.5.
- Seasoned project managers know not everything is foreseeable. They use time and money buffers to deal with it. These buffers can be used to regulate pressure. They, and no one else, manage them.
- Bad practice: Reducing Testing to meet the delivery milestone.
- Bad practice: Having a “Requirements” phase. Requirements is a technique or an outcome of Analysis activities.

Project Estimations



Final duration and real expenses of the project (represented linearly for the sake of simplicity)

Too short estimation of time or budget. Often done by business stakeholders instead of by the IT department and/or project team. It can be negotiated, which is also bad. Creates pressure, insufficient resources, … Too short estimates are a reason of project failures, particularly when they are frozen. A cause of "Death March".

Additional budget and/or time are allocated (by negotiation?) until it meets the final duration and cost. Not only the short estimates have negative effects, allocating budget and time requires also a lot of additional time and effort.

Time and budget estimates tend towards the final real time and budget.

Rarely time and budget are overestimated.

Reasons of project failure (related to estimates):

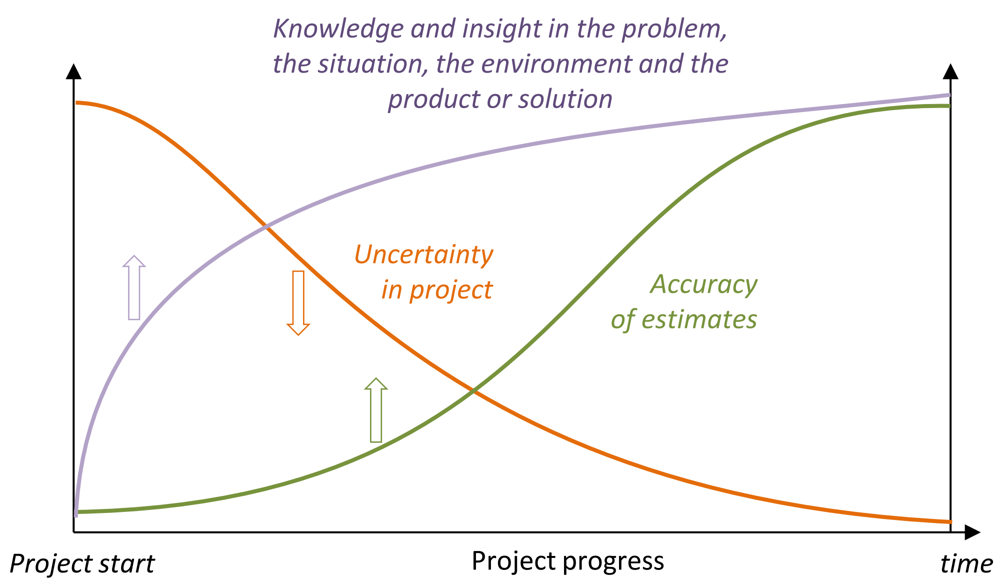
- Underestimation (Causes: lack of experience, wanting to appear as competent, over-optimism, fear of not getting a GO for the project, stakeholder's pressure, result of compromise, …)
- Estimations done at the beginning of the project when greatest uncertainties and most unknowns.
- Both in combination with frozen estimates.

Dealing in a rigid way with estimates is very problematic

Project Estimations

Estimate

- **Reliability** : depends of reliability, completeness, … of information
- **Accuracy** : - 5 days to + 10 days
- **Variability** : conditions are very stable, stable, … very variable; high risks of unexpected adverse events, variable pace of work, …



The lack of knowledge and insight creates a greater uncertainty. Both prevents from having accurate and reliable estimates in the beginning of the project.

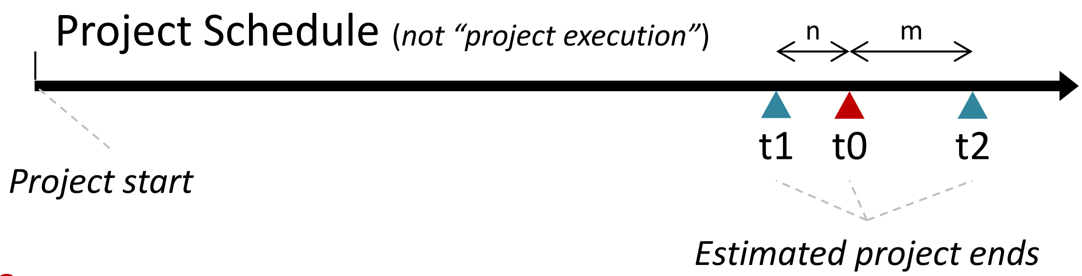
Questions:

1. How can the uncertainty be decreased as quickly as possible and as early in the project as possible?
2. How can knowledge and insight be acquired as early as possible?
3. How can the estimates be improved? (trade-off)

Notes:

- Estimations competencies (methods, skills, experience) are necessary.
- When estimating, we can make use of assumptions. They have to be expressed together with the estimates.
- In the end, we can't always have what we want.

Planning: Estimates



t0:

Ideal project duration estimated by Laplace's Demon

t2: overestimation *(team has more time)*

- More verification
- More aspects can be taken into account
- More learning
- Idea maturation
- More tests
- Experimentation, exploration, optimisation
- Time for alternatives
- Deployed later
- Risk for wasting resources

t1: underestimation

- Faster delivery
- Insufficient resources
- Higher pressure. Working faster
- More assumptions are made
- Stress, conflicts, burn out
- Lesser investigation
- Lesser verification
- More superficial thinking
- Fewer tests (risk of releasing solutions with more bugs)
- Higher risk for inappropriate, awkward solution, or even a non-solution creating more damage.

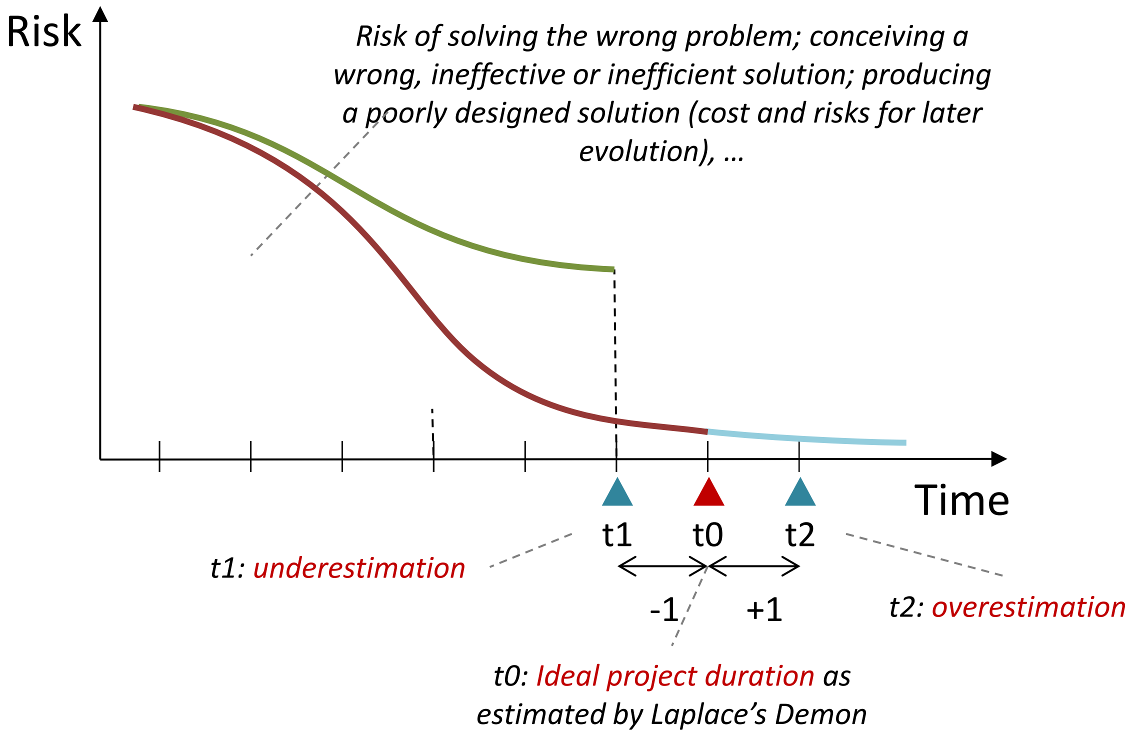
Even if n<m, the drawbacks and risks of t1 are more important than for t2.

Better to overestimate, than to underestimate.

Notes:

Laplace's Demon is a superintelligence that knows and understands everything of the whole universe at all times. It can deduce everything that is deductible from this knowledge and understanding, except the truly unpredictable, like for example emergence, creativity(?), ….

Planning: Estimates



A slight underestimation may quickly pose a high pressure.

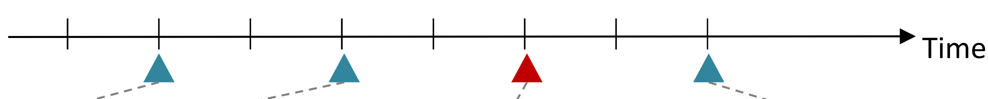
If a project's duration and budget are underestimated, the risk is likely to remain high. Right estimations may become underestimations when hindrances occur.

Risks will quickly decrease with right estimations. Even on delivery some risks remain. It is impossible to exclude all risks.

With overestimations, the risks may continue to be lowered (unsure). The question is whether the effort and time are worth this reduction. Beware that tasks are like a gas. It takes tends to take all the time and resources allocated to it. Overestimation doesn't necessarily lead to a timely delivery.

The **assumption** is made that the team works well and don't waste time.

Free time can be used for experimentation (innovation), improvement, ..



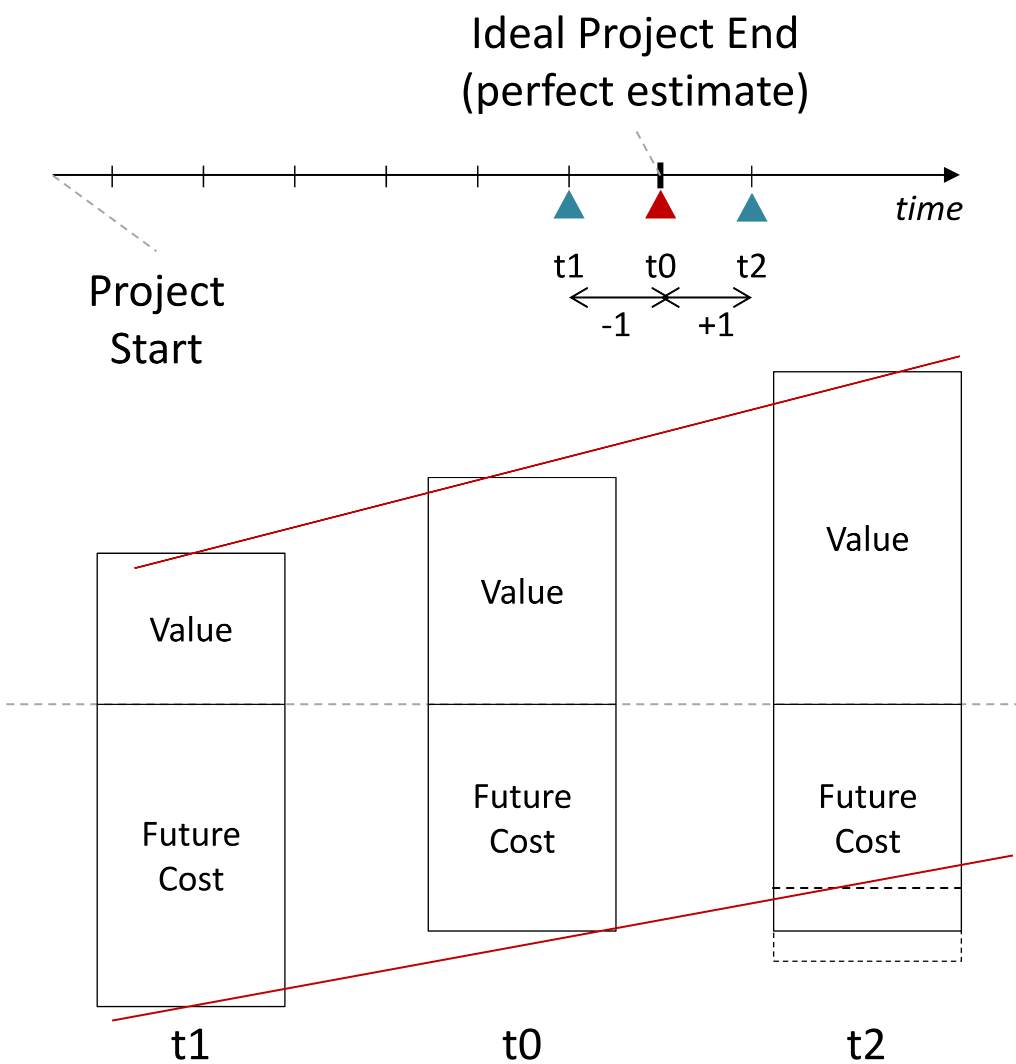
Business person's estimate

Junior's estimate
Seeks to prove himself, optimistic, ignoring some obstacles, set backs, …

Laplace's Demon's estimate
ideal estimate

Senior expert's estimate
Right amount of work, but don't have to prove himself. No stress. Buffer for set backs.

Investment, Cost, Benefit of Product



Probably …

t0: expected cost and value is created

t1: likely to have much higher cost, and much lesser value or increased risk. Risks of getting lesser net value if seeking to save too much on project.

t2: Cost can be lower or somewhat higher, but value is more likely to be significantly higher (or risks much reduced)

Estimating too short is more risky than estimating too generously.

Project: Estimating

	UNDERESTIMATION Too little ← RISKS		OVERESTIMATION RISKS Too much →
Duration	Unchecked info, superficial insight in problem and impact, weak foundation, inelegant design, lesser features, short cuts, more errors, work not done, technical debt, …	Realistic / Acceptable	Waste of time (likely)
Cost	Insufficient experience and competencies, low cost tools, furniture, …		Wasted money
Difficulty	Oversimplification, real complexity is postponed		Overly complex (unlikely)
Quality	Lack of quality, inappropriate design		Luxury (likely)

May render the product completely useless and/or lead to <u>serious </u>post-project problems

Waste, but unlikely to menace the project

Devastating effects are on this side.

"Faster is Slower"
"Hasty speed is seldom good"
"Qui va piano va sano "
"Cheaper is more expensive"

Planning: Estimations

- Estimations are **ALL WRONG by definition,** but they should be useful.
- **Unrealistic estimations are worthless**. They do more harm than good.
- Estimation must help to manage the project. If they don't, something is fundamentally wrong.
  The same is true for all kinds of plans, methodologies, methods, tools, … Often the usage is wrong.
- The point is to **reduce the error margin** to get an estimation that is as optimal as possible.
- The fewer and **uncertain** information, the greater the uncertainties (beginning of the project), the more **unreliable the estimations** are.
- The **more knowledge and insight and the more things are settled** we have about the objective, the product, the situation, and so on, the **more precise** the estimation can be.
- Improve the estimation techniques, improve estimation skills and decrease uncertainty and risks.
- Don't stick with first estimation. Get the estimations reviewed and confirmed. Or, **re-estimate regularly**.
- **Estimations are, by their nature, <u>never negotiable</u>**. Maybe one can negotiate the scope, resources, features and other characteristics. Estimations are the deductions of these.
- Some project managers multiply the estimate by a factor 1.5 or 2. Some remove the highest and lowest estimates and calculate an average and then multiply it with a factor.
- Use buffers ! The PM should include buffers (and tell no one else). They manage and use these buffers when necessary. Is adapting plans not better?

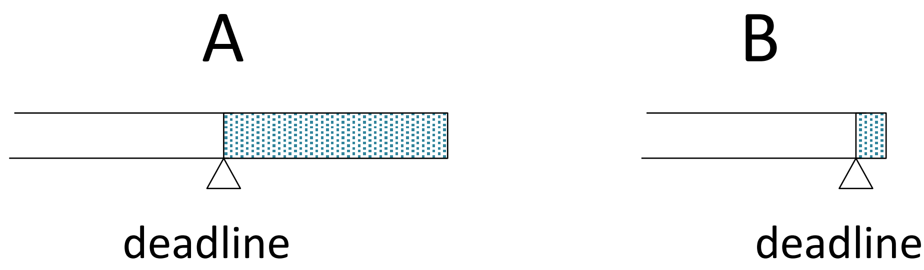
<u>Notes:</u>

Wrong estimations is not about "being wrong".

Reviewing and re-estimating a project may lead to adapting the project plan. Yes, this is more work for the project manager. But this is part of the job.

Missed Deadline (1)

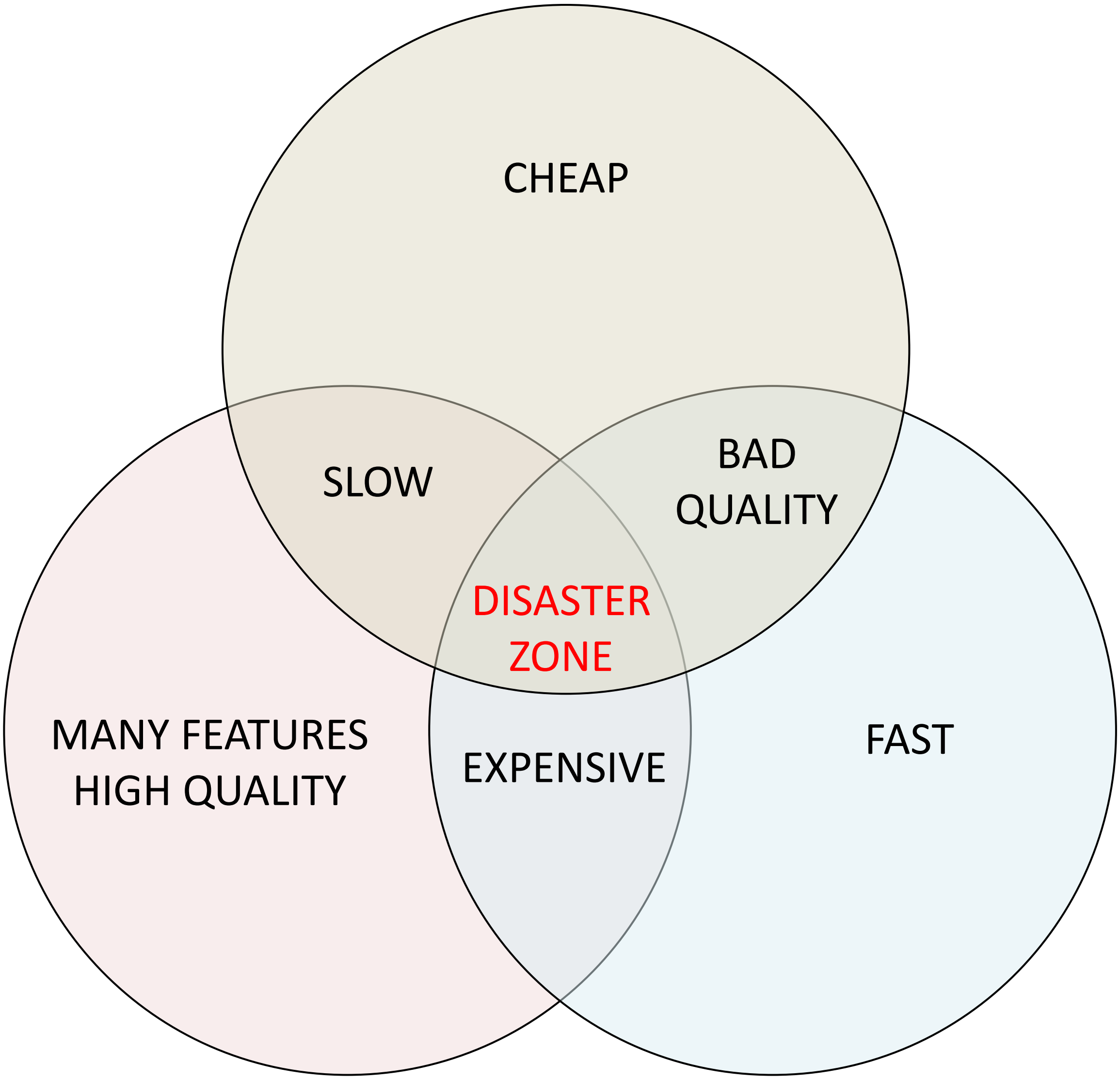
Missed Deadline



Which case is the worst? A or B ?

Project Estimations

30/10/2018



There are lower limits:

- In time: 9 women can not make a baby in one month
- In cost: if you pay peanuts, you get monkeys
- In quality: the price to pay will come later.

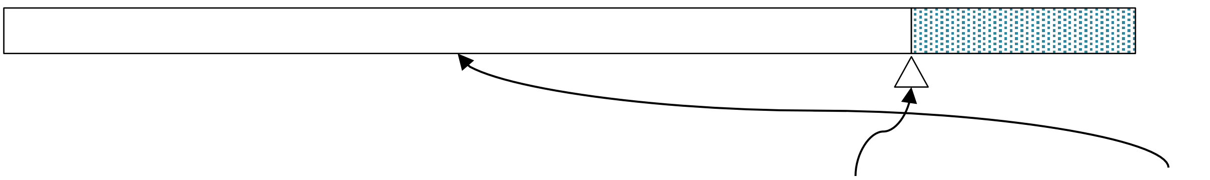
Fast	becomes	Slow
Cheap	becomes	Expensive
Many Features	becomes	a lack of quality

Missed Deadline (2)

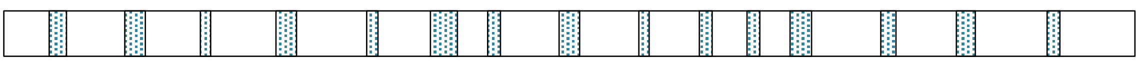
Missed Deadline

Missing a smaller deadlines is not as bad as missing a big deadline. But this is misleading.

Case A

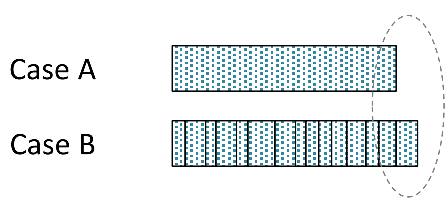


Case B



By cutting the process or time in slices (like short iterations), the deadlines can then be spread. The missed delays are smaller, but they are more frequent as well. It hides the true effect of the delays.

Small differences are not always documented (recorded, written, …)
They aren't (always) visible.



This principle exists in other situations: energy, effort, waste, costs, …

Question: Is missing a deadline so bad? Should we …

1. improve our estimating skills?
2. create circumstances allowing better estimates?
3. adapt the development approach to deliver within deadlines?
4. Or let the plan to vary (no deadlines, but rather expected delivery dates)?

Rigidity of Deadlines

Why Do We Deal with Deadlines in a Very Rigid Way ?

Why Do We Think so Obsessively over Deadlines ?

- Estimated Deadlines (estimated! guessed! Imposed)
    - Not Delivering within a Deadline (on time) is a FAILURE
- Sprints have a fixed length
- Time boxing

Deadlines are used to create pressure.

Pressure is a bad substitution for motivation, for drive, for collaboration, for being interested, for attitude.

Pressure inhibits learning, curiosity, innovation and may destroy quality. It may create conflicts and burn-outs.

Does a company want/need a decent system or solution or does it want just something that can be built in a limited period of time and at a certain cost?

Do we value and check speed of development or do we value good systems?

Why does meeting deadlines matter more than conceiving and developing good systems ?

Missing a deadline may indeed require to adjust plans. But that’s inherent part of dealing correctly with plans.

Negative Effects of Time Pressure

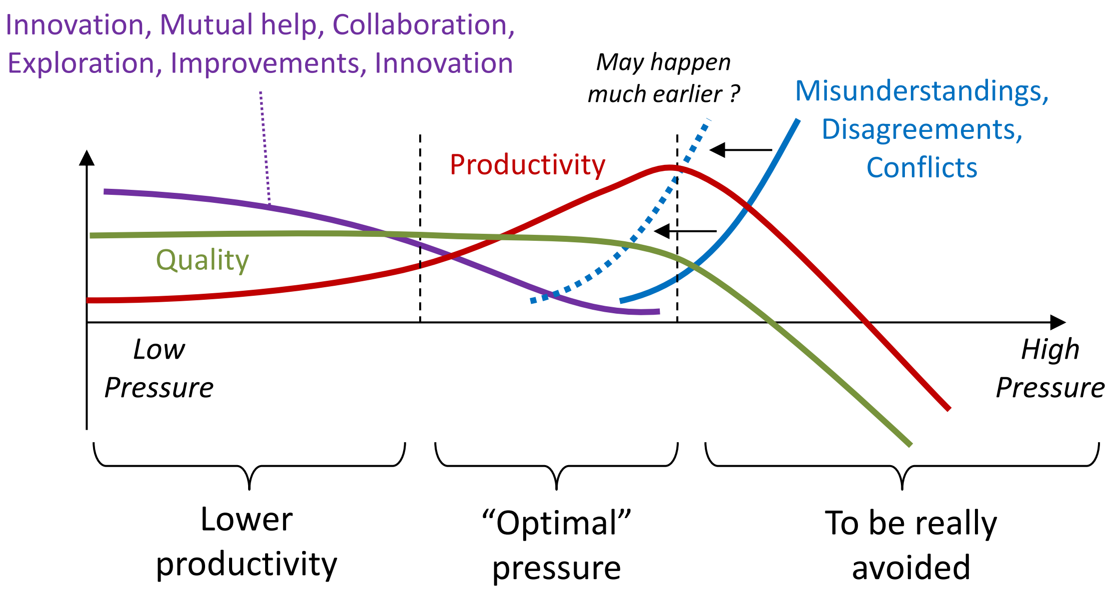
Page to be reviewed

- Lesser time is dedicated to analysis. The superficial understanding increases the risk for a bad conception (design) and bad decisions.
- Much lesser is verified at any stage and at all levels. Verifications take time.
- Unconditional trust of demands, decisions, choices and information of others, even if not justified. ("We deliver or do whatever you ask for (even if the request unwise) and we perform the work the way you tell us to do").
- More assumptions will be made and blanks of knowledge will be filled creatively.
- Likely to chose for the first, simple, local short term or solutions. The chosen solution may be rudimentary and easy and fast to implement.
- Lesser or even no alternative solutions are considered. Sticking to the first simple solution.
- Lesser features are built. Features are kept unsophisticated.
- Lots of mechanisms and features necessary for the survival of the system (like controls, maintenance, ...) are not implemented.
- Cargo cult: Filling in templates, producing analysis artefacts and models; but not doing real analysis and real design
- Fewer tests are performed.
- Lesser time is spent on optimising and improvement
- Lesser time is dedicated to exploration and experimenting
- Lesser innovation
- The final solution is of lower quality and the opportunity to create a more valuable solution is destroyed.
- More likely to opt for temporary solutions. Temporary solutions may become definitive.
- Leaving out apparently lesser important deliverables
- Lesser communication
- Lesser sharing, exchanges and collaboration. Lesser mutual support
- Decreased efficiency
- More misunderstanding and conflicts
- More mistakes are made and goals aren't met.
- More corrections (rework) creating additional delays
- Increased blames and punishments.
- Tighter deadlines, obligations, blames and punishments instil fear.
- More self-protection at cost of others, of the project and of the solution. (letting others take decisions, information retention, hiding issues, taking shortcuts, ...)
- Exhaustions, burn-out
- The chosen "solution" may not even solve the problem or constitute hindrances or limitations later. It may cause problems elsewhere or may undermine the supra-system.
- Implementing (possibly unknowingly) time-bombs
- Risk for creating problems elsewhere in the system or organisation
- Meeting the demand gets a higher priority than meeting the expectations , satisfying the needs or reaching the objectives, let alone maximising the created value.
- Obtaining a solution undermining the supra-system and the

Pressure & Productivity

Increase Pressure to Increase Productivity ?

Know what you gain.
Know what you loose.
And think again.



Increased production comes at a cost.

- We can follow on the graph what happens when pressure gradually increases. Thinking: Why does it affects the other 'lines' the way is showed?
- Picture is illustrative to represent an insight. It shows what can possibly be expected.
- Not all people react the same way to pressure.
- A big quality drop may always occur. This risk is always present.
- Pressure is not the only way to increase productivity (work environment, work atmosphere, hiring the right employees, good leadership, tools, …)
- When there is low pressure, some people will use the time they have to learn, to explore, to investigate, to think, to be more creative, to teach others, to help colleagues, to share knowledge, to support others, … while others will waste time with activities not contributing to the organisation.
- People sometime do things, not measured, not asked, not visible, not known by management, maybe even not known by anybody but so much important for the company.

The Obsession of Time

Why Do We Have a Very Rigid Way of Dealing with Deadlines ?

Why Do We Think so Obsessively over Deadlines ?

- Estimated Deadlines
    - Not Delivering within a Deadline (on time) is a FAILURE
- Sprints have a fixed length
- Time boxing

Deadlines are used to create pressure.

Pressure is a bad substitution for motivation, for drive, for being interested, for attitude. It creates stress and stress is bad for health.

Pressure inhibits learning, curiosity, innovation and may destroy quality. It may create conflicts and burn-outs.

Does a company want/need a decent system or solution or does it want something that can be built in a period of time and at a certain cost?

Tips

- Define mission, product, release + time required
- Principle: “It’s ready when it is ready”
- Start Early - Remove all pressure – Remove all fear

DON'T USE
STRICT
DEADLINES AND MILESTONES

Progressing correctly and steadily is most important

Deadlines and milestones may serve as a guide, as an ideal situation.

Deadlines and milestones are (often) based on wishes or on estimates.

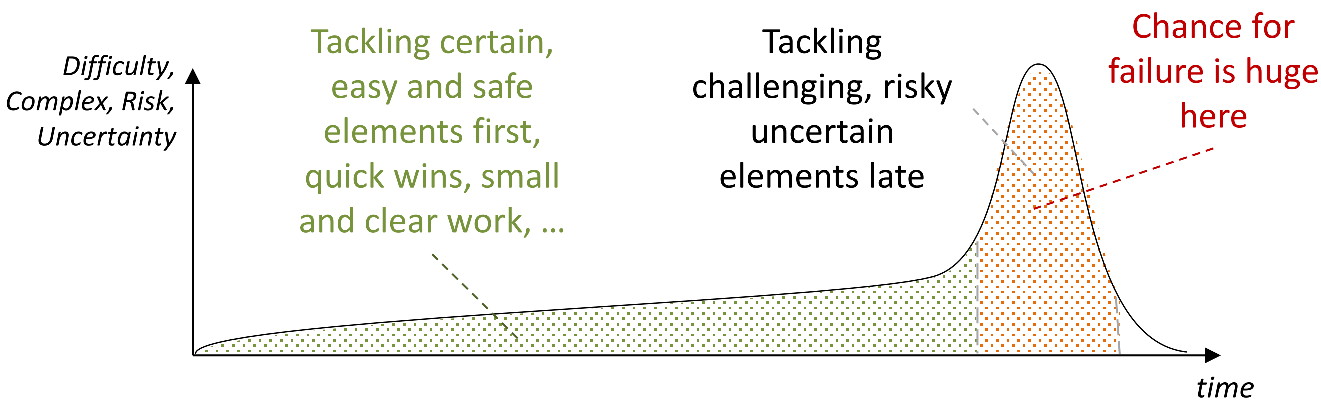
It is (often) better to miss a deadline and

- to do a sloppy job .. consequences and cost will come later
- to be able to implement a better solution creating much more value
- to be able to innovate.

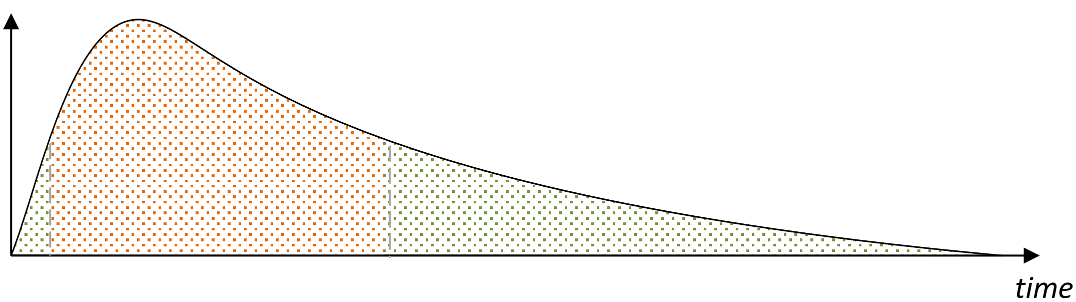
Missing a deadline or milestone can be more beneficial for the company than meeting it.

Notes:
Although, there are circumstances when deadlines are critical.

Uncertainty, Difficulties and Risks



If the project fails on the complex, challenging, uncertain and risky part, then the easy work performed earlier might be wasted.
It’s better to fail early in the project.



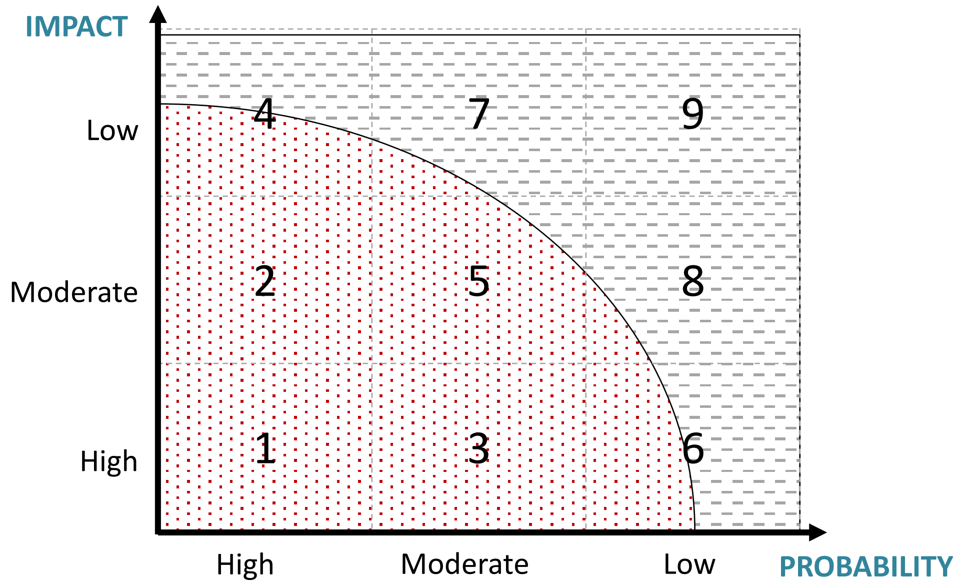
- Decrease risks early
- Decrease uncertainty early
- Deal with complexity early
- Tackle most difficult and risky parts first.

⇒ *How ? By Analysis, most risky elements first*

Risk comes from not knowing what you're doing.

Warren Buffet

Risk Management



Risks are inherent to projects.

Major risks are often easily and quickly identified. This doesn't mean that all major risks can be identified immediately. A lot of smaller risks (smaller impact) may remain hidden for a while. Risks may surface at any time in the project.

It's a good habit to deal with major risks early in the project. Risks with minor impact can be dealt with later in the project.

The acceptance of risks depends of the company, of the stakeholders and of the product.

The severity of the impact, the probability and the cost to mitigate the risk are key factors in the evaluation. Other factors, like professionalism, responsibility, moral values and reputation, may also play a role.

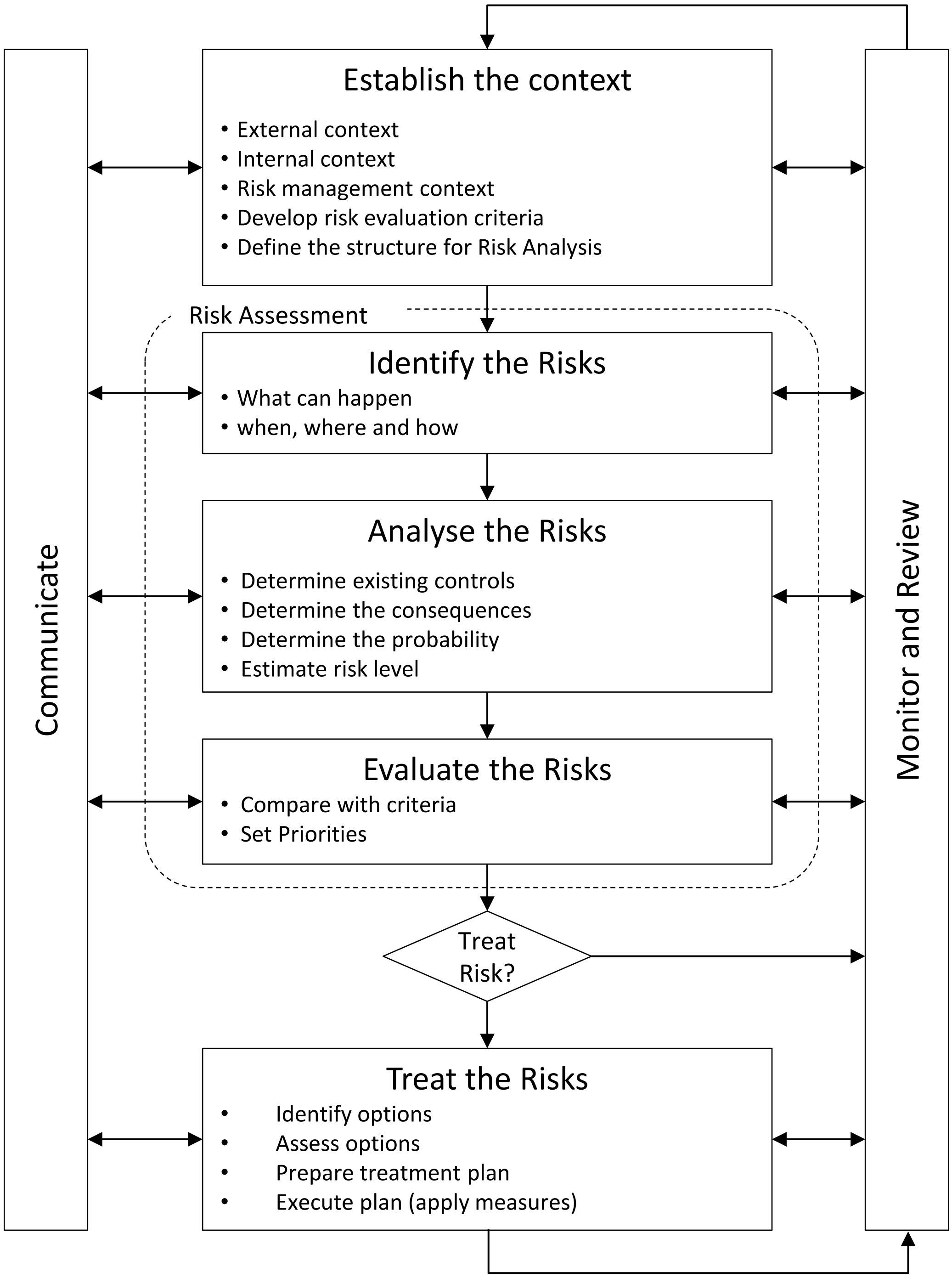
Risk identification, which preferably has to happen as early as possible, require an understanding. This is provided by a decent upfront correct Analysis.

Dealing with Risk

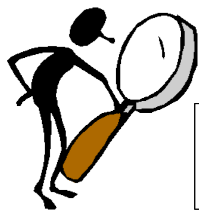
- **Tolerate** : Accept it & do nothing
- **Transfer** : Externalise it
- **Treating** :
  - Prepare for the risk
  - Take measure to reduce the consequences if the risk materialise
  - Reduce the likelihood of the risk to happen
- **Terminating** : Avoid / Eliminate the risk

Risk Management Process

30/04/2019



Learned Lessons



PROJECT

ONE OF THE <u>KEY ACTIVITIES</u> IN THE PROJECT

It increases the chance of future successes

How?

- Personal Improvement
- Development of company’s capabilities
- Lessons have to be shared (learn from someone's else mistakes)
- Allows to avoid to make same mistakes in all the future projects (saves cost, resources, time and problems in the future)
- Allows to tackle more important challenges in the future

The project is the way companies use to develop and to transform themselves. If project and engineering skills lacks, the company can’t adapt and evolve. If it can’t adapt and evolve, it is doomed to die.

- What went wrong? What caused frustrations, dissatisfactions, ..? What could have been done better?
- Why did it go like that?
- How can it be improved? What had to be done? What was necessary? What would had been a better way?

INFORMATION SYSTEMS DEVELOPMENT FRAMEWORK

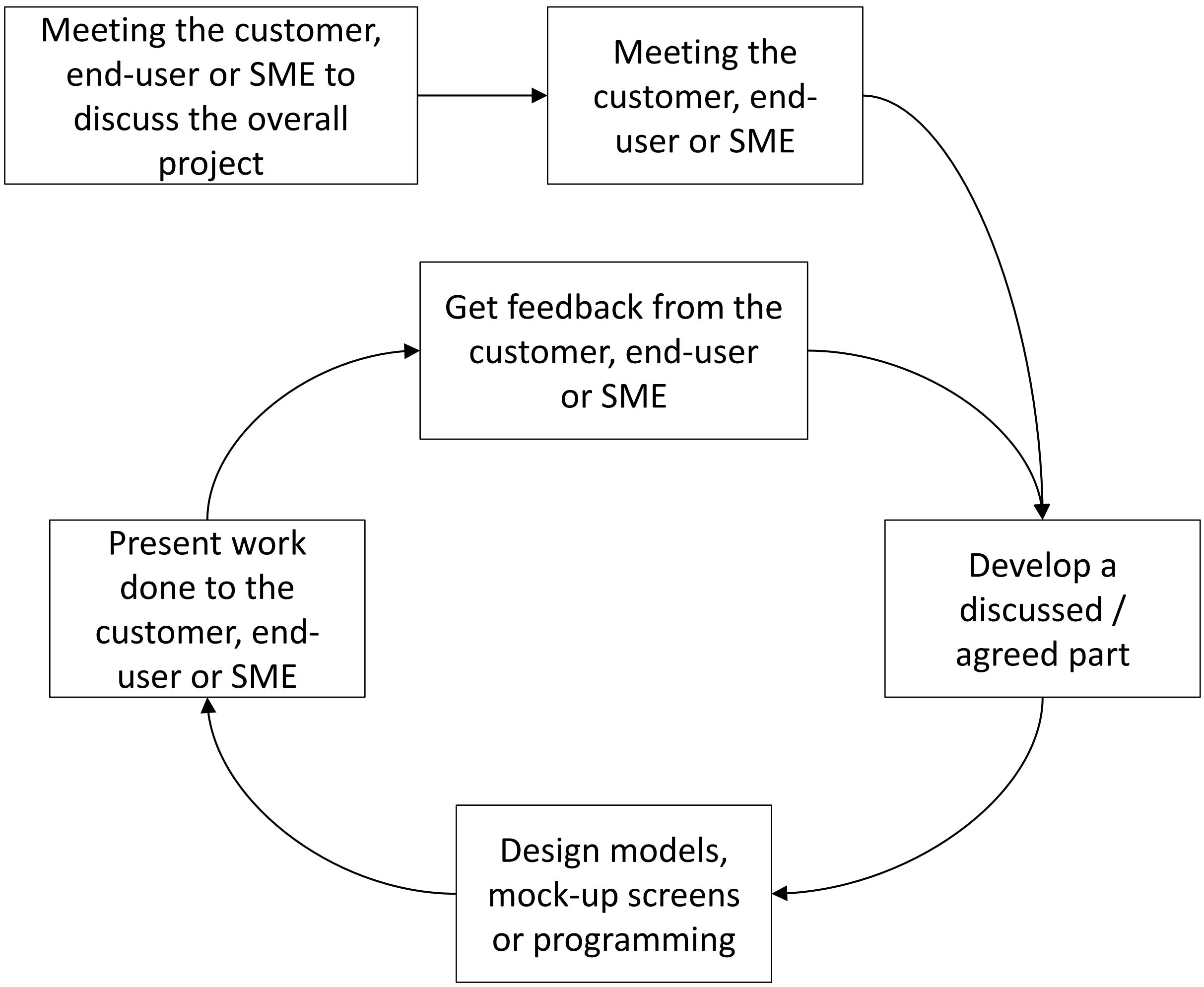
Approach, Framework, Methodology

Philosophy	Set of values, ideas and principles
Framework	A basic global description of an organisation or structure. It may include patterns useable to conceive a global organisation for a specific initiative.
Approach	Vague description of a global process
Methodology	A precise description of a global process, consisting of activities and methods. It can be enriched, for example, with artefacts, principles, standards or rules and techniques.
Method	A particular process with a well-determined purpose to accomplish something specific and consisting of several ordered steps.

