# Managing Projects with openSE

## for Executives and Line Managers

## References

The following resources were used to prepare this training session material :

ISO 21500 :2012. *Guidance on Project Management.* International Organization for Standardization, Geneva, Switzerland. 42 p.

D. Milosevic, P. Patanakul. "Standardized Project Management May Increase Development Projects Success." *International Journal of Project Management* **23** (3) Apr. 2005. 181–192.

The openSE editorial community (2014) *openSE Framework*, Geneva, Switzerland.

—— (2016) *Initiating a Complex Systems Project. Drafting and Releasing a Project Proposal/Roadmap*, Geneva, Switzerland. openSE Guidelines no. 1009.

—— (2014) *Setting up a Project Management System. Drafting and Releasing a Project Management Plan*, Geneva, Switzerland. openSE Guidelines no. 1000.

PMI Standard Committee (2008) *A guide to the project management body of knowledge.* 4th ed. Newton Square, PA : Project Management Institute. 403 p. ISBN 1933890517.

## 0. Foundation

Managing Projects with openSE

**D**iagnose
needs
problems
opportunities
means

**D**efine
objectives
processes
roles
results

**D**ecide
actions
assignment
delegation
validation

D³

 Pierre Bonnal

## Managing Projects with openSE

i.e. studies and projects

### Entrepreneurial activities

- Specific mandates, organizations and objectives
- Change-oriented
- Unique product
- Heterogeneous teams
- A start and an end

### Operations activities

- Permanent mandates, organizations and objectives
- Status quo-oriented
- Standard product
- Homogeneous teams
- No temporal limitation

Intrusiveness

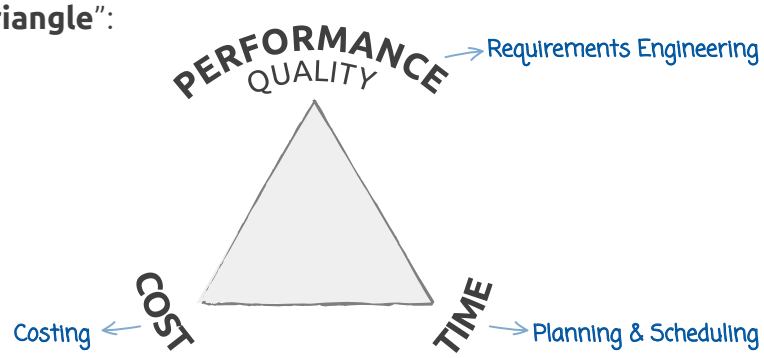
6. **New projects**
5. **Upgrade projects**/activities
4. **Consolidation projects**/activities
3. **Corrective maintenance activities**
2. **Preventive maintenance activities**
1. **Inspection activities**

## Managing Projects with openSE

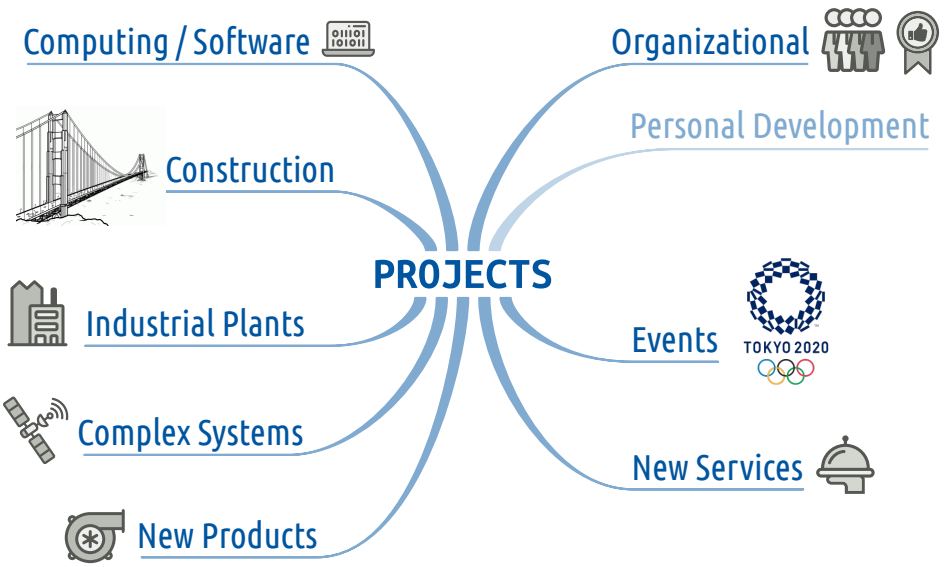
A unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve project objectives.

ISO 21500:2012

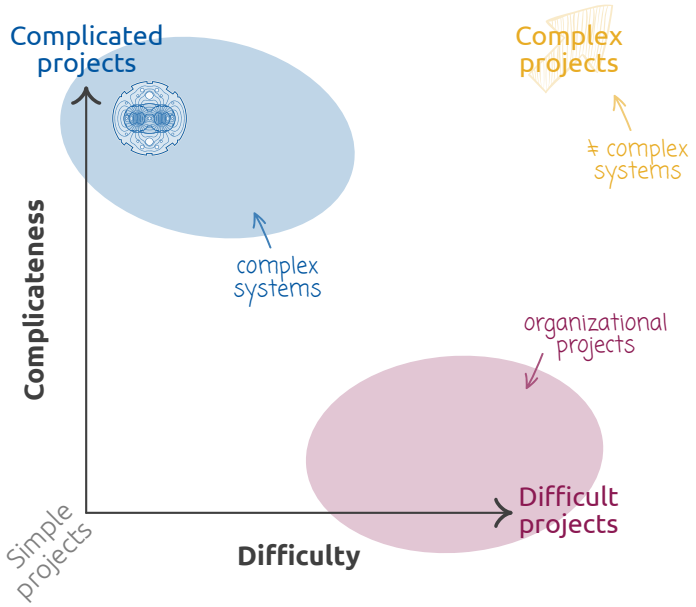
"**Project triangle**":



## Managing Projects with openSE

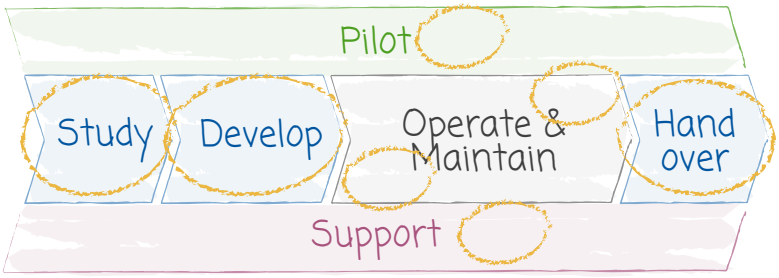



## Managing Projects with openSE



## Managing Projects with openSE

**Projects** can be found everywhere!




## Managing Projects with openSE

**Project** = { project activities }

⚠ ∃ activities ≠ project activities

**Program** = { projects, non project activities }

focused on a common goal

**Portfolio** = { projects, non project activities }

not necessarily focused on a common goal

## At **CERN** (in the A&T Sector)
## **Typology of projects**
Regimented by EDMS 1398374

- **Beam-facility-related** (large-scale) programs and projects
  *LHC Project*, LIU Project*, HL-LHC Project*, HIE-ISOLDE Project, AWAKE Project, etc.
- **Non beam-facility-related** programs and projects
  SM18 Refurbishing Project, Building 107 Project, Building 311 Project, etc.
- **Equipment-** and **systems-related** projects
  Consolidation and renewal of the demineralised water production plant of building 378
  Renovation of the Meyrin site electrical safety network
- **Facility-related** sub-projects (work package of a facility-related project)
  Development of the RF cryomodules for HIE-ISOLDE
  Development of the cryolink in IR3 of the LHC
  Development of the crab cavities for HL-LHC
  Development of beam diagnostic boxes for HIE-ISOLDE
  Installation of the cooling and ventilation system of the Linac 4 building
  Upgrade of the HVAC system of the CERN computer centre (building 513)
  Development of teleoperated shielding doors for MEDICIS

## At **CERN** (in the A&T Sector)
## **Typology of projects**
Regimented by EDMS 1398374

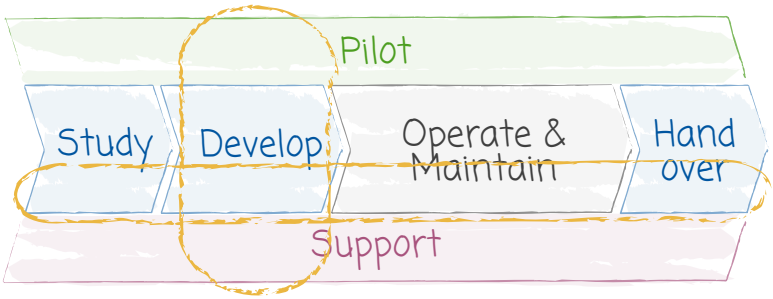
- **Large-scale studies** managed as programs or projects
  CLIC Study, FCC Study, etc.
- **Organisational** or **IT-related** programs and projects
  CAD'20 Replacement Program, EDMS Portal Refurbishing Project, etc.