Goal

- To Facilitate the project, the work
- To help the team

Pre-Methodological Era



This works for small teams, simple problems, simple and local solutions.

For larger, tentacular, multi-disciplinary solutions crossing organisational borders which share components or resources and interacts with other systems a more holistic, supportive and organised approach is required.

Different Software Dev. Projects

- Website
- Company's Intraweb
- Small single-user applications
- Accounting Software
- Embedded software
- Large Multi-Player Online Games
- Data re-organisation and clean-up Project
- Software for spacecraft
- Software Re-engineering Project
- Software for medical imaging or for surgery
- Software for nuclear power plants
- Data Warehouse
- Greenfield software development
- Software for corporate data management
- Adaption of existing systems
- SCM-software
- ERP-software

- Different philosophies, vision, values, priorities, constraints
- Different levels of integration
- Different spread of knowledge
- Different types of stakeholders
- Different ways of deployment, deployments constraints
- Different risks and risk acceptance (criticality, quality requirements)
- Minimal required software to be complete, functional and valuable

DIFFERENT PROJECTS → DIFFERENT METHODOLOGIES

Notes:

Some operators (users) can operate machine, but have no clue of the internals of the systems, thus of the required implemented logic.

A spacecraft can't be sent into space with only the most important features required for taking off installed. A spacecraft's software system must be complete before the spacecraft is launched.

In Software Engineering

doing things by the book

and

thinking dogmatically

is a recipe for FAILURE

regardless of the approach

Be PRACTICAL and ADAPT

so that your processes, methods and tools fit your situation

Software Development Initiatives

are

NOT initiatives based on STRICT FORMAL PROCESSES

They are

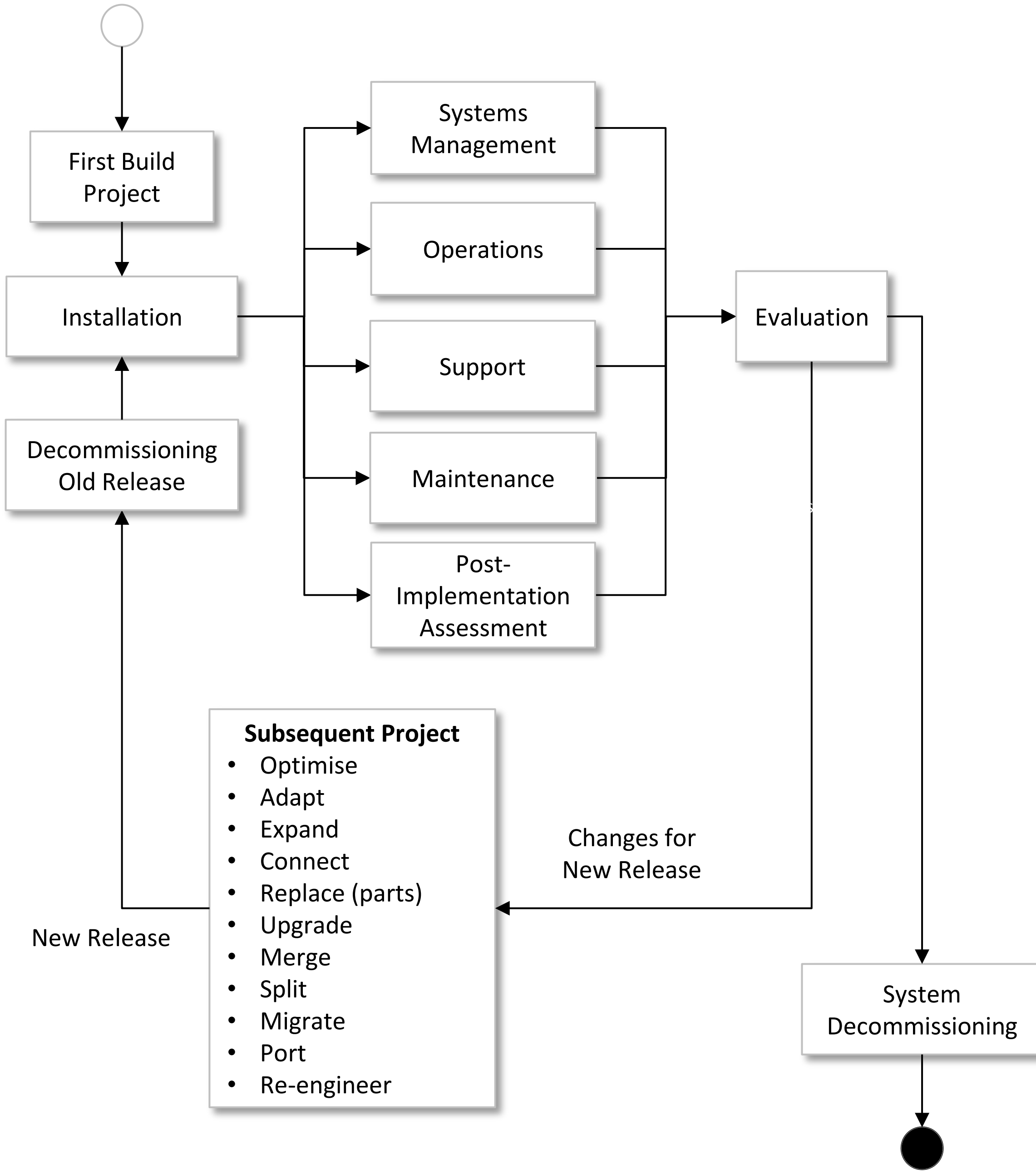
Semi-structured / CASE-based Process

Initiatives

Any Methodology or Process defined upfront will have to be adapted during the execution

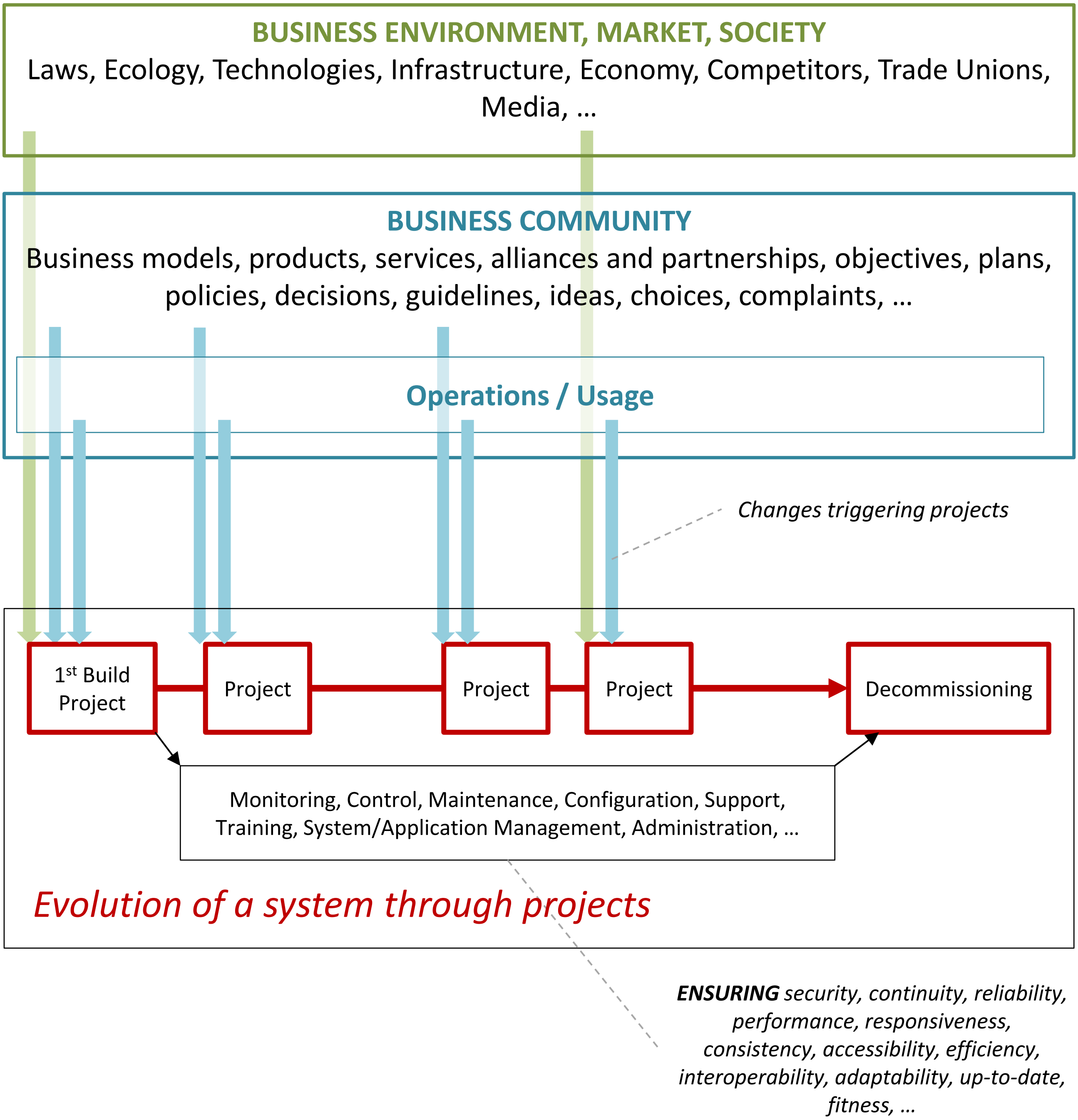
Mastery of the Discipline, in-depth understanding and common sense are critical

Software System Lifecycle (1)

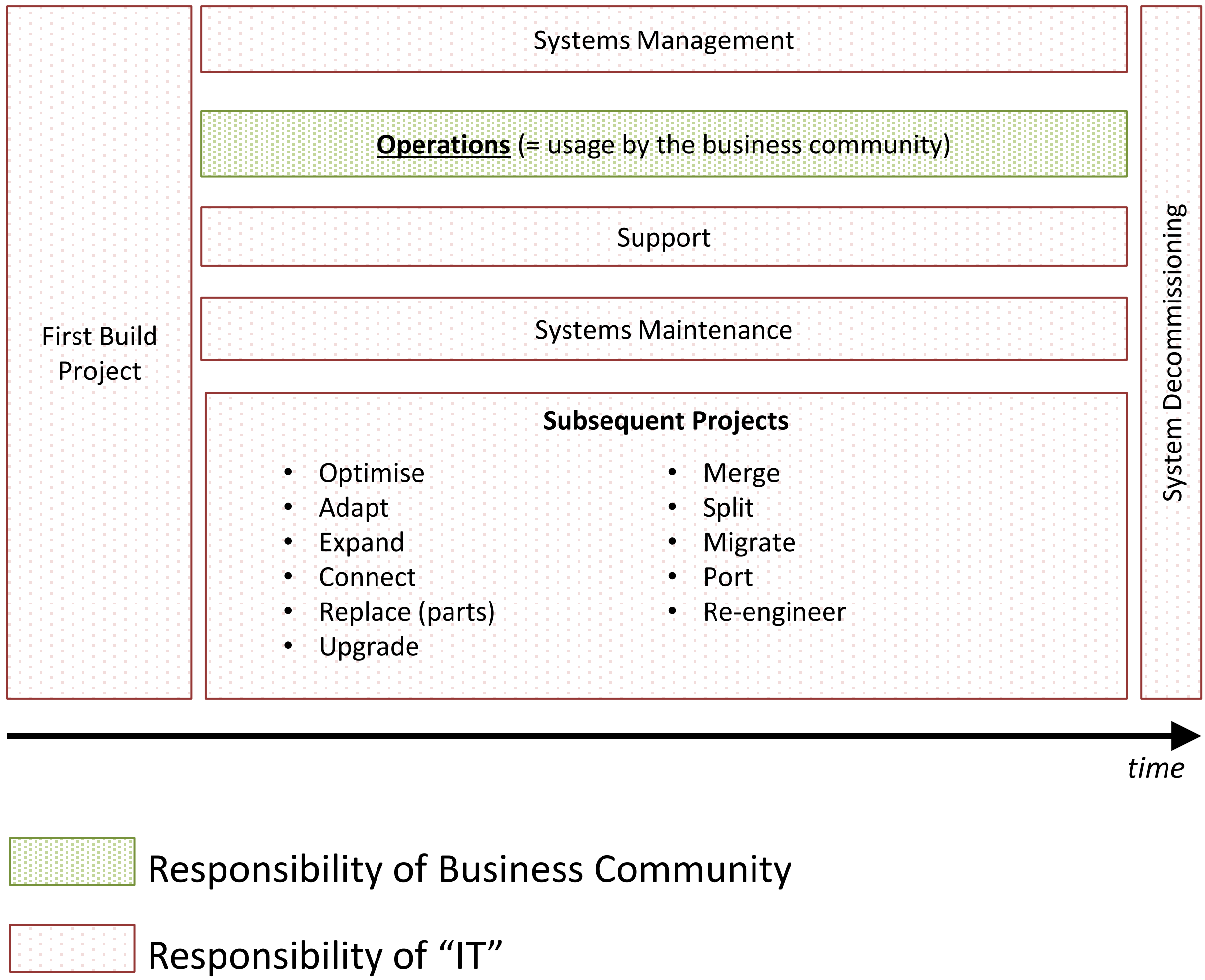


Lifecycle ≠ Development Cycle !!

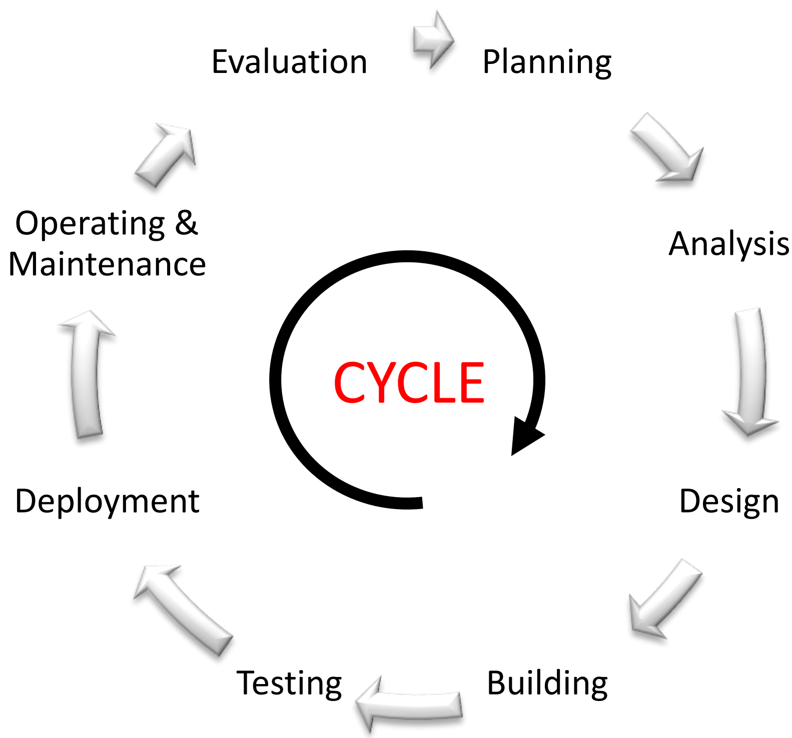
Software System's Life (2)



Software System's Lifecycle (3)



System / Software Development Lifecycle



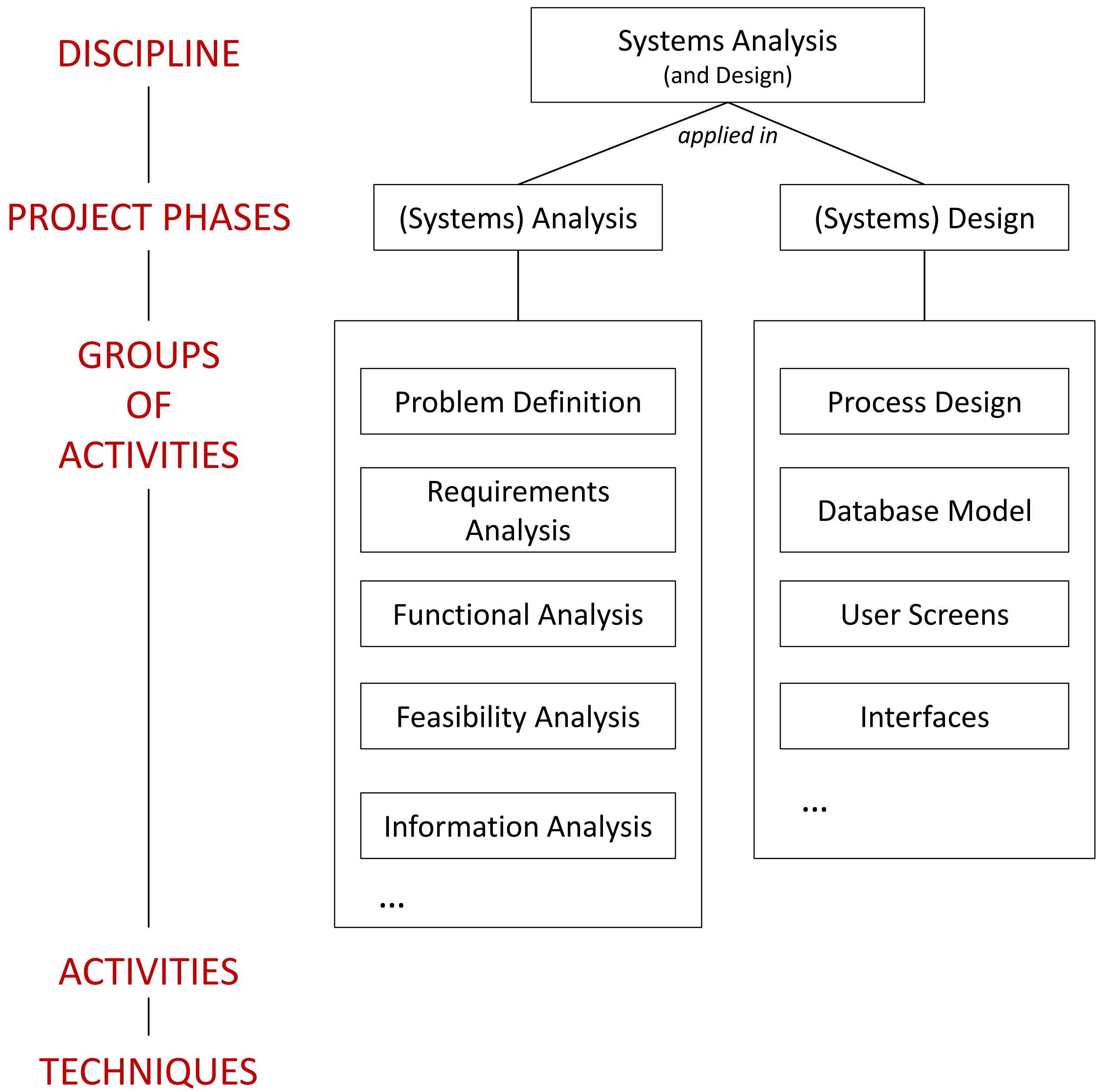
<u>Note:</u> Some SDLC have lesser phases or the names may differ. However, the concept, the idea, remains the same.

Development Cycle ≠ Life Cycle !!

"Requirements" or "Requirements Analysis" are techniques, not phases !!

Discipline → Activities

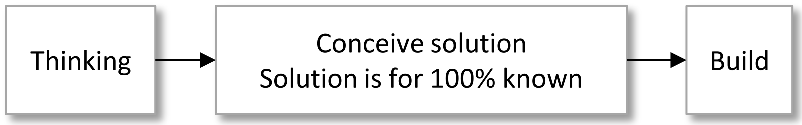
30/10/2018



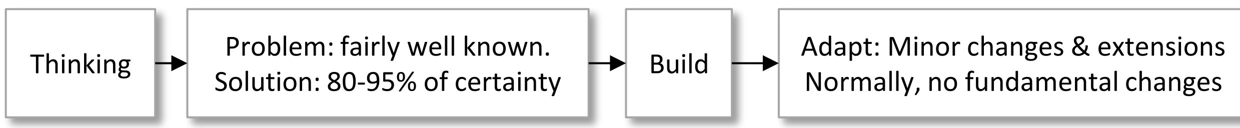
Notes:

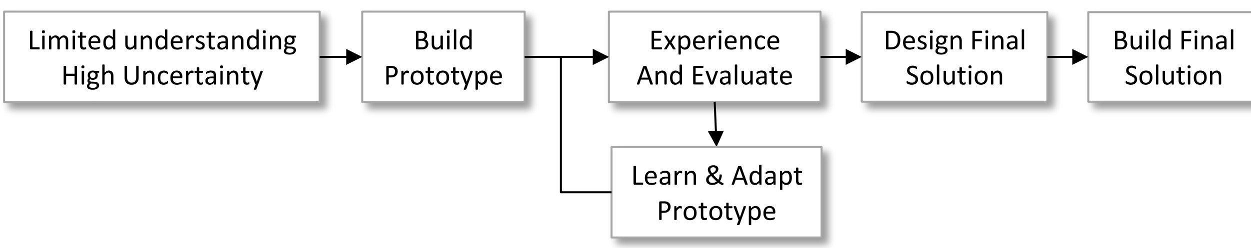
- Systems Analysis is exercised throughout the whole project. However, it is essentially exercised during the Analysis and Design phases (whatever their names). The "Groups of activities" represent a part of the "Analysis" phase. They can be defined as a phase on their own, but the practitioner must make sure not to forget critical activities in the process.
- "Requirements" is rather a technique requiring several activities like (requirements elicitation, req. analysis, req. management, req. prioritisation, req. validation, …)

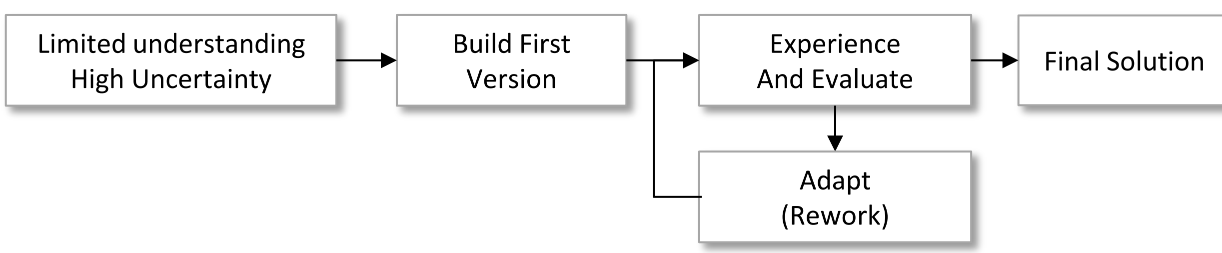
Philosophies in Approaches



➔ *Ideal case. Not possible in most cases.*







➔ *Slow, Costly, Time and budget depending on # cycles and amount of rework, late final delivery, …*

Methodology

METHODOLOGY is a global methodical (structured) process, which is commonly decomposed in phases, sub-processes, gates, activities and milestones, and which can propose or be enriched with values, principles, rules, roles, skills, products, methods, techniques, standards, artefacts, tools, technologies, ...

It's a an organised and ordered collection of elements **proposed** to projects (not just one) and which **can be useful** to them.

Advantages

1. Facilitates transfer of Project Experience
   - The methodology accumulates this experience, insight, ...
2. Facilitates the set-up and planning of projects
   - The project can start with a 'template' instead of from a blank slate. Not everything need to be redefined from scratch. It's "just a matter of" adapting the standard methodology to the specific case of the project and its needs.
   - It supports the knowledge and experience (lesser chance to forget taking something into account or to include something.)

As a way to introduce some standardisation

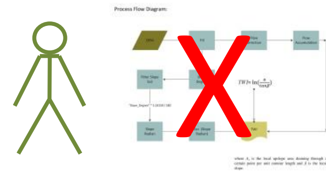
2. Facilitates communication
   - Usage of common terms across projects
   - Common concepts facilitates reporting to management
3. Facilitates collaboration
   - Easier to step into a project.
4. Facilitates the management of programs and project portfolio
   - Obligatory steps and artefacts common to all company's projects can be defined**.**

Risks

1. Overly trusting and relying on the methodology.
2. Assumption that a methodology replaces understanding of Software Development Processes and projects.
3. Misuses and Abuses of the methodology. Confusion between a methodology and a procedure.

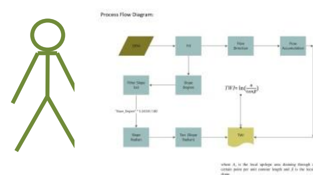
Methodology Usage

No Framework, Methodology, Process, Procedure, Guideline, Method is available



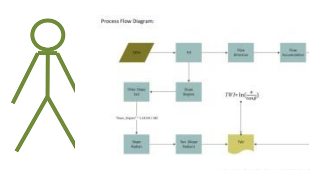
- Free to act
- Having to think and to take decisions
- In same situation, people will act in different ways.

A Framework, Methodology, Process, Procedure, Guideline, Method is available



- Individuals may, have to, or assume they have to follow it faithfully
- Assumption:
    - That the process description is perfect
    - That every case can be resolved by following it
- More superficial understanding, lesser thinking, lesser taking responsibility
  → Effects on result and on risks?

A Framework, Methodology, Process, Procedure, Guideline, Method is available



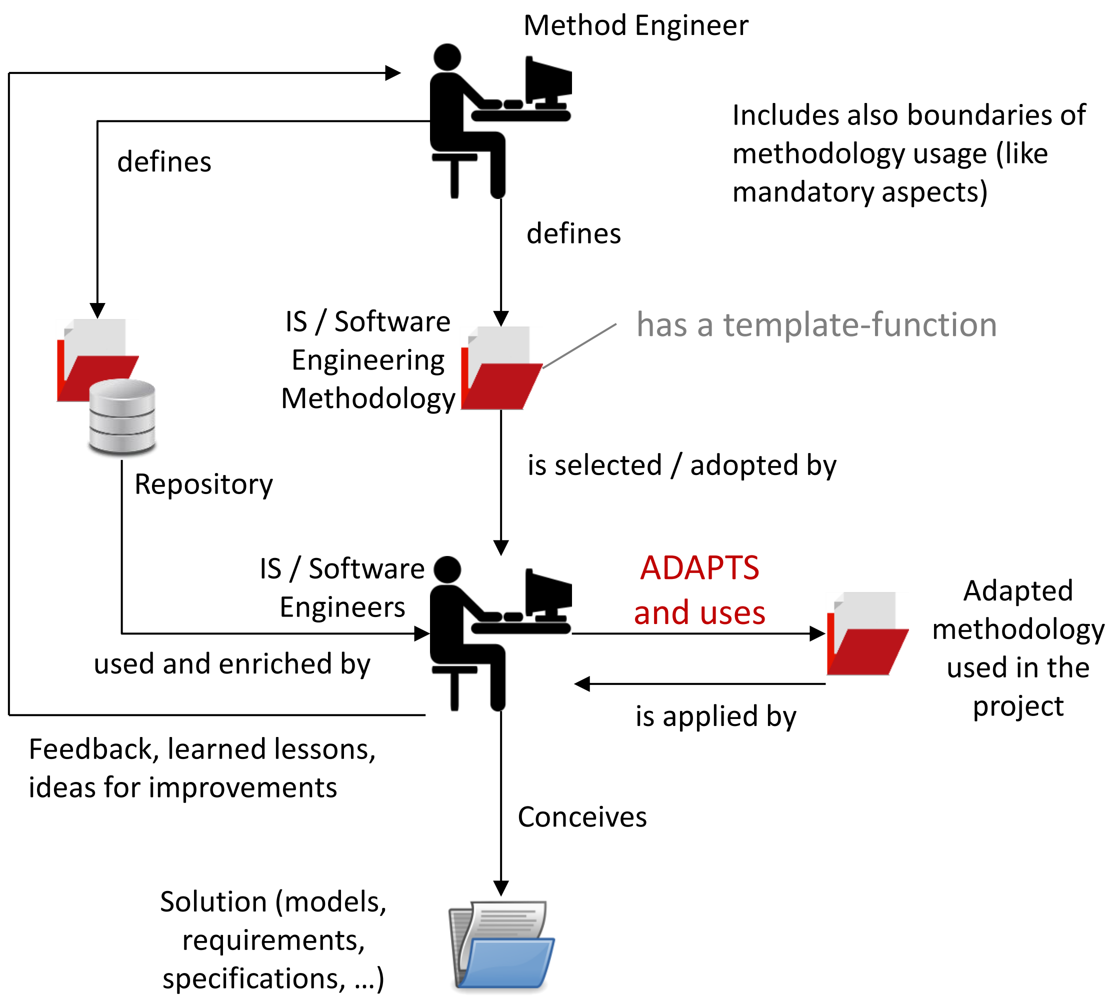
- Used as input for taking own decisions of the right course of actions
- Used to support the thinking. If the step makes sense, then it is performed. If the order of steps make sense, then it is respected. If the artefact is useful, then it is produced. Else we adapt, reorder, ..
- Require true expertise. Responsibility is being taken.

Methodology Usage

METHODOLOGY = A GENERAL PROCESS *supporting specific cases*	PROJECT = SPECIFIC CASE

- A methodology ≠ a procedure, a recipe.
  - A methodology describes (and doesn't prescribe – unless the methodology is also defined as a standard)
  - It shouldn't and can't be followed blindly. Never do something "because it is prescribed in the methodology". A methodology does NOT dictate!
- A methodology must be adapted to suit the specific situation of the project
  - Is an activity, model, document or other product needed ?
  - Adding or removing products – selection of methods
  - Adding, reordering, removing activities
- Richer methodologies are usually better / offer more possibilities
  - The practitioners have more suggestions, more choice
  - It's easier to ignore (leave out) an unnecessary activity, artefact or technique than to search, create and add one.
- A company can decide to have some parts of the methodology to be mandatory to every or to certain classes of projects (milestones, artefacts, KPI's, …).
- A methodology is based on knowledge. It contains (some of the) knowledge the practitioner should possess. However, it doesn't replace this knowledge !! Without knowledge, deeper insight, critical thinking and sound judgement … follow the methodology is a recipe for disaster.
- No methodology, approach or philosophy can cope with the consequences of lack of insight, a restricting vision or a rigid mind-set. The vision must be clear and large. Mind must be open and flexible.
- The application of a methodology, on its own, is NEVER a guarantee for success. Let alone a strict and faithfully application.
- A methodology is never responsible for a project failure. People who chose it and executed it are !!

Methodology Usage



Method Engineers and the IS/Software Engineers (including all types of Analysts and Architects), require a profound understanding of projects and their products in general. The IS/Software Engineers need also to have a good understanding of the particular situation of the initiative and its context.

Methodology Usage

The problem with framework, methodologies, processes and other standards is not that they are predefined.

The following FALSE assumptions are made too easily:

- These standards have to be respected.
- The experts have thought about the framework, methodology, etc, so the practitioner don't have to think about it anymore.
- They have the role of an authority that dictates.
- They tell the practitioners, the experts, what to do or how to do their job.
- They have to be applied as defined.
- They oblige and limit practitioners.

Rigid Mind-set

They are used as a replacement

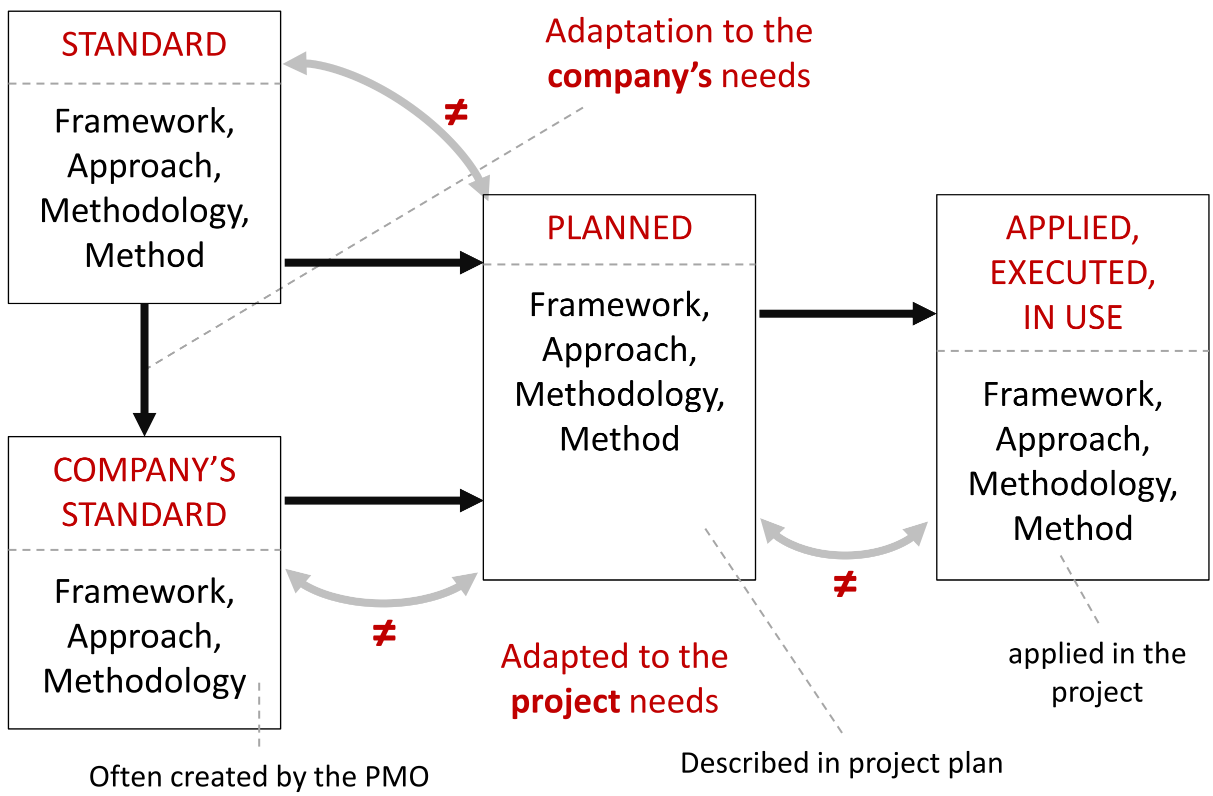
- to insight in the profession (mastery)
- and to autonomous thinking.

while they aren't and can't be.

Actually, they are only a basic template, a toolbox, with which the practitioner can start to work with. They only suggest steps, activities, methods, etc. They support practitioners in their thinking and decision making about the approach.

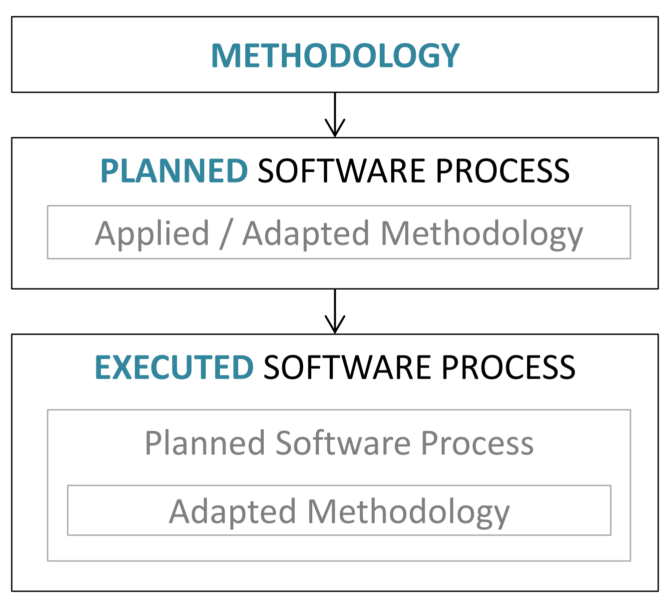
Note:
Some organisations may indicate some parts of methodologies, of frameworks, etc . as mandatory.

Methodology Usage



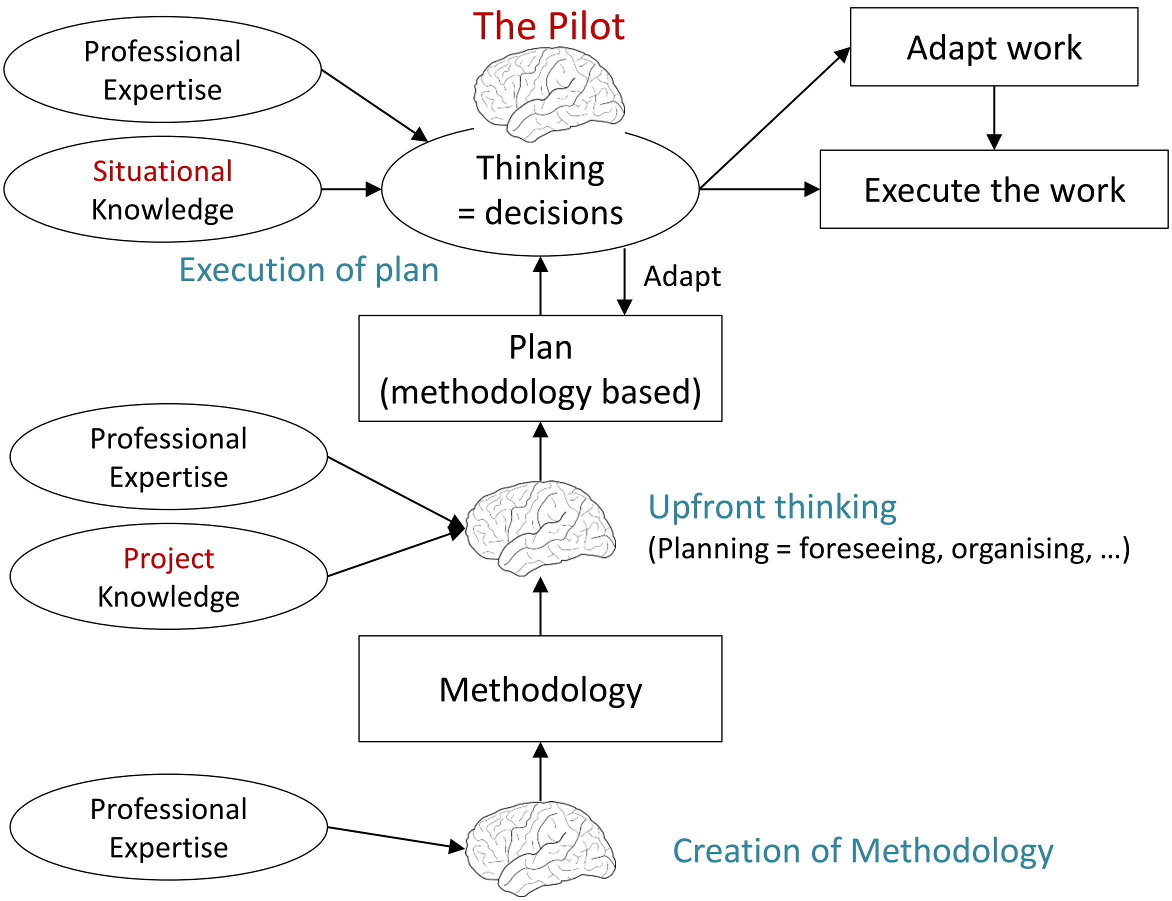
The execution of a plan and the plan are different things. And both, from a process perspective, always differ to some degree.

The necessity during the project execution determines how a methodology is executed. Practitioners have to understand these necessities and adapt the application of the methodology to it.



Despite the divergence between these 3 concepts, a great similarity should be distinguishable. A lot of elements and patterns should still be present and recognisable.

Methodology Usage



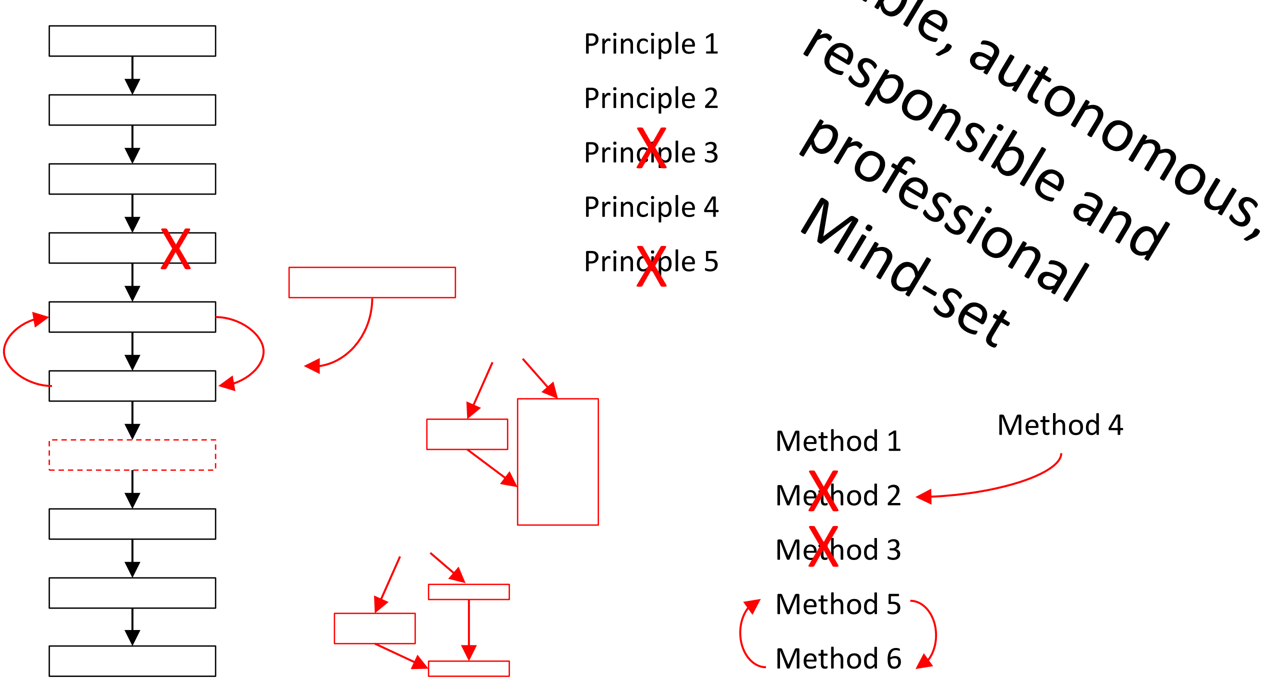
It is ALWAYS the responsibility of the project manager and the project team to decide how the project is executed and what is needed, what is necessary to succeed with the project.