**Facility-related projects → multi-trade projects**

Several equipment groups involved

## Managing **Projects** with openSE

**Programs** are more transverse!




## **Managing Projects** with openSE

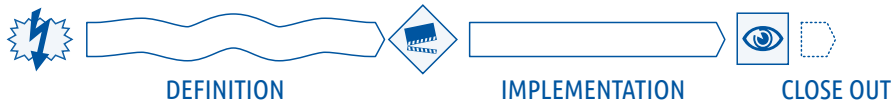
The application of **methods**, **tools**, **techniques** and **competencies** to a project

ISO 21500:2012

PMI PMBoK
ISO 10006:2003
openSE
IPMA ICB
Hermes HERMES 5.1
ANSI #748
CCPM
NASA Systems Engineering Handbook NASA/SP-2007-6105 Rev1
INCOSE SEBoK
RUP RATIONAL UNIFIED PROCESS
ECSS EUROPEAN COORDINATION FOR SPACE STANDARDISATION
SCRUM +KANBAN
PRINCE2
gdpm
XP EXTREME PROGRAMMING
ISO 21500:2012

## Managing Projects with openSE

Concept of **lifecycle**




**Creativity** is required

some clumsiness can be beneficial !

collaboration

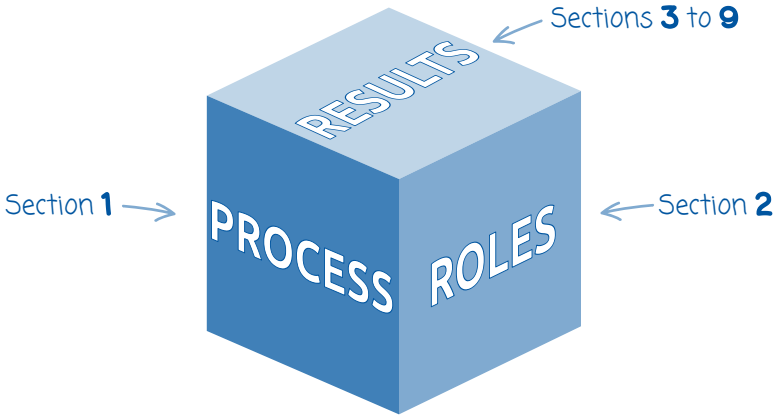
**Rigour** is required

a disciplined approach is essential !

co-operation


## Managing Projects with openSE

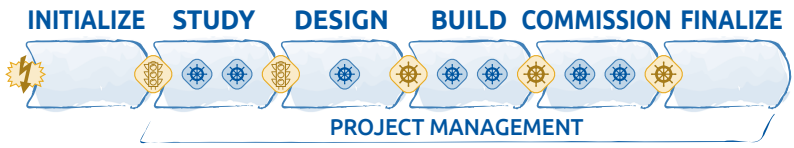

Managing **Projects** with openSE




Inspired from Hermes

# 1. Project Management Processes

## Phases and Decision Points




Phase

Support process

Emerging need or problem

Gonogo decision point

Inter-phase decision points

Drift decision point

Intra-phase decision point

Inspired from Hermes

## Phases and Decision Points

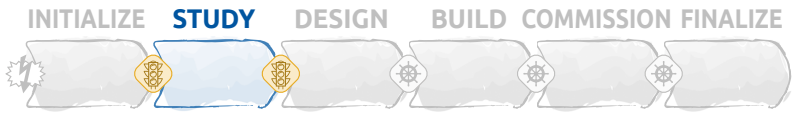

Inspired from Hermes

## Initialize


- Formalize the **decision** to perform the project
- Analyse the **current situation**; define the **problem**
- Propose some **possible solutions**

Inspired from Hermes

## Study




- Define more precisely the **scientific/user requirements**
- Convert the gathered UR's into **product/systems requirements**
- Identify straightforwardly all possible solutions
- Propose one solution and demonstrate its **feasibility**
- If required, develop **prototypes**, mock-ups…

Inspired from Hermes

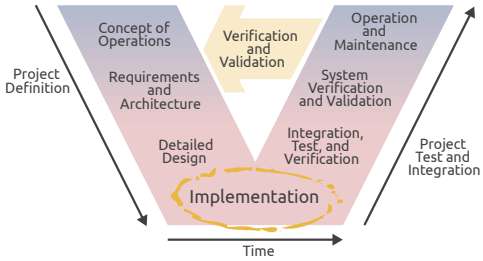
## Design


- Finalise the definition of the **scientific/user requirements**
- Finalise the **product/systems requirements** accordingly
- Design the solution (design and engineering tasks)
- Plan the **BUILD** and **COMMISSION** phases
- If required, develop further prototypes, mock-ups…

Inspired from Hermes

## Build


- Perform the **detailed design**
- **Materialize**, i.e. procure, manufacture, assemble…
- **Verify** and **validate** at components and subsystems levels



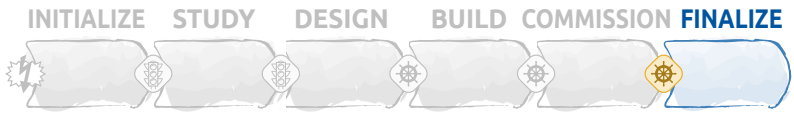

Inspired from Hermes

## Commission


- Further **validate** (i.e. commission) at systems level
- Refine and ramp-up
- **Train** of the users
- Adapt to the evolving context

Inspired from Hermes

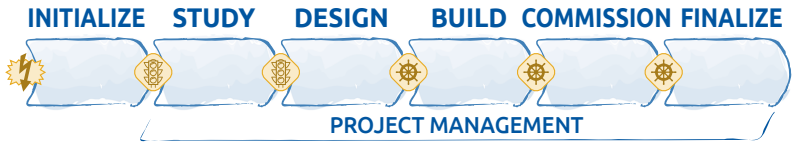
## Finalize




**Capitalize** of the lessons learned

Inspired from Hermes

## Support Processes




Launching a project

Ensuring quality

Defining requirements

Costing

Planning & scheduling

Managing risks

Reporting progress

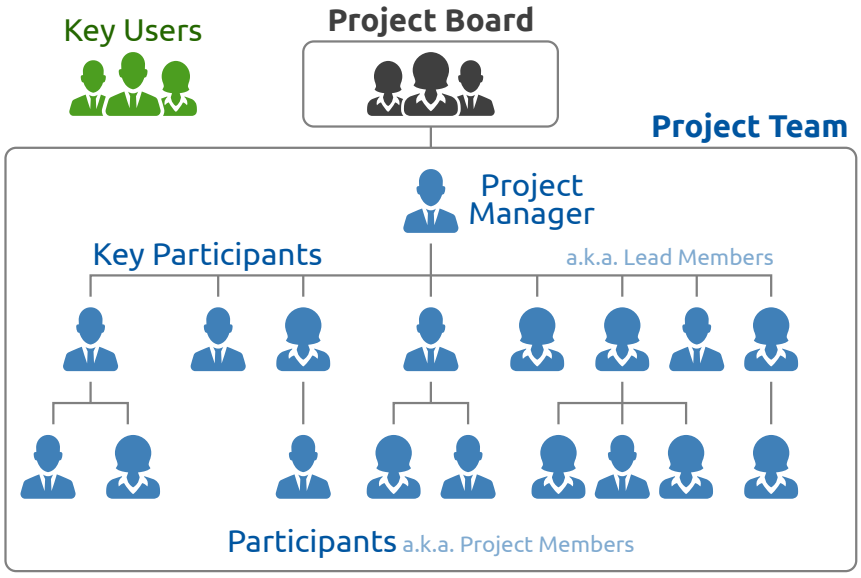
Handling issues

Finalizing a project

# 2. Project Management Roles

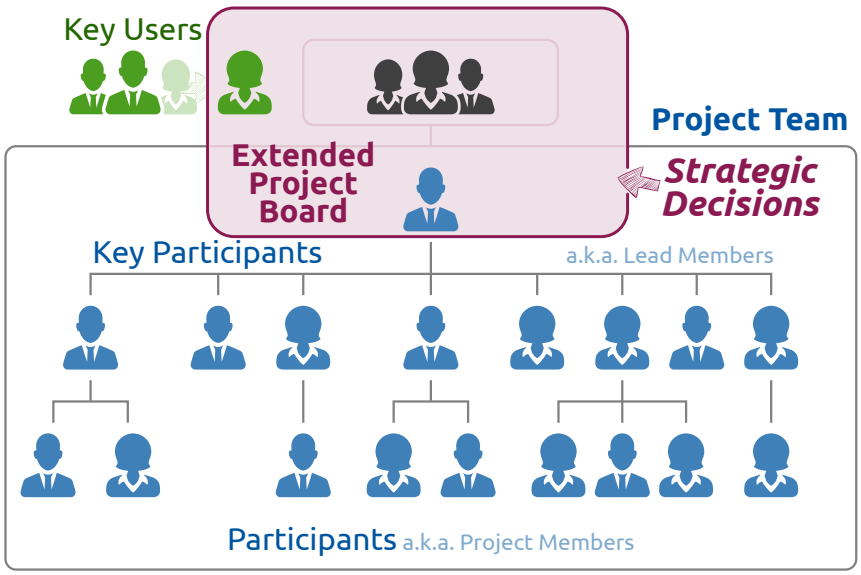
## Roles

Core roles



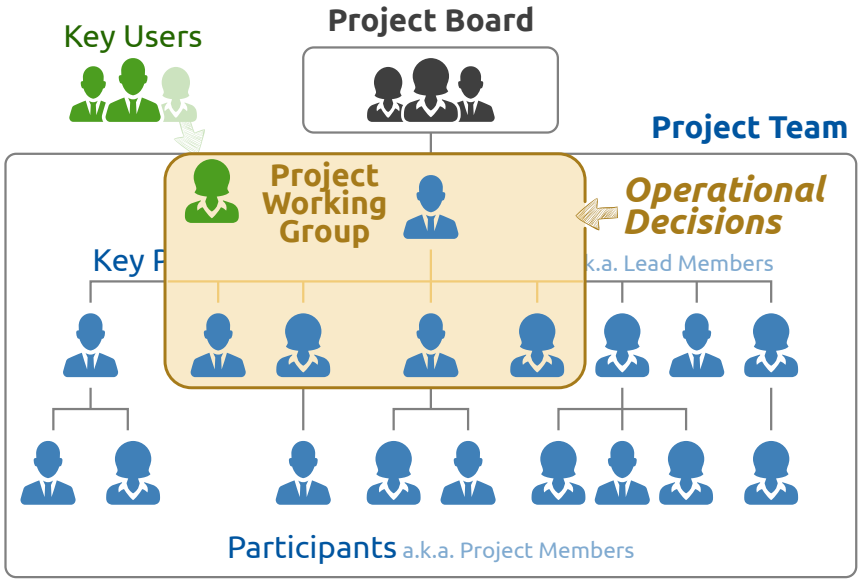

## Roles

Core roles



## Roles

Core roles




## Roles

Core roles

## Roles
Responsibilities

### Project Board (PB)

Strategic/Steering Board/Committee,
Project Owner, Product/Systems Owner,
Comité de projet (CoP),
Comité de pilotage (COPIL),
Donneur d'ordre,
Maître d'ouvrage (MOU),
Projektausschuss,
Comitato di progetto...

- Ensure the **strategic management** of the project
- Is ultimately responsible w.r.t. successfull completion of the project
- Guarantee the acquisition and availability of resources
- Validate transitions between phases (and intra phases also)
- In case if conflict or disagreement within the project team, arbitrate

## Roles
Responsibilities

### Project Manager (PM)

Project Leader (PL), Project Coordinator, Coordinator,
Chef de projet (CP), Maître d'œuvre (MŒU),
Projektleiter (PL), capoprogetto (CP)...

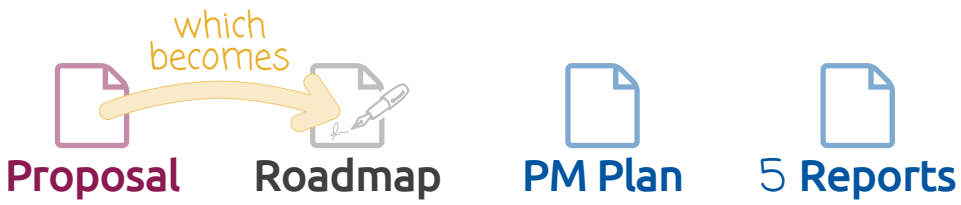
- Ensure the **operational management** of the project
- Is responsible for the **organisation** of the project and for its coordination

Most of project management
is about setting this organisation

# 3. Project Management Results

## Key Results

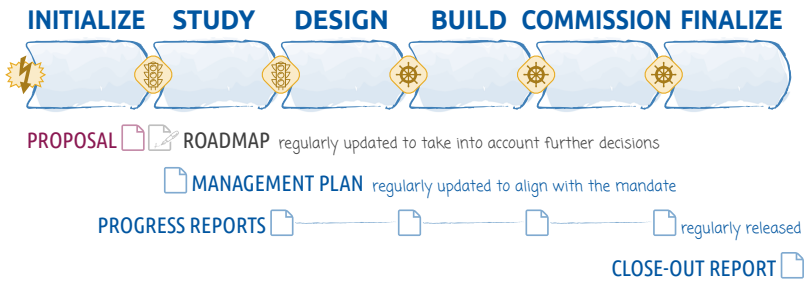
"Lean Project Management"




8 documents!

## Key Results

Project Management Documents



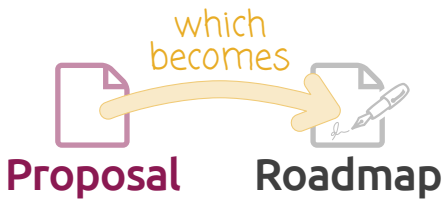
# 3.1 Project Mandate / Roadmap

## Project Roadmap

It is a document that summarizes the direction to be followed by the project team (for the **STUDY**, **DESIGN**, **BUILD** and **COMMISSIONING** phases)

Other names for this document:

- (Project) Charter
- (Project) Mandate (e.g. GDPM)
- (Project) Mission Statement
- (Project) Brief
- Concept of Operations (systems eng.)




## Project Proposal

Typical Table of Contents

0. **Executive Summary** To the attention of the Project Board
1. **Initial Situation** Problem statement, rationale, current situation
2. **Project Objectives**
3. **Possible Solutions**
4. ***A priori* Preferred Solution**
   - 4.1 Description of the preferred solution
   - 4.2 Stakeholders and "approched Project Board" membership
   - 4.3 Phasing, project organization, masterplan
   - 4.4 Required resources
   - 4.5 Outcomes and benefits of the project
5. **Preliminary Risk Register**

## Project Proposal

Editorial Process

- **Authoring:** Project Initiators 
- **Verification:** Some experts in the field
  The foreseen Project Manager
  A few possible Key Project Participants
- **Validation:** Ø

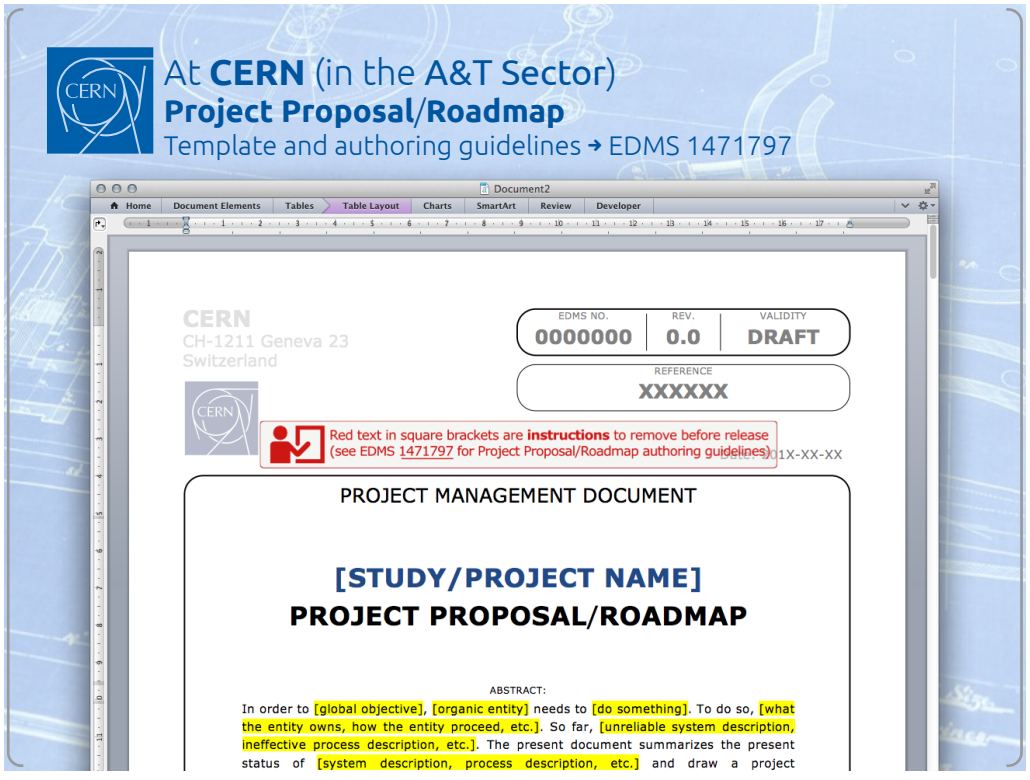
## Project Roadmap

Typical Table of Contents

## Project Roadmap

Editorial Process

- **Authoring:** Project Initiators
- **Verification:** Some experts in the field
  The foreseen Project Manager
  A few possible Key Project Participants
- **Validation:** **Project Board**



# 4. Project Quality Management

## Quality

At a glance

Quality Planning

Quality Assurance

"I say what I will do

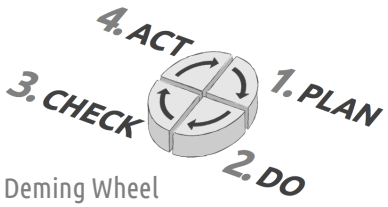
Someone checks that it is appropriate

I do what I have said

I provide evidence of compliance"

Quality Control

"I also identify defects in the processes and seize the opportunity to improve them"




Deming Wheel

## 4.1 Project Management Plan

### Project Management Plan

- The "**entry point**" to project information
- The aim of the PMP is twofold:
  - Ensuring that the project participants agree upon and share a common framework for organizing their project
  - Giving the project board the assurance that the project expectations are well understood and that everything is done to ensure the operational success of the project
- A few possible approaches depending on the project participants maturity level w.r.t. project management processes

See openSE brochure #1000 "Setting up a Project Management System"

## Project Management Plan

Typical Table of Contents
Simple Approach

1 **Project Overview** PMP Scope + Reformulation of the Project Roadmap

2 **Project Organization** Project Board, Project Team, roles, OBS

3 **Project Management Processes**

- 3.1 **Scope Management** WBS, Work Packages, Work Units, Activities
- 3.2 **Time Management** Master and Coordination Schedules
- 3.3 **Resource and Cost Management** Manpower, budgeting, EVM
- 3.4 **Quality Management** Document management, V&V, configuration management, issue and non conformity handling
- 3.5 **Communication Management** Meetings, reporting periodicity
- 3.6 **Risk Management** Project Risk Register, Project Continuity Plans
- 3.7 **Procurement and Contribution Management** Ordering, contracting