A methodology is a basic template **suggesting** activities, artefacts, techniques, an order of activities, roles, …

The main role of a methodology is to **support the thinking** of the project manager and the team, it does not replace this thinking.

Methodology Usage

Adapting a Methodology

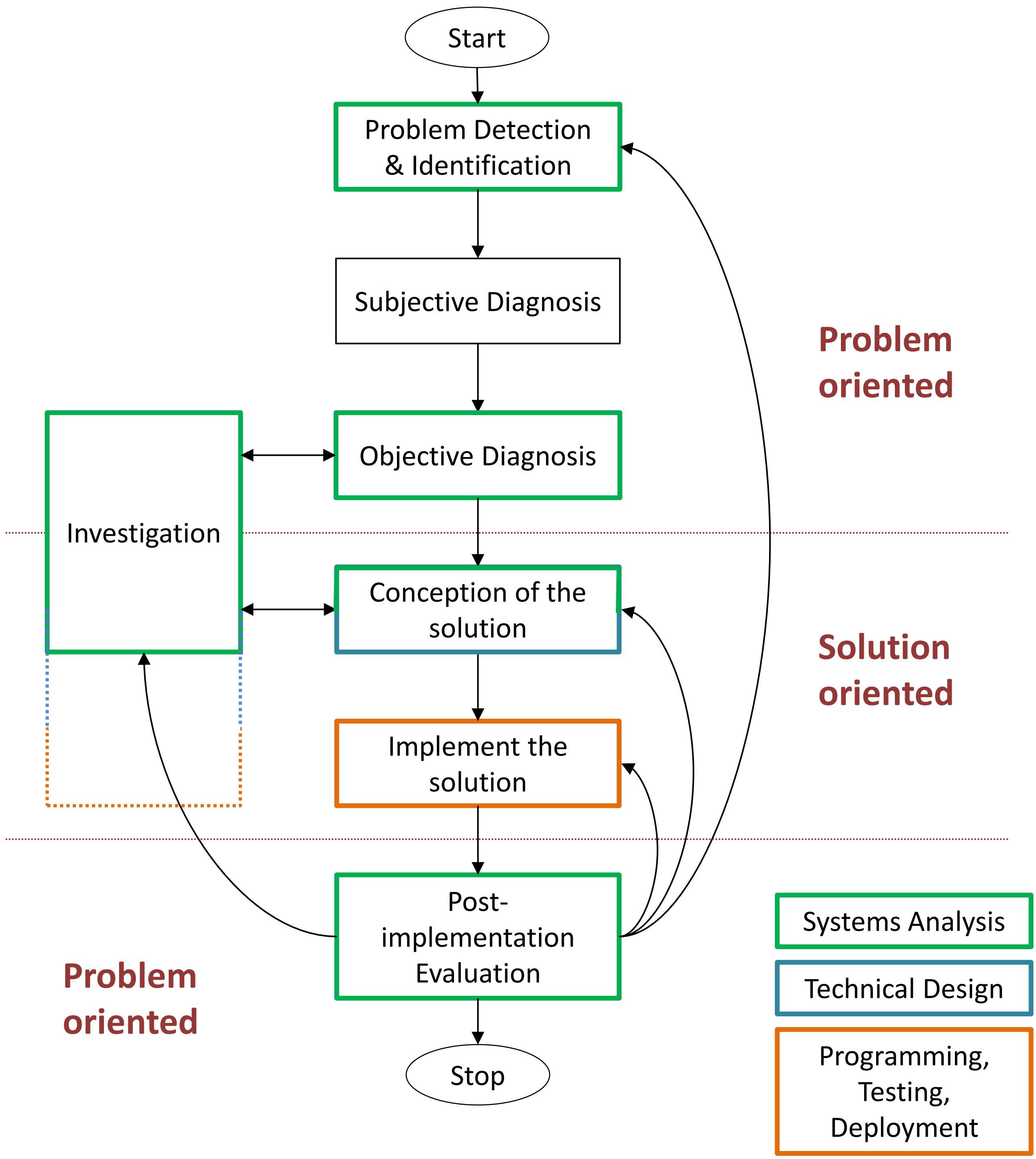


A predefined methodology is a template that has to be manipulated to suit the project.

<u>Possible of Adaptations</u>

- Phases can be dropped, expanded, reordered, split up, added, merged, …
- Process steps can be dropped, expanded, reordered or added. Choice about timing, trigger, sequential, overlap, … are other aspects to decide.
- Artefacts can be ignored. Or they can be enriched or adapted in any other way.
- Methods can be applied or not, adapted or other methods can be used instead or added.
- Principles can be applied or not, or applied in an adapted manner.
- Tools, … chose what suits.

Mapping Methodological SD Approach on Problem Solving Approach



Problem solving process matching software development activities.

Fundamental Steps in Software Development Approaches

Evolution of the Software Development Process:

Small and Simple

PROGRAMMING

Most fundamental process for simple software application

DESIGN → PROGRAMMING

Thinking about how to solve a need/problem and how to organise UI, database and the source code.

Reason: Avoiding spending time into re-organisation and rewriting of source code

DESIGN → PROGRAMMING → TESTING

Reason: Avoiding to deliver a bugged application to the end-users. Limiting the amount of bugs reaching the production environment.

ANALYSIS → DESIGN → PROGRAMMING → TESTING

Reason: Avoiding to solve the wrong problem or to design solutions without understanding the problem and its context.

Larger and complex systems

Challenges as Initiative Scales Up

1) Issue: Development of a very simple and small software application

Programming — Can be started right away

⇩

2) Issue: Development of larger software application

Software Design — Design and organisation of the software elements and components.

Assumption: Solution is known

⇩

3) Issue: What if the solution is unknown

"Solution Engineering" — Solution-oriented analysis: SA&SD analysis not only the system, but also the system's environment.

Assumption: Existing systems and environment are simple

⇩

4) Issue: What if systems and environments are complex

Systems Analysis and Design — Problem-oriented analysis: Study of existing systems and their environments.

Assumption: Problem is known

⇩

5) Issue: What if the problem is unknown

Complaints and symptoms surface. The problems are not understood or not even correctly identified (root cause). The existing systems and environment is insufficiently unknown.

Systems Analysis and Design — DIAGNOSIS !!!

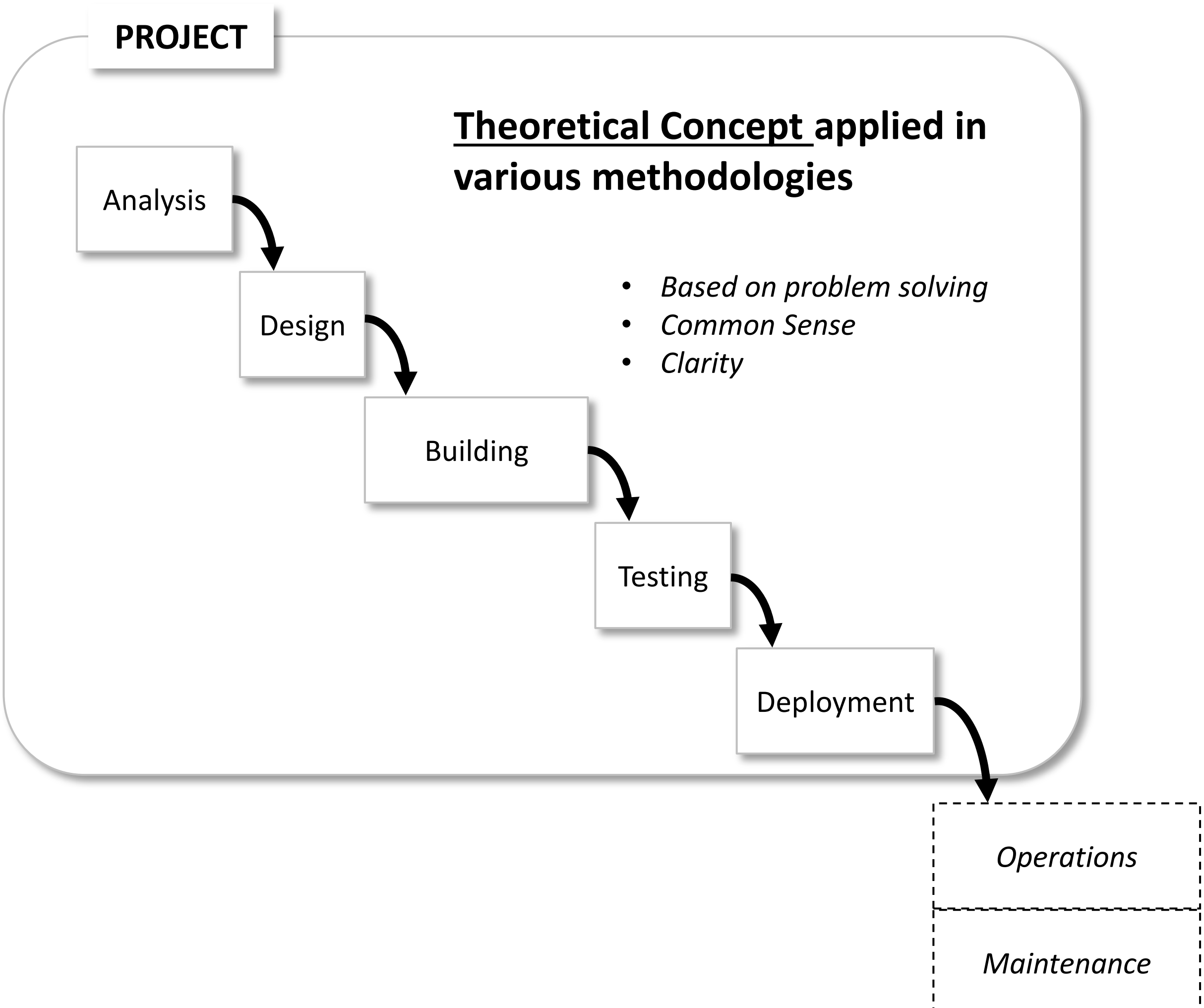
Continuing on next page

Challenges as Initiative Scales Up

6) New issues emerge …

- Sharing information
- Reuse of information, allowing multiple usage of information
- Coherence in the business logic across the company
- Ensuring real information problems (root causes) are solved
- Dealing with multiple users groups, different business domains and different objectives (sometimes conflicting)
- Conceive solutions that maximally exploit the possibilities of software and computers (no simple-minded solutions or impossible solutions)
- Integration in the environment
- Keep the system of systems coherent and clean
- Information security
- Ensuring evolvability of software systems (easy evolvability)
- Reuse software components, component based systems
- Ensuring the manageability of the entire collection of stored information
- Preserving the value of the information
- Information entropy
- Possibility to maximally exploit information
- …

Basic SDLC



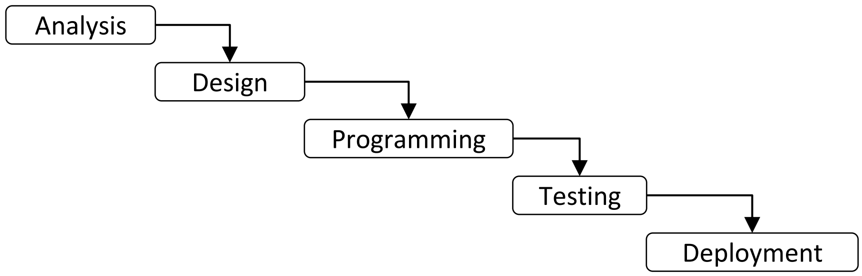
The concept of this simple SDLC is a pretty simple and straightforward process. It represents a logical approach that puts understanding the problem and the solution requirements before starting to build it.

Thanks to its modularity, it allows to deliver intermediate solutions, increments, systems and sub-systems, releases, …

This flexibility makes this SDLC also very scalable.

Waterfall

What is the "Waterfall" ?



- A ~~methodology~~
- A methodological idea, concept, principle, pattern
  - based on earlier problems and general problem solving
- An SDLC

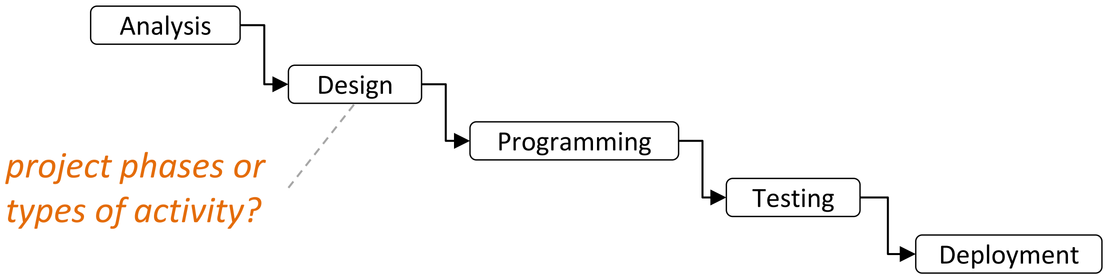
Remarks:

- A drawing, a model, that may slightly vary
- No established number of phases or defined names
- No official set of practices
- No official established rules and principles
- No official standard of the waterfall exists
- No official guideline on how to apply it
- But a lot of interpretations and assumptions
- A lot of principles and bad practices added to it → CONFUSION

How do we know how to apply the waterfall?

How do we know how to apply it correctly?

Some Bad Practices



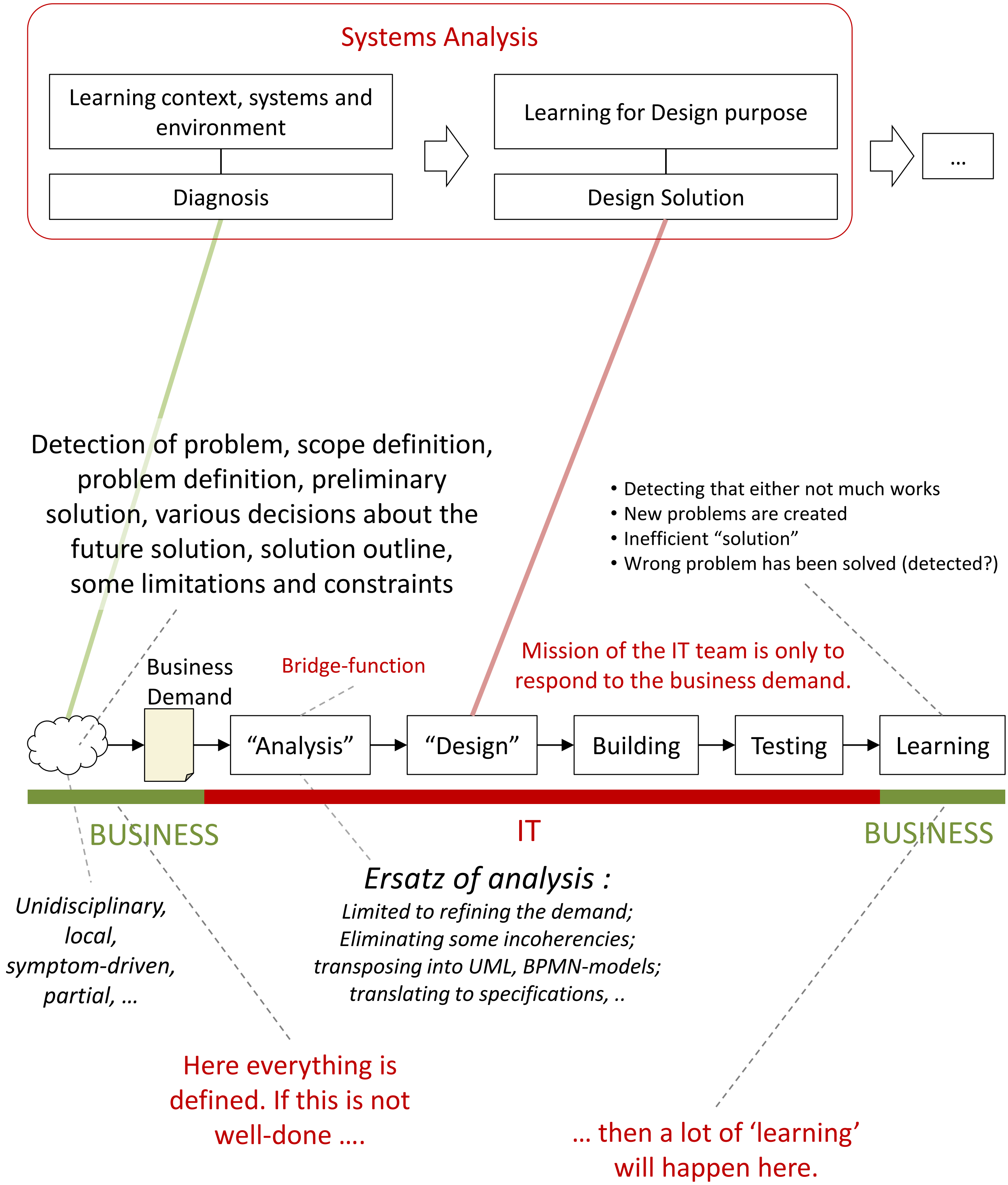
Practices Assigned to the Waterfall (to be abandoned):

1. The sequence of phases is strict and unidirectional
2. Complete a work for 100% before moving to a next phase
   - *100%? Is this possible?*
3. Phases may not overlap
   - *What with projects with sub-projects running in parallel?*
4. Only activities of one certain type may be executed during a phase
5. Follow methodologies and methods by the book
6. Big Up-Front Requirements
7. Big Up-Front Design
8. Plan in advance and in great details and don't do course corrections
9. Freeze work done earlier before moving to a next phase
   - *verifying and validating ≠ freezing*
10. Perform work imposed by the methodology (even if it is unnecessary)
11. Perform unnecessary work
12. Perform a lot of bureaucratic work
13. Write extensive documentation
14. Death march. Do not correct a situation by performing activities of a type performed earlier or don't jump back to an earlier phase. Continue until delivery.
15. If a type of activities that have been performed earlier have to be executed, you have to move the whole project to the corresponding earlier phase.
16. Testing happens only at the end of the project during the Test phase.
17. "Big bang" deployment

- …

Groundless interpretations of the Waterfall-diagram lead to nonsensical practices of the Waterfall SDLC

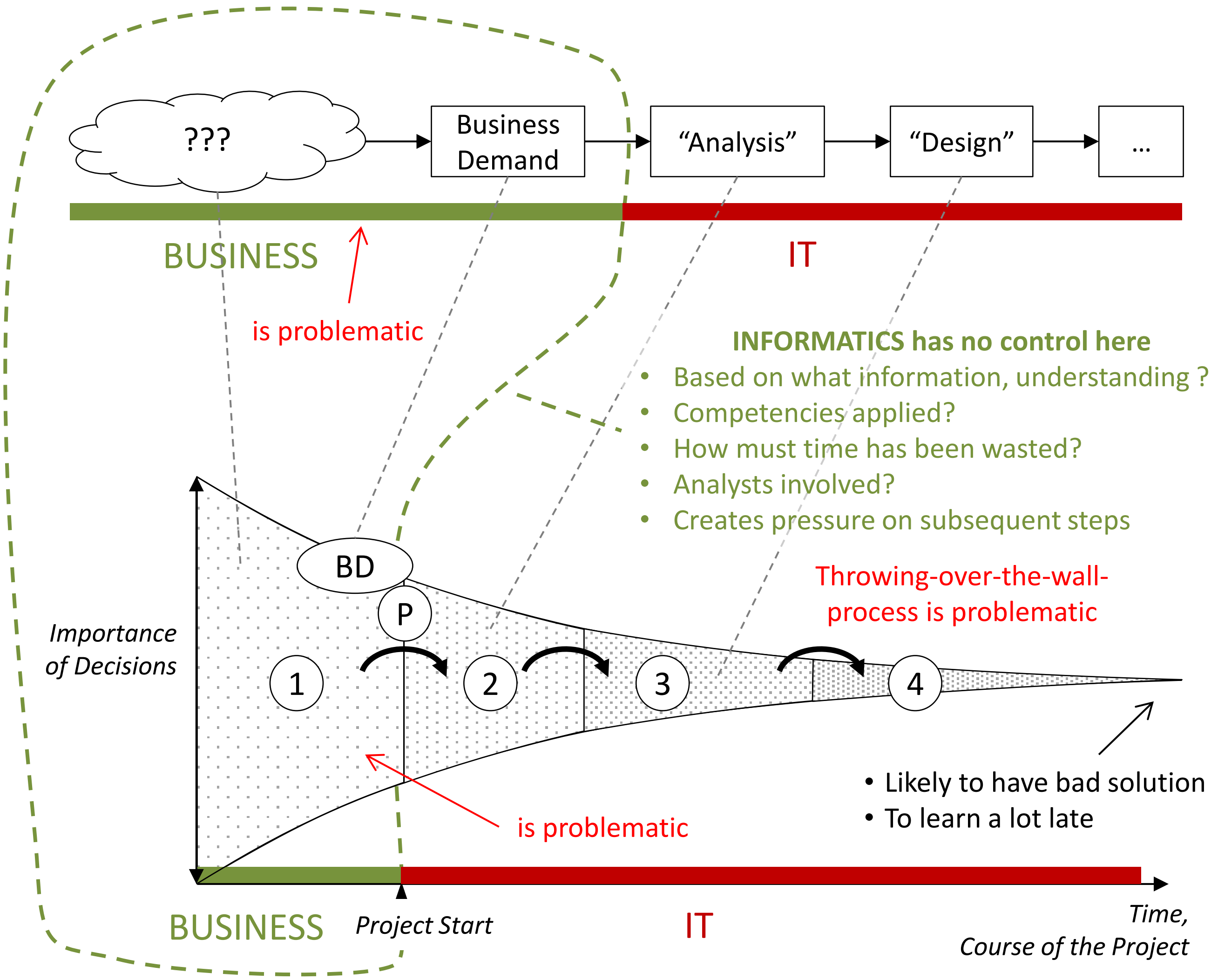
Common Bad Practices



How can meaningful innovation happen in this context?

Common Bad Practices

10/01/2019



(1) The business stakeholders, SME’s, end-users determine the problem, what they want, the scope and the outline of the desired solution.

(4) The developers build the requested software system

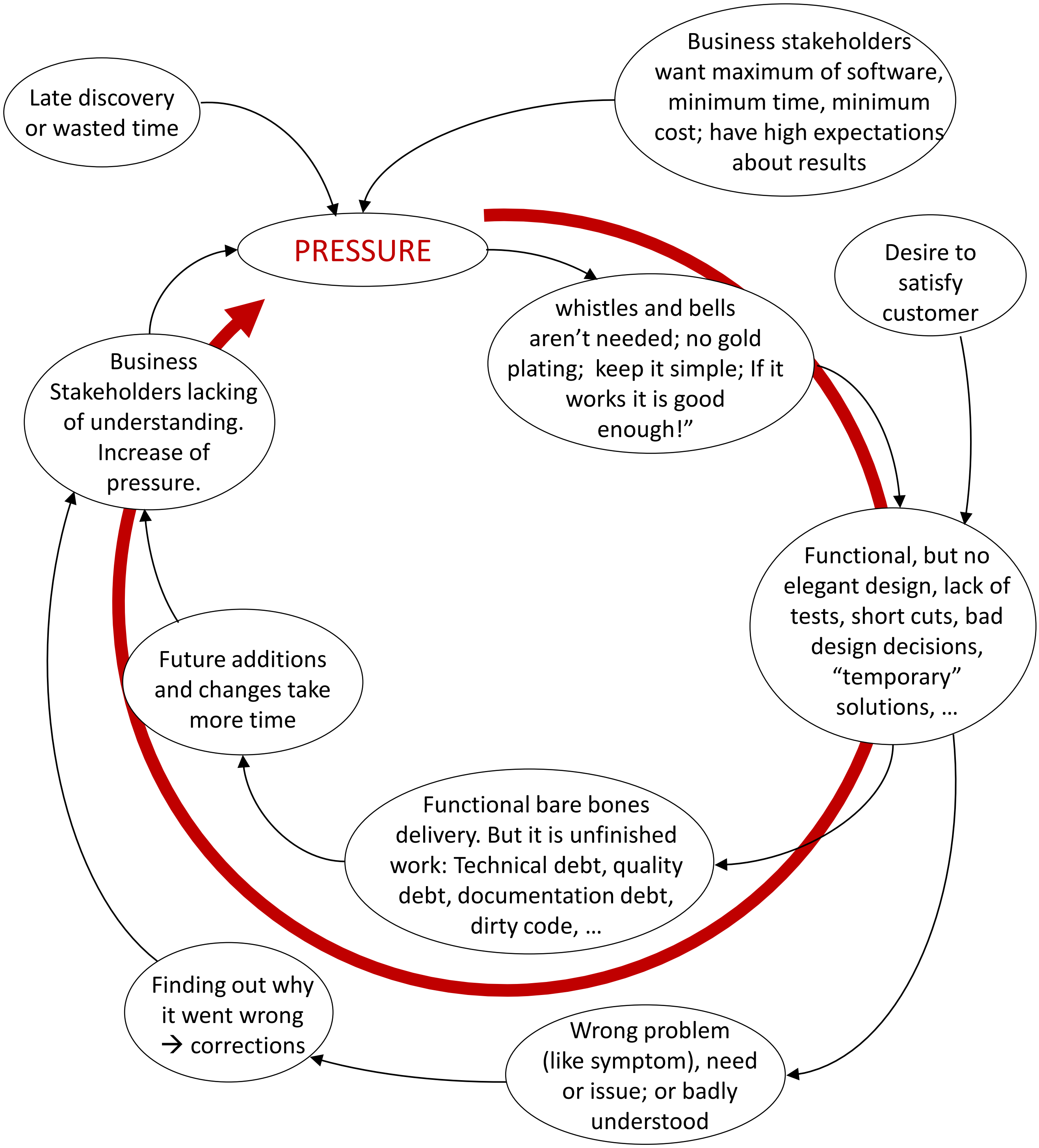
(2) The analyst receives (gathers) requirements, refines, checks, translate, models, turn into specifications

(3) The IT analyst, designer, SE or developer(s) elaborate the technical solution.

P Plan

- Scope
- Delivery Date
- Budget
- Solution Outline

Failure Cycle

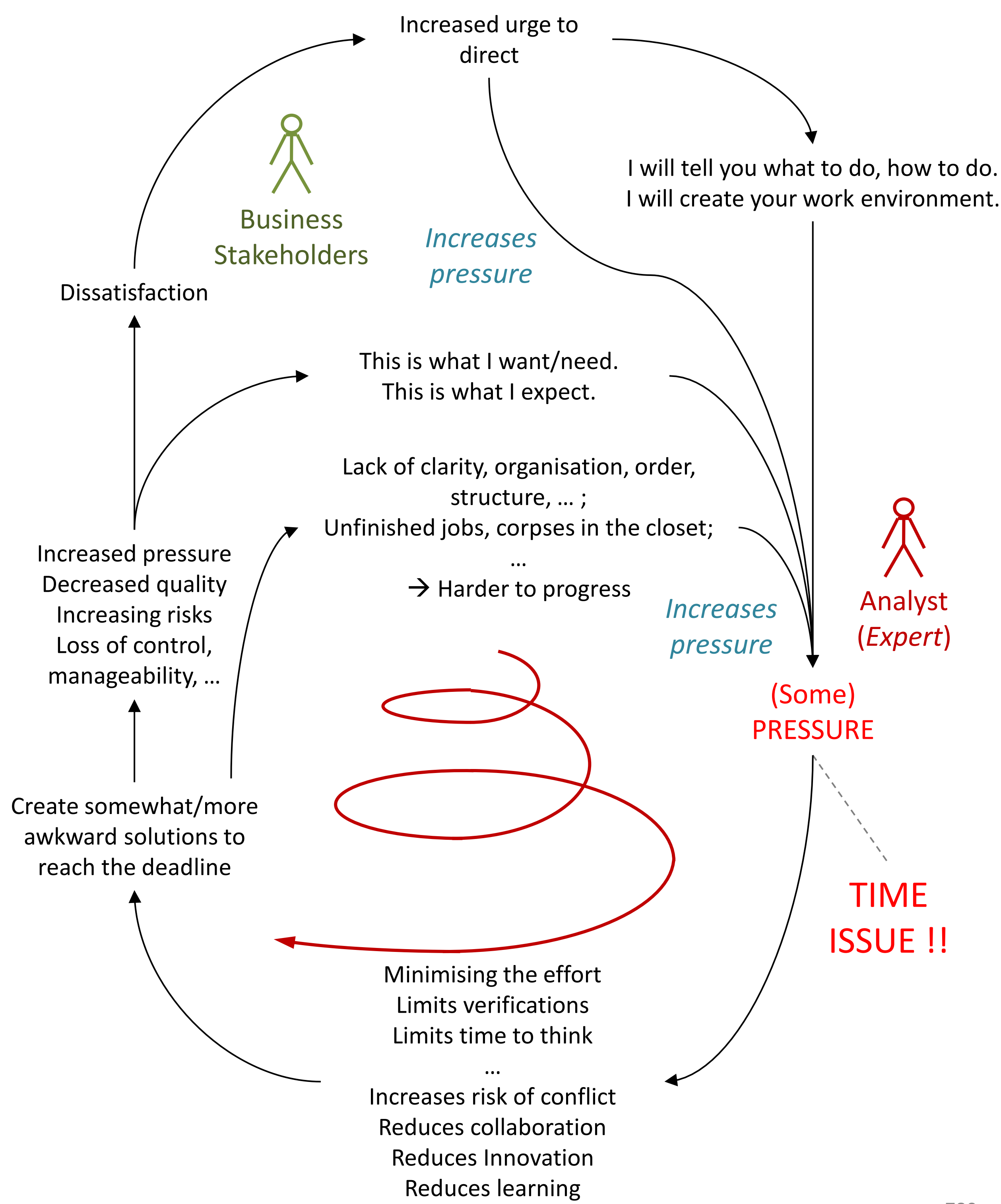


Causes: Part of the Analysis is performed by business people, by an inexperienced analyst or by developers; no verification; no alignment of expectations with delivered results; ….

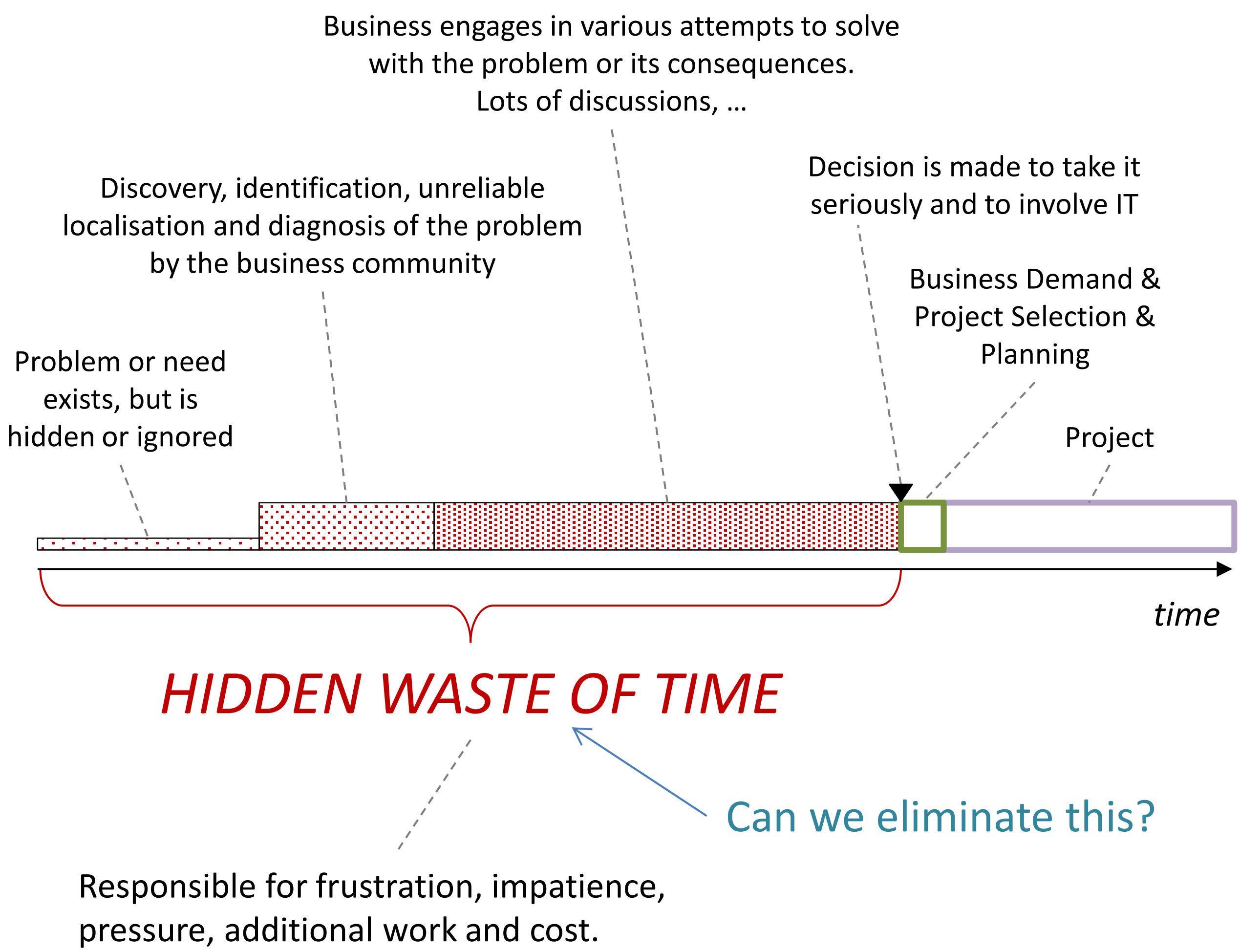
The effect of the "poor solution" shouldn't be ignored either.

15/04/2019

Deadly Spiral of Debt, Pressure and Lack of Quality



How to Speed Up Software Development



Since a lot of time has been wasted:

- Needs and problems had the time to exist, to evolve and to cost.
- Pressure is created on the project. Once the decisions made, once the demand is transferred then, suddenly, everything must go fast.
- While no guarantee that the demanded solution will solve the problem or even that the tackled problem is the right problem.

How to Speed Up Software Development (Answer)

1) CONTINUOUS ANALYSIS

to hunt for problems and improvement opportunities

- by analysing the implemented systems;
- by analysing goals, policies and plans
- and by continuously gathering ideas and complaints

2) Don’t design flawed solutions

The solutions designed today cause the problems of tomorrow. Information solutions must be designed by top professional analysts, architects and designers (particularly if system or solution is critical).

Try to do the right things right from the first time.

3) Have models, rules and principles matching the implemented systems

Never document the “As-Is”. It is the former “to-Be”

4) Use an architecture, components, services

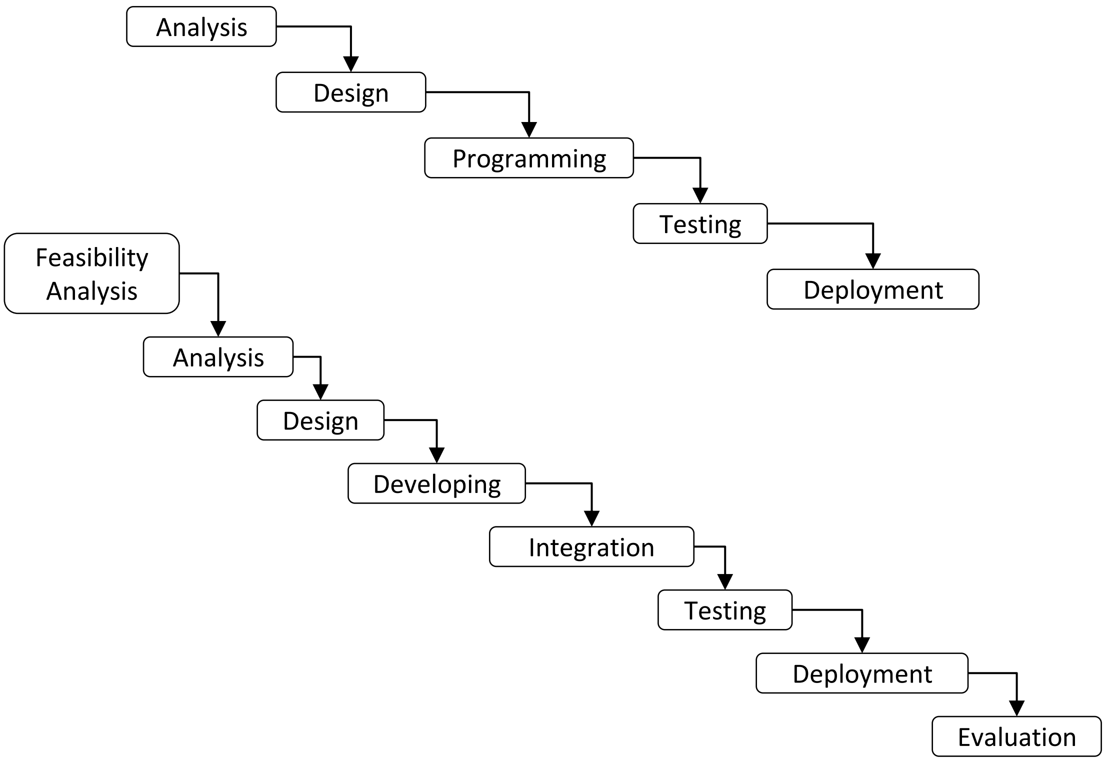
5) Design for Re-use

Wiser Practises

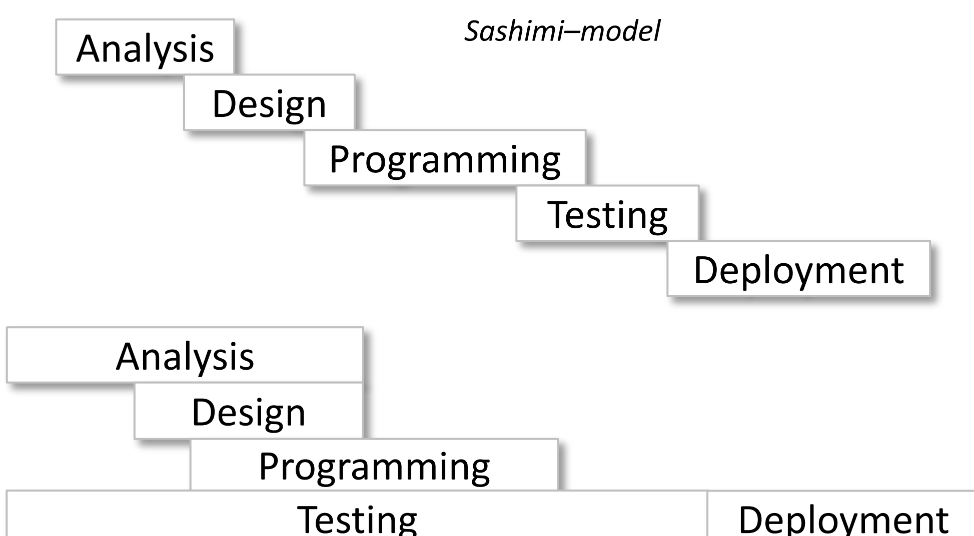
- Preferably linked to goal, outcome rather than to a defined solution
- Focuses on and maximisation of value creation
- Innovation
- Doing more the right and necessary thing and less responding to demands, wants, preferences
- Servant Leadership
- Structure and organisation
- Scalable
- Multi-disciplinary
- Collaborative
- Freedom not to follow rules, principles, structure, …
- Iterative
- Incremental
- Modularity in waterfall - phases or stages, releases, sub-projects, sub-tracks, …)
- Continuous investigation-driven over demand-driven
- Preference for proactivity over reactivity
- Righteousness, quality and steadiness over Speed and Deadlines
- Sustainable
- Take decisions as early as possible, but not before understanding
- Put risky, structuring and critical elements first, then most valuable, and then other aspects.
- Continuous Learning & Root Cause Analysis
- Planning and Analysis over testing and rework
- Predictive and Adaptive
- Holistic - including in time
- Top-down, bottom-up and bottom-top-down
- Understanding precedes Action - Know what you do before you do it
- Analysis-driven
- Model-based
- Integrated
- Feedback
- Flexible product over flexible process
- Component based and solution scalability when possible and useful
- Build stable systems – foundation, layers, agents, …
- Reuse
- Avoid solving symptomatic solutions
- Conscious execution - Know why you are doing something, why not, why this way and not the other way
- Situational Process Decisions - Adapt the process
- Testing during the whole project
- Remove waste - Don't do unnecessary work.