A **Applicable Standards**

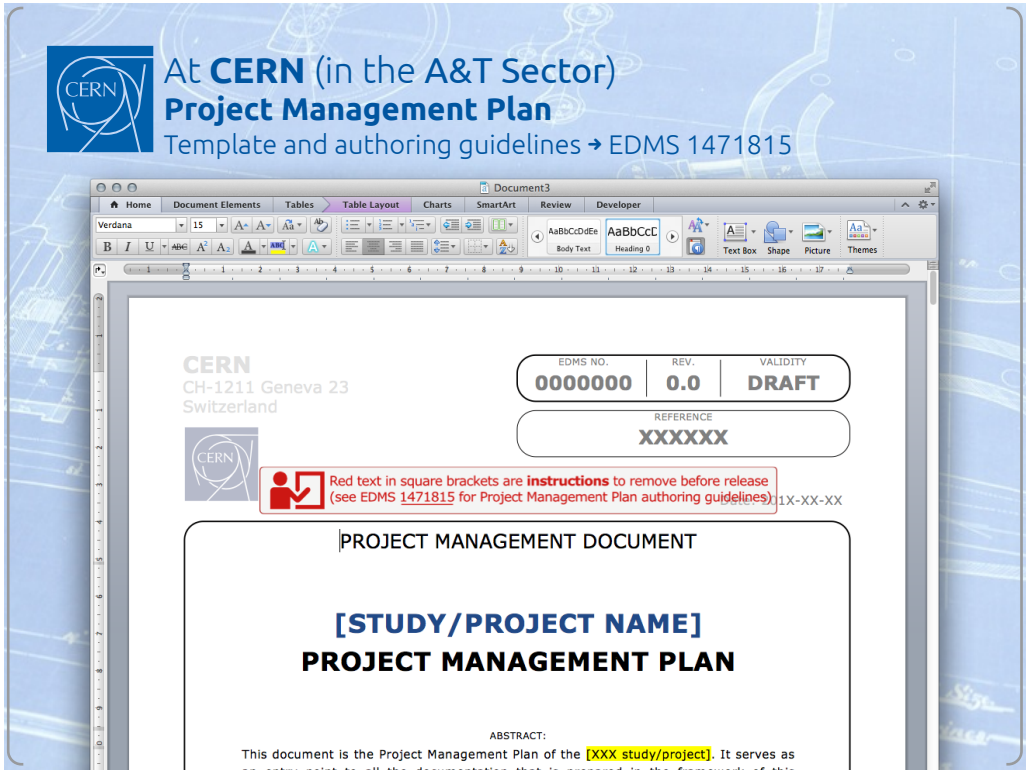
## Project Management Plan

Editorial Process

**Authoring:** Project Manager + a few Key Project Participants

**Verification:** Some other Key Project Participants + some Project Management Experts (e.g. members of the PMO)

**Validation:** **Project Manager**




## 4.2. Document Management System

### Project Document Register

| Unique ID | Document title | Ver. | Date | Authored by | Verified by | Validated by |
|---|---|---|---|---|---|---|
| 100 | Project Roadmap | | | | | |
| | | 0.1 | 2014-01-13 | Alberte | | |
| | | 0.2 | 2014-01-20 | — | Ursule, Yvone | |
| | | 1.0 | 2014-01-22 | — | — | Xavier, Zélie |
| 101 | Project Management Plan | | | | | |
| | | 0.1 | 2014-02-05 | Alberte, Barnabé | | |
| 102 | Project Work Breakdown Structure | | | | | |
| 103 | Project Cost Estimate | | | | | |
| 104 | Project Budget | | | | | |
| 105 | Project Master Schedule | | | | | |
| | | 0.1 | 2014-02-07 | Alberte, Cyprien | | |
| 106 | Project Coordination Schedule | | | | | |
| 107 | Project RACI Matrix | | | | | |
| 108 | Project Risk Register | | | | | |

## At **CERN** (in the A&T Sector)
## **Project Document Registers**

- **EDMS** → 100% engineering and PM documents
- **EDMS/CDD** → 2D drawings
- **CATIA/SmarTeam** → 3D models
- **CDS** → Scientific publications (reports, notes)
- **Indico** → Presentations
- **SharePoint** or **Drupal** → General project information
- **DFS** → Nothing! Very bad practice
- **CFU/CDS** → Released procurement documents

**No project-wide document register!**

## Project Document Template

| Unique ID | Version | Status | Date |
|---|---|---|---|
| 101 | 0.3 | DRAFT | 2014-02-22 |

the whatever project

**PROJECT MANAGEMENT PLAN**

| Authored by: | Verified by: | To be validated by: |
|---|---|---|
| Alberte Barnabé | Cyprien Denise | Ernest |

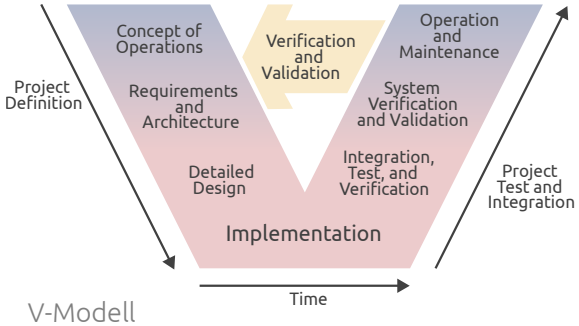
This document is uncontrolled when printed.
Check the Project Document Register to verify
that this is the correct version before use

## Verification vs. Validation

Check vs. Approval

From Software Engineering but also widely applied to document lifecycle

Concept introduced by **Barry W. Boehm** (1981)




V-Modell

**Verification**:
*Are we building the product right?*
*Are we solving the equation right?*

**Validation**:
*Are we building the right product?*
*Are we solving the right equation?*

# 5. Requirements Engineering

## Requirement(s) Engineering

The process of documenting, analyzing, tracing, prioritizing and agreeing on requirements and then controlling change and communicating to relevant stakeholders

en.Wikipedia.org

- Procurement and Purchasing → **technical specification** writting
- Quality Management → **QFD** (Quality Function Deployment) and the ***House of Quality*** ← 60's-70's in Japan
- New Product Development → gathering **customers needs** and translating them into **specifications** or specification items ← 80's
- Software Engineering → capturing **users requirements**
- Systems Engineering → identifying **users** vs. **functional** vs. **non-functional requirements** ← 90's, ca. 2005

## Typology

**Requirements**

**Business & User Requirements***

~ **Customer Needs***
or Customer Attributes**
or Stakeholder Intentions*
or sometimes just Expectations

**Problem Domain**

**System(s) or Product or Service or Organization Requirements**

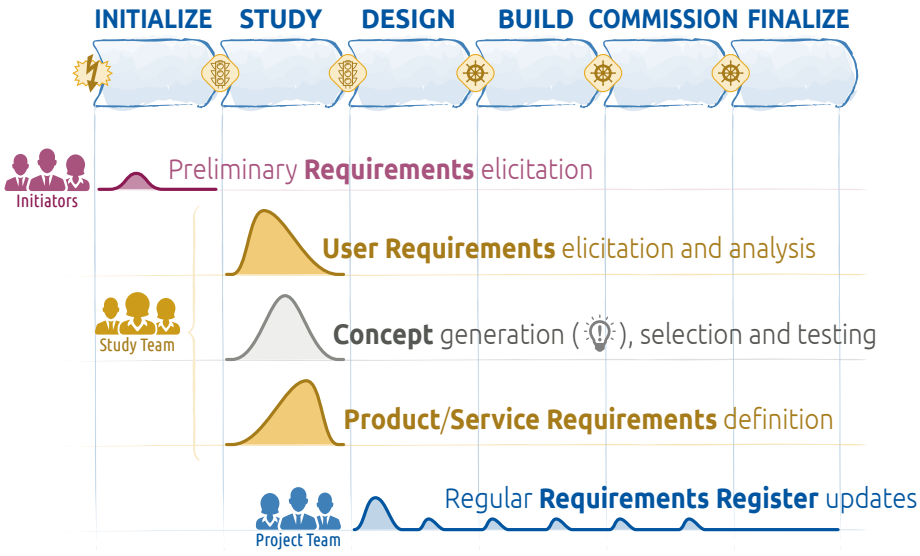
~ **Product/Service Specification**
Functional Requirements*
or Product/Service Characteristics

**Solution Domain**

- *ISO/IEC/IEEE 29148:2011 Requirements Engineering
- *Karl Ulrich, Steve Eppinger (2011) Product Design and Development. McGraw-Hill/Irwin
- *Nam-pyo Suh (1990) Principles of Design. Oxford University Press
- *John Hauser, Don Clausing (1988) The House of Quality. HBR

## Requirements Engineering

When and which effort?



## User Requirements

1. Identifying the **stakeholders** (end users, key users, customers, etc.)
2. Elicitating the **user requirements**
   - 2.1 Gathering **raw needs**

     When and why do you (or will you) **use** this product/service?
     Walk us through a **typical usage** of it
     What do you **like** (👍) about the (existing) product/service?
     What do you **dislike** (👎) about the (existing) product/service?
     What issues do/will you consider when using it?
     What **improvements** would you make to it?

   - 2.2 Translating raw data into **interpreted user requirements**
   - 2.3 Organizing the IUR's into a list → prelim. **Requirements Register***

*Stakeholder Requirements Specification (StRS) or preliminary Systems Requirements Specification (SyRS)

## User Requirements

2.2 Translating raw data into **interpreted user requirements**

- Raw needs → *"in any vernacular spoken by the users"*
- Requirements → in a formal language*, a.k.a. *"shall-statements"* or "**deontic statements**"

  this applies to all types of requirements

  - "**Shall**" indicates **mandatory** or **binding** requirements strictly to be followed in order to conform and from which no deviation is permitted
    ("shall" equals "is required to")
  - "**Should**" indicates that among several possibilities one is **recommended** as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required
    ("should" equals "is recommended that")

*ISO/IEC/IEEE 29148:2011 Requirements Engineering → § 5.2.4 Requirements Constructs

## User Requirements

2.2 Translating raw data into **interpreted user requirements**

- "**May**" is used to indicate a course of **action permissible**, of **allowance** or **suggestion** ("may" equals "is permited to")
- "**Can**" is used for statements of **possibility** and **capability**, whether material, physical, or causal ("can" equals "is able to")
- "shall" or "should" or "may" or "can"

Mandatory | Desirable | Optional | Possible (future enhancement)

- ~~"must"~~

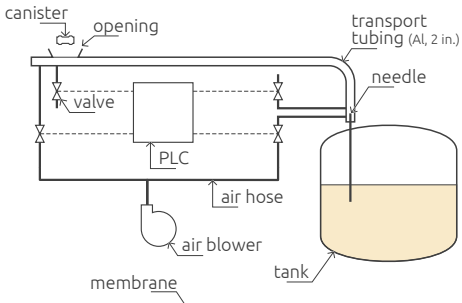
"It is best to avoid using the term 'must' due to potential misunderstanding as a requirement"*

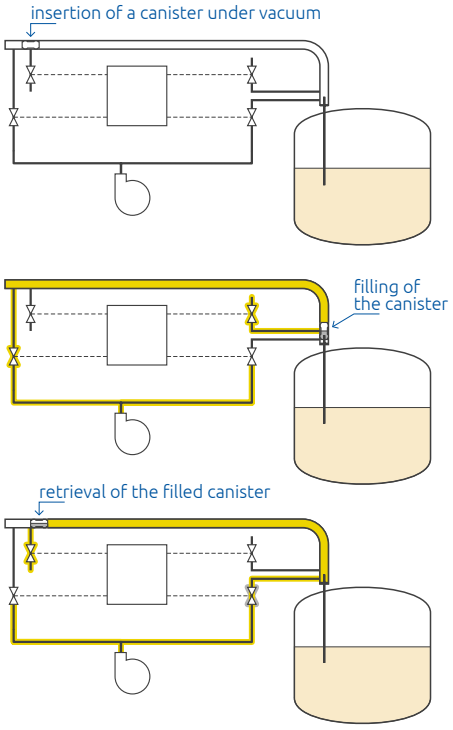
- "**Will**" is used for **statement of fact**, **futurity**, or **declaration of purpose**

*ISO/IEC/IEEE 29148:2011 Requirements Engineering → p. 10

## The CanNet Pilot Project

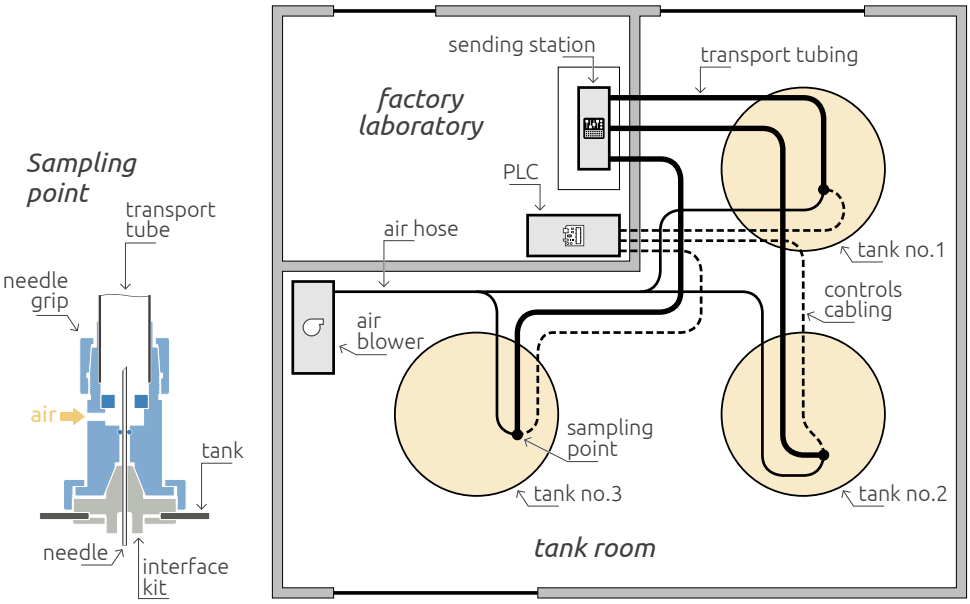
### *The process*



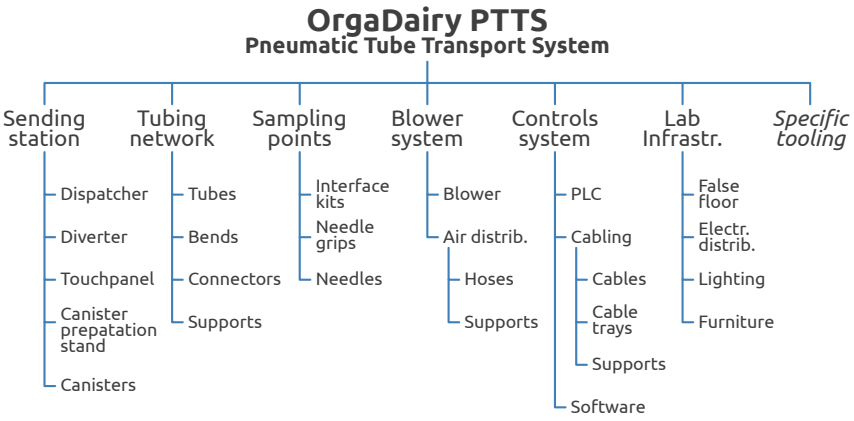
## The CanNet Pilot Project

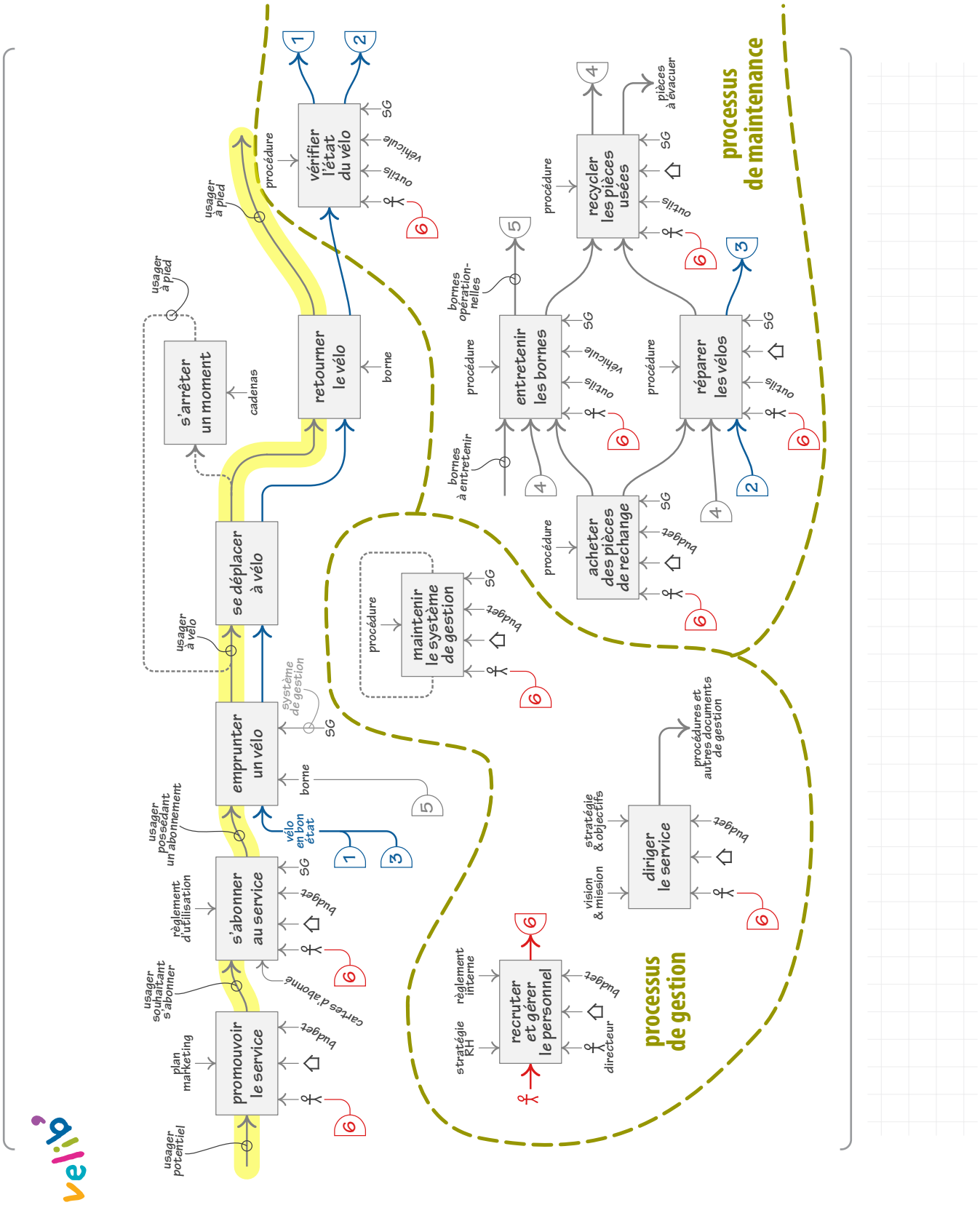
### *The layout*




## The CanNet Pilot Project

### *Product Breakdown Structure (**PBS**)*




processus de maintenance
processus de gestion
usager potentiel
usager souhaitant s'abonner
usager possédant un abonnement
usager à vélo
usager à pied
promouvoir le service
s'abonner au service
emprunter un vélo
se déplacer à vélo
retourner le vélo
s'arrêter un moment
vérifier l'état du vélo
maintenir le système de gestion
entretenir les bornes
réparer les vélos
recycler les pièces usées
acheter des pièces de rechange
recruter et gérer le personnel
diriger le service
plan marketing
règlement d'utilisation
cartes d'abonné
vélo en bon état
borne
système de gestion
cadenas
outils
véhicule
budget
SG
procédure
bornes à entretenir
bornes opération-nelles
pièces à évacuer
stratégie RH
règlement interne
directeur
vision & mission
stratégie & objectifs
procédures et autres documents de gestion

## User Requirements

2.3 Organizing the IUR's into a list → prelim. **requirements register**

- Merging all interpreted user requirements in a list
- From a few dozens to several hundred IUR's
- Eliminating redundant "shall-statements"
- Flagging them: **M**andatory, **D**esirable, **O**ptional, **P**ossible
- Grouping them according to the similarities of the needs they express

⚠ UR's (and IUR's) can be contradictory! → "the product shall be red" "the product shall be blue"

- Requirements breakdown into more focused requirements

## Product/Service Requirements

- User requirements are expressed in the language of the user
- Too much space is left for subjective interpretation
- The achievement of product/service requirements shall be measurable
- Product/service requirements are expressed in engineer's language

4 Translating the **user requirements** into **target requirements** (~ target specifications setting)

- 4.1 Based on the IUR's, preparing a list of **metrics** → one to one mapping (House of Quality, QFD)
- 4.2 Collecting **competitive benchmarking** information
- 4.3 Setting ideal and marginally acceptable **target values**
- 4.4 Translate target values into **target requirement** statements → "formal shall-statements"

## Service Requirements

4.3 Setting ideal and marginally acceptable **target values**

- Five ways to express values in metrics:
  at least *X*, at most *X*, between *X* and *Y*, exactly *X*, discrete values

**Metric #1:**
Attenuation from drop out to handlebar at 10 Hz > 13 dB
**Metric #2:**
Spring preload > 700 N

**Metric #3:**
Number of travel requests processed per day > 10
**Metric #4:**
ERP - Travel-IT DB synchronization < 10 min

4.4 Translate target values into **target requirement** statements

- In the form of a formal *"shall-statement"*:
  "the product/service [shall | should | can | may] do, be, etc..."

**Product Reqt. #1:**
The fork shall have an attenuation from drop out to handlebar at 10 Hz that is at least 13 dB
**Product Reqt. #2:**
The fork should have a spring preload of at least 700 N

**Service Reqt. #3:**
The travel arrangers shall process at least 10 travel requests per day
**Service Reqt. #4:**
The Travel-IT DB shall be synchonized with the central ERP at most every 10 minutes

## Requirements Register

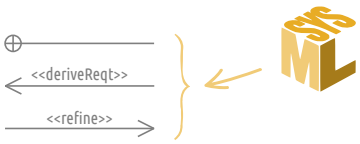
ProR eclipse
consentor
IBM DOORS
Innoslate

It is a structured list of requirements

- Rqt. **ID** and a short description
- So-called "***shall-statement***"
- Category or **type**, e.g. raw need/IUR or P/S Reqts and **subtype**
- **Compliance** to solutions, and for each solution:
  - Compliant (C)
  - Partialy compliant (PC)
  - Not compliant (¬C or NC)
  - Compliance not applicable (NA)
  - Compliance to be defined (TBD)
- **Deviation** request(s) and decision(s)

## Requirements Register (cont'd)

- **Relationships** between requirements:
  - **Containement** Split of a composite reqt.
  - **Derivation** Reqt. of lower level in hierarchy
  - **Refinement**




- **Qualification** method:
  - **Tests** (T), destructive on samples or not destructive
  - **Analyses** (A), calculations, etc.
  - **Inspections** ( I ), incl. visual inspections
  - **Reviews** (R), design reviews, etc.
- **Qualification** procedure(s), report(s) and status
- **Nonconformance** report(s) and decision(s)
- Editorial quality control: comments, traceability information, requirement status (draft, V&V, etc.)