Elaborating the Basic SDLC

Adding Phases and Activities

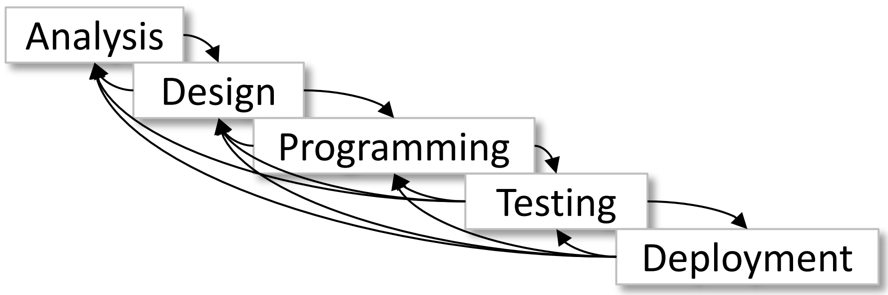


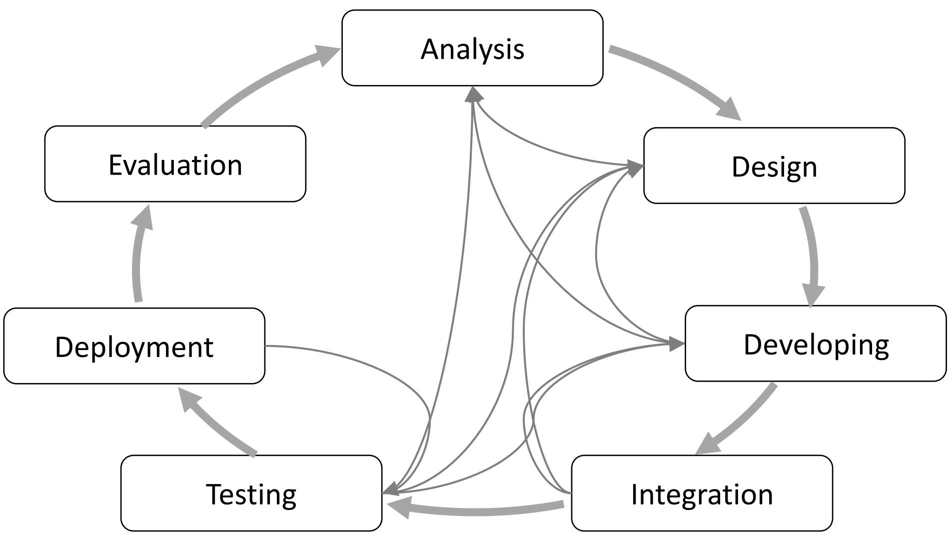
Overlapping



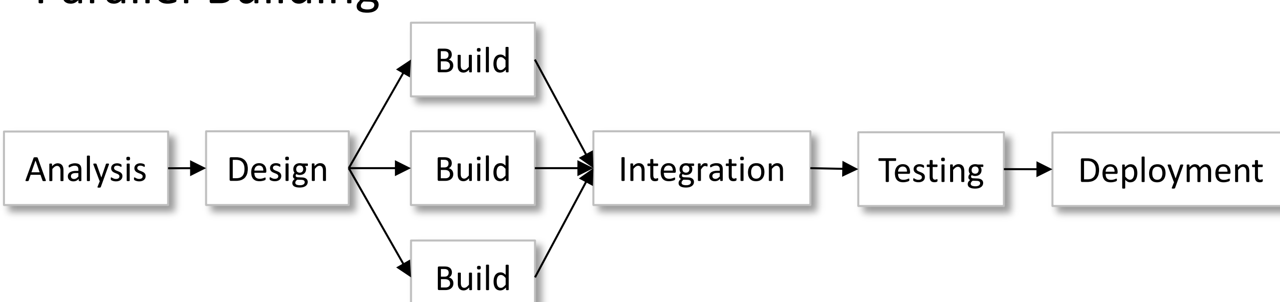
Elaborating the Basic SDLC

Iterations





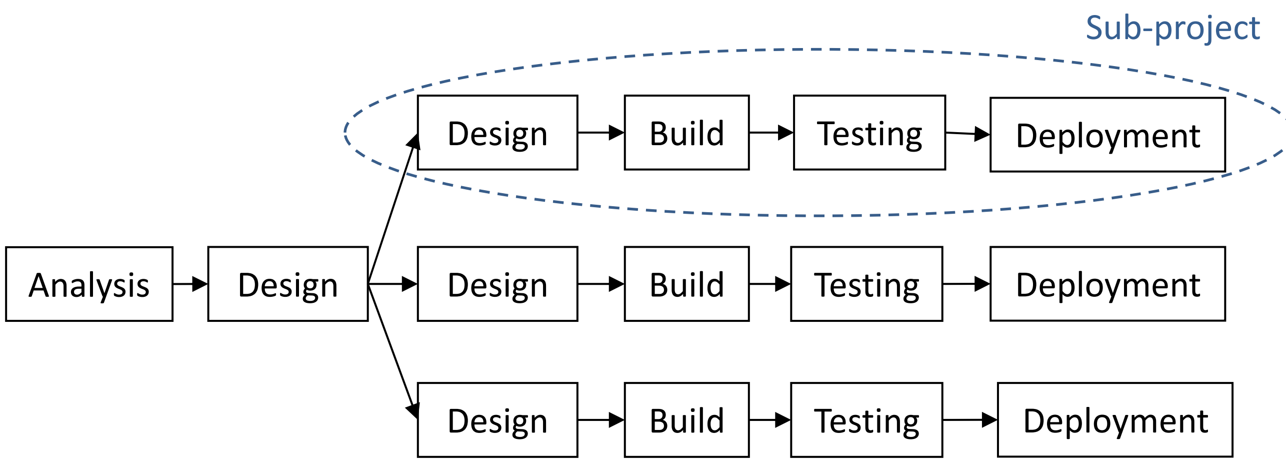
Parallel Building

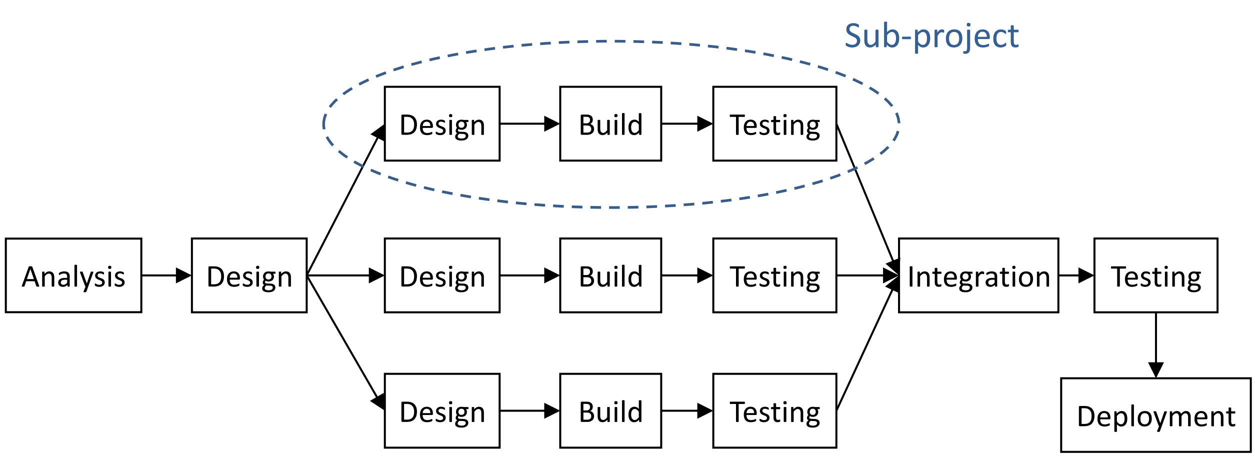


Elaborating the Basic SDLC

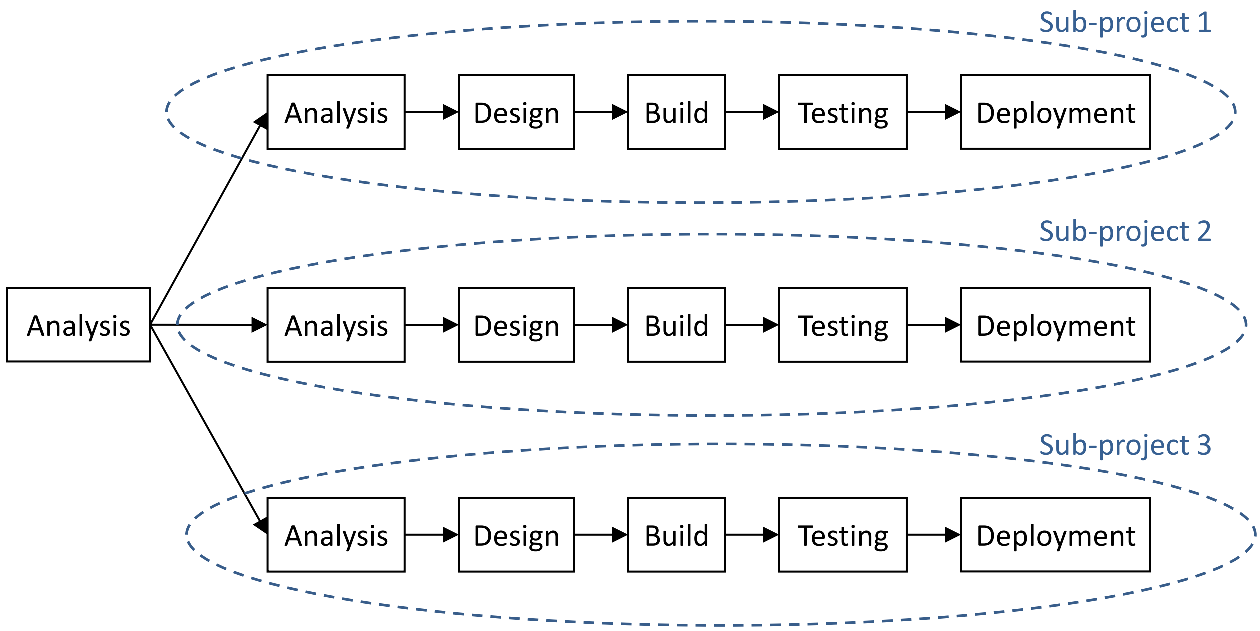
Phases used as Building Blocks

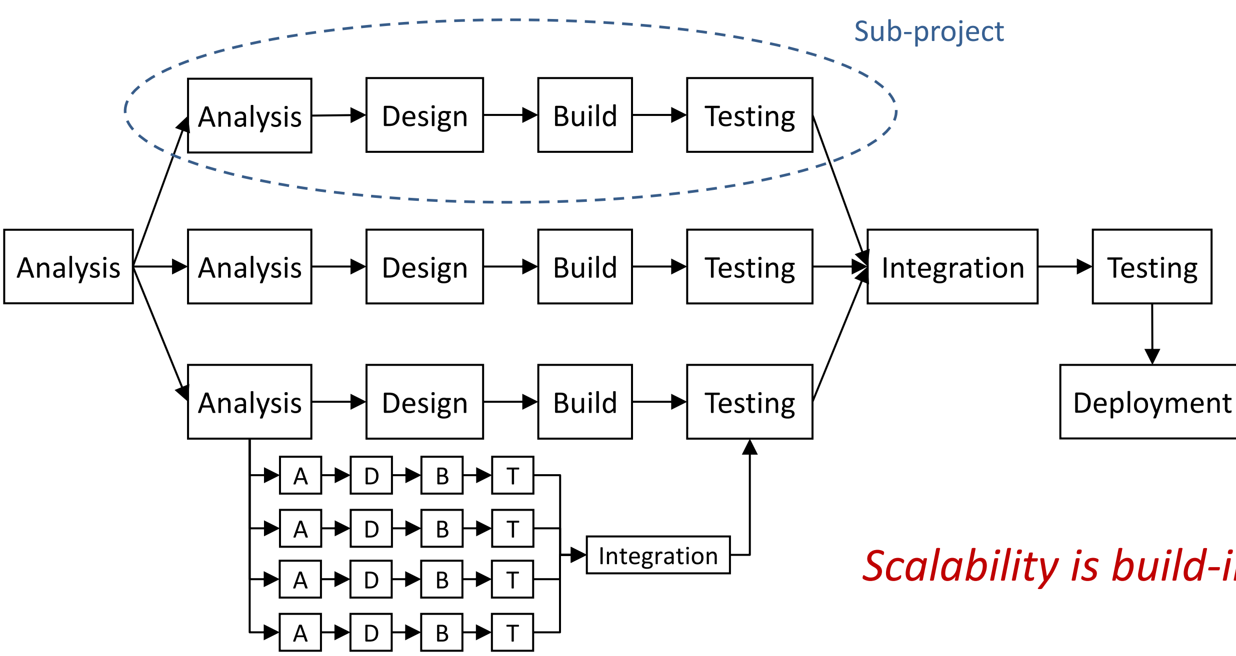
Parallel Development





Elaborating the Basic SDLC



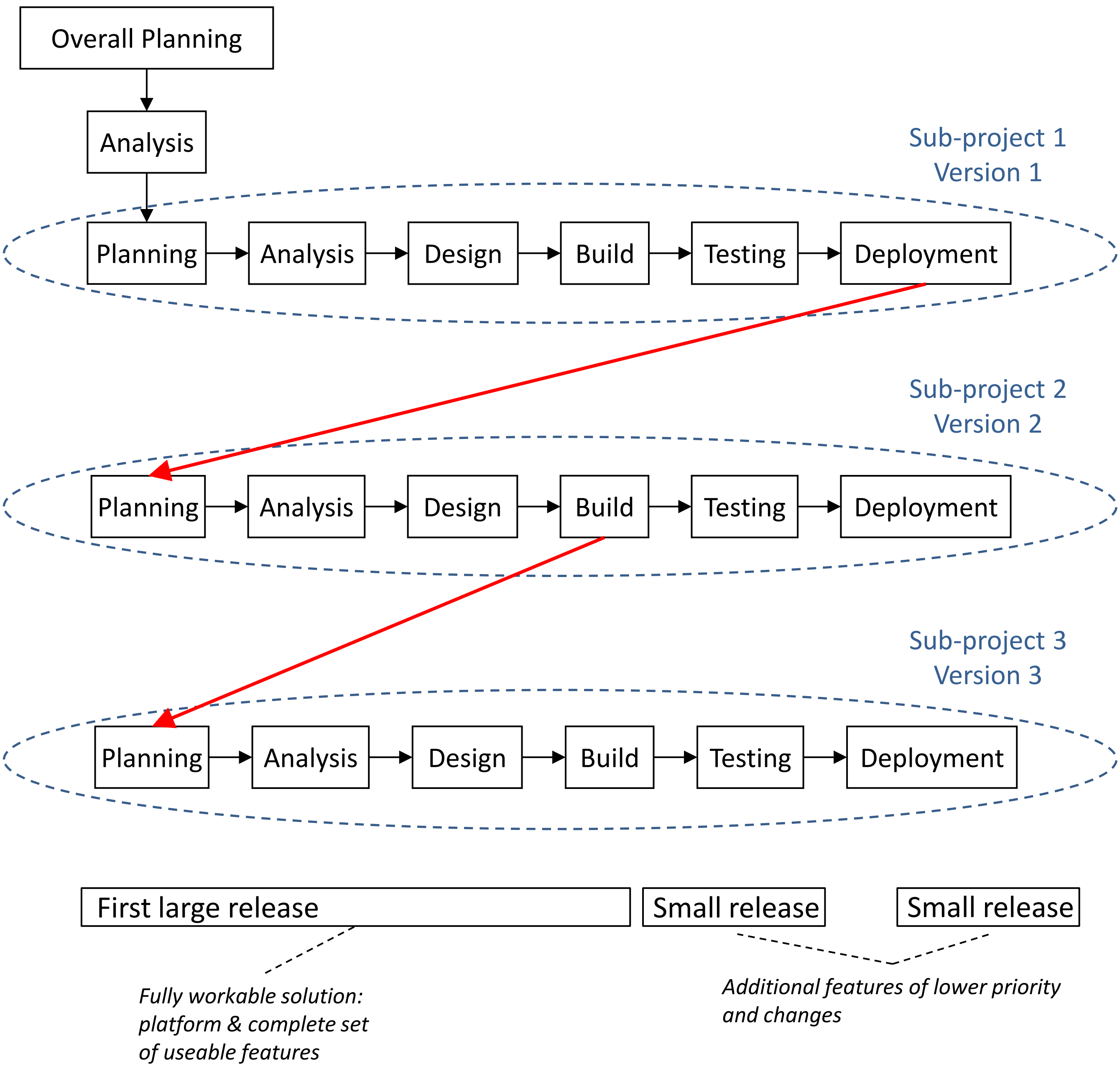


Scalability is build-in

Phases are like building blocks. They help to organise and manage projects, and to focus the attention without limiting the activities.

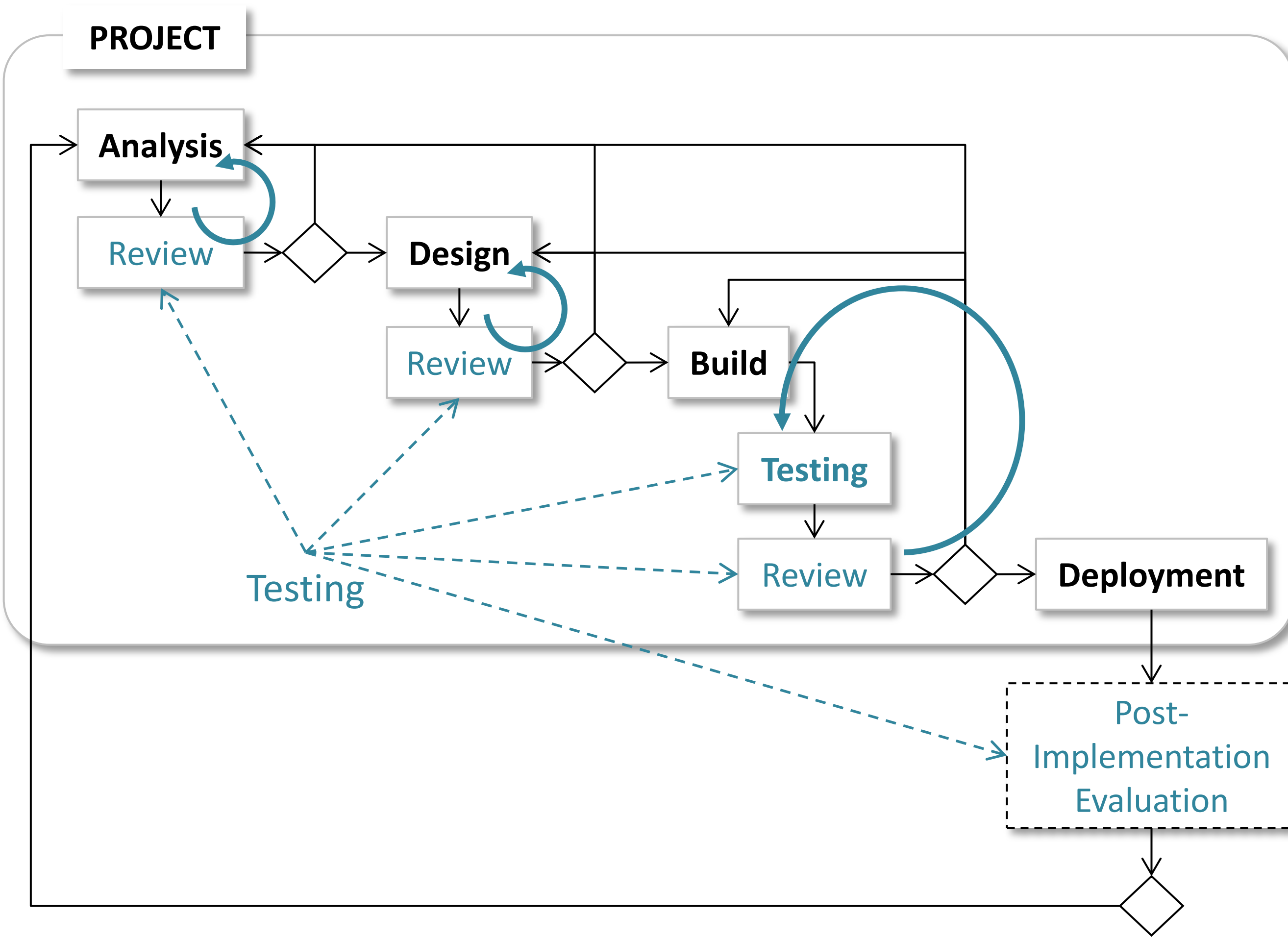
Elaborating the Basic SDLC

Phased Development



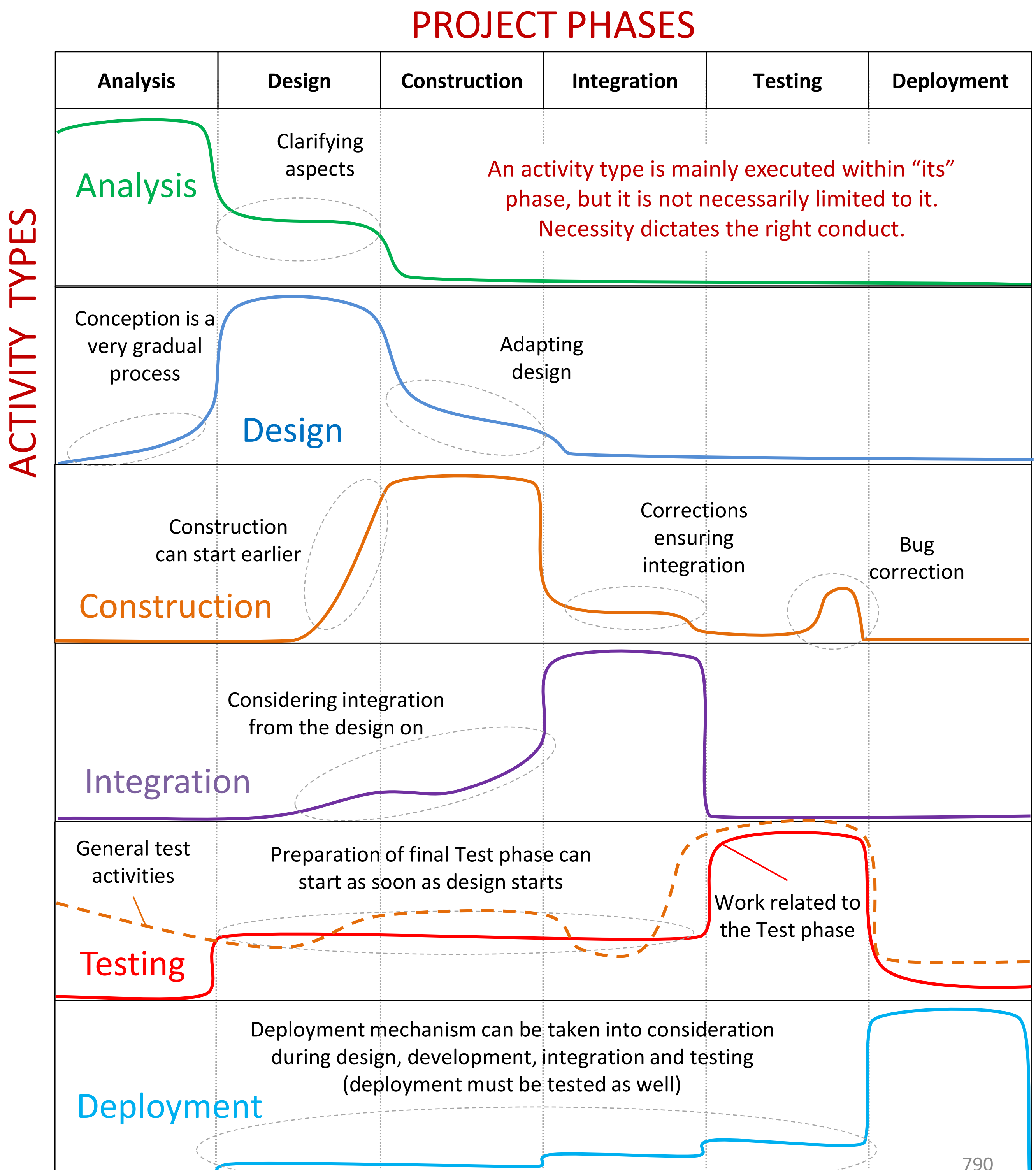
Elaborating the Basic SDLC

Feedback and Testing during the whole process

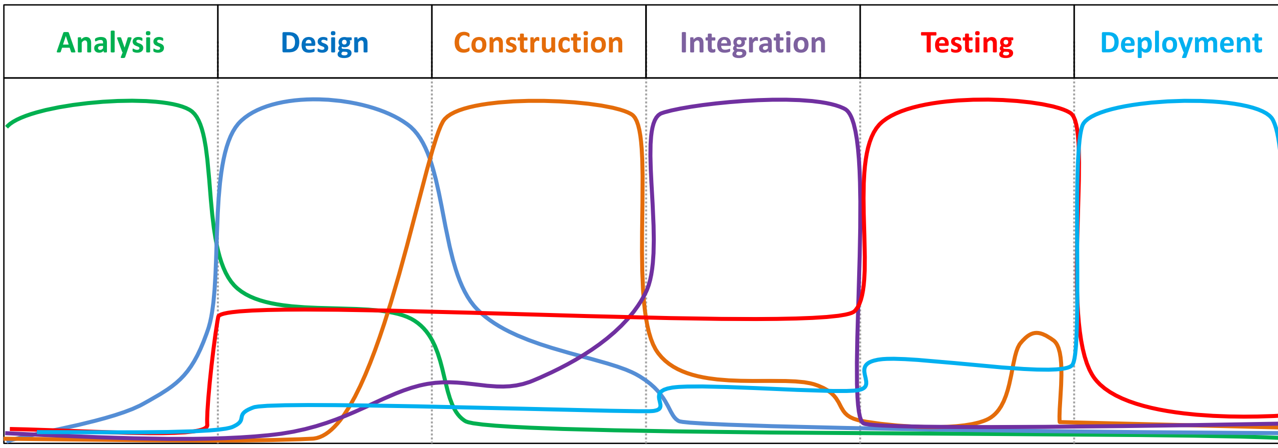


Flexibility in Basic SDLC 'Execution'

A possible execution of a the SDLC



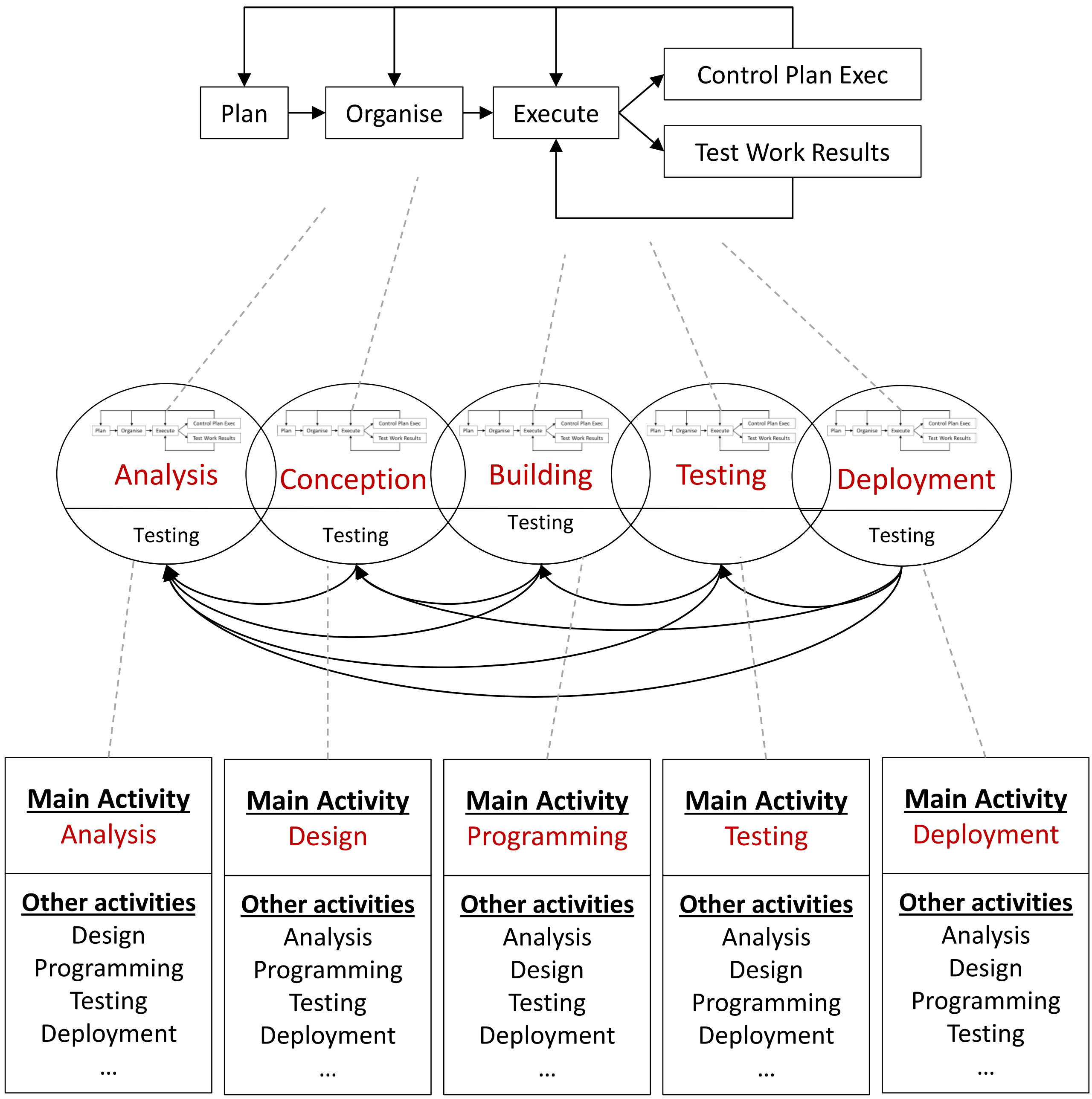
Overlap of Activities



Why tasks are normally executed with overlaps?

- The **mind thinks often ahead** on certain aspects or parts of the future product and on subsequent work. For example:
  - During the Analysis phase, the Analyst may already think on possible solutions (Design). (S)He can already prepare some sketches and models of the future solution.
  - Integration and testing have to be taken into account well before the actual project phase.
- Despite the effort, it happens that a task has **not be completed for 100%** or that the result is **not for 100% correct**.
- **Some parts may already be settled and ready for future work** to be started, while other parts still need additional work.
  - For example: Some parts of the design may be ready for construction while other parts still have to be further defined.
- There is **not always a clear border between two types of different activities**.
  - For example, integration and testing are also a matter of design.
- An **activity requires often specific activities like planning and preparation**. These activities may happen before the actual phase. Example: Writing test scenarios for the test phase can start once the Analysis phase is finished.

Elaborating the Basic SDLC



Note:

This represents one single track in a project showing a more flexible interpretation of the waterfall SDLC.

TARB is favourable to a continuous monitoring and analysis of the system. This leads to packages of changes which are then implemented in a project of variable duration (from a week or month to a year, longer?) depending on the size and priority of changes).

Prototyping

Types :

- Forms:

  Proof of Concept, mock-up screens, simulation, paper prototypes, computer animations, video, scripting language, …

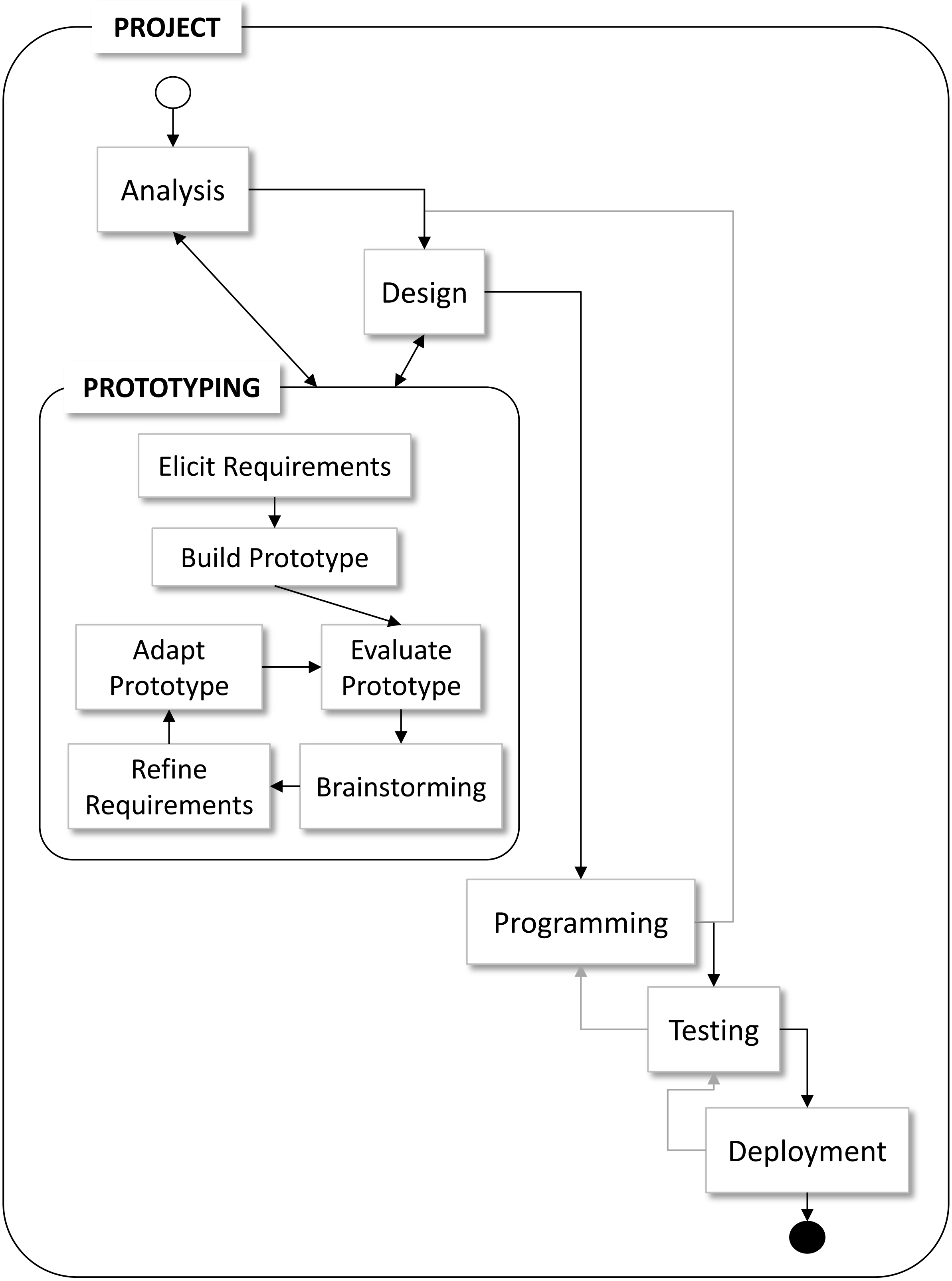
- Categories:

  discovery prototype, rapid prototypes, iterative prototype, developmental/evolutionary prototype (to be part of the final system), …

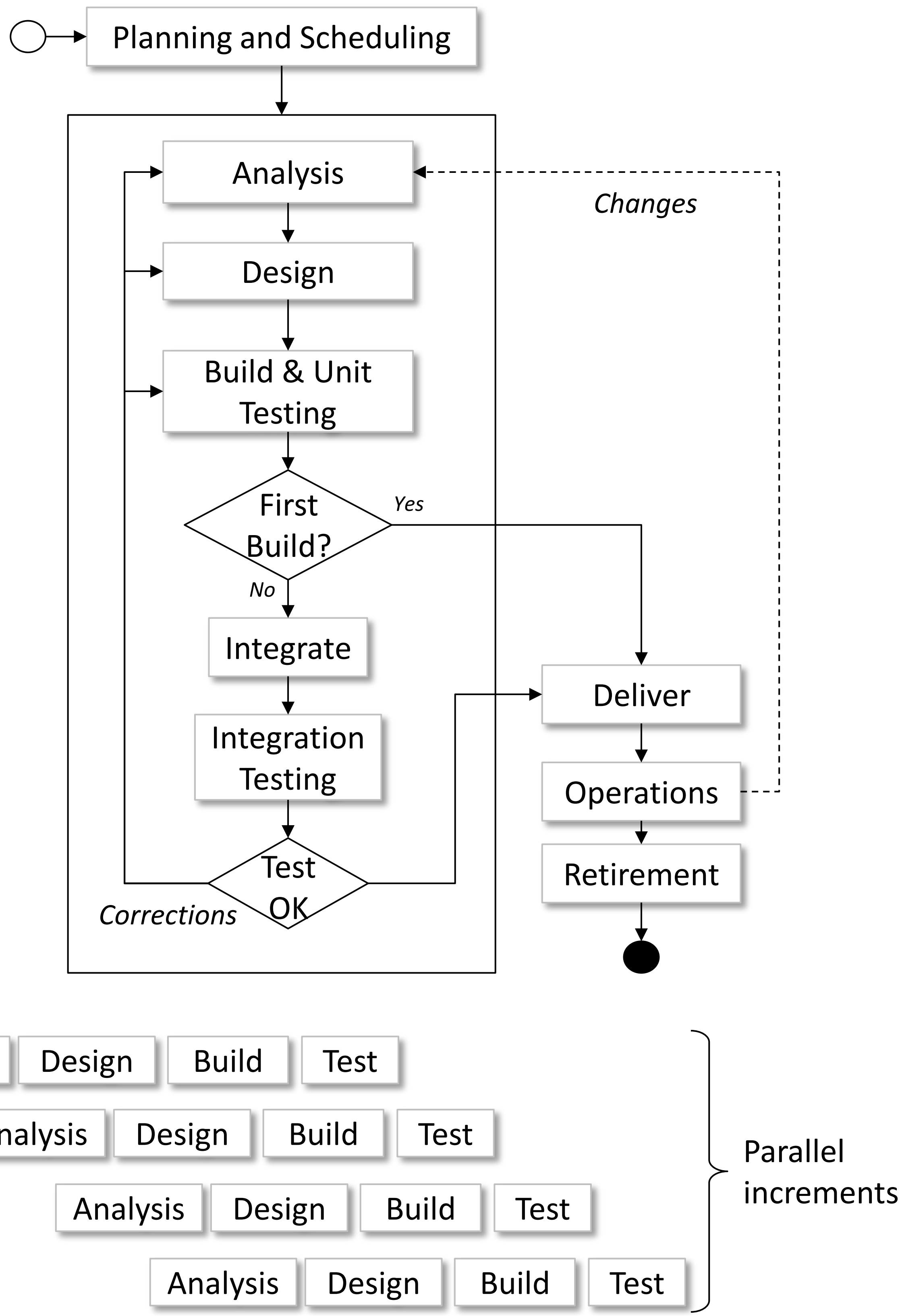
- Strategies:

  horizontal prototyping, vertical, task-oriented, scenario-based

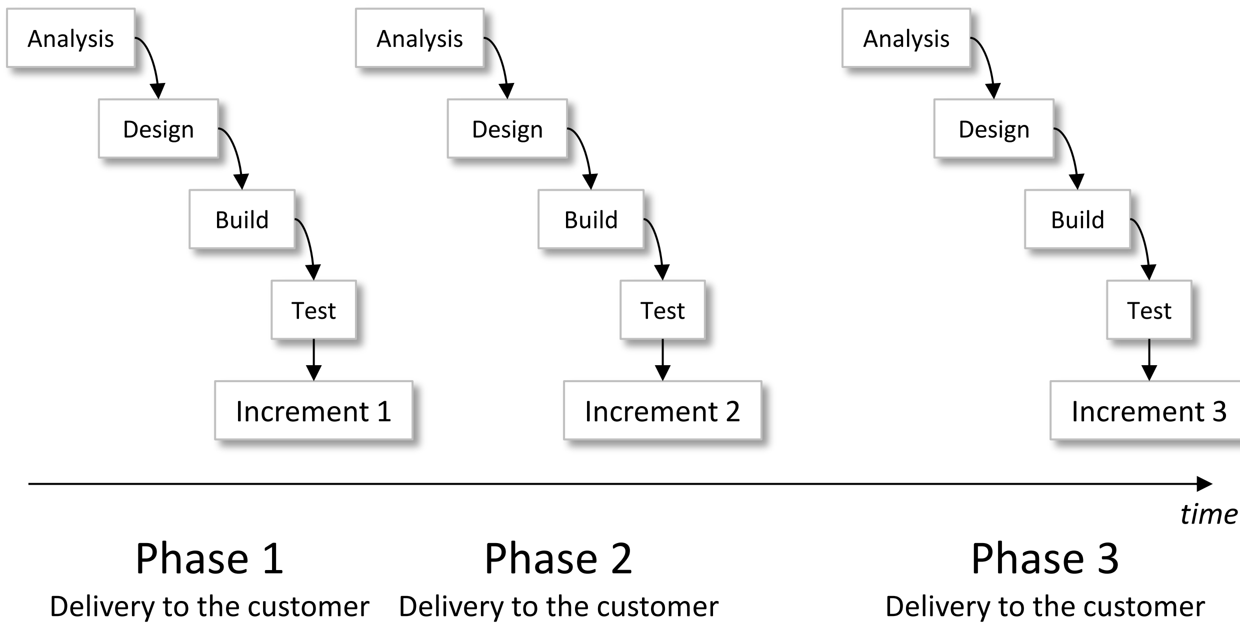
Prototyping in the Basic SDLC



Incremental Basic SDLC Model

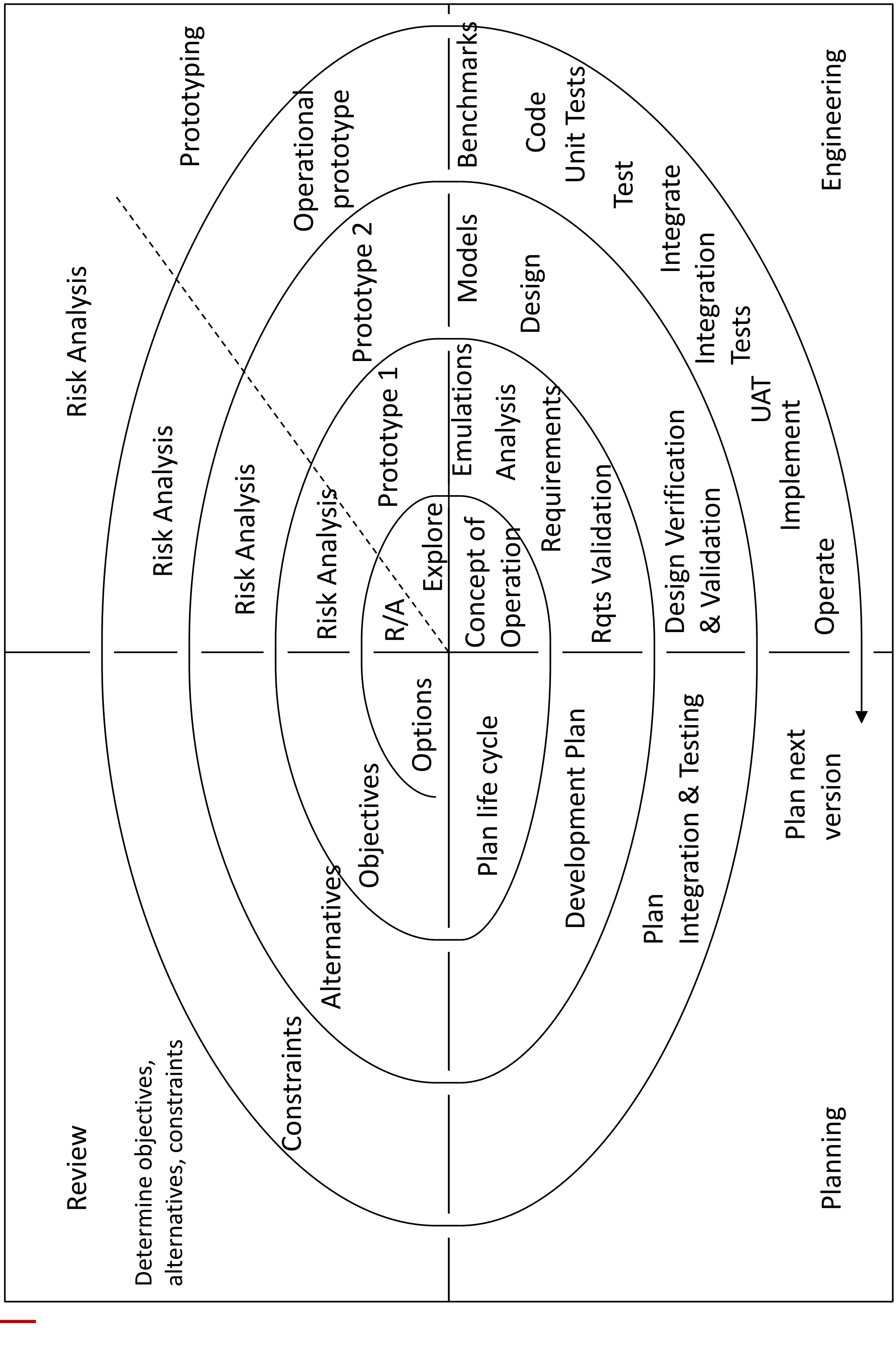


Incremental Basic SDLC Model

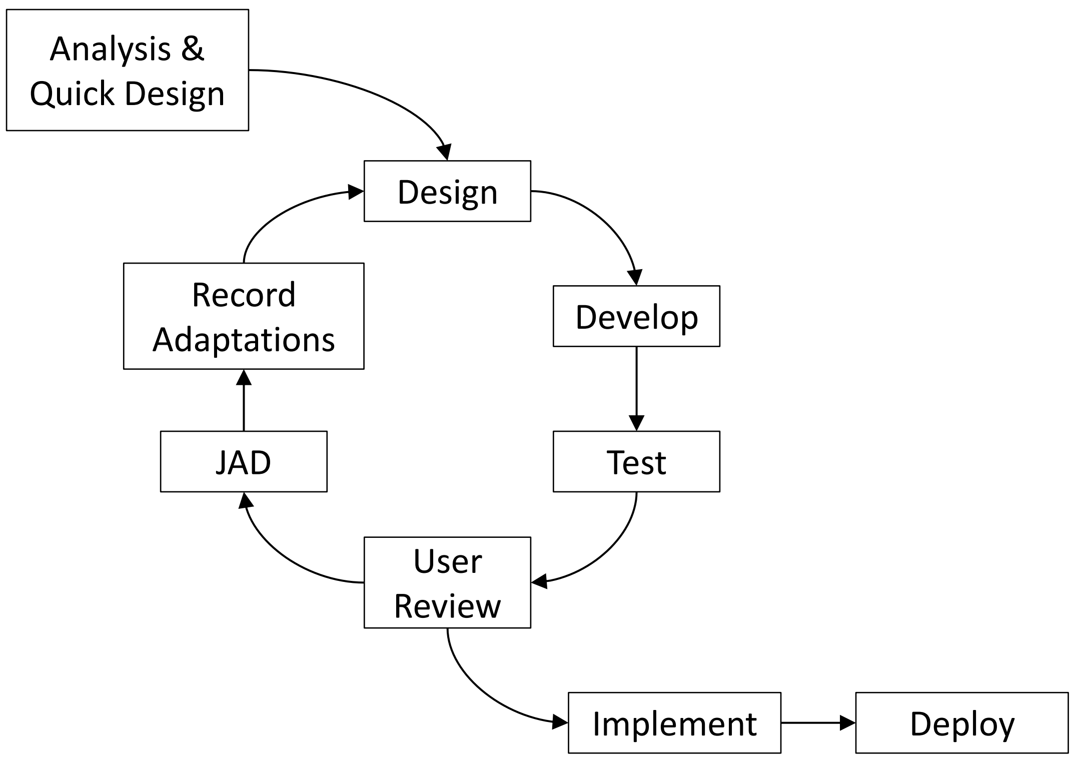


After each phase the customer has a workable system which is adapted and/or expanded in the future phases.