Verification for P/SRs
Validation for IURs

but also **theatralization** for service devt. projects

for reqt. statements

# 6. Planning & Scheduling

## Typology

2 types of **project schedules**

### Master Schedule
~ Summary Schedule
Masterplan
*Calendrier directeur*

Strategic level
The whole project
Intuitive approach

One page/slide
Can be in the **Project Roadmap**

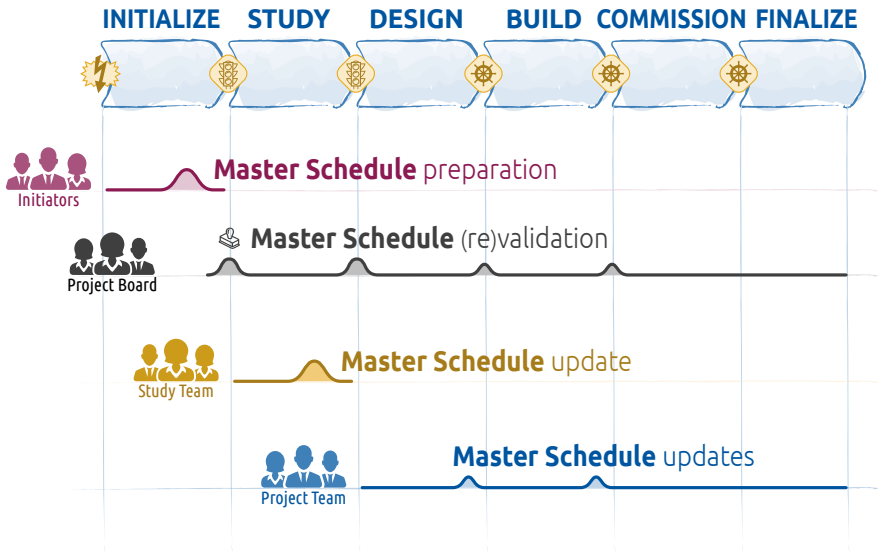
### Coordination Schedule
~ ~~"PERT"~~, Gantt chart
Activity network
*Calendrier de coordination*

Tactical level
One or a few phases
Analytical approach

Several pages
Can be in the **PMP**

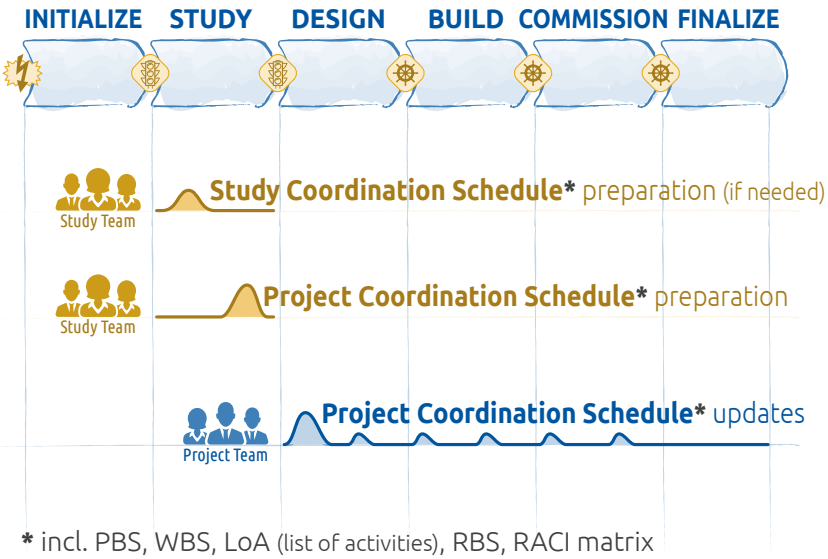
## Master Schedule

When and which effort?




## Coordination Schedule

When and which effort?




* incl. PBS, WBS, LoA (list of activities), RBS, RACI matrix

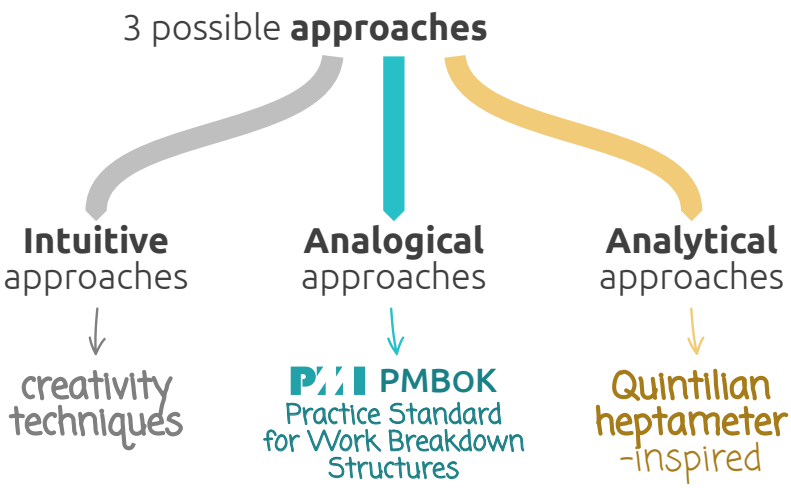
## Coordination Planning & Scheduling

A three-step process

1. Identifying the project **activities**
   - The **Work Breakdown Structure** (**WBS**)
2. Identifying the **resources** available, estimating the **resources** required
   - The **RACI Matrix**
3. Scheduling the **activities**
   - The **Coordination Schedule**
     - a **Gantt chart**
       - ProjectWizard® Merlin® Gantt chart
       - Microsoft® Project® Gantt chart

## Coordination Planning & Scheduling

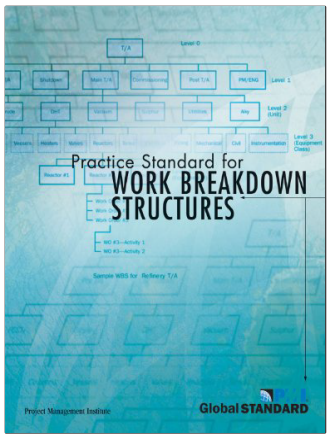
1 Identifying the project **activities**



## Coordination Planning & Scheduling

1 Identifying the project **activities** → analogical approaches

- Approach sold as *systematic*, but not that much!
- Global lessons learned collected by the Project Management Institute




- Project Management Institute's Practice Standard to Work Breakdown Structures
- NASA's Work Breakdown Structure Handbook (NASA/SP-2010-3404)

## Coordination Planning & Scheduling

1 Identifying the project **activities** → analogical approaches

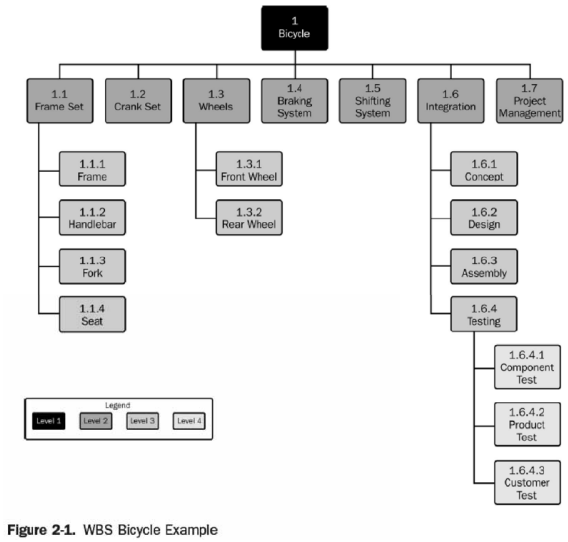



**Figure 2-1.** WBS Bicycle Example

| Level | WBS Code | Element Name |
|---|---|---|
| 1 | 1 | Bicycle WBS |
| 2 | 1.1 | Frame Set |
| 3 | 1.1.1 | Frame |
| 3 | 1.1.2 | Handlebar |
| 3 | 1.1.3 | Fork |
| 3 | 1.1.4 | Seat |
| 2 | 1.2 | Crank Set |
| 2 | 1.3 | Wheels |
| 3 | 1.3.1 | Front Wheel |
| 3 | 1.3.2 | Rear Wheel |
| 2 | 1.4 | Braking System |
| 2 | 1.5 | Shifting System |
| 2 | 1.6 | Integration |
| 3 | 1.6.1 | Concept |
| 3 | 1.6.2 | Design |
| 3 | 1.6.3 | Assembly |
| 3 | 1.6.4 | Testing |
| 4 | 1.6.4.1 | Component Test |
| 4 | 1.6.4.2 | Product Test |
| 4 | 1.6.4.3 | Customer Test |
| 2 | 1.7 | Project Management |

- Project Management Institute's Practice Standard to Work Breakdown Structures

## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

Inspired from the **Quintilian heptameter**

| | | | | |
|---|---|---|---|---|
| quis<br>who | quid<br>what | ubi<br>where | quibus auxiliis<br>which means | |
| cur<br>why | quomodo<br>how | quando<br>when | | |

**Marcus Fabius Quintilianus**
(c. 35 – c. 100 CE) was a Roman rhetorician from Hispania, widely referred to in medieval schools of rhetoric and in Renaissance writing

1.1 Describing the final **deliverable**(**s**)
- The **Product Breakdown Structure** (**PBS**)

1.2 Deriving the **Work Breakdown Structure** (**WBS**) from the PBS
- The **WBS *top nodes***, then the **WBS-matrix**

1.3 Generating the list of **activities** from the **WBS-matrix**
- The **activity portfolio**

## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

? What is an **activity**?

- ≠ deliverable! ← a.k.a. work unit
- **action verb** (infinitive tense) + **noun**

To avoid confusion, clever professional practices (e.g. MIL-HDBK-245B + appendix A) and several textbooks suggest to label activities as follow:

Some examples:
Manage the project
Prepare PM documents
Perform detail design of wing surface
Supply rope & straps
CFT for moulded ABS parts

An **activity**:
- consumes **time**
- consumes **resources**
- has **start** and **end** dates
- creates (a) **deliverable**(**s**)
- is **measurable**
- is **assignable** to one (and only one!) project participant

## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

? What is an **activity**?

An **activity**:

- consumes **time** ⚠ Yes, but within certain limits!

What is the maximum duration?

- No definitive answer!
- No more than **5%** to **10%** of the project duration
- No more than **13 weeks** (long lead projects)
- One or up to 1% of **level-of-effort** activities

And how many activities on a coordination schedule?

- No definitive answer!
- But not more than **400 activities**, otherwise difficult to manage

activities vs. planned activities (ANSI) #748

## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

? What is a **deliverable**?

a.k.a. result

- ≠ activity!
- ≠ product! → e.g. the brz-kite
- **noun** + **verb** at past participle tense
- ≠ milestone!

Some examples:
bzh-kite designed
bzh-kite specified
bzh-kite prototype tested
bzh-kite manuf. facility commissioned

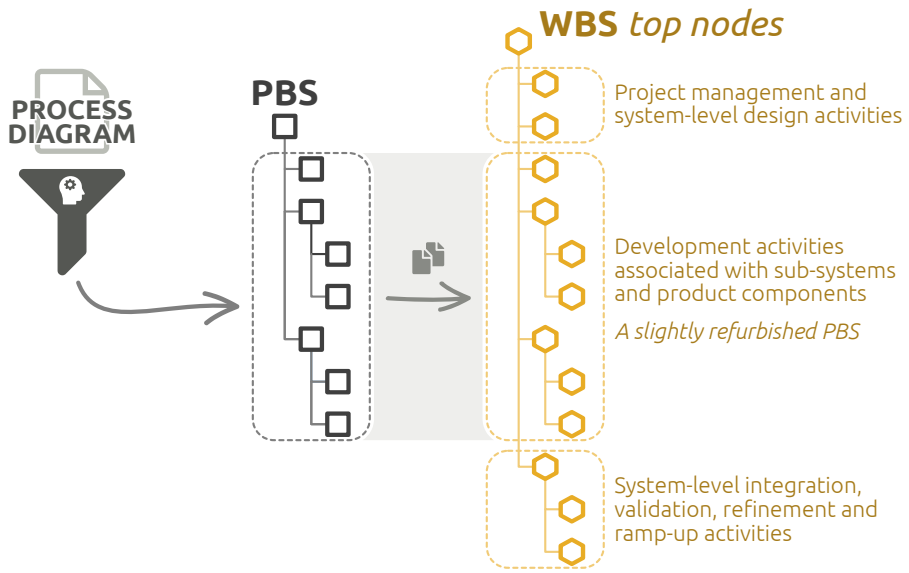
Deliverable is a term used [...] to describe a tangible or intangible object produced as a result of the project that is intended to be delivered to a customer (either internal or external). A deliverable could be a **report**, a **document** [...] or any other **building block** of an overall project.

en.Wikipedia.org

## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

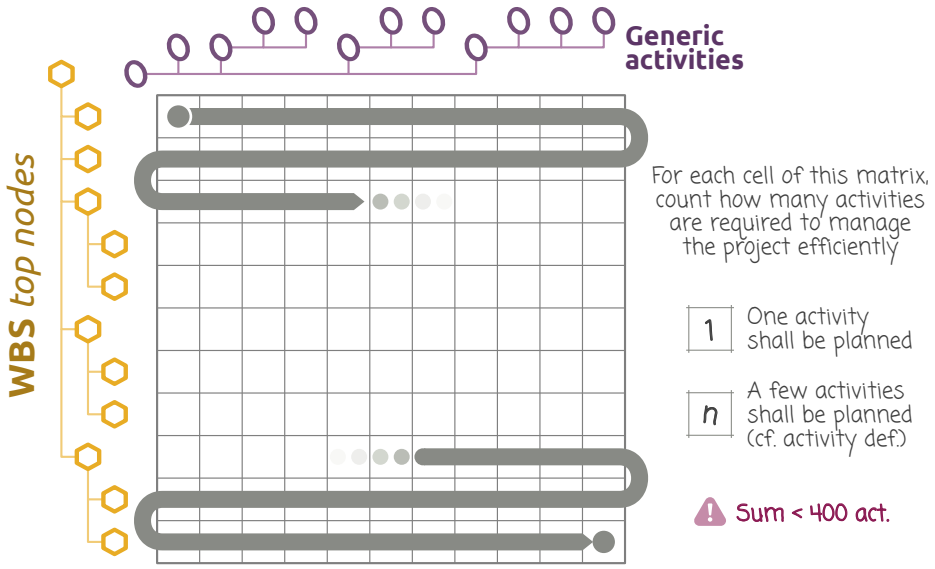
1.2 Deriving the **Work Breakdown Structure** (**WBS**) from the PBS




## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

1.3 Generating the list of **activities** from the **WBS-matrix**



## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

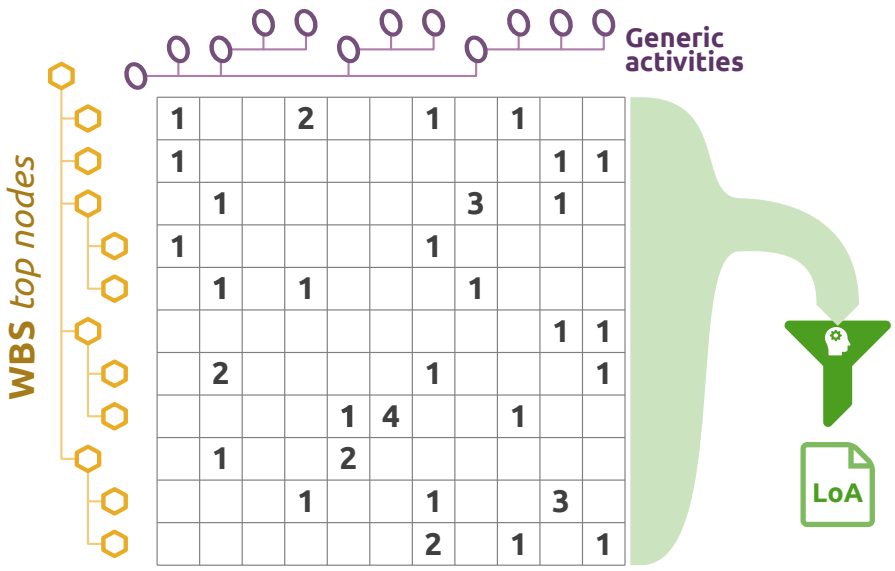
1.3 Generating the list of **activities** from the **WBS-matrix**

ⓘ Generic activities suited to a **new service development project**


## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach

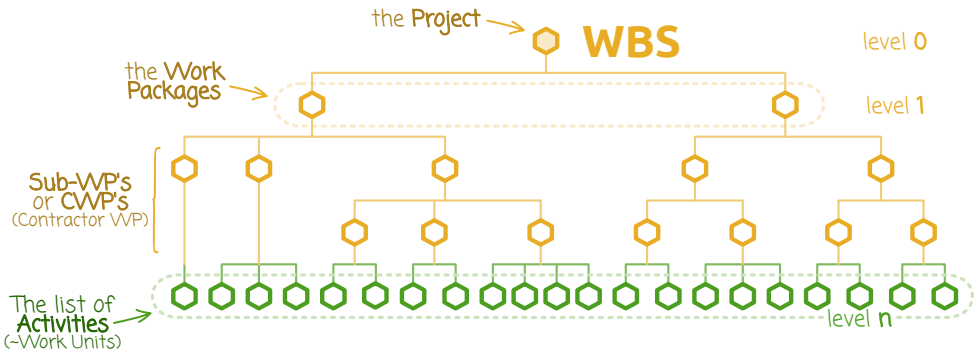
1.3 Generating the list of **activities** from the **WBS-matrix**




| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | 2 | | | 1 | | 1 | | |
| 1 | | | | | | | | | 1 | 1 |
| | 1 | | | | | | 3 | | 1 | |
| 1 | | | | | | 1 | | | | |
| | 1 | | 1 | | | | 1 | | | |
| | | | | | | | | | 1 | 1 |
| | 2 | | | | | 1 | | | | 1 |
| | | | | 1 | 4 | | | 1 | | |
| | 1 | | | 2 | | | | | | |
| | | | 1 | | | 1 | | | 3 | |
| | | | | | | 2 | | 1 | | 1 |

## Coordination Planning & Scheduling

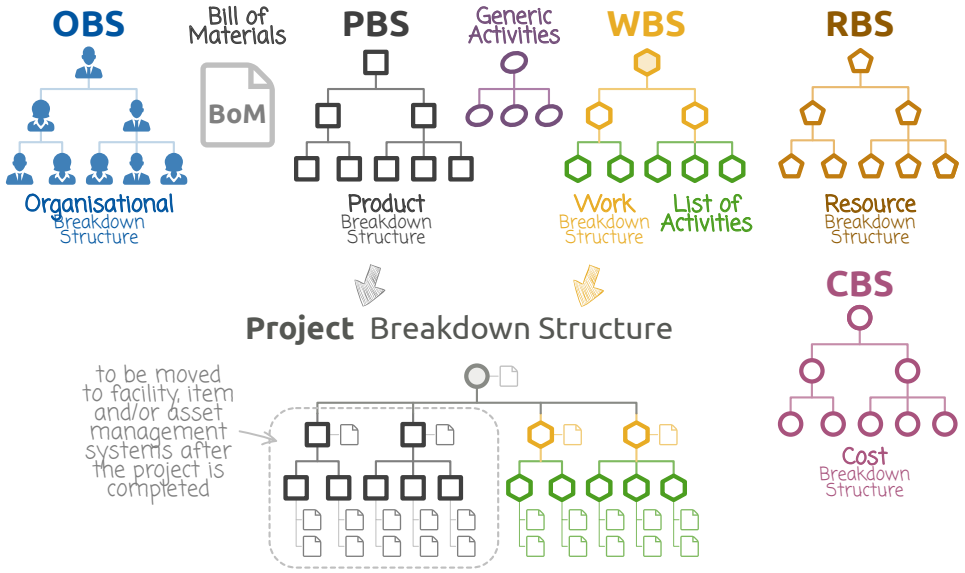
1 Identifying the project **activities** → analytical approach




- **Work packages** = level 1 of the Work Breakdown Structure
- **Activities** = the *leaves* (🍃) of the WBS (from level 2 to level 6 max.)
- There is no requirement to have all activities at a same level!