Spiral Model (Barry Boehm)



Rapid Application Development (RAD)



Other Types of Approaches

- Joint Application Design (JAD)
- Exploratory Programming
- Lean

- Developed in-house
- Turnkey
- Off-the shelf
- Contracted out - Offshore

Methodology

- Project Management Methodology
- Software Development Methodology
  - Analysis and Design Methodology
  - Software Integration Methodology
  - Software Testing Methodology
  - Data Migration Methodology
  - Software Deployment Methodology
  - …

METHODOLOGY?

- Based on **principles**
- Based on a **<u>set of</u>** common/best(?)-**practices, methods, …**
- **Adaptable** process
  - One-size-fits-all methodologies don't exist
  - Ready-to-use methodologies don't exist !!
  - A Methodology ≠ Procedure !!

    (can't be executed like a procedure)

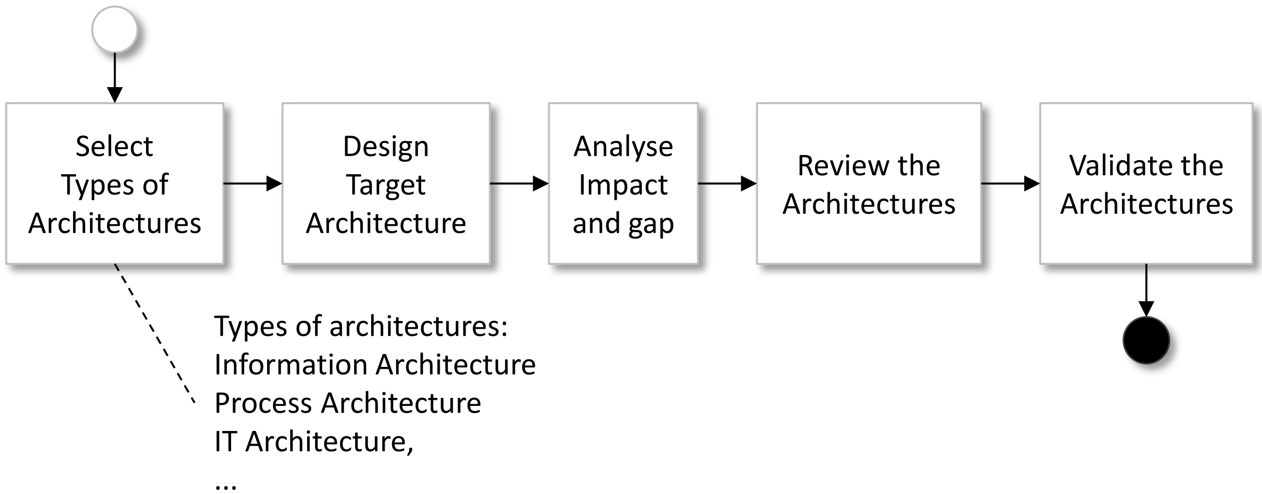
Traditional Main Processes

30/10/2018

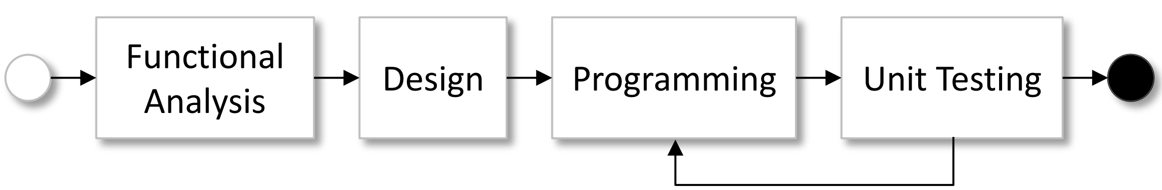
Program / Project Portfolio Mngmt	Project Proposal	Project Evaluation	Project Selection	Project Prioritisation	Project Planning	Project Authorisation	Post-implementation Product Evaluation
Project Mngmt	Project Launch	Initial Planning	Project Set Up	Project Planning	Guiding and Managing the Project Execution	Project Evaluation	Project Closure
Business Analysis	Enterprise Analysis	Business Analysis Planning and Monitoring	Reqs. Elicitation	Reqs Analysis	Requirements Management and Communication	Solution Assessment and Validation	
Architecture	Select Architecture / Architecture Types	Design Target Architectures	Analyse impact Architectures	Perform Gap Analysis	Review and Validate Architecture		
Software Development	Functional Analysis	Design	Programming & Unit Testing				
Environment Management	Environment Planning	Environment Installation	Environment Testing				
Testing	Test Preparation	Test Planning	Test Set Up	Test Execution	Test Evaluation	Classification and Prioritisation of Test Results	
Data Migration	Plan Data Migration	Design Migration Process	Develop Data Quality Control & Migration programs	Test Programs	Migrate Data	Test Data	
Deployment	Planning Implementation	Implementation	Configuration	Data Migration	Planning Implementation	Deployment	
Training	Assess Training Needs	Plan Training	Prepare Training	Provide Training	Evaluate Training Results		
Documentation	Plan Documentation	Structure Documentation	Write Documentation	Test /Review Documentation	Release Documentation	Assess Documentation	

Process: Architecture / Software Development

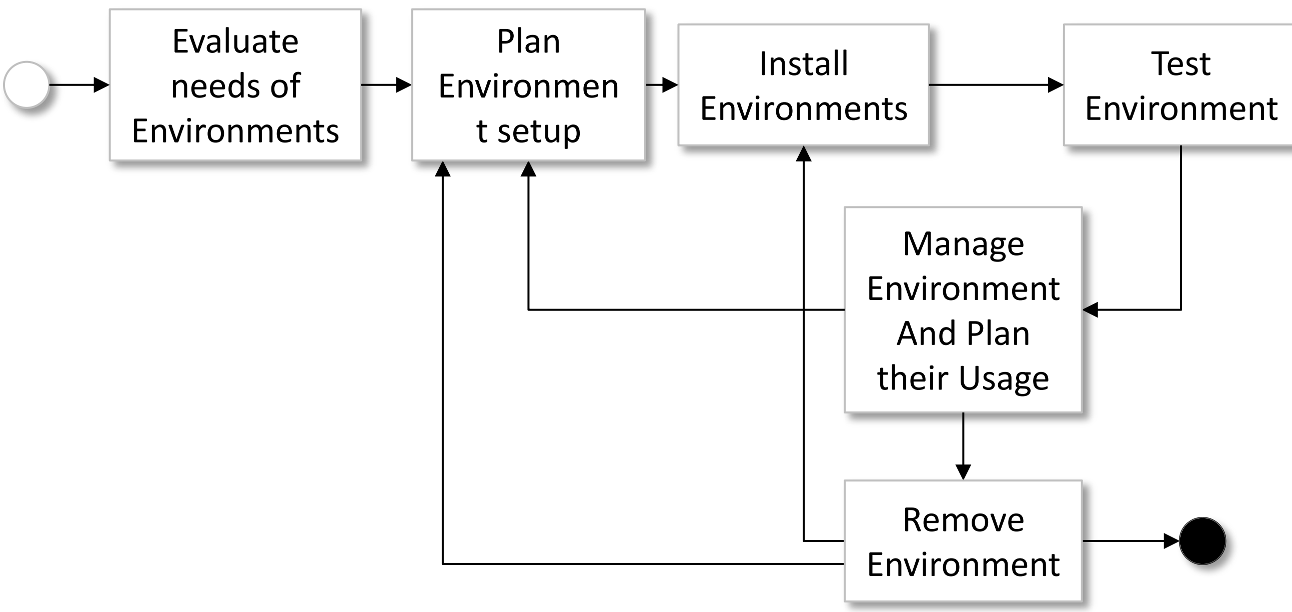
ARCHITECTURE



SOFTWARE DEVELOPMENT



Process: Environments

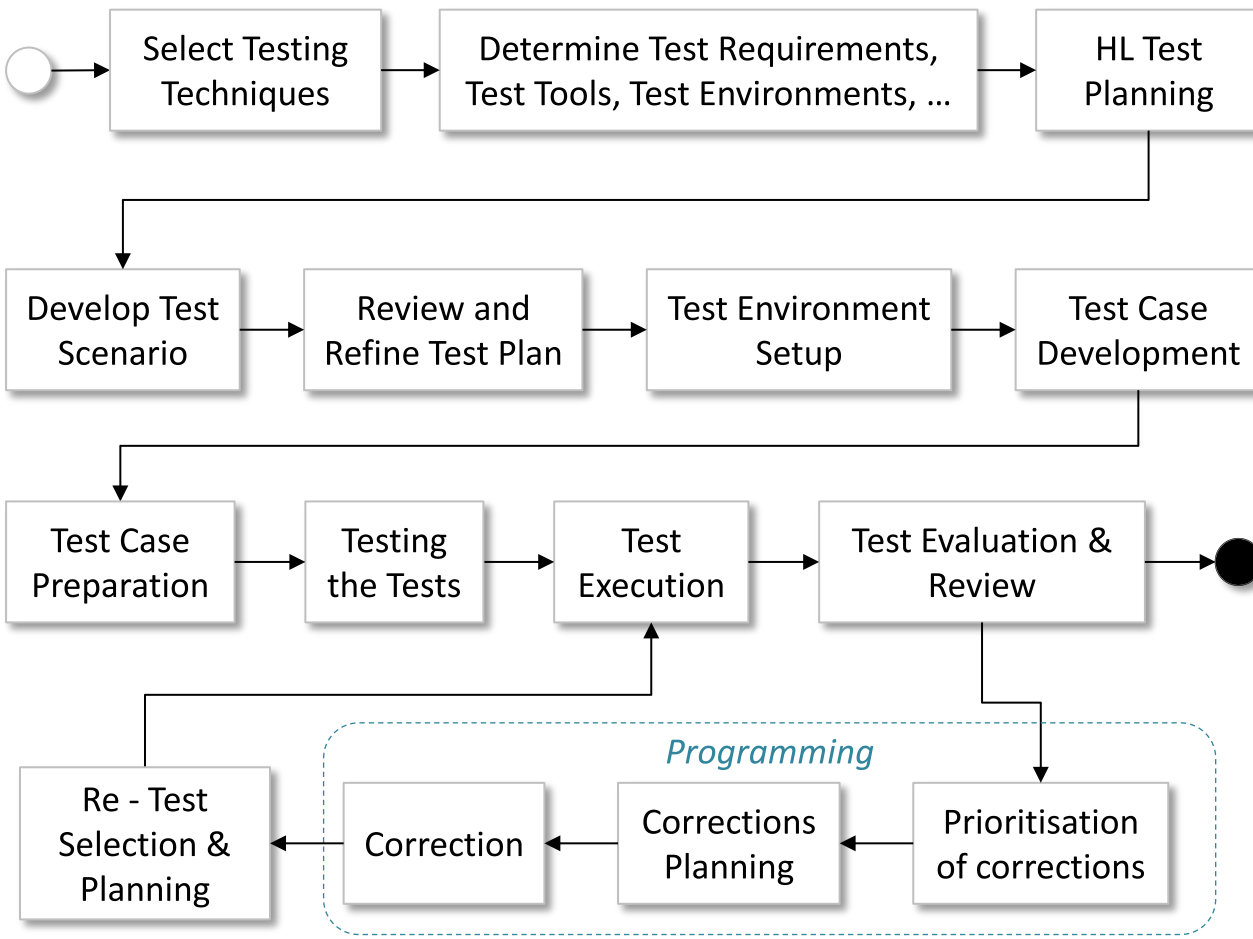


Different Types of Environments

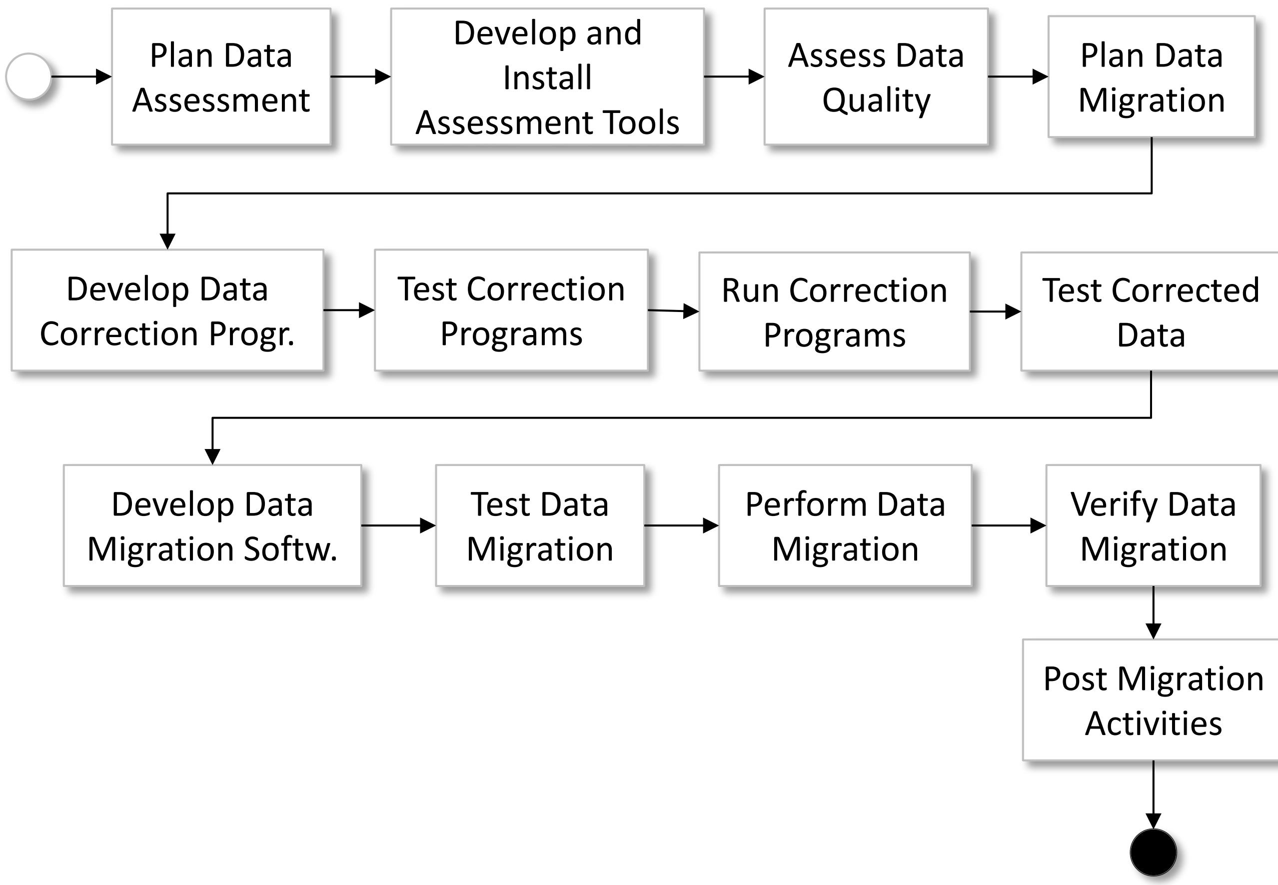
- Development Environment
- Test Environment (examples: load tests, stress tests, .. Each requiring a specific environment)
- Training Environment
- Sandbox Environment
- UAT Environment
- Stage Environment
- Production Environment
- Disaster Recovery Platform

Some environments may be duplicated when dealing with different releases at a time.

Process: Testing
Software Testing LifeCycle(STLC)

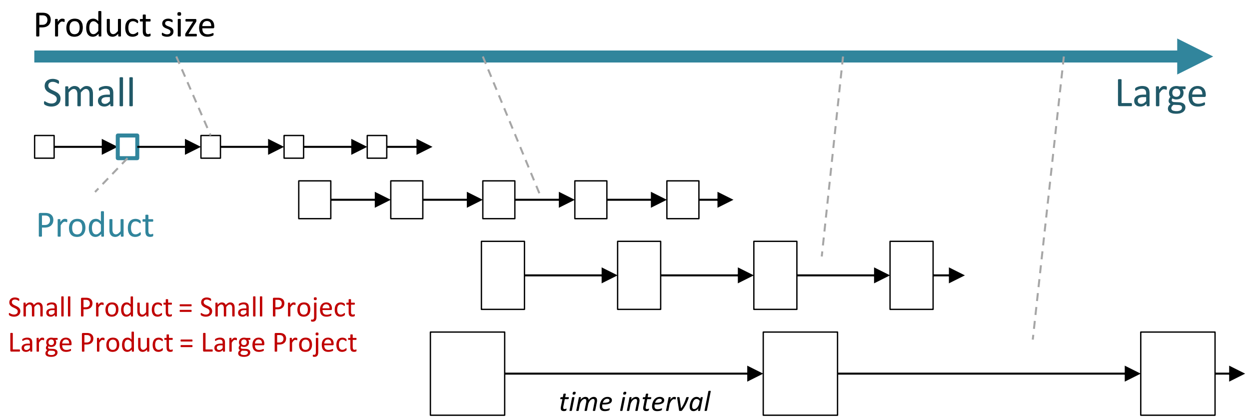


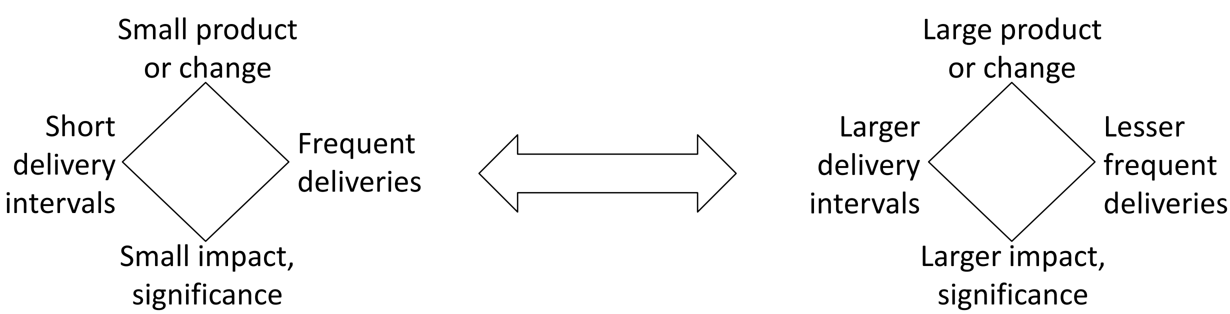
Process: Data Migration



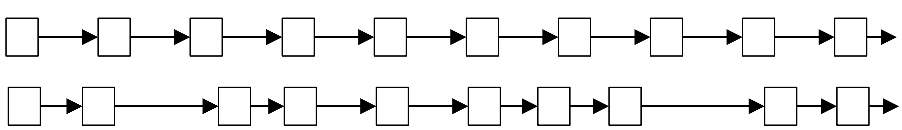
Product & Project Size

Size – Time – Deliveries - Significance

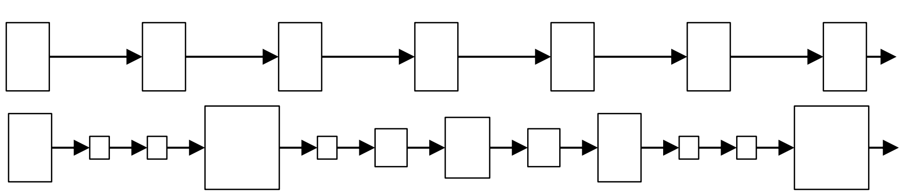




Regular / Irregular Intervals



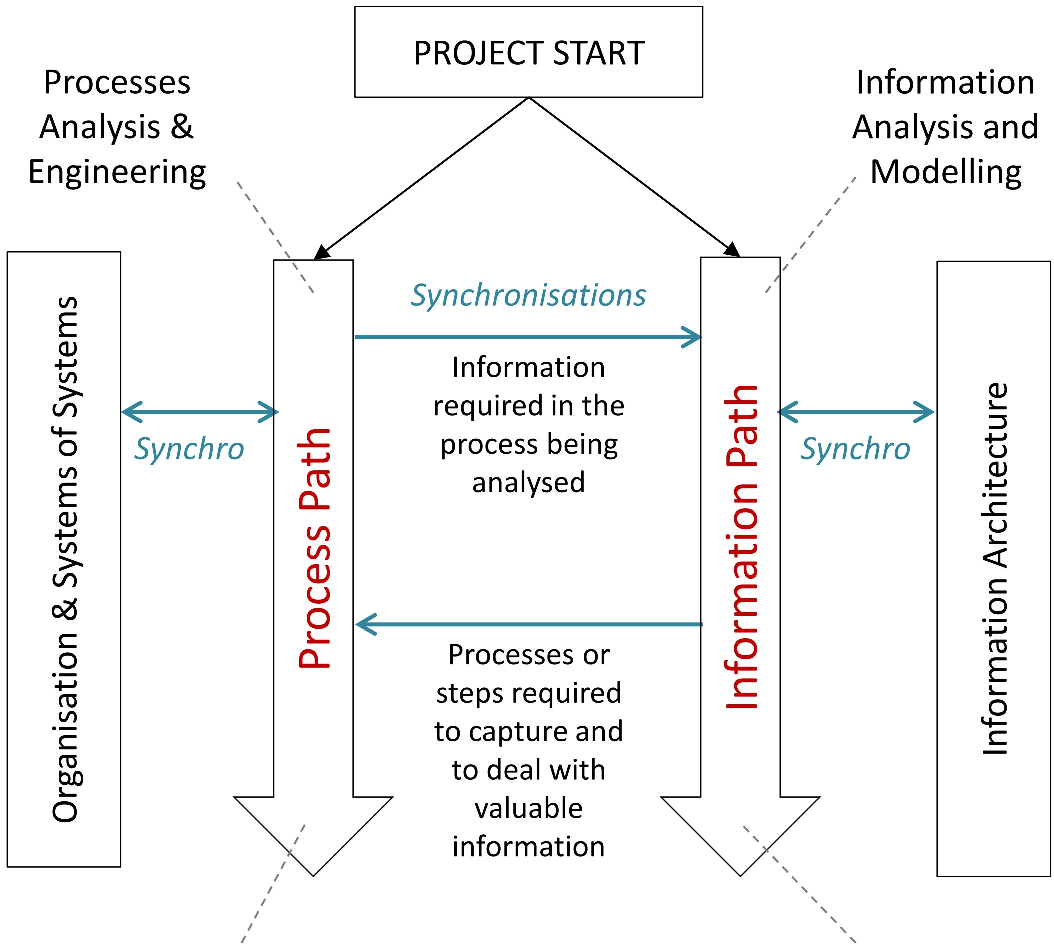
Similar Size – Variable Size



Typically this depends of

- Environment
- Product, solution, change
- Urgency of the product

Process & Information Analysis



- Process Models
- Creation of value through information transformation

- Inventory of information entities
- Information Models
- **Increases STABILITY in the project !!**
- Creation of value through information as a resource

Notes:

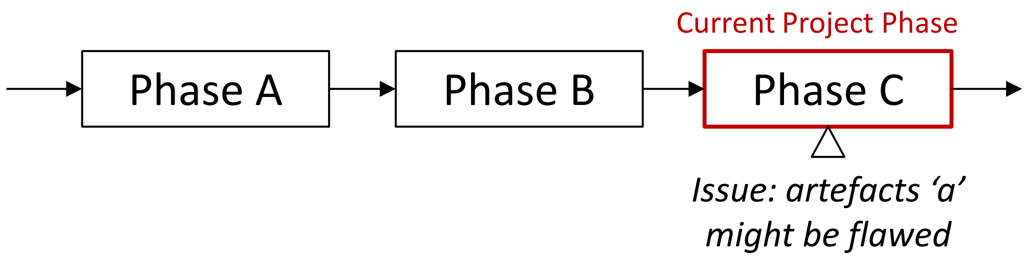
Information Path: Defining what information is required and stored. Modelling this information.

Process Path: Identifying the required processes and engineering them.

Synchronisation: Processes need information. The synchronisation makes sure this information is foreseen in the information models, databases and other information artefacts.

Information has value. Interesting information has to be captured and processed. Each identified information entity will thus have to be captured and transformed by processes.

Flawed Work in Previous Phase



Phase A: Mainly activities of type ‘a’, producing artefacts ‘a’

Phase B: Mainly activities of type ‘b’ producing artefacts ‘b’

Problem: Artefacts ‘a’ resulting from phase A are unclear. They don’t take some aspects into account. There might be something wrong or incomplete.

1) Keep the project in phase C
2) Recheck the concerned problem area, rethink it
3) Adapt the artefacts ‘a’
4) Check the broader impact of the adaptation
5) Validate artefacts ‘a’, with focus on changed and impacted area. Rest of the artefacts were unchanged. Review and validation should go swiftly.
6) Repeat for artefacts ‘b’

Difficult? Strange? Developers do this all the time in waterfall-approaches

Bugs found during the test phase are corrected by programming activities without having to move the whole project back to “programming phase”. Only the corrected software features are retested before the software code gets clearance to be released in production. Sometimes regression tests are required.

This same process can be applied to analysis, design, architecture, …

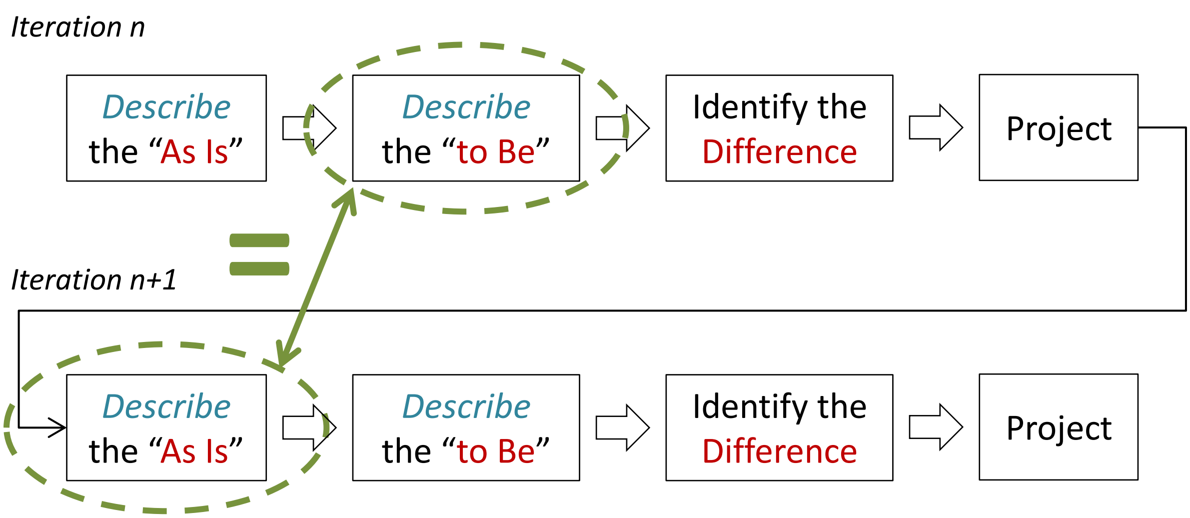
Sufficient verification and testing has to be implemented during the whole course of the project. Often, a flaw may already be detected in the next phase.

If a previous phase has been very badly executed, it might be necessary to redo it. This is a drastic decision.

AS IS – TO BE

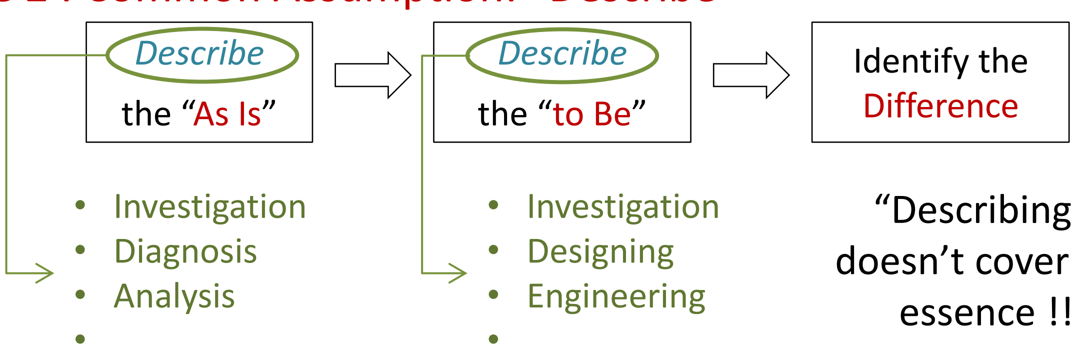
Traditional Approach

Issue 1 : To Be = As Is



- Doing 2x the same job is a waste of time and resources.
- If former "to Be" is different from present "As Is", then there is a problem. What happened ?
- Use former Analysis and Design artefacts to think and conceive.

Issue 2 : Common Assumption: "Describe"

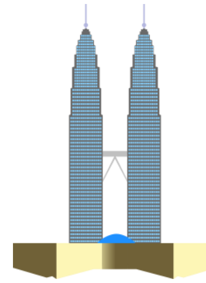


"Describing "
doesn't cover the
essence !!

“Scalability” in Methodologies

Building
a shed

Building
a house



Building
a skyscraper

Building a city

Can the same philosophy and methodology be used to build these different projects? Why not?

Scalable Methodology?

Each initiative of different orders of magnitude faces new types of challenges.

- Scalability (managing several and/or larger teams)
- World view adapted to the new challenge
- Awareness of new types of risks and issues that may be met
- Awareness of new types of aspects to be considered
- Ability to enrich methodology with new activities, methods, techniques, solutions, …
- Additional customer and engineering knowledge areas, disciplines and skills

Notes

In order to devise an approach or a methodology to deal with a smaller, easier endeavours, a simpler belief system and limited vision suffices. In that case, it can be suitable for smaller initiatives, but won’t suit the larger and more demanding initiatives. The reason is that many principles, issues and aspects haven’t been taken into account in the approach or methodology for a smaller initiative.

It’s easier to downscale a methodology than to upscale it.

Developing Information Systems requires a different approach than developing a collection of features. Similarly, developing **enterprise software systems** requires a different approach and thinking than developing **consumer software applications**.

Creating Order Out of Chaos

A few strategies and tactics

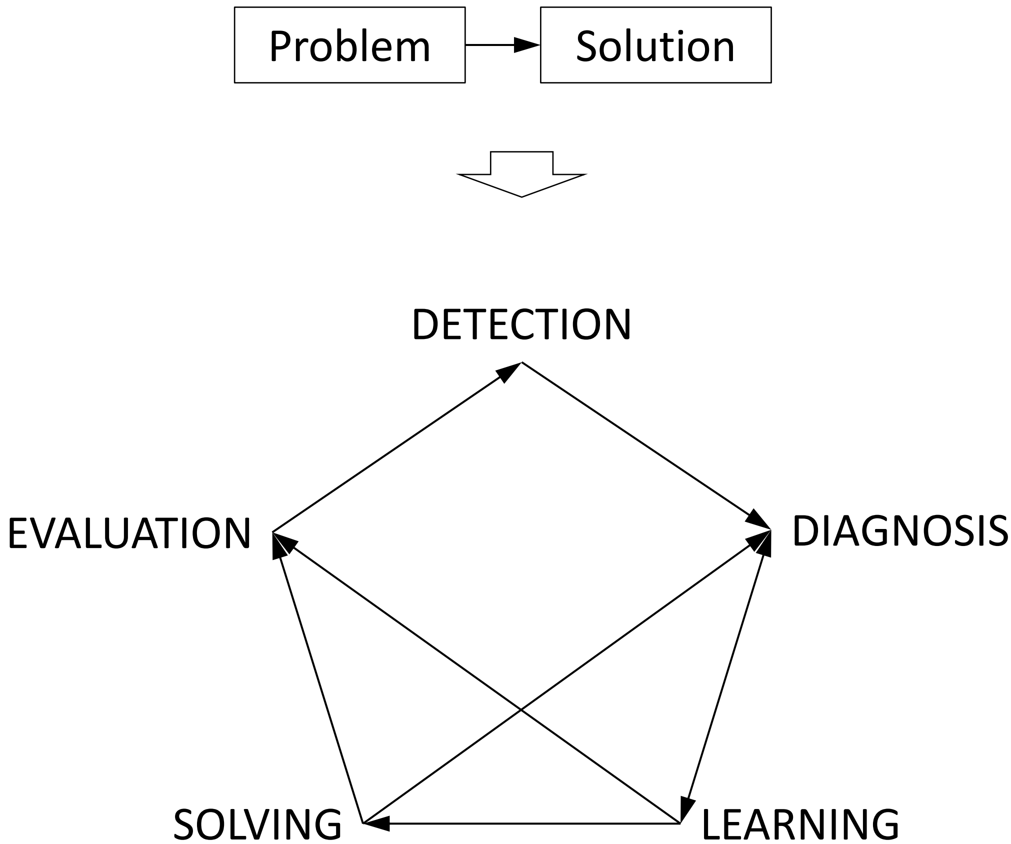
- Avoid first creating more chaos
- Avoid first to continue to allow bad input
- Identify the garbage and remove it
- Map what is known and gain understanding by further analysis and mapping
- Work follow-the-flow, top down or from fundament to what's built on top (bottom-up)
- Separate what's good and in order from what's bad. Protect what's good.
- Identify areas, clean up area by area (or system by system, process, by process, DB by DB, …)

Avoiding creating chaos

- Put in controls
- Build upon truth and understanding of reality
- Think of consequences, impacts, ..
- Is the result an increase in order or complexity (hiding complexity also increases complexity) or increase of order and clarity.
- Consider a decision, an action, a behaviour, an exception, an issue, an event, a project, anything and imagine it to happen 1000x, or more. If order is maintained, then it is fine. It the expected result is a dysfunctioning, imbalance, waste or chaos, then it is a bad practice that shouldn't happen or happen with prudence and sparsely.

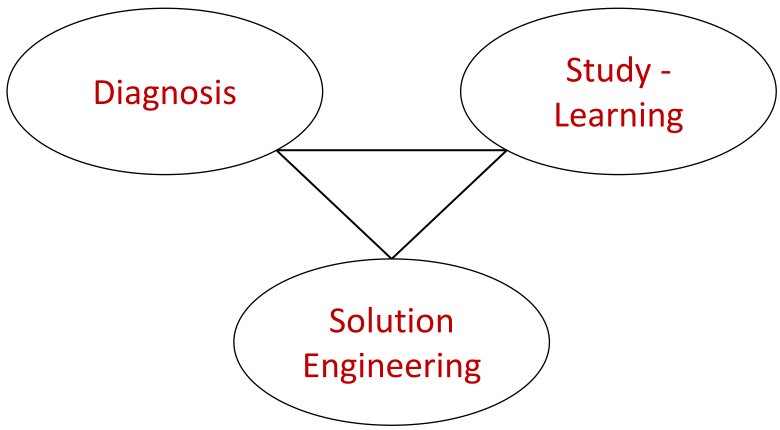
- ANALYSIS -

Key Elements of Analysis



Key Elements of Analysis

Three Key-activities of the Analysis



All three
- are equally important
- must be performed by a professional Analyst

A demand, requirements, an analysis or a solution outline not resulting from these activities performed by a professional Analyst, should be considered as unreliable.

Building upon it is building on quicksand.

Key Activities in Analysis

- Learning the systems, processes, structures and their environment.
- Diagnosis: Identify gaps, problems, needs, obstacles, issues, opportunities
- Align demands, intentions, expectations with the NECESSITY

It is not about what people wants (“not mainly”, “not always”, ... ; What people want does not always solve the problem or contribute positively to the whole organisation).

Systems Analysis is not a discipline that aims to please people, but to conceive systems, structure, processes to solve problems.

The alignment of the expectations with the necessity is important in order to create motivation, aligned collaboration and to avoid disillusion.

- Align conflicting interests, demands, priorities, rules, …
- Conceive a solution
- Get consensus about the solution

Analysis should be ideally) right and complete. Usually, a fairly right and fairly complete works also.

But an Analysis that aims to solve the wrong problem or which is insufficiently based on the reality, on the truth, like superficial insight, is likely to do more harm than good.

Needs Analysis

Cause of the need, driver, links with other needs, goals, objectives

- Need
- Want, desire
- Expectation
- Intention
- Obligation
- Goal, objective

- Non-essential
- Important
- Vital, critical

- Unknown, unidentified
- Known, identified

- Unarticulated
- Articulated

- Not understood, wrongly understood
- Partially, vaguely understood, somewhat unclear
- Understood, clear

- Justified
- Partially justified
- Unjustified

- One-shot
- Some occurrences
- Many occurrences

- Beneficial to a part
- Beneficial to the whole

- Uncertain
- Stable
- Variable

- Short term
- Long term

- Local
- Global

Needs Analysis

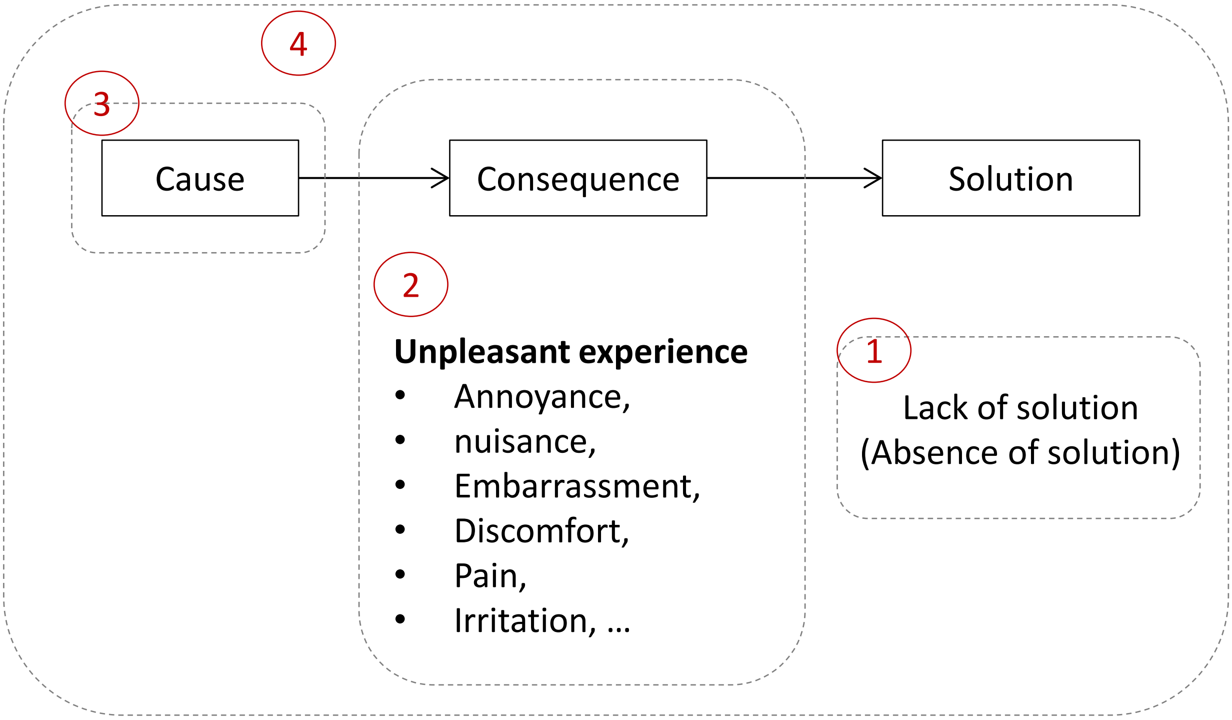
	NEED	SOLUTION
"I need a drill"	Drill	Drill
Why?		
"I need to make a hole in the wall"	A hole	Anything that makes a hole
Why?		
"I want to hang a painting on the wall"	Hanging an painting	Any mechanism that fixes a painting on the wall
Why?		
"To make to room cosy in order to relax"	To relax	Anything for relaxation
Why?		
"I am stressed."	Not being stressed	Anything to decrease stress
What stresses you ?		
Work? Relationship? Family? Conflicts? Problems? Uncertainty? …	Not being stressed	Remove the real causes of the stress

Questioning can continue to get to the deeper cause

Wrong solutions:	Drill, hole, painting, making a room cosy, relax
Bad diagnosis:	Stress (=consequence)
Right diagnosis:	Cause of stress

More 'needs' and solutions appear.

What is the Problem?



Is a problem …

1) the lack of something, the missing solution, …

   “we need a database”; “we need a system”; “we must have (object, product, solution>”

2) getting rid of the unpleasant experience, unpleasant feeling, irritation, inability, …
3) eliminating the cause
4) the whole concept

- What do the stakeholders ask?
- What do they want?
- What is the motive of the demand?
- What is their expectations?
- What is their demand about?
- What is required?

Are the answers related to 1 or 2

→ Need for more questions

What to Analyse

Understanding System and Environment and determine the NECESSITY

Organisation
Systems
Structures
Processes
Dependencies
Flows
Resources

Concepts
Principles
Rules
Guidelines
Classifications

Strategy
Plans
Tactics
Policies

Objectives
Intentions
Motives
Complaints
Issues
Needs
Obstacles
Lacks
Results
Inefficiencies
Ineffectiveness
Wastes
Costs

Environment
(& interactions with and within environment)

Various business knowledge and expertise domains
Business Perspectives
Aspects

Constraints
Prohibitions
Impossibilities
Possibilities
Risks
Probabilities

Capabilities
Capacity
Aptitudes
Resources

Value
Purpose
Role
Ranking, Position
Significances
Criticalities
Priorities

Evolutions
Tendencies
Inclinations
Forces

Unknown needs and unarticulated needs

Personal insights

Personal Perspectives
Insights
Conflicting views
Belief systems
Assumptions

Articulates needs, partially articulated needs, known but not expressed needs, unjustified needs and expectations, …

What the stakeholder, the customers or the end-users want

Opinions
Subjective diagnosis
Ideas, Suggestions
Disapprovals
Dislikes

Demand
Wants
Desires
Preferences

* : for concerned business domains, business stakeholders, …

Weak & Strong Analysis

10/01/2019

STRONG Analysis

Study Context, systems and environment
–> **necessity:**
finding out what is necessary

Business goals or outcomes

Customer’s intentions

Customer’s expectations

Customer’s goals

Customer’s wants

Customer’s demand

WEAK Analysis

LOWER RISK FOR FAILLURE
Much more reliable diagnosis

HIGHER RISK FOR FAILURE
Customer does the diagnosis, & missing insight in context and existing situation

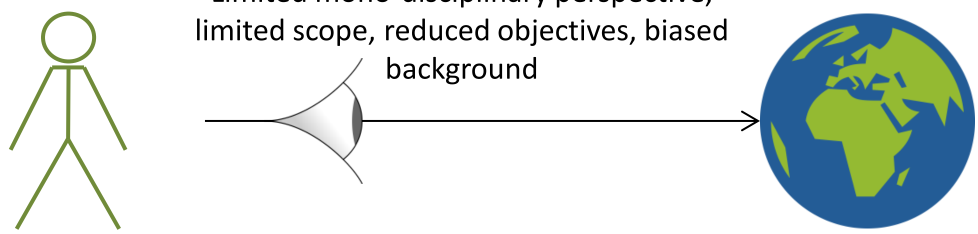
- WRONG, AWKWARD, INNEFFICIENT, INEFFECTIVE SOLUTION
- SOLVING CONSEQUENCES
- MISSED OPPORTUNITY
- NO INNOVATION

Seeking to know “only what we have to know” to conceive a solution is a principle that doesn’t work, let alone being told what to implement.

Wants vs Reality

30/10/2018

Limited mono-disciplinary perspective, limited scope, reduced objectives, biased background



Stakeholders & Users

Satisfying People ≠ Solving Real Problems

Satisfying People	Solving Real Problems
Finding out what people want	**Analysis of reality**
• Pain points, annoyances • Wants & Desires • Preferences • Choices • Dislikes • Demands • Expectations	• What the situation, the reality, requires • What is possible & impossible
Trying to please others; being dependent of other people's thinking, desires, expectations, , … Subjective diagnostic: Subjective, emotionally influenced, from single perspective, distorted, partial, vague, biased by belief system (eg. View on IT)	Thinking critically Being autonomous Taking responsibility Doing what you decided is necessary Suits the situation More objective diagnostic & view Performed by competent analyst

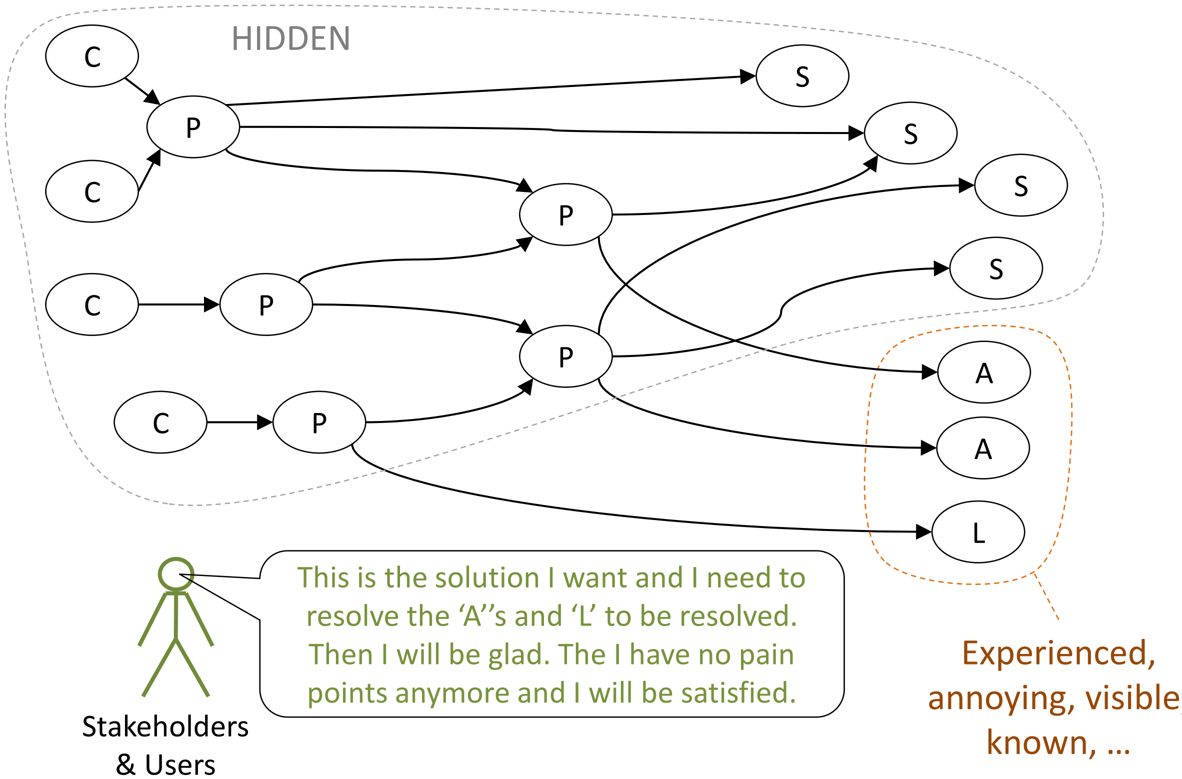
Serving Clients REALLY by FINDING OUT what is NECESSARY and solving the REAL Problems with REAL Solutions

Notes:

Doing what is necessary may, in the end, suite and satisfy people much more. Doing what is necessary, does not mean people choices should be ignored. It's more a matter of having different priorities.

Wants vs Reality

(P) : Problem (underlying / hidden / root)
(C) : Circumstance(s)
(S) : Symptom or consequence
(A) : Annoyance (experienced consequence)
(L) : Limitation, obstacle



- From a people's perspective : pain points will be eliminated.
- From a systemic perspective : Problems still exists.

If you were the client ….

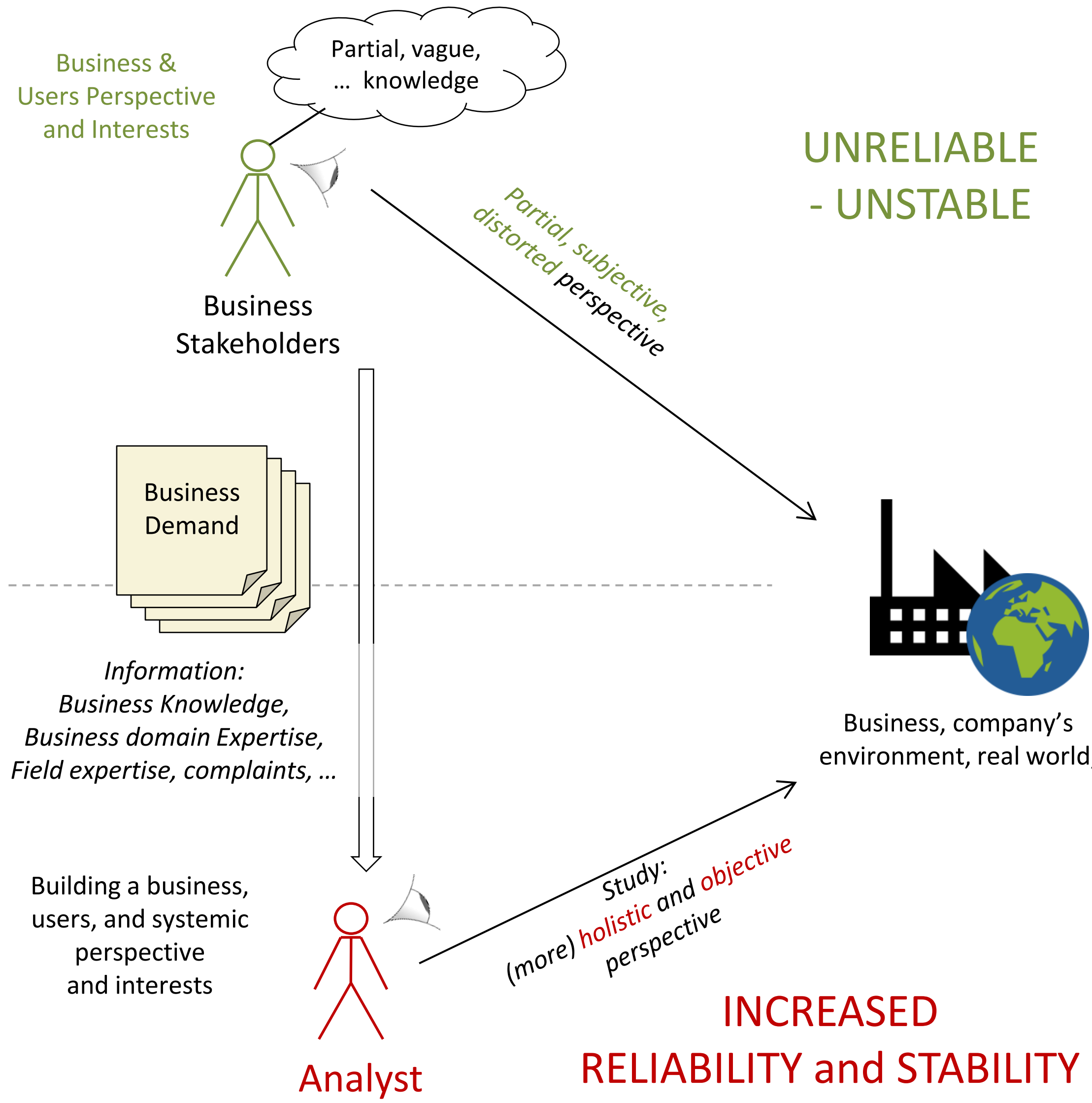
- Would you be satisfied if you got the solution you wanted, but it doesn't solve the annoyances and limitations or it creates new ones?
- What if the (P) continue to create negative consequences?
- Would you choose to get a solution to the annoyances and limitations or would you prefer to see all the problems to be resolved?

In the end, people prefer all problems to be resolved, even the one's they don't know of rather than having their solution and still having problems.

Reflect: What if doctors would treat only based on the patient's diagnosis, what he or she asks? What if they would treat only symptoms?

Studying Reality

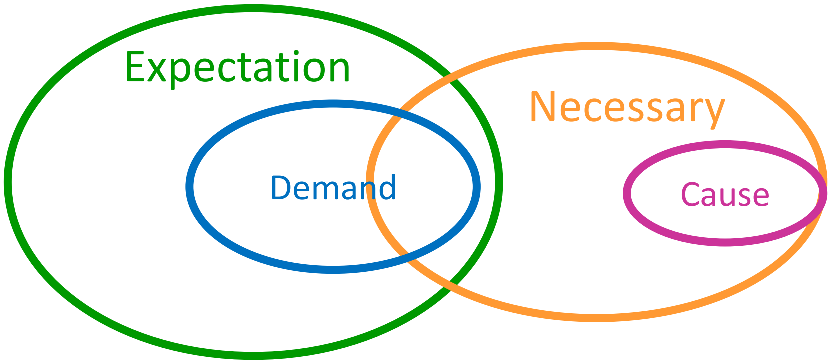
30/10/2018



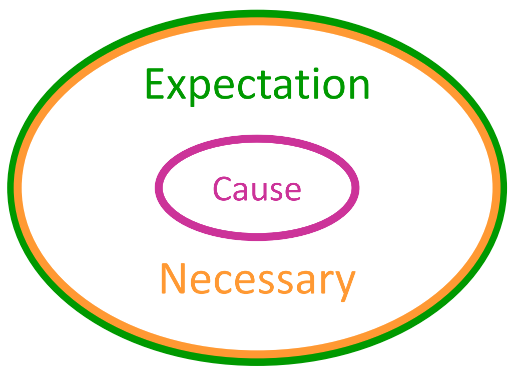
REALITY MATTERS

What has to be changed in reality
and will truly solve the
problem/needs and meet the
company's systemic requirements:

Human – Reality Alignment



Analysis aligns cause, necessity and expectation



Conflicting Views

Causes of different views and different expectations

- Different knowledge
- Partial understanding of the whole problem or solution, its obstacles, its constraints and implications
- Different perspectives
- Different goals and priorities
- Different solutions in mind

Four possible solutions (ordered from best to worse)

1. Listening to the explanations and arguments to create a final global insight – merging the knowledge and perspectives
2. Finding a solution that meets all different perspectives, interests, goals and priorities
3. Making a compromise among the different parties to come to a final solution, hopefully the best solution
4. Choosing the solution of the most authoritarian party

Bugs

Analysis → Analysis FLAWS

Architecture → Architecture FLAWS

Design → Design FLAWS

Programming → Programming BUGS

We know how to test/detect programming bugs.

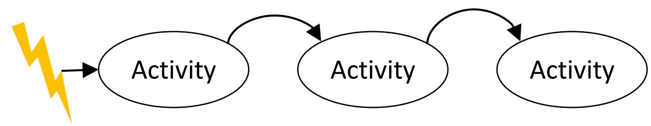
But how to detect (on time)

- Analysis flaws?
- Architecture flaws?
- Design flaws?

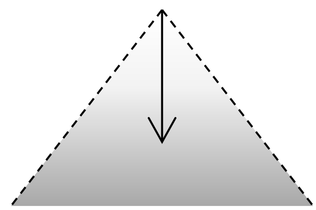
If we don't detect them, and handle them as simple 'changes', how can we improve?

Analysis Tactics

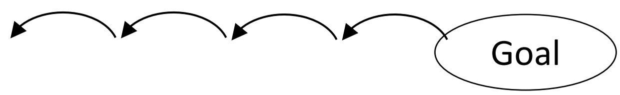
1. Follow the Flow - Chronological



2. Top Down

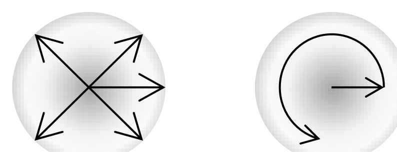


3. Begin with the end in mind - Goal oriented



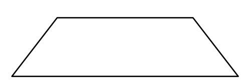
4. Radial Expansion

Starting at a point (centre, core) then moving towards the periphery



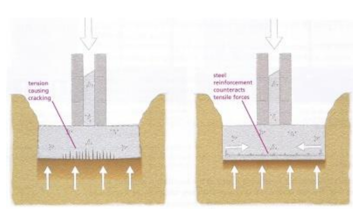
5. Build based on / around stable aspects

Starting with clear, definitive, stable elements



6. Foundation First.
Then building on top.

Atomic elements, most basic aspects



Note:

"Top down" means to look first at the broader picture, a drone-view. "Top" does not point towards the top organisational level (management).

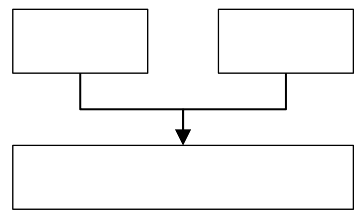
Analysis Tactics

7. Greenfield Approach or Reengineering

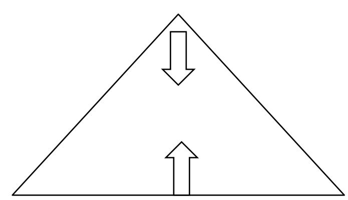
8. Approach for Adaptation of Existing System(s)

9. Aspect-based

Study specific aspects, domains, perspectives one by one. Then putting it all together when conceiving the solution. Example: process perspective and information perspective of a software application.

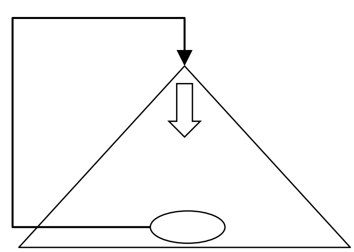


10. Mixed Top-down and Bottom Up



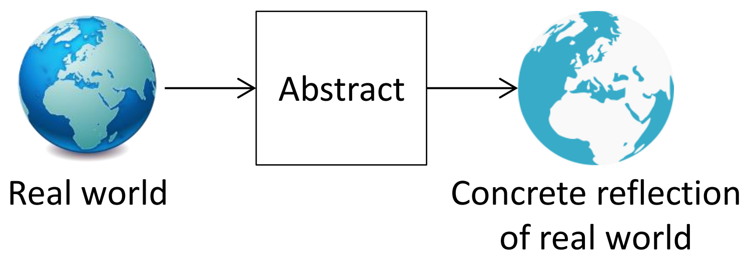
11. Initiate Bottom Up and Go Top-down

Detecting, identifying, study, … something at the bottom. Bring the subject to the top. Work with it downwards by taking this new subject, intentions, plans, insight, … into account. While the detection and start is below, the top-down process facilitates the integration and alignment.

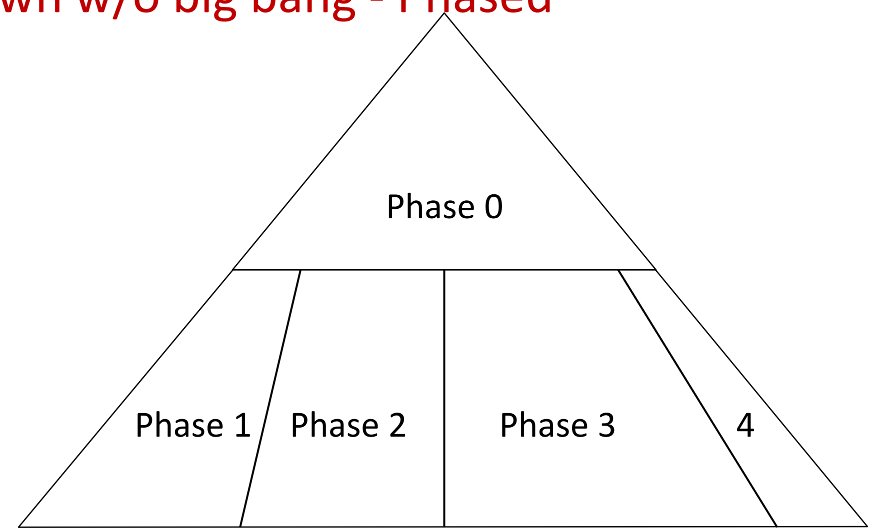


Analysis Tactics

12. Concrete to Abstract



13. Top-down w/o big bang - Phased



Phase 0 provide an overall framework, organisation (and architecture). It shapes the whole initiative.

Then (sub-)projects can be launched one after another as phase 2, 3 and so on. These phases can overlap. They can be executed in parallel or they can be delayed if necessary. This offer a greater flexibility.

14. Follow the Structures

Take an existing structure. Define parts of it. Treat part by part.
Example: cleaning up a house room by room

Notes:

An approach for **chaotic and undocumented environments** can be to make first inventories. Get rid of the obvious waste. Then compartmentalise accordingly to previous approaches. Prioritise them and then clean up one compartment after another.

Analysis Tactics

Sub-Optimal TACTICS (from a logical perspective)

1. Risky Parts First

A project can fail on a difficult and risky part. This part is dealt with early in the project. If it fails, the project can be stopped or an alternative solution can be searched. If this difficulty is postponed until later in the project and it fails, then time and resources have been wasted and the lost investment will be larger.

2. Quick Wins First

Quick wins show usefulness and may create buy-in and motivation. The quick wins may correspond to simple issues that can easily be solved (see easy parts first). Or, it may be motivated by short term results orientation rather than by a system/long term ambition.

3. Following Established Priorities

Priorities may be defined by using different criteria and with different motives. How have these priorities been established? For what motives? Who defines the process? Based on what competencies? Or what aspects have to been taken into account and which have been underestimated or neglected?

4. Easy Parts First

Postponing the more difficult part can be driven by fear of complexity. This is not a good sign.

5. Known Parts First

Postponing the lesser well-known parts can be driven by fear of the unknown. Risks and true challenge may lay in the unknown (or lesser known) area's.

'sub-optimal' doesn't mean 'bad'. It means that the risk is higher to have a lesser good solution from the perspective of concept, logic, effectiveness, …
For practical reasons, they might be the best choice. One need to understand the risks and drawbacks of each.

Analysis Tactics

Sub-Optimal TACTICS

6. Bottom - Up

…

7. Follow the Boss, the Demand, the Sponsor, …

…

8. Smallest First

…

9. Highest Business Value First

…

10. Organic expansion based on Usage and User's perspective

    1. Need-driven
    2. Problem-driven
    3. Short-term-goal-driven
    4. Result-driven
    5. Demand-driven
    6. Priority-driven (based on usage)
    7. Opportunity-driven

WORST

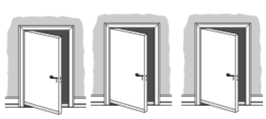
Reactive, symptomatic and organic growth guided by persons having only superficial knowledge of information, systems, information /software systems and systems engineering (engineering of systems).

Analysis Perspectives

Analysts investigate and think about the environment, system, problem from different perspectives:

Objectives - Plans - Intentions

Causes - Consequences

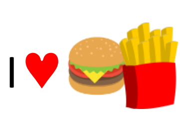


Opportunities

Priorities – Importance - Criticality

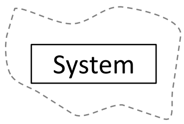
Value
(not just stakeholder's appreciation)

Stakeholders
(their domain, objectives, …)

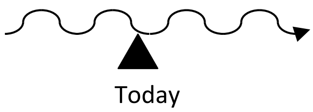


Necessity – Preferences & Desires

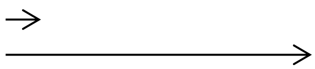
Analysis Perspectives



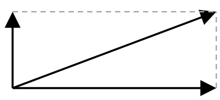
System and System Environment



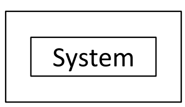
Evolution (past, present, future)



Short and Long Term



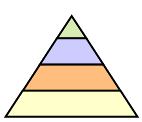
Forces - Tendencies



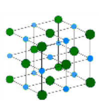
Hierarchy of Systems

Whole - Parts

Capability and Attributes

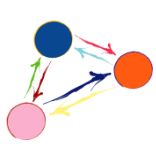


Different levels of details



Structure & Mechanisms
(behaviours, dynamics, processes, …)

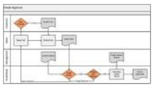
True Nature of Things



Interactions - Influences

Flows of Energy, Information, Matter, Money

Analysis Perspectives




Abstract - Concrete

Lifecycles of systems, information, products, services, documents, …

Mainstream - Exceptions

Balance & Harmony

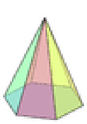

Effectivity - Efficiency

Flexibility - Evolvability


Usage – Maintenance – Manageability

Integration
(all levels, aspects and perspectives)


Risks & Security



Various other perspectives: Company culture, values, vision, organisation, policies, geographical locations, innovation, progress, speed, strengths and weaknesses, viability, …

Cost

Three Key Perspectives of Thinking

Thinking in terms of …

1) A WORLD OF SYSTEMS

- Supra-systems, systems of systems, systems and sub-systems,
- Systemology, Systems Thinking, Systems Design, Systems Behaviour, …

2) MULTI-DIMENSIONAL THINKING

Purpose, role, meaning, intentions, reasons, context, implications, knowledge areas, skills, perspectives, subjective versus objectivity, usefulness, location, focus, alternative usages, appropriateness, similarities, commonalities, differences, cohesiveness, coupling, characteristics, parts – whole - greater whole, object versus environment, structures, systems, processes, lifecycles, flows, concrete and abstractions, mechanisms, balance, harmony, action – reaction, nature of things, cause-effect, different levels of detail, evolution, small amounts versus larger amounts (numbers, repetitions,…), what-if's, strengths and weaknesses, opportunities and limitations, obstacles, importance, criticality, options, generalisation versus specific case, mainstream and exceptions, forces, interactions, influences, relations, certainty (probability), precision versus vagueness, approximation, variability, classification, priorities, order, cost, risk, value, timing, circumstances, and so on. (see previous slides)

All these aspects can be applied iteratively.

3) INFORMATION EXPLOITATION

- Presence, Availability
    - Creation, capturing, gathering, dissemination
- Value and Quality
    - Includes relations (connections, links, …)
- Processability
    - Format, structure, organisation
- Usage, Innovation

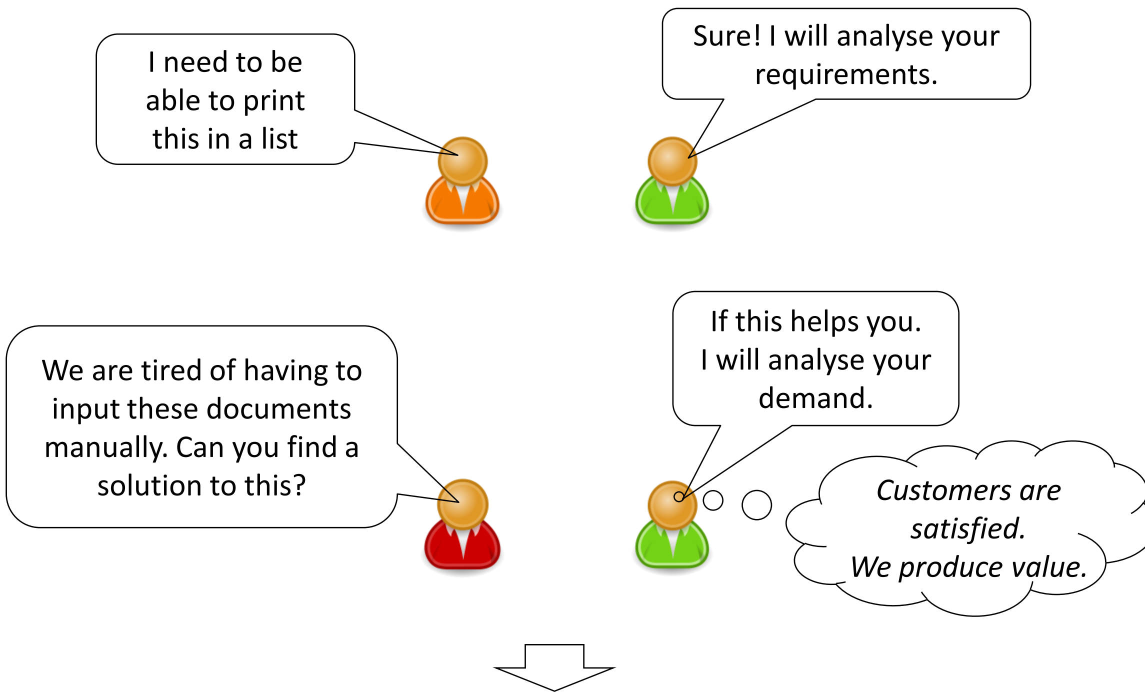
Models

- Business Model
- Business Canvas
- Business Strategy Model
- Five-Forces Model
- Business Domain Model
- Value Network
- Value Chain Model
- Value Stream
- (System) Context diagram
- Organisation chart
- Goal Model
- Stakeholder Map
- Product / Feature Roadmap
- Business Function Model
- Business Activity Model
- Business Scenario Model
- Business Role Definition
- Business Function/Process Models:
  - Process Model / Swim-lane
  - Role Activity Diagram
  - Data Flow Diagram
  - Process Flow Diagram
  - Workflow diagram
  - Use Case Model
  - Flow Chart
  - Function Hierarchy
- Functional Dependency Diagram
- Sequence Diagram
- Business Event Model
- Interaction Diagram
- Timing Diagram
- State Transition Diagram
- Information/Data/Database Models:
  - Information Architecture
  - Logical Data model
  - Conceptual Data Model
  - Entity Relation Diagram
  - Physical Data Model
  - Class Model
  - Business Object Model
- Implementation Diagram
- Component Diagram
- Composite Structure Diagram
- Deployment Diagram
- Physical Model
- System Architecture Diagram

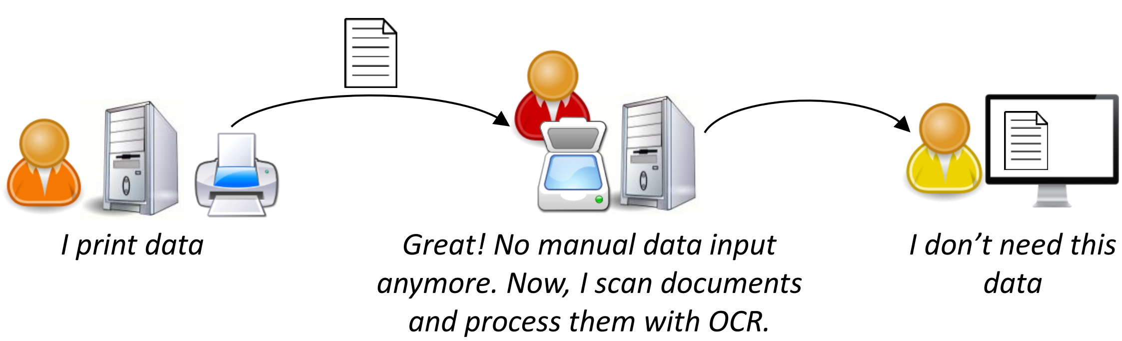
ANALYSIS Traps

Assumption:
THE DEMAND DESCRIBES THE PROBLEM
AND/OR THE REQUIRED SOLUTION

You ask, I deliver – Your wish is my command
Giving Users What They Want



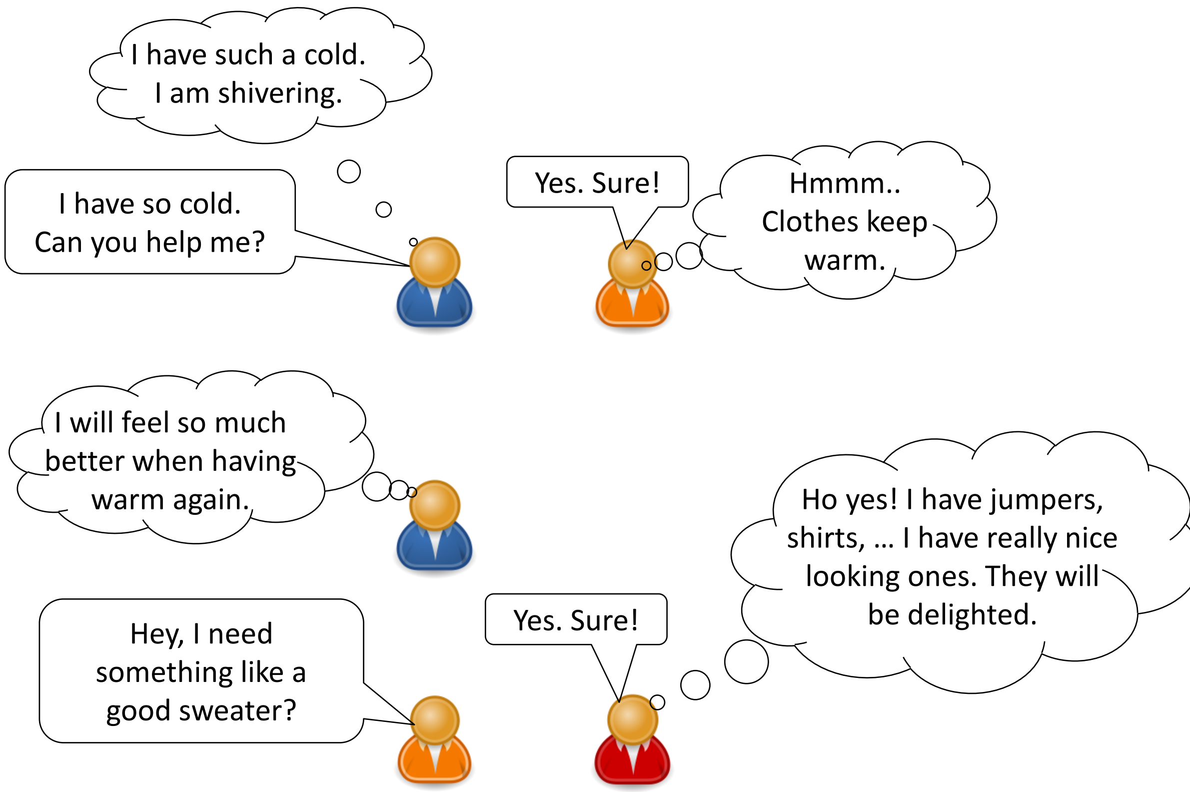
Improved Process



Traps:

- Missing the detection, diagnosis, learning, evaluation
- Trusting the demand, confusing the demand or complain with the diagnosis; assuming a diagnosis has been done.
- Limited scope, local thinking
- No analysis is done, only a refinement, translation of the demand

ANALYSIS Traps



Problem statement:	Someone feels cold
Demand:	Something to get warm
Expectation:	Feeling fine once problem is solved
Need:	Something to get warm
Objective:	Feeling warm (normal)
Requirement:	Must keep person warm or deliver warmth
Solved:	When demand is satisfied, when person feels warm (normal) again.

Does this look right for you?

ANALYSIS Traps

How About Alternatives?

- Go into the sun
- Going inside the house
- Switch the heating on
- Take a warm bath or hot shower
- Get a blanket
- Drink a hot drink
- …

How about questioning?

Having cold

↓ What caused that feeling of having cold?

Fever

↓ What caused the fever?

Lung infection

↓ What caused the lung infection ?

Weakened immune system

↓ Why is the immune system weakened?

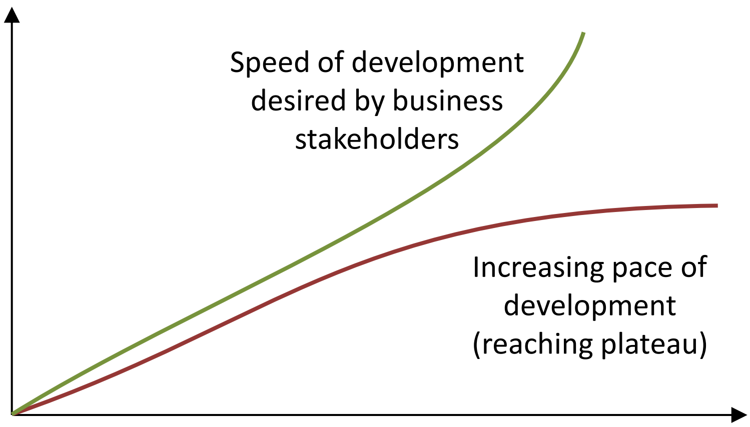
Unhealthy lifestyle

Whole set of causes

The real problem can be solved and real solutions can be found.

Questions provide a totally different view on the problem and on the problematic situation.

TRAP: No LIMIT



The Business Stakeholders have **NO LIMIT** in their demand of:

Maximising

- Control
- Pace of development
- Adaptability
- Number of features
- Instant result, knowledge, …

Minimising

- Cost
- Risks
- Effort

Maximising benefits,
Easier and lesser effort
And masking the own
shortcomings and limits

Informatics (or IT) seeks maximal time, resources, autonomy and reward.

Notes:

The business world is dynamic and competitive. Speed is important.

If the business community changed a decision or a choice, or if a mistake has been made, then IT has to be able to correct this as quickly as possible. This puts pressure on IT-people. The IT-community has to adapt. This is a symptomatic 'solution'. How about preventing bad choices and decisions being made, reducing mistakes, wrong problems being 'solved' or inappropriate solutions being demanded? The solution for this is a true Analysis.

ANALYSIS Traps

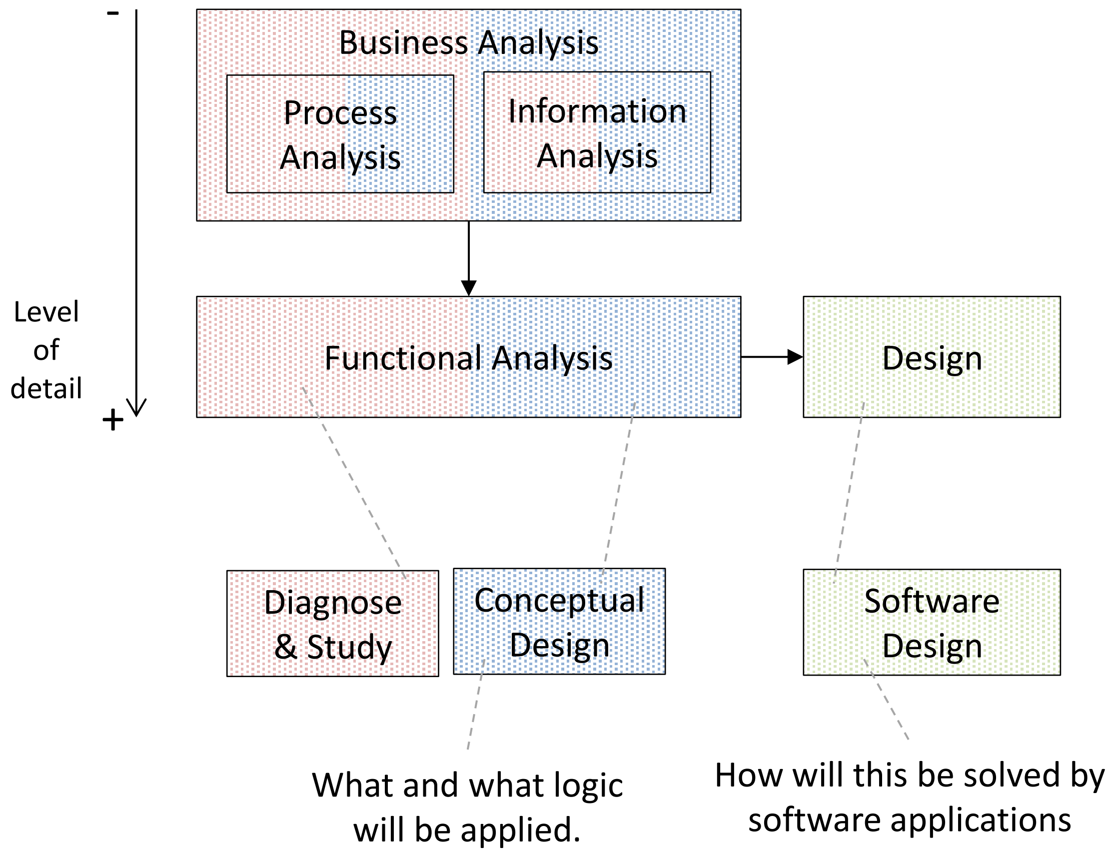
Confusions

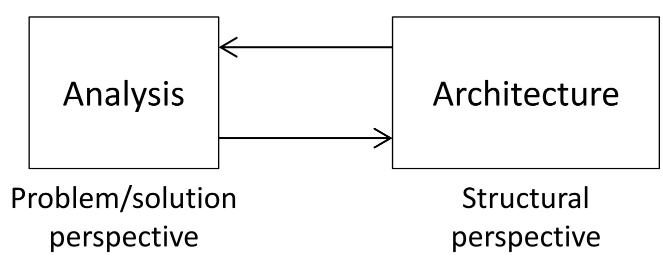
- Understanding the demand ≠ Understanding the problem
- Understanding requirements ≠ Understanding the situation, the context, …
- Understanding requirements ≠ Understanding the required solution

Some Dangerous Assumptions

- The complaints or the demand tell us what the problem is.
- The complaints must be resolved.
- The demand or requirements tell us what is needed.
- A demand or requirements is based on an analysis.
- A demand or requirements is reliable.

Analysis and Design





Notes:

If a diagnosis has been performed at the level of BA, then the FA doesn't have to do a diagnosis. However, it is possible that the FA refines the diagnosis, new information about the problem changes the diagnosis or new problems are detected (like dead bodies in the closets).

Managing Stakeholders

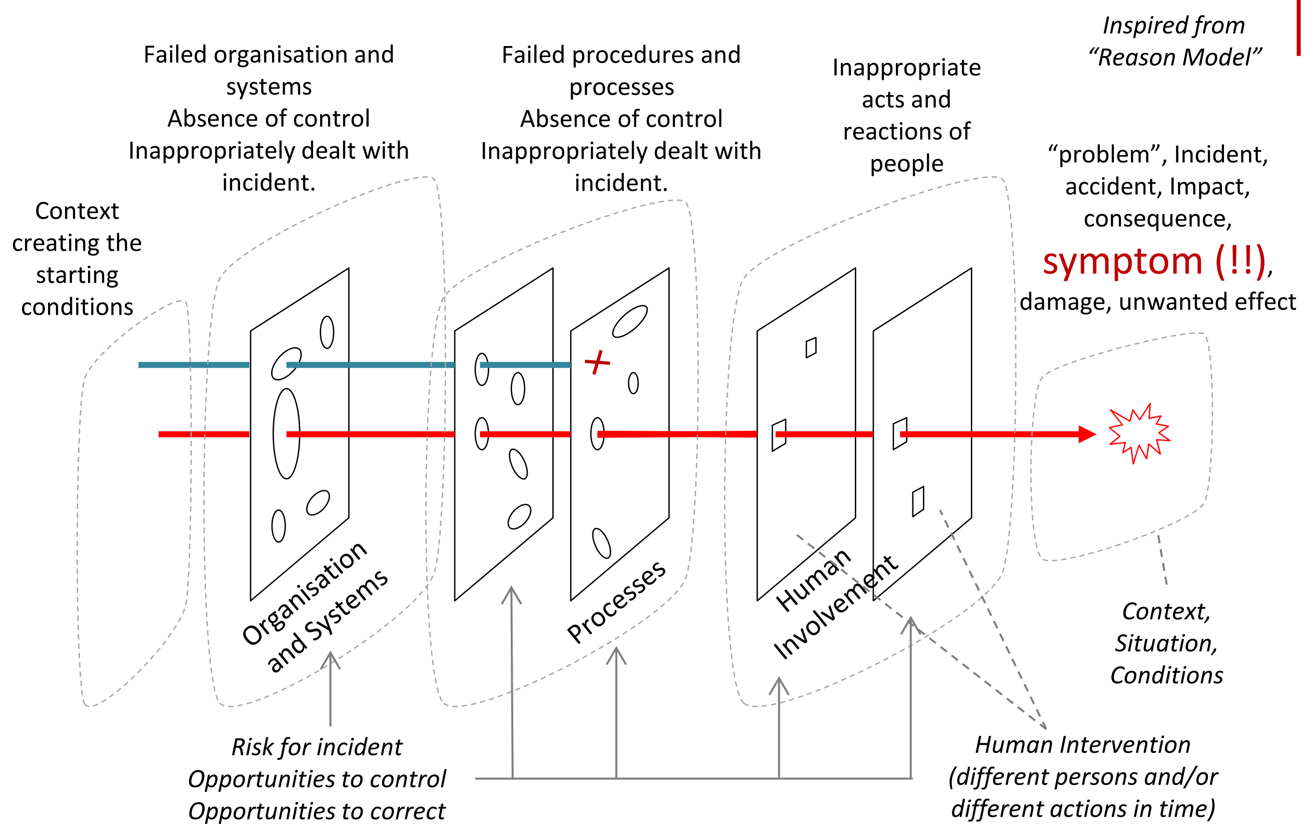
Managing The Stakeholders Contact Data

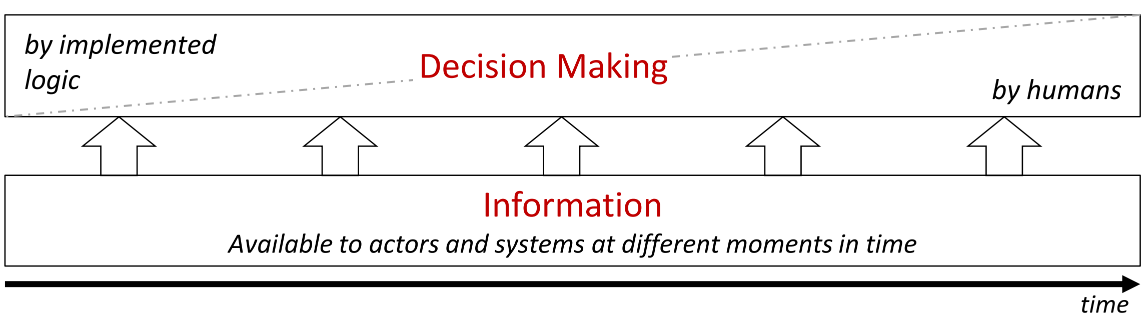
+

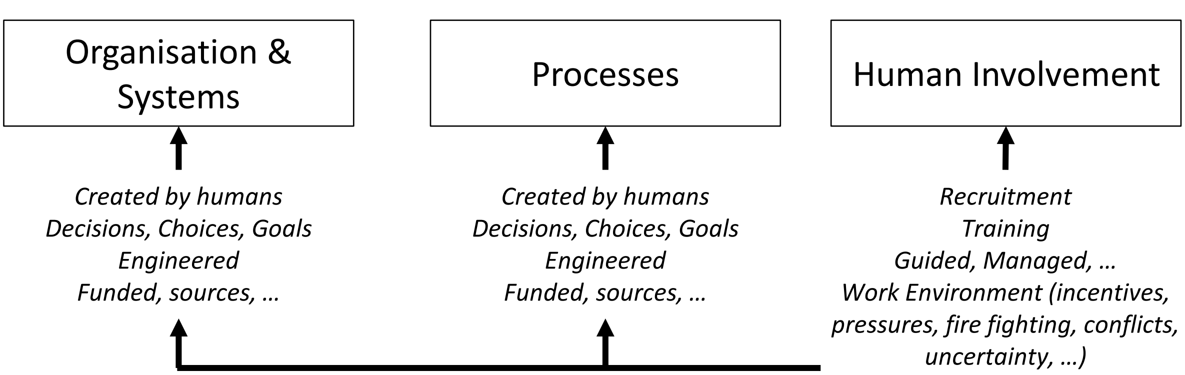
"Managing"

- Their vision
- Their understanding of the situation
- Their perspective
- Their objectives (linked to their department, service or team)
- Their priorities related to their jobs
- Their function and responsibilities
- The level of control they seek to exercise
- Their level of freedom and autonomy they have
- Their level of required flexibility
- The degree of collaboration among business units or with the project
- Their role, importance and contribution within the overall organisation
- Their agreements and disagreements
- Their support to the project and solution
- Conflicting views
- Their expectations (explicit and unexpressed, unawareness)
- Their apprehensions and fears
- …

Incident / Symptom Investigation





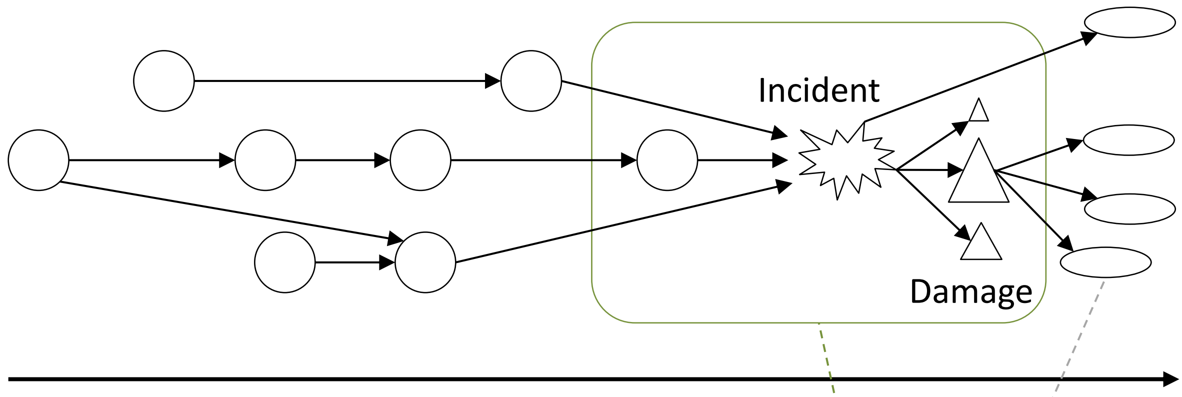


Example: If a system or an organisation failed, why did it fail ? Is the engineering approach right?
Who took the decisions? Why did engineers fail ? Do we have competent engineers?

Incident Investigation

Investigation of the Chronology of the Events

Chain of Events



Evolving Conditions

Events happen in certain conditions
Events change or create conditions

Other / indirect consequences

We may not limit the investigation and insight to this part

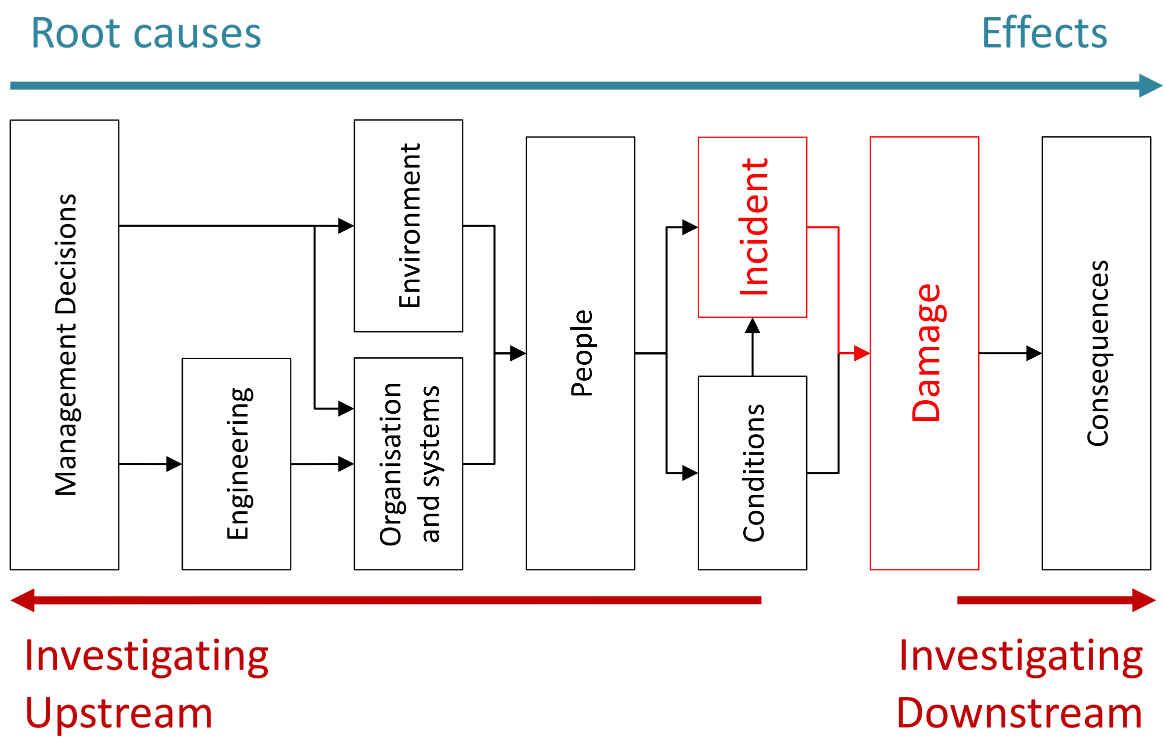
We may also have a network-model of causes and factors or link them to the events-model.

Major Common Event Elements:

- Time, duration
- Present Information, knowledge
- Decision
- Motivation, intention, goal, expectation
- Action or process
- Changes something
- Performed by person, organisation, physical system, software system
- Producing a result
- Involves energy, matter, information, money
- Mechanism
- Trigger
- Conditions in which the event happened (starting, during, after event ended)

Incident Investigation

Investigation of the System (Involved Actors, Elements and Areas)



This diagram may not be suitable for all cases. It depicts a way of thinking. Once understood, it is easy to devise an approach of investigation based on an adapted model.

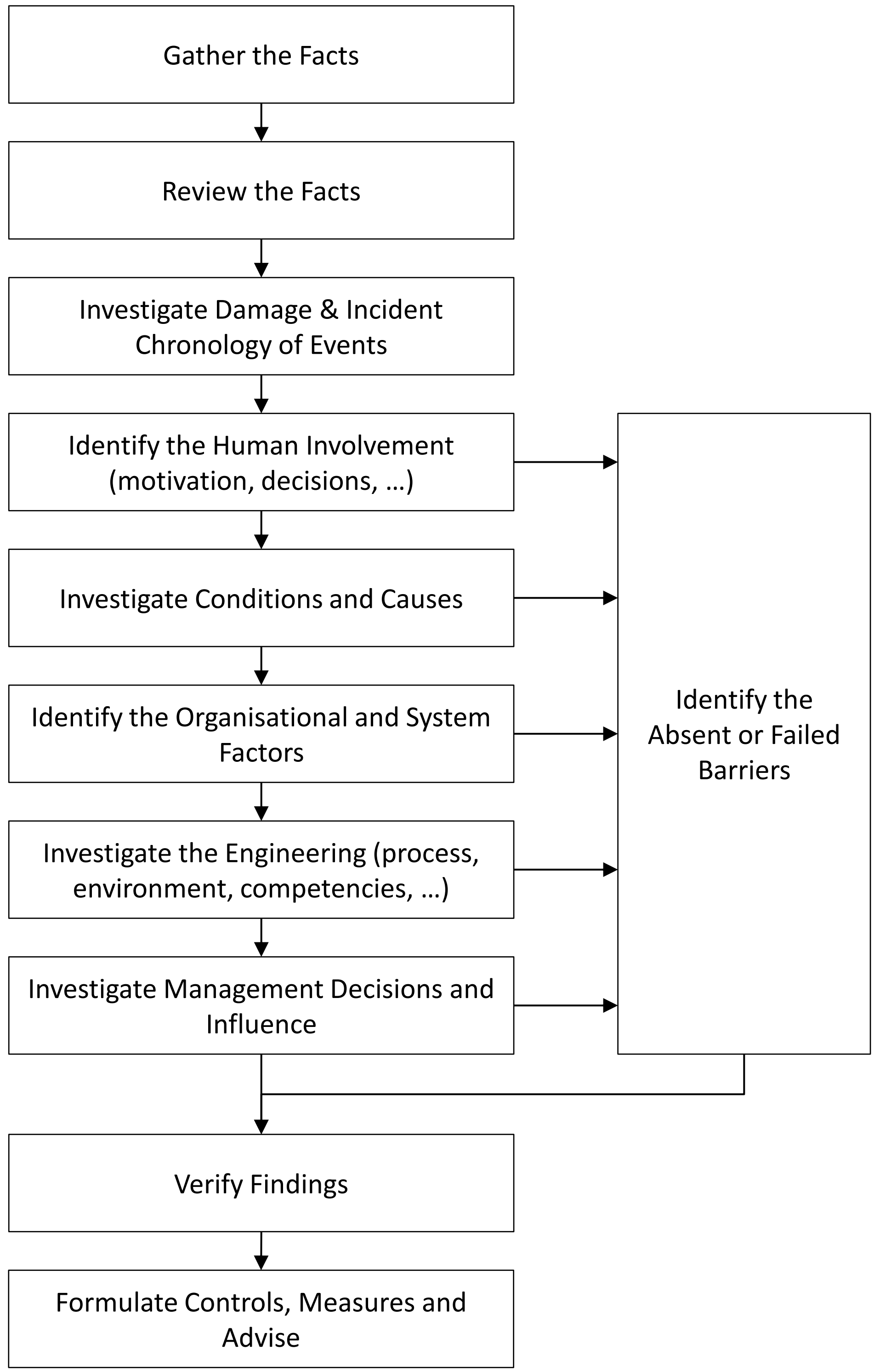
Notes:

See page "Barrier Functions in a System"

Incident Investigation

Systemic Incident Analysis Approach

10/01/2020

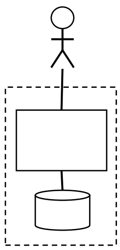


Notes:

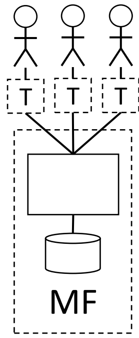
See page “Barrier Functions in a System”

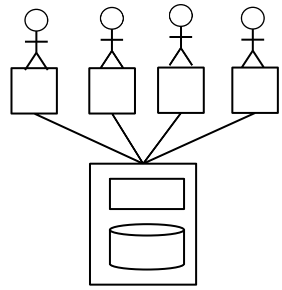
- ARCHITECTURE -

A Few Types of Architectures

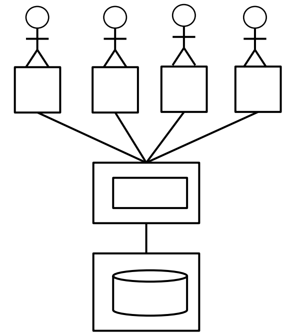


Single User

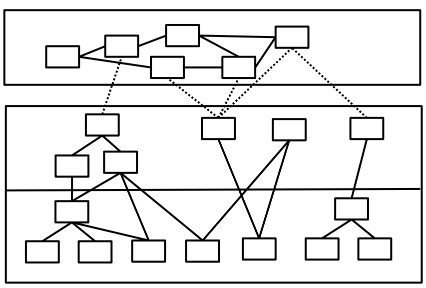




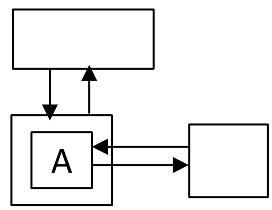
Client-Server



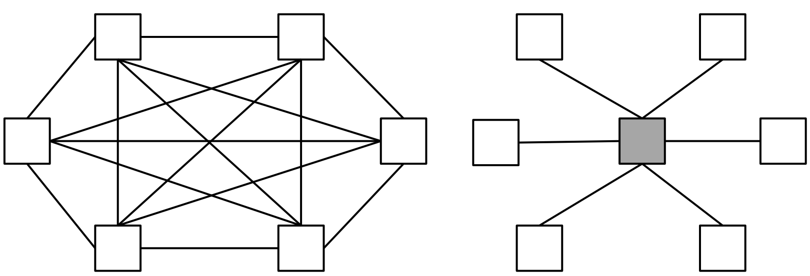
3-Tier



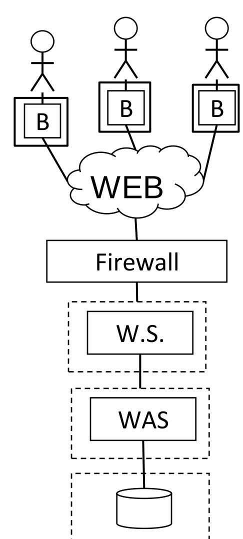
Service-oriented

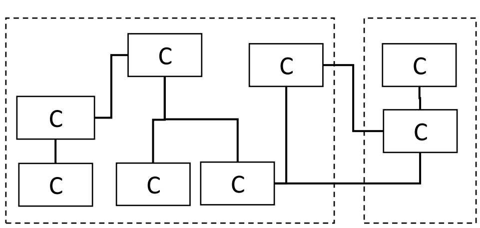


Agent Based System



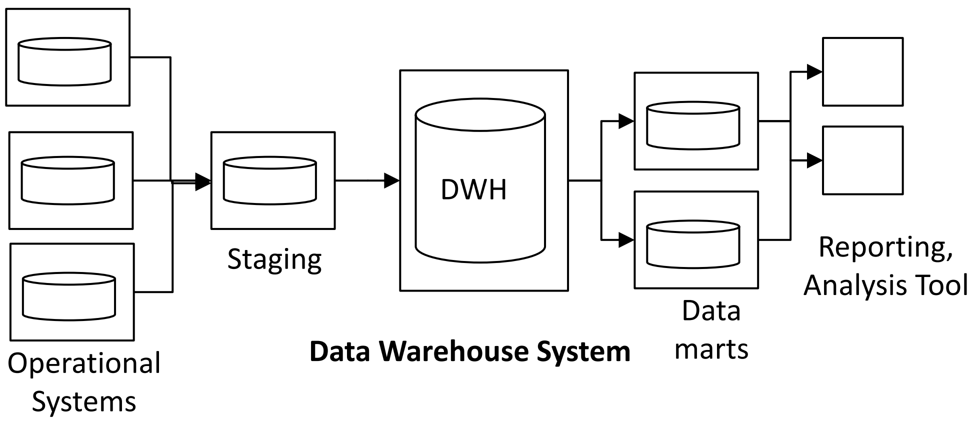
Peer – to - Peer

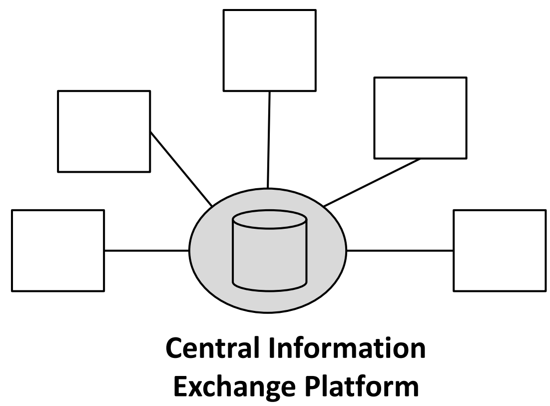


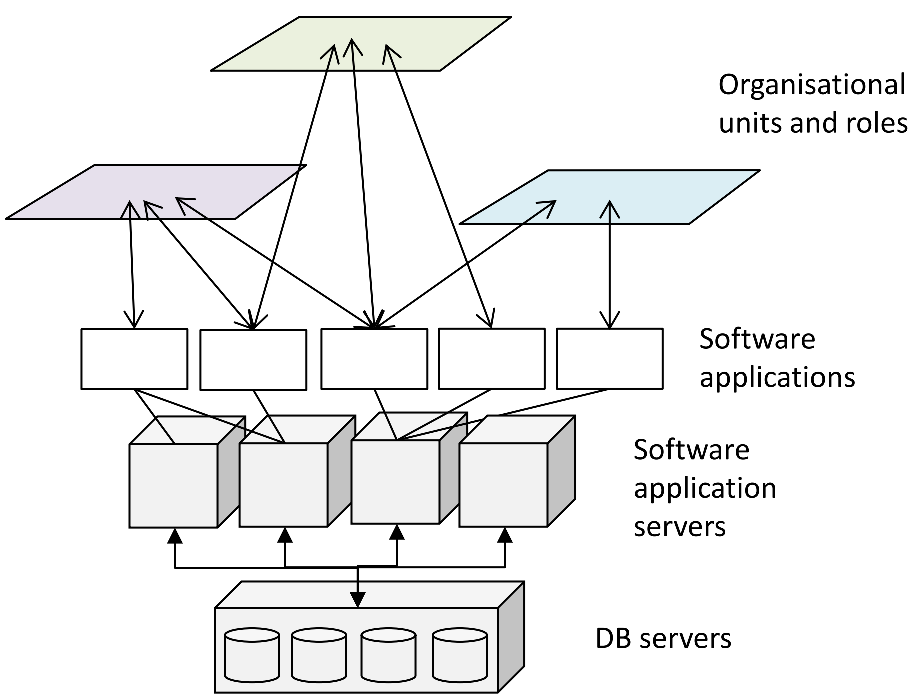


Component-based

A Few Types of Architectures







Conway’s Law

“Any organization that designs a system (defined broadly) will produce a design whose structure is a copy of the organization's communication structure.”

Melvin Conway

This is actually an observation (and not a law) that organisations have the tendency to design systems that reflecting the organisational structure.

Understandably, copying the structure of the organisation into the system is the first thing that may come to the mind of the designers and architects.

However, sometimes, it is better that the architecture matches the organisation. The organisation itself is the supra system. And sometimes, it is not the best thing to do.

The important lesson is to study the communication structure, communication flows of an organisation.

An alternative way of organising systems is the information architecture.

Factors Determining the System's Architecture

Indicative List of Factors (not exhaustive)

- Number of actors
- Geographical spread of actors
- Geographical spread of usage of information (capture, processing, usage)
- Other existing systems and infrastructure
- Functional decomposition/organisation
- Different involved independent parties
- Distribution of responsibilities among the involved parties (sponsors, stakeholders, users)
- Nature of information (type, structure, subject matters, ..)
- Communication structure and channels
- Degree of connectedness of information
- Required systems qualities (flexibility, evolvability, reusability, scalability,..)
- Emphasis on workflow, on processes, on data, on security, on system's qualities
- Degree of expected resilience
- Degree of scalability
- Degree of dynamism in information change
- Degree of spread and fragmentation of information
- Push or pull philosophy (in information distribution)
- Nature of processes (formal, ad-hoc, cohesive, event-driven fragments of processes)
- Degree of desired integration
- Usage of information
- Ownership of information
- Degree of control over systems, processes and information
- Degree of sharing information (desired, achievable)
- Required level of standardisation and compliancy to some laws, policies, agreements or rules
- Amount of information
- Future plans, intentions, ...

- DESIGN -

Systems Design

People have virtues and character flaws.

As an individual, it has limited effect on the surrounding.

Systems are meant to obtain a greater effect. They are designed to amplify the capabilities and thus the power of humans.

Systems may amplify the virtues. But the system can also be abused by people. Then it will amplify some character flaws.

ALL Systems have to be designed

- to amplify the virtues
- while mitigating human flaws.

+ Thinking carefully about ALL the upsides, downsides, implications and consequences.

Systems designers, architects and organisation developers have to pay much attention to this.

Good Design

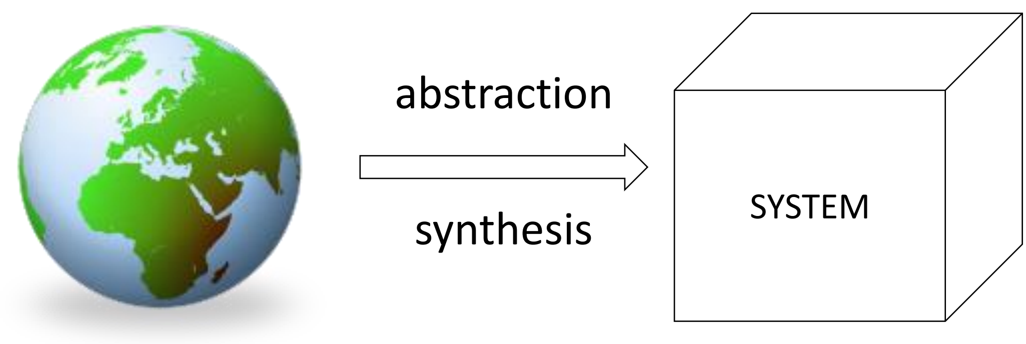
- In line with the **purpose**
- **Simple**, no unnecessary complexity and no oversimplification
- Easily **adaptable**
- **Expandable** (horizontal)
- Can be built on top (vertical)
- Reflects **reality**
- Nothing can be left out
- No mechanisms that undermine the system

Requires
excellent abstract thinking skills

Design ≈ Reality

System's design has to reflect the real world (reality)

(as much as possible)

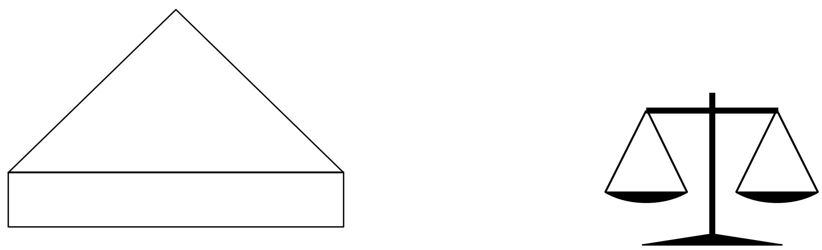


Understanding the world, the reality, the "what is", the objective reality (versus partial subjective perspectives)

Analyst's key abilities

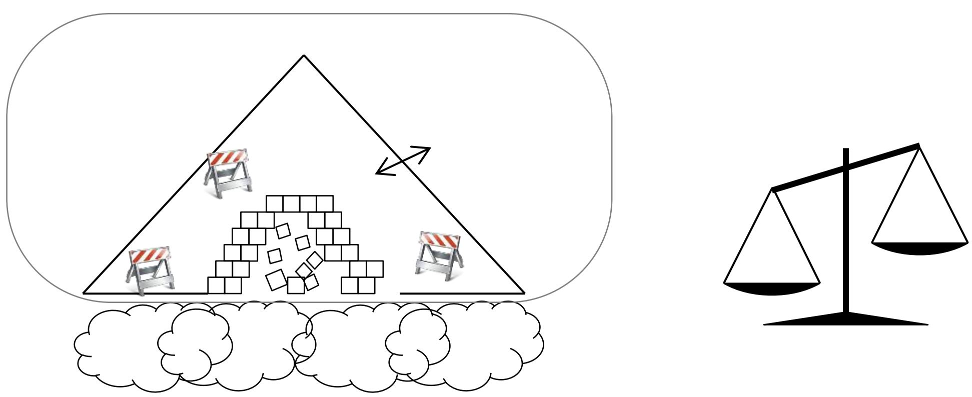
- Learning and understanding the reality
- Discerning the signal from the noise, the essence from the details, the truth from the distortions
- Abstraction and Synthesis skills

Major Types of Design Flaws



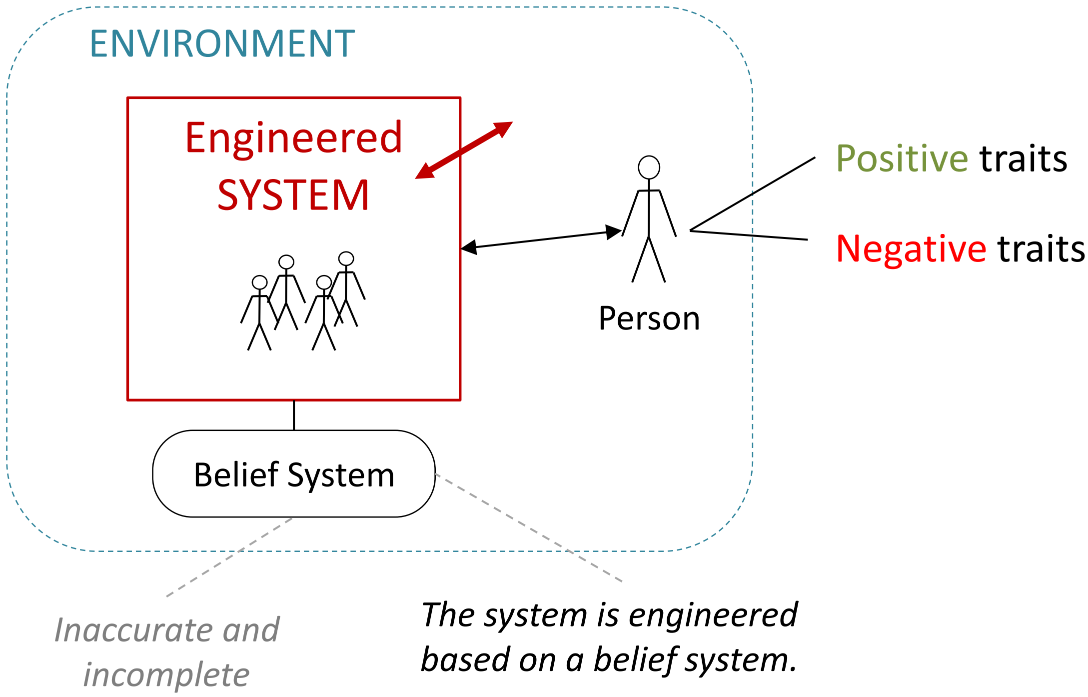
Solid foundation, harmony, balance, stability, …

Major types of design flaws



1. Solving symptoms, local problems
2. Lack of controls
3. Inappropriate structures
4. Incomplete solution
5. Imbalances
6. Internal built-in limitations preventing a full exploitation
7. Internal mechanisms undermining the system (may create imbalances)
8. Inappropriate internal organisation
9. False beliefs, assumptions, principles, values, … (foundation)

Major Sources of Poor Design



1. Wrong diagnosis (trying to solve consequences, symptoms)
2. Not understanding the problem
3. Not understanding the environment, the context, the circumstances surrounding the problem
4. Wrong priorities
5. Not respecting purposes and goals
6. Not understanding systems and information
7. Inaccurate, distorted, incomplete belief system
8. Not taking into account the negative traits of people. People can be part of the system (solution) or they can use the system.
9. Not understanding or underestimating the implications, consequences, risks and limitations of the future solution

Designing Approach

General hierarchy of aspects and priorities for designing a system

"General" → always to be adapted to a specific system, solution or case.

Purpose / Role

Environment

Key Functions — Survival Mechanisms

All mechanisms and functions keeping the system clean and healthy, protecting it, keeping it under control, …

Critical Qualities

Structure

Integration

Other Qualities and Functions

Usage / Interface

The higher in the hierarchy, the more it impacts (the core of) the design.

Notes

Usage comes last because usage is determined by the interface. This interface is not the system. It is a layer on a system allowing users or other systems to interact with the system. One system can have different interfaces. An interface can be complex; It can be a system on its own.

Designing Approach

Example of different possible priorities:

System	Top Most Key Aspects
• Military submarine	under water, resistance to water pressure
• Stealth fighter jet	air/flying, aerodynamics, stealth aspect, agility
• Race car	road, speed, road holding
• Nuclear power plant	security, energy production and transportation

System's key aspects
define
the design process

A second factor defining the design process :

The interactions of some factors
upon each other

For example, the strength of a structure influence the weight. The weight influences the performance. This may require a some kinds of adjustments (iterations) until a right and balanced solution is found.

Notes

This is

Designing Systems

Hierarchy of aspects / Priorities for designing a system

PROCESS

1. What is the top most important aspect?
2. Repeat the question to obtain the hierarchy. Some aspects may be equally important.
3. Design the system accordingly to the obtained hierarchy.

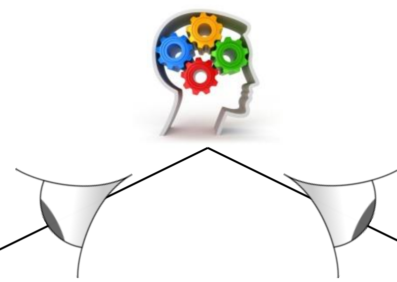
The obtained hierarchy serves as overall guideline for the systems design approach. However, it is not a strict hierarchy. And trade offs decisions may have to be taken.

Notes

This is

Process Design

Two mind-sets / perspectives to consider when engineering processes



Domain, Roles, Functions, Components

Horizontal end-to-end processes

Focus: Ability to perform a function, a role and to manage information

- Function/feature-oriented
- Stronger expandable functions, systems, components, agents,..
- Responsive to events
- Harder to get optimised, controlled seamless horizontal cross-border processes
- Understanding and mapping end-to-end-processes?
- Better for systems supporting ad hoc and unstructured actions (like managing data).

Focus: Ability to produce

- Easier to engineer seamless horizontal cross-border processes
- Easier to measure and to optimise these processes
- Greater mix of different business domains in the logic
- Reduced flexibility to react to different types of events, exceptions, …
- Aspect of role, agent, .. is weaker.
- More suitable for business processes

Business Process Modelling

1. Preparation

- Identify Trigger
- Identify Outcome (all products, changes, …)
- Existing Process Exists?
- Identify start of process, end(s) of process (across the entire organisation
- Identify Stakeholders
- Gather information
- Determine the established performance goals

2. Modelling of the HL Business Process

- Identify order and add:
    - main stages / phases
    - the different obligatory intermediary results across the process
    - the main business decisions
    - the purpose and intentions
    - the concerned locations
    - the pre-conditions
    - the criteria
    - the end-criteria
- Verify the process

- Record specific key business expertise to take into account during the detailed modelling

3. Detailed Business Process Modelling

- Model the process
- Main case
- Exceptions – Exception handling
- Assign executors (ppl, machines, software apps/ computer)
- Check inter-process interactions
    - Ex.: Delivery process & Client’s address change
- Check & define user access authorisations
- Add controls
- Add measures

- List involved information entities
- Are they present in the information architecture and databases)?
- Check the states and the events triggering state changes of these entities for effects on the process or if the process changes the states as noted?

- PROGRAMMING -

Internal Organisation of Program Logic

Unreadable, confusing, incoherent, unorganised code increases effort to adapt and risks

Organisation of code increases clarity

- For understanding
- For reducing risks
- For people needing to maintain the code
- For re-use
- To avoid increasing the entropy
- Increases maintainability and evolvability
- Lowers cost and increase the longevity of the system

A few methods:

- **By component, package, library**
  - Loosely coupled externally and with a high internal cohesion
  - Often about a same subject
- **By Layer**
  - Higher layers have lesser details and use code from the lower and more detailed layers.
- **By Kind (By type, by subject, purpose, …)**
- **By Technology**
- **Or a mix of the previous methods**

Check the "SOLID principles"

Many assume knowledge of
programming languages and
technologies suffice
to be a programmer.

As a consequence

Software Engineering

and

Programming Techniques

are ignored by many

Brief Overview

Types of Programming

- Structured programming
- Procedural-oriented programming
- Functional programming
- Logic programming
- Event-driven programming
- Object Oriented programming
- Scripting

Programming Techniques

- User Interface Design
- Interface design
- Multi-user
- Multi-language, multi- …
- Distributed computing
- Data formatting
- Patterns
- Logging, tracing
- Messaging
- Buffering techniques
- Commenting
- Sorting Algorithms
- Linking, Chain algorithms
- Encryption and decryption techniques
- Graphics, Sound
- Fuzzy logic
- Transaction
- Recursively
- Back tracking
- Dead lock
- Immutability
- Lambda
- Safe Call
- Closures
- Concurrency
- …

Environments

- Apps
- Web
- Mainframes
- …

Huge Numbers

Is code optimisation overdoing?

An optimisation reduced the processing time of a transaction by 0.1 second.

# Transactions	Gain
10.000	16,6 minutes
1.000.000	27,7 hours

Since computers work extremely fast, 1 hour of computer time represents a lot of computer time and computer work.

A company has more than one computers, running several applications day and night, executing many different transactions and operations.

The global optimisation is more than code optimisation. An efficient data architecture, usage of performant technologies, optimised systems, and correctly configured databases are also part of the optimisation.

- TESTING -

Differentiating ‘Test’

TESTING ACTIVITIES

Synonyms: Verify, Control, Check, Test, Feedback, Evaluate, Review

Testing activities include all kinds of verifications (even those done as part of the analysis), simulations, trials, prototype, Proof of Concept, reviews, ...

These activities happen always during the whole course of the project, from the very beginning, regardless of the project phase.

The **objective of testing activities** is to know the obtained information is correct, the understanding is correct, the decisions are right, a concept will work, the design is fine, the work is well done, and so on.

Software can only be tested once it exists, after it has been programmed. But many other things can be tested earlier.

ORGANISED TESTS

Specific tests can be organised during the course of the project (regardless of the project phase)

- Proof of concept
- Simulation
- Reviews
- Validation
- Unit tests
- Integration tests
- Data quality tests

Differentiating ‘Test’

TESTING PHASE at SDLC-level

The Test phase is the project phase that focusses on executing a global set of tests right to make sure the product can be released and no bugs make it to the operational level.

The Test Phase

is NOT the phase in which

the first tests are performed

to see if they did a good job.

The Test Phase

is the phase in which

the last, the ultimate, tests are performed

to ensure the product is ready for the production environment.

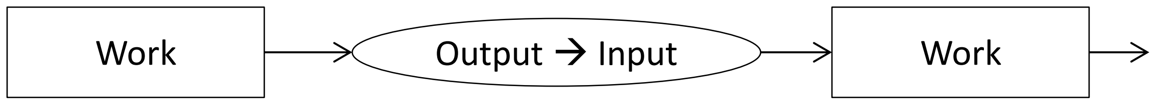
Tests provide a feedback from which can be learned and correct. This learning is about corrections and adjustments. More learning can be done by techniques such as Proof of Concepts, Prototypes and Pilot Products. This kind of test methods ‘tests’ ideas. These and other explorative methods don’t replace Analysis. They are a part of Analysis.

“TESTING PHASE” in the WBS

Testing activities ≠ Project Test Phase
The project’s WBS’s often contains a branch called “Test Phase” or “Testing”.
This branch contains the planned activities of the “Test-phase”. However, this Testing section of the WBS also include a lot of other testing activities which are executed outside the “Test phase”.1

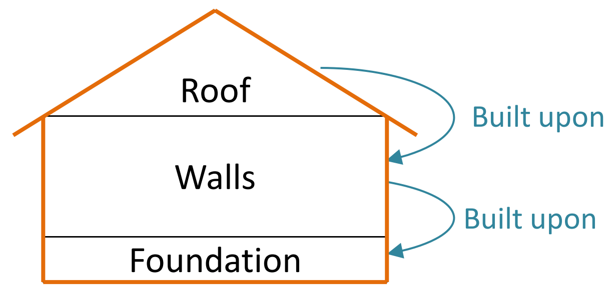
GIGO in Projects

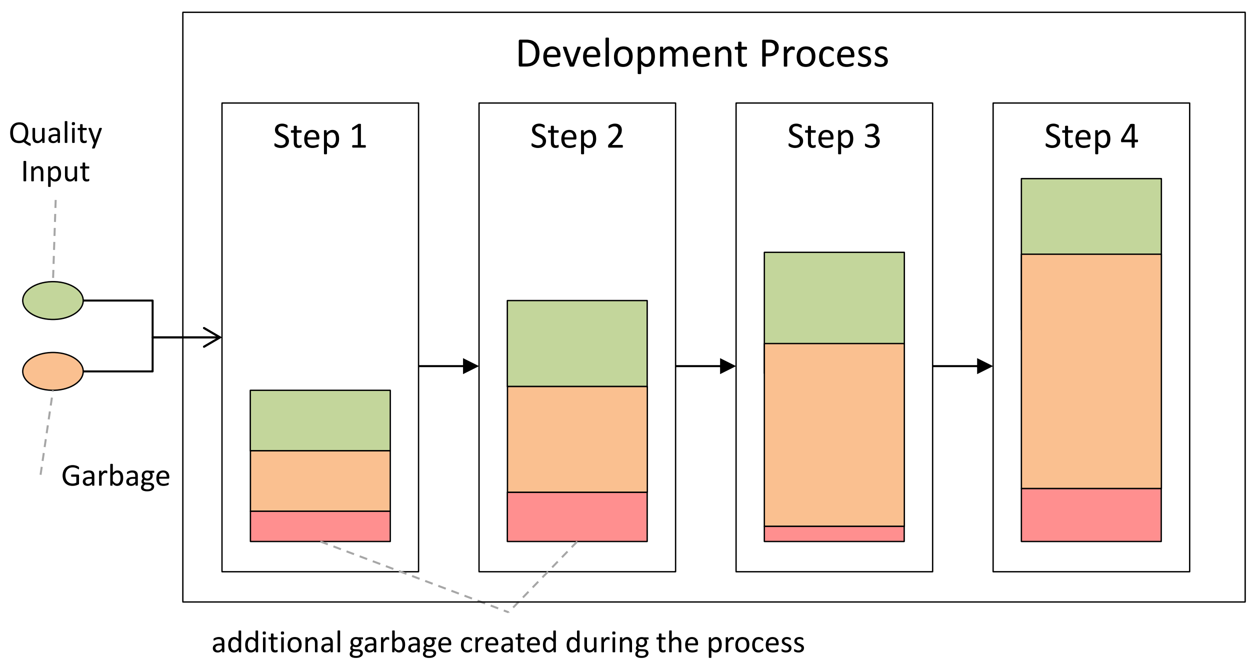
GIGO-prone process



Project = Progressive Elaboration Process

A house is built upon its foundation. Its roof rests upon the walls.





while the project is on track and deliver the demanded product within scope, on time and on budget.

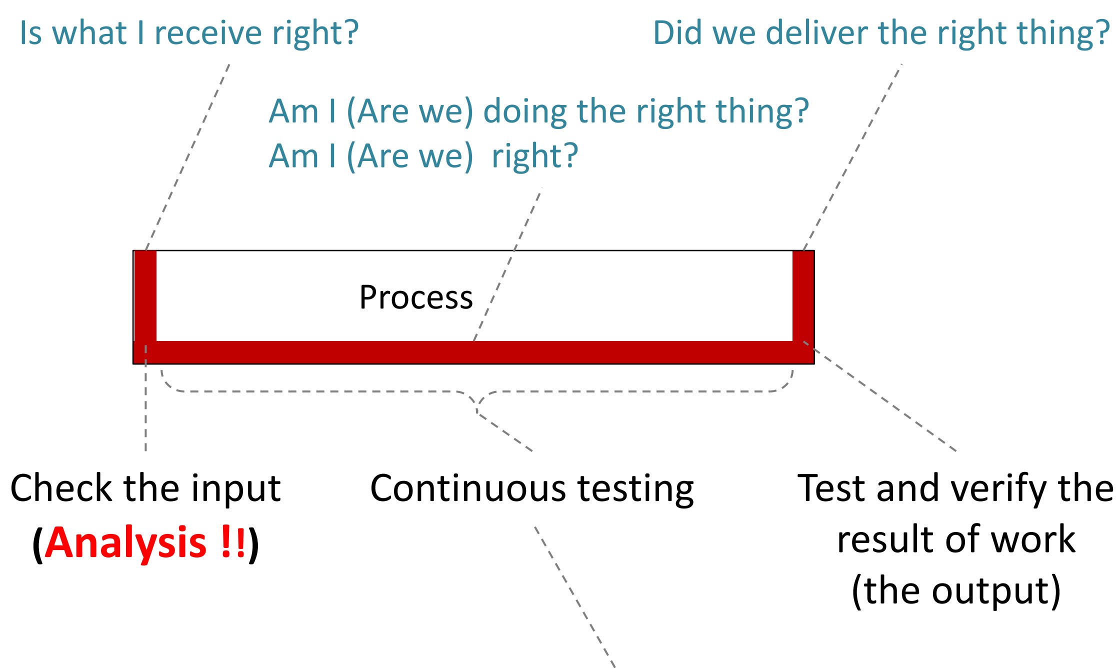
Notes:

All work requires an input. And often this input is the result of previous work.
Garbage may not be inputted in the project or be created by the project and to be dragged all the way downstream through the process.

Avoiding GIGO in Projects

No GIGO in project process

No creation of garbage



Principle: Test at the end of a each unit of work

For example:

- A problem has been diagnosed → test the cause
- An area has been analysed → test the understanding
- A part of the software has been designed → test the design part
- A set of screens has been designed → test the screens
- A component has been developed → test the component
- An integration has been done → test the integrated components
- An artefact has been produced → test the artefact

Test Phase

The Test phase in a project SDLC is the <u>final complete ensemble of tests before</u> the product is released to <u>production environment</u>.

The goal of this ultimate large scale testing is to verify whether the product is <u>ready for production environment</u>.

- The parts of the product function as expected. These products can be integrated. The whole product meets the requirements, and has to be able to meet the goal (or to contribute as expected). Although, at this stage, there has to be already a great confidence in these aspects.
- The product has to function as expected.
- Ensuring the product is ready for being released in the operational environment. It is the last chance before going into operations to detect and remove bugs.
- Idea: Maybe we should have a
  - *"Regular Testing"*: normal testing of the software being developed. This testing occurs as soon as it is possible (unit testing, integration tests, deployment tests, ..)
  - *"Pre-release test phase"*: final tests aimed to get the approval for deployment and release to the operational environment. This phase follows the *Regular Testing phase*.
  - This does not eliminate the need of testing thorough the whole course of the project.

<u>Notes:</u>

Wrong assumptions:

- It's during that phase that the first tests happen. The project has to wait until the test phase to do tests
- Testing happens only during the test phase.

In a WBS, all tests activities, regardless of their phase, can be gathered in a "Test"-branch of the WBS. (A WBS-branch is often confused with a project phase.)

Test Methodology

Main steps:

Plan Tests → Design Tests → Prepare Tests → Execute Tests → Evaluate Tests → Take Measures

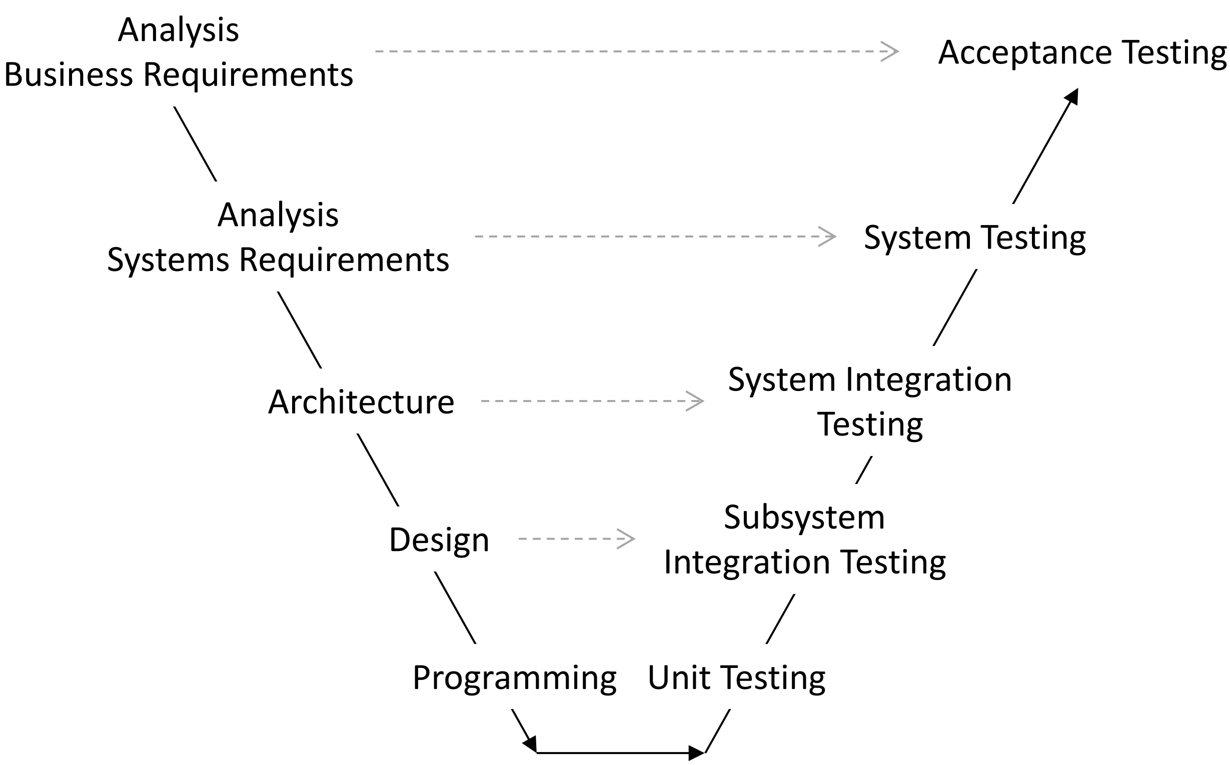
Following activities can be added

- Reviewing test scenarios
- Validating test scenarios
- Acquiring test tools
- Developing test scripts
- Establishing test environment check list
- Preparing test environment
- Testing the test environment
- Test the tests
- Preparing test data
- Training the testers
- Controlling test execution
- Analysing test results
- Analysing defects
- Test Environment Clean-up
- Elaborating a Test Report
- …

Related:

- Acceptance Criteria
- KPI's
- Metrics
- Validation Matrix
- Test Log
- Test Strategy
- Test Model ((network)model of subsequent tests to be carried out)
- Bug reporting
- Tests incidents
- Defect communication
- Review Matrix
- Test Data, Test Data Management
- Test automation
- Cycle Runs, Manual Runs
- Evaluation meetings
- Learned lessons

V-Model

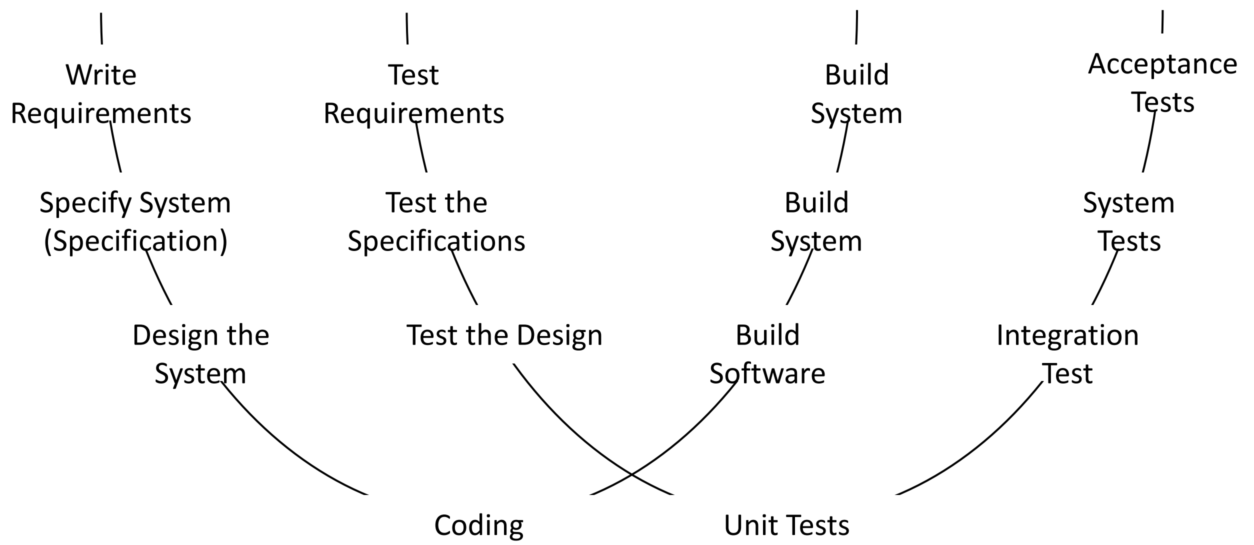


Notes:

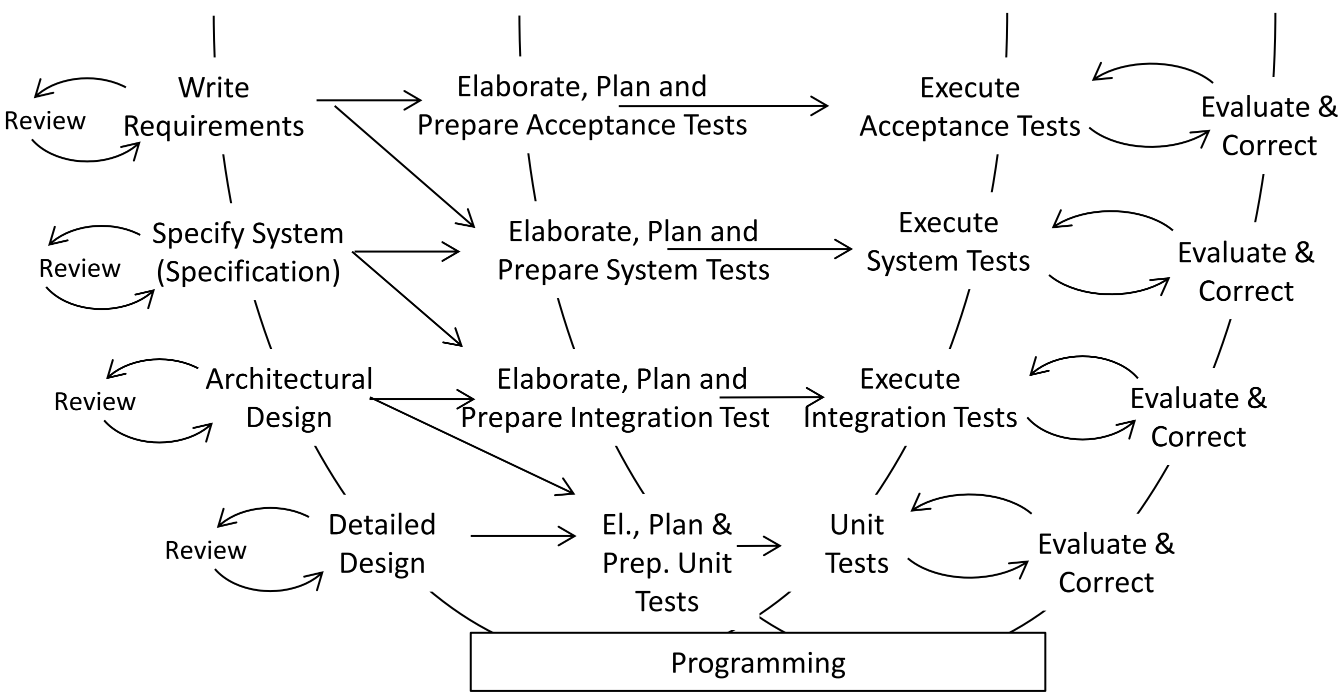
V-model shows the order in which some tests are being performed (and why)

W-Model

Variant 1



Variant 2



Notes:

- Improved V-model - Many variants of the model exist
- Easily to be incorporated in Waterfall-type approaches
- Understand the idea
- Activities related to testing start way earlier than at the end of Programming phase.

Misconceptions

Testing is NOT limited to the Testing phase

Various forms of testing (including checking, verifying and reviewing) are done during the whole course of the project. Specific tests (like proof of concept, simulation, unit tests, integration tests, data tests) can be organised thorough the project. The Test phase is only an ensemble of tests aiming to prevent faulty software to make it to the production environment. It is the ultimate chance to catch bugs before reaching the operational phase.

Testing Phase is NOT a "Proof of Concept"

The goal of the Test phase is not to find out if the product works or not. Other techniques, like a "Proof of Concept" serves this purpose. When a product reaches the test phase, there must be a fair amount of confidence that the product is ready for production. The Test phase is a final test that should detect the "last" issues and bugs and, once corrected, to provide confirmation of its readiness for release.

Testing Phase is NOT a "Product Discovery Phase"

Business stakeholders and representatives often see the product for the first time during the Test phase. They should have seen and tried the software product (or any product) during the design activities (prototype, screens mock-ups, ..) and during the programming/building (even partially, non-working software applications can be showed). Major flaws have to be discovered early. The goal of such reviews is not to capture latest preferences and new ideas. If they are important, they should be treated as real changes (depending on their importance and impact).

Testing Phase is NOT a "Learning Phase"

Learning happens all the time. However, one of the major goals of the Analysis is to learn (not just to be told). Then, a lot should be learned when presenting artefacts, models or the product in construction to the stakeholders. Finally, some learning happens also once the product is in production, leading to adjustments.

Types of Tests

ACCEPTANCE TESTING Testing to verify a product meets customer specified requirements. A customer usually does this type of testing on a product that is developed externally.

BLACK BOX TESTING Testing without knowledge of the internal workings of the item being tested. Tests are usually functional.

CHAOS TESTING Testing by deliberately injecting failure into their services and systems (tools: "Chaos Monkeys").

COMPATIBILITY TESTING Testing to ensure compatibility of an application or Web site with different browsers, OSs, and hardware platforms. Compatibility testing can be performed manually or can be driven by an automated functional or regression test suite.

CONFORMANCE TESTING Verifying implementation conformance to industry standards. Producing tests for the behaviour of an implementation to be sure it provides the portability, interoperability, and/or compatibility a standard defines.

FUNCTIONAL TESTING Validating an application or Web site conforms to its specifications and correctly performs all its required functions. This entails a series of tests which perform a feature by feature validation of behaviour, using a wide range of normal and erroneous input data. This can involve testing of the product's user interface, APIs, database management, security, installation, networking, etc. testing can be performed on an automated or manual basis using black box or white box methodologies.

INTEGRATION TESTING Testing in which modules are combined and tested as a group. Modules are typically code modules, individual applications, client and server applications on a network, etc. Integration Testing follows unit testing and precedes system testing

LOAD TESTING Load testing is a generic term covering Performance Testing and Stress Testing.

PERFORMANCE TESTING Performance testing can be applied to understand your application or web site's scalability, or to benchmark the performance in an environment of third party products such as servers and middleware for potential purchase. This sort of testing is particularly useful to identify performance bottlenecks in high use applications. Performance testing generally involves an automated test suite as this allows easy simulation of a variety of normal, peak, and exceptional load conditions.

REGRESSION TESTING Similar in scope to a functional test, a regression test allows a consistent, repeatable validation of each new release of a product or Web site. Such testing ensures reported product defects have been corrected for each new release and that no new quality problems were introduced in the maintenance process. Though regression testing can be performed manually an automated test suite is often used to reduce the time and resources needed to perform the required testing.

SMOKE TESTING A quick-and-dirty test that the major functions of a piece of software work without bothering with finer details. Originated in the hardware testing practice of turning on a new piece of hardware for the first time and considering it a success if it does not catch on fire

STRESS TESTING Testing conducted to evaluate a system or component at or beyond the limits of its specified requirements to determine the load under which it fails and how. A graceful degradation under load leading to non-catastrophic failure is the desired result. Often Stress Testing is performed using the same process as Performance Testing but employing a very high level of simulated load.

SYSTEM TESTING Testing conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of black box testing, and as such, should require no knowledge of the inner design of the code or logic.

UNIT TESTING Functional and reliability testing in an Engineering environment. Producing tests for the behaviour of components of a product to ensure their correct behaviour prior to system integration.

WHITE BOX TESTING Testing based on an analysis of internal workings and structure of a piece of software. Includes techniques such as Branch Testing and Path Testing. Also known as Structural Testing and Glass Box Testing

(Src: various websites on the web publish this list.)

DEPLOYMENT

- TECHNIQUES -

List of Techniques

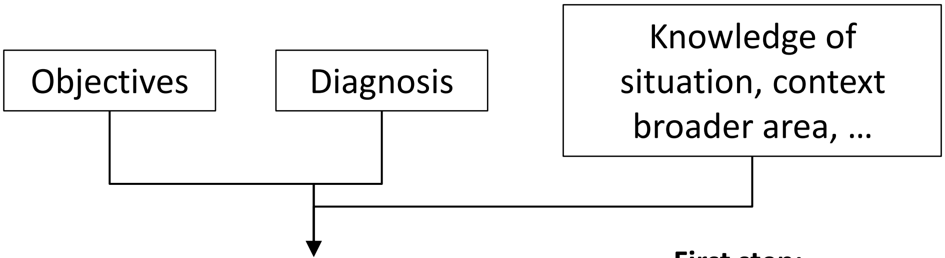
30/10/2018

- 5W1H
- 5Why's
- MoSCoW method
- Business Case
- CATWOE
- Critical Success Factors
- de Bono's 6 Thinking Hats
- Force Field Analysis
- Heptalysis
- Interviews
- Ishikawa
- KAOS (Knowledge Analysis in autOmated Specification)
- Mind Maps
- MOST analysis
- Net Present Value
- Job Observation
- PESTLE/PESTELI
- Proof of Concept
- Prototyping
- Questionnaires
- Requirements Analysis
- Requirements Engineering
- Rich picture
- SCRS
- Soft Systems Methodology
- Stakeholders Analysis
- Storyboarding
- SWOT
- Task Demonstration
- Use Cases
- Theme / Epic / User Stories
- WBS
- Workshops
- CRC
- …

Models
ERD
Finite State Machine

Languages
UML
BPMN
Specification and Description Language (SDL)
User Requirement Notation (URN)
Use Case Maps (UCM, a URN language))
Goal-oriented Requirements Language (GRL)
Systems Modelling Language (SysML)

Requirements



- What must the solution?
- What must the solution comply with?
- What do we know for sure?
- …

First step:
Establishing an as stable information as possible fundament that allow starting design. Using most sure and stable information.

Requirements give an indication about the future solution to the design process. These requirements will be implemented in the final solution. Thinking about what the solution should be able to do and comply with, is solution–oriented thinking. On the other hand, requirements are deduced from and by the analysis activities. They are not created as a result of creativity.

A **requirement** is a statement expressing a function, a key aspect, attribute, principle, characteristic, capability, constraint or limitation that is mandatory to reach the objective, solve the problem or satisfy the need. The future solution must implement it or comply with it. A requirement is related to a necessity.

The Analyst works with a **set of requirements**.

The Analyst extracts requirements through investigations, interviews of stakeholders and analysis. The requirements are the result of an Analysis, of an investigation.

The Set of Requirements is an artefact serving as a criteria.
The usage of this set of requirements is a method.

Notes:

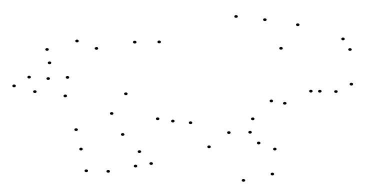
Techniques: Volere, Planguage, EARS (Easy Approach to Requirements Syntax)

Requirements

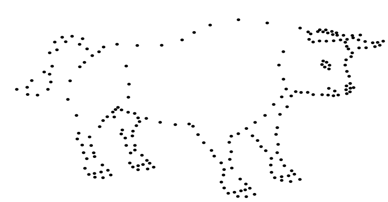
The Requirements technique is a Problem Solving technique

The following metaphor illustrates the functioning of requirements in the problem solving. Each dot can be seen as a requirement.

Elicited (not gathered) requirements provide some information about what has to be incorporated in the future solution.



The more requirements are elicited, the more become known about the future solution.



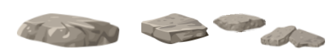
Sometimes, in the end, a pattern showing the future solution <u>may</u> emerge (in the illustration: a bull) from the set of requirements. The requirements help the mind to connect the dots and to fill in the blanks. If no pattern emerges, it is up to the Analyst to conceive a solution. They also help the Analyst excluding very early on solutions that do not meet the requirements. In any case, requirements help conceiving a solution.

After requirements have been elicited, the solution has still to be defined (conceived). Requirements facilitate this task.

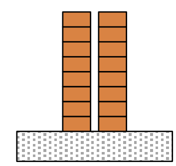
Requirements

Three Main Purposes

- To facilitate the process of conception of the solution by providing key elements that must be incorporated in this solution. It is the first information we know about the future solution.



- Purpose of **foundation** for further thinking. They form the stable basis for creative thinking. (stability of requirements!)



- To keep the conception of a solution in the right direction. Ensuring that the important aspects which have been identified are taken into account in the design, or, preventing to forget or ignored some of them. This can be verified by requirements-based tests.

Requirements can be optional

1) There might be several ways to reach a same objective. Each way may have its own sub-set of requirements. Depending on the chosen way, the other sub-set requirements won't be necessary.
2) An overall solution may tackle several issues. Some issues can be optional. As a result the requirements linked to these issues, become optional as well.

Requirements

- Requirements represent needed capabilities, constraints, limits or other characteristics.
- A requirement should state what a system must comply to, not or rarely how. However, this is likely to be in terms of business logic (in particular as business rules).
- Requirements without a right prior diagnosis are unusable.
- Requirements have to be feasible / attainable.
- Requirements should be deduced from the objectives, from the business knowledge and field expertise, from the business forecasts, from the supra-system and from the environment.
- A requirement is the result of an analysis, a deduction, an observation, a conclusion. If a requirement doesn’t comply with this and is the product of creativity, then it is not a requirement but already a design statement. Such early design statements, as false requirement, narrow the range of solutions. This is not the role of requirements.
- An approach in which different subjects, like an area, a domain, an aspect or a level of detail, are subsequently analysed is motivated by the objective to elicit requirements about that subject. The assumption is often made that only requirements about the subject being analysed will be elicited. It can’t be excluded that when analysing a subject A, requirements impacting subject B or impacting the solution or system as a whole.
- Requirements are by their very nature incomplete.
- The future solution has to comply with the ensemble of final requirements.
- The set of final requirements does not represent “THE SOLUTION”.
- Requirements help to solve problems. It’s a (possible) stage in the problem solving process. But it is not the magic bullet that replaces problem solving skills.
- Requirements are not a substitution for insight in the situation, in the context and in the broader area. Conceiving a solution based on a set of requirements without understanding the supra-system and the broader environment is a good receipt for disasters. It’s better to have this insight and no requirements than to have requirements and no decent broader understanding.
- Business requirements are requirements concerning the business domain, field experience, business activities. It does not mean “owned by the business” or “expressed by the business”.
- A future solution not complying with the final set of requirements, provided they are right, guarantees that this solution won’t function properly or, at least, be significantly lesser valuable.
- Any solution meeting the set of final requirements doesn’t guarantee the right problem is being tackled or contributing to the right goals. It doesn’t guarantee the problem will be solved, the solution resulting from it being right and the best, the solution being valuable nor does it guarantee customer’s satisfaction.
- A solution matching the requirements can still be refused.

Requirements

- Requirements are obligatory or alternatives or optional.
  - Alternative: different solutions may lead to a same result
  - Optional: for expansions of a solution
- Requirements have to be certain.

  The objective is to get requirements as stable and certain as possible. They have to be based on sound insight and be verified and validated.
- Requirements can be changed, but decent upfront analysis is done to prevent this. It is possible, yet unlikely to change.

- *Received (demanded)* 💣☠ ?
- *Assumed, guessed* 💣☠ ?
- *Imagined* 💣☠ ?
- Deduced from objectives
- Deduced from the real situation

Based on knowledge and insight (obtained by Analysis)

Notes

'Requirements' describing what is asked or what someone wants, by definition, these requirements are unreliable. (Usable for SW-development?)

Giving what is asked for is uncertain and short term.

If requirements are nothing more than desired and uncertain statements of desires and assumptions, then the whole approach should be questioned as well as the understanding of '*requirements*' as a technique.

Requirements Norms

Qualities

- Unitary, atomic
- Clear
- Complete
- Cohesive
- Consistent
- Non-conjugated
- Traceable
- Current
- Feasible
- Unambiguous
- Necessary
- Importance specified
- Verified
- Verifiable, testable

A requirement has first a temporary and uncertain status, like draft or preliminary. Later its status may become more definitive or final when it is found to be true, certain, accepted, validated or agreed (depending of the organisation).

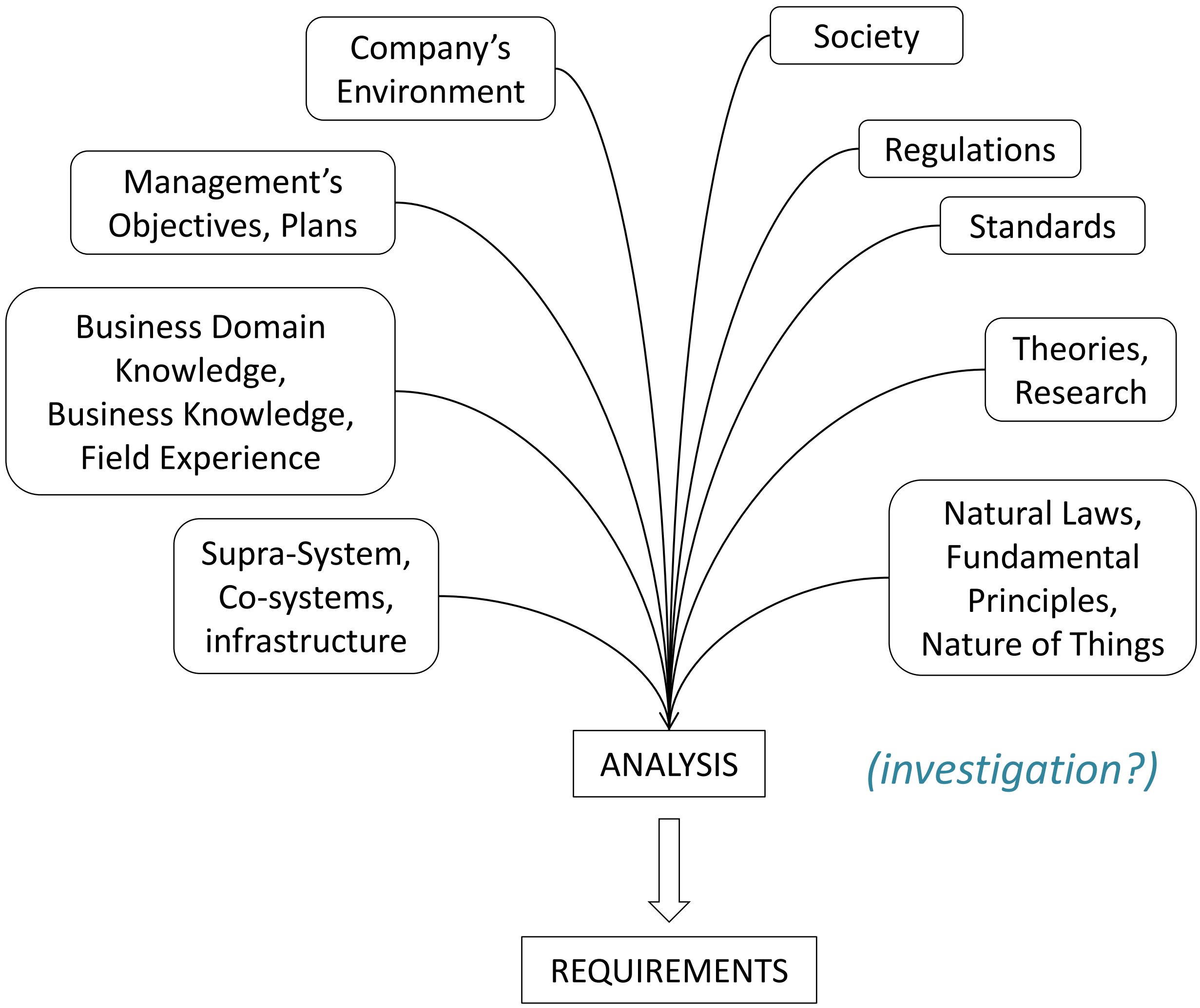
Let's call these the "*final requirements*".

Types of Requirements

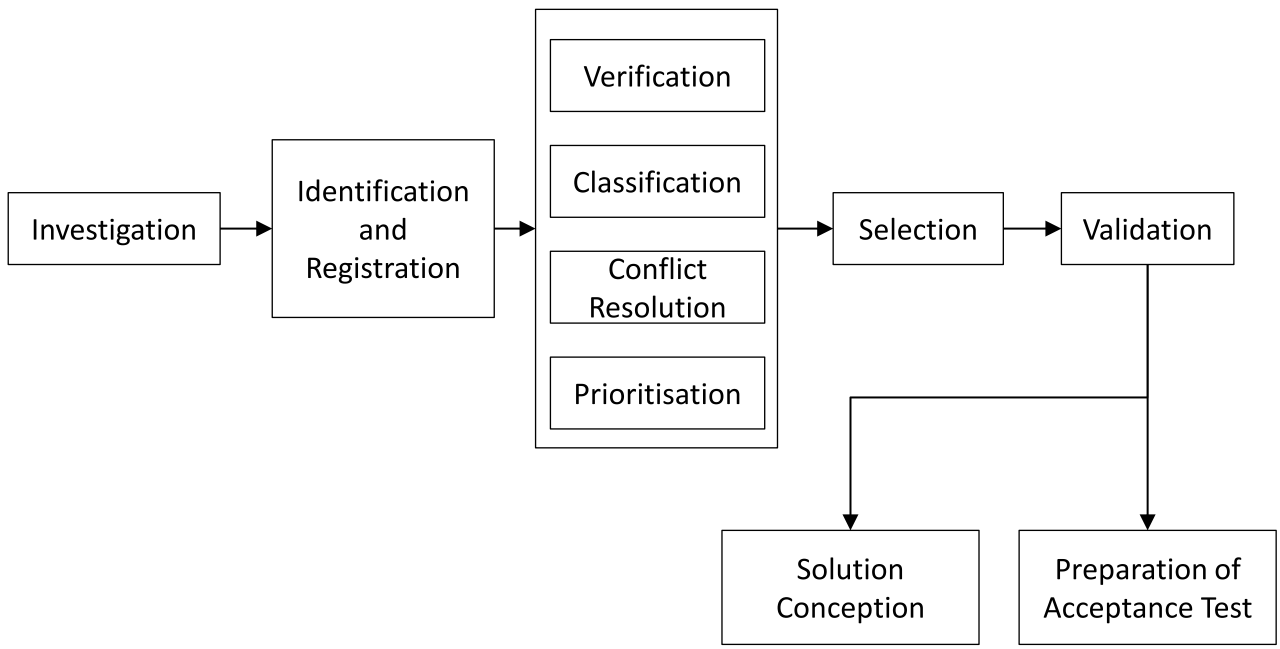
1. Business Requirements
2. Goal Requirements
3. Stakeholder Requirements
4. User Requirements
5. Program Requirements
6. Project Requirements
7. Process Requirements
8. Management Requirements
9. Enterprise Requirements
10. Environmental Requirements
11. Solution Requirements
12. Product Requirements
13. Architectural Requirements
14. System Requirements
15. Software Requirements
16. Change Requirements
17. Regulatory Requirements
18. Quality Requirements
19. Quality-of-service (non-functional) requirements
20. Functional Requirements
17. Non-functional Requirements
18. Usability Requirements
19. Indirect Requirements
20. High-Level Requirements
21. Detailed Requirements
22. Information Requirements
23. IT Requirements
24. Data Requirements
25. Design Requirements
26. (non-)Technical Requirements
27. Testability Requirements
28. Security Requirements
29. Documentation Requirements
30. Implementation Requirements
31. Transition Requirements
32. Requirements Specifications

… and there are many more

Sources of Requirements



Requirements Process Engineering



Notes:

This model shows a general idea. It is not the only way of working and can be adapted, for example, the selection and validation can be swapped.

Requirements

Requirements ??

- The new database must be online 24h/24h – 7d/7d.
- The software application must be able to print the customer's data.

These are NOT requirements

- What if the problem can be solved without new database?
- What if another software application would print the customer's data? Or what if the customer's data could be made available in another way?

Whether a new database is required, what software application should print or if printing is required are all design decisions.

If a statement is based on a design decision, then it is NOT a requirement.

Correct requirements:

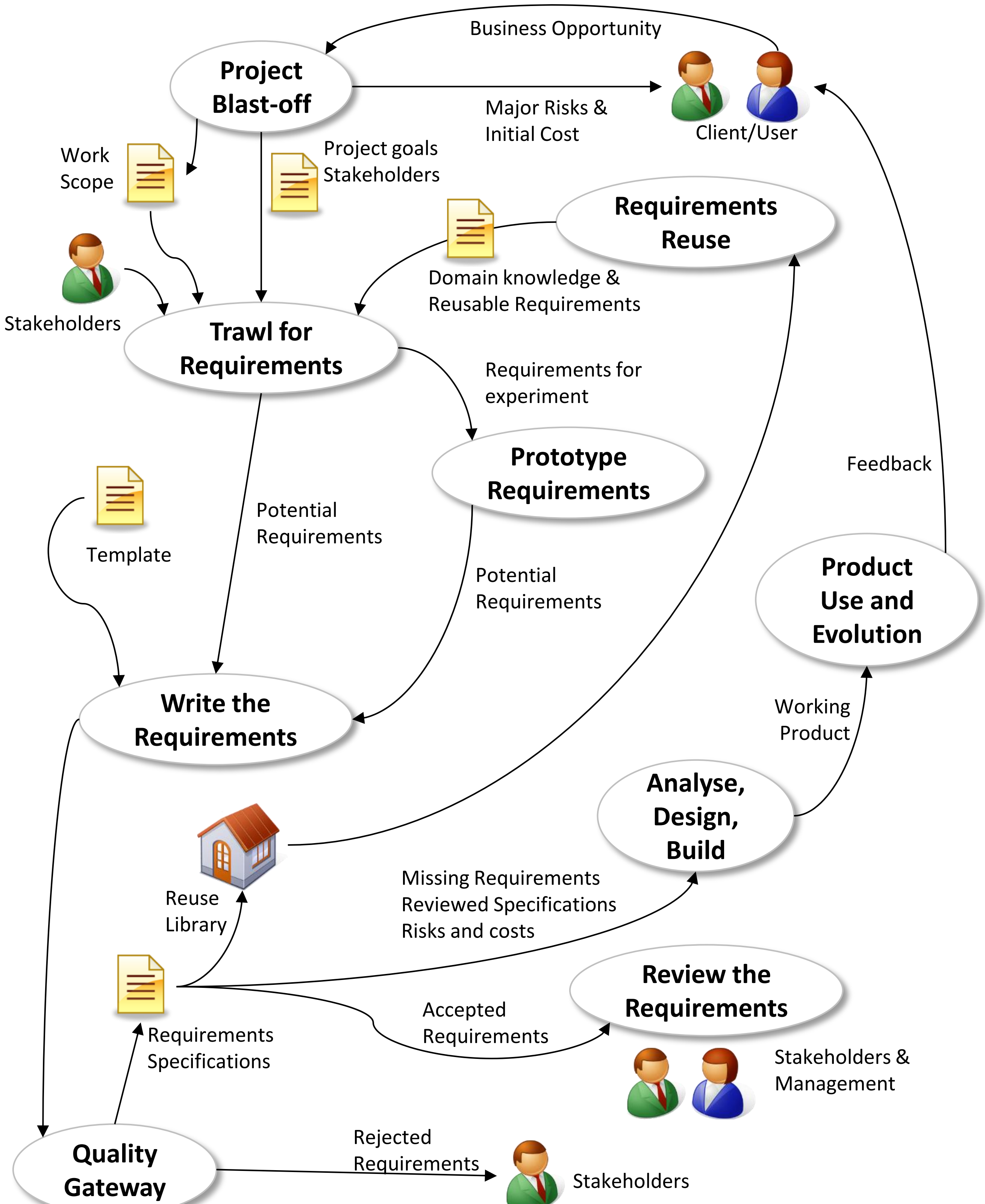
- The information should be available 24/h/24h – 7d/7d
- The customer's data should be made available to the customer.

Notes:

Requirements precede any design decisions. They are not the result of a design decision of any kind.

Requirements – Volere Process

30/10/2018



Good or Bad Requirements

Requirements are the result of an Analysis Process.
Good requirements result from the understanding
the environment, the situation, the business domain,
the objectives and systems.

Requirements are NEITHER **GATHERED** NOR **RECEIVED** !!
Some requirements are obvious.

Generally, spoken it is hard work to get sufficient relevant requirements. Some critical requirement are well hidden.

Obtaining bad requirement / bad practices:

- Gathering requirements
- Asked, received or expected from the business community, SME, …
- Accept requirements at face value
- Deduced from "what the business wants"
- Asking the business community to confirm the requirements they provided

Bad requirements result from an insufficient insight in the context and the situation.

A "requirement" stated by the business community CAN be valid, but it must be verified by the Analyst checked with the reality, with what "is", by investigating the broader context and see if this requirement matches and fits in this broader contexts.

WRONG PURPOSES of REQUIREMENTS

Requirements as a goal

"The goal is to meet the requirements." This shows little care about whether the solution will solve the problem or need or not. Basically, we don' mind to create value. Meeting requirements is good enough. Or we assume that by meeting requirements, value is created. Requirements are not a goal. Meeting requirements is an important criteria among others.

To replace a diagnosis

Requirements are a **post-diagnosis activity**. Requirements result from investigation activities (Analysis). The diagnosis should have been done by the time requirements technique is started.

To understand the problem or solution

Understanding requirements is not the same as understanding the problem or the solution. Requirements only express elements of the solution. They don't describe the problem or context. Having requirements does not discharge the Analyst from understanding the situation and the context. Requirements may describe a fraction of the problem or solution. Requirements are incomplete and may be wrong. Understanding requirements is insufficient to build a suitable solution.

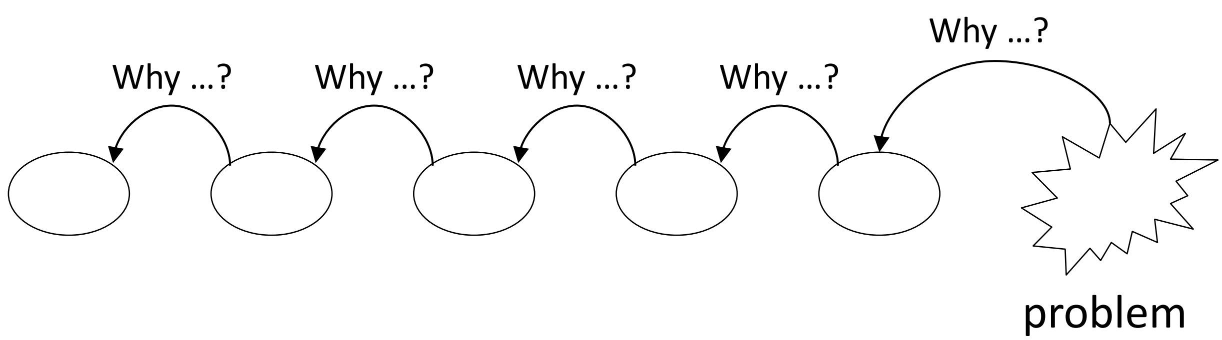
To describe the solution

Requirements describing a solution are called "specifications". Seeking to have all the requirements is impossible and senseless.

Questions

1. Why?
2. What?
3. When?
4. Who?
5. Where?
6. How?
7. Which?
8. What kind of ?
9. What for?
10. Whose?
11. How long?
12. How much?
13. How old?
14. How come?
15. How far?
16. Why not?
17. What if?
18. Whom?

5 Why's



Purpose: Finding the root cause

- The number of 5 shouldn't be taken literally. The idea is to repeat the question as many times as possible.
- The answer may consists of several reasons → branching
- It is simply a matter of answering the question based on the present knowledge. If necessary, it should lead to further investigation (new knowledge) of the question.

5W1H

- *Who* was involved?
- *What* happened?
- *Where* did it take place?
- *When* did it take place?
- *Why* did that happen?
- *How* did it happen?

THE ANALYST'S RED BOOK

THE END