## Coordination Planning & Scheduling

1 Identifying the project **activities** → analytical approach



## Coordination Planning & Scheduling

2 Identifying the **resources** available, estimating the **resources** required

2 types of **resources**

**Renewable** resources

**Non-renewable** resources

2.1 Identifying the **resources** that are **available**

→ The **Resource Breakdown Structure** (**RBS**)

2.2 Estimating the **resources** that are **required**

*See section dedicated to Project Costing*

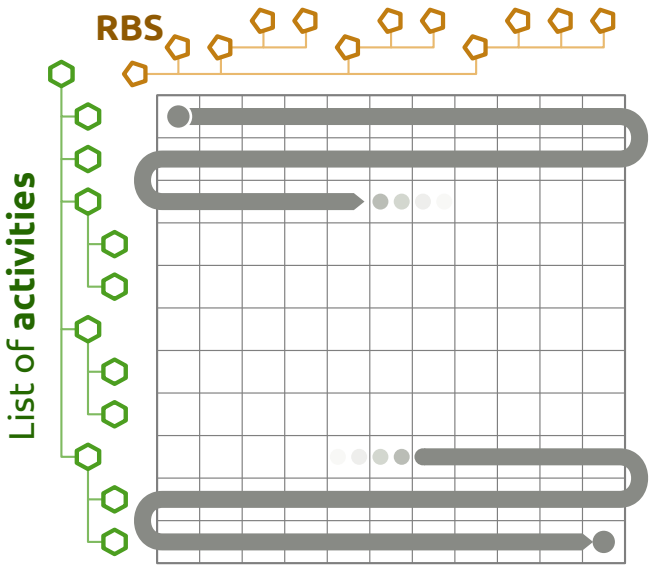
2.3 Assigning **resources** to **activities**

→ The **RACI Matrix**

## Coordination Planning & Scheduling

2 Identifying the **resources** available, estimating the **resources** required

2.3 Assigning **resources** to **activities** → **RACI Matrix**




for each cell of the matrix, resource implication is elicited

Executes **X**

Follows up **F**

Is informed **I**

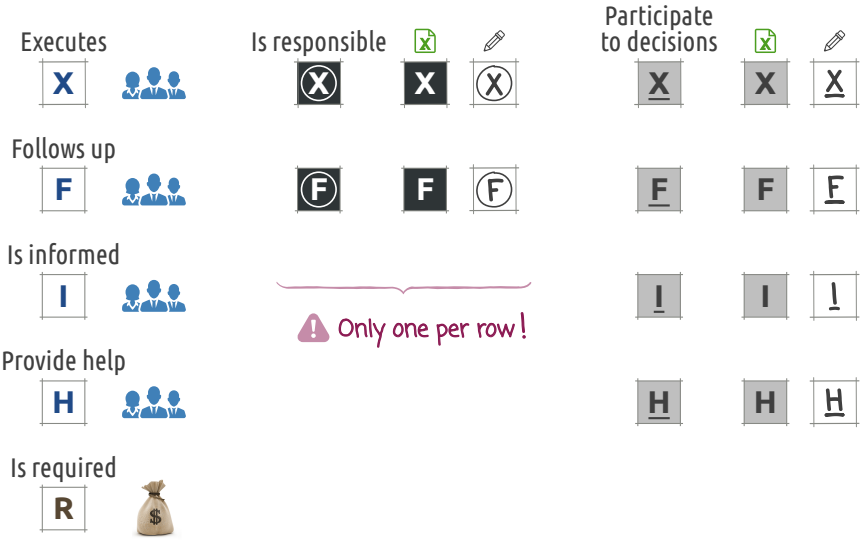
Provide help **H**

Is required **R**

## Coordination Planning & Scheduling

2 Identifying the **resources** available, estimating the **resources** required

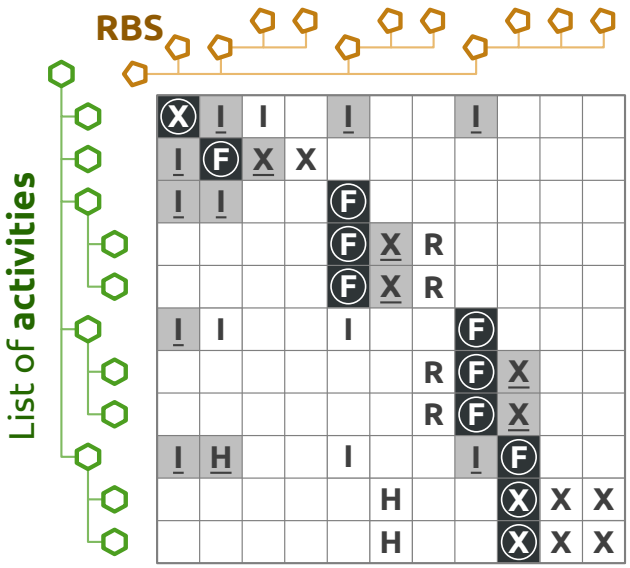
2.3 Assigning **resources** to **activities** → **RACI Matrix**




## Coordination Planning & Scheduling

2 Identifying the **resources** available, estimating the **resources** required

2.3 Assigning **resources** to **activities** → **RACI Matrix**




The purpose of this RACI matrix is twofold:

1. identifying the required resources ('**X**','**R**' and sometimes '**F**' and '**H**')
2. organizing information circulation (mailing lists)

→ Microsoft® Excel® spreadsheet

## Coordination Planning & Scheduling

3 Scheduling the **activities**

- 3.1 Estimating the **duration** of the activities
- 3.2 Defining **technical constraints** between activities
- 3.3 If required, getting rid of **loops**
  - ⇨ **DSM** (Design Structure Matrix)
- 3.4 If required, defining **temporal constraints**
- 3.5 Calculating earliest/latest start/finish **dates**, **floats** + **critical path**(**s**)
  - ⇨ **PDM** (Precedence Diagramming Method) + **Gantt Chart**
- 3.6 If required, defining **resource constraints**
- 3.7 Calculating (earliest) start/finish **dates** and **floats**
  - ⇨ **RCPS** (Resource-Constrained Project Scheduling) + **Gantt Chart**

# 7. Costing & Budgeting

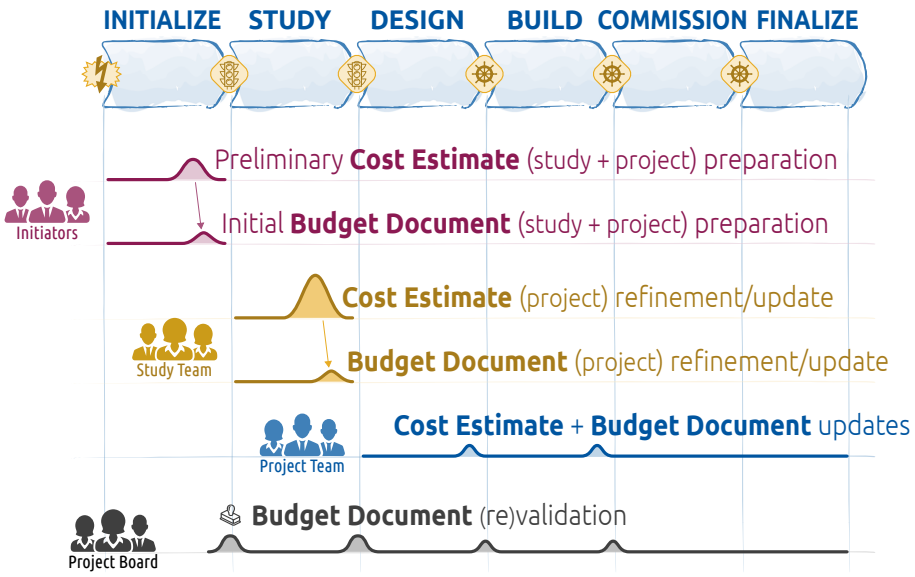
## Project Costing

A three-step process

1. **Estimating** the resources required to perform the project
   - ⇨ The (project) **Cost Estimate**
2. **Budgeting** the resources allocated to the project
   - ⇨ The (project) **Budget Document**

## Project Costing

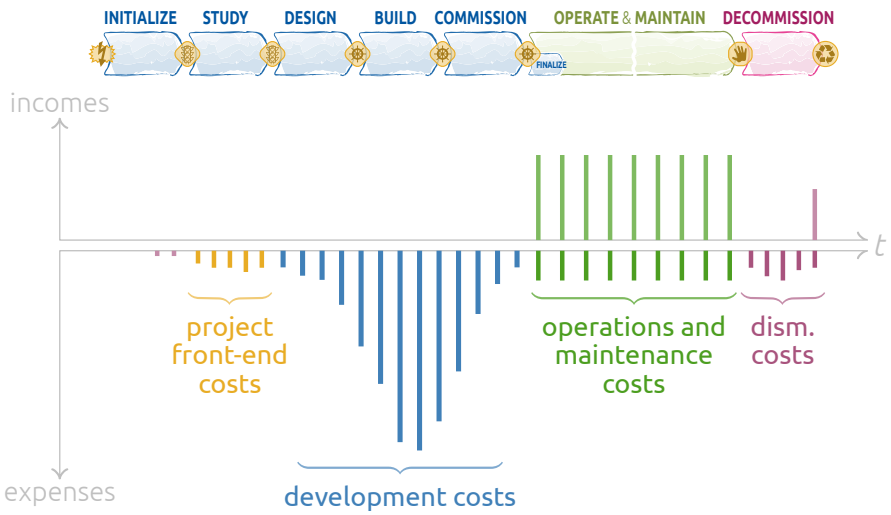
When and which effort?




## Project Costing

1 **Estimating** the resources required to perform the project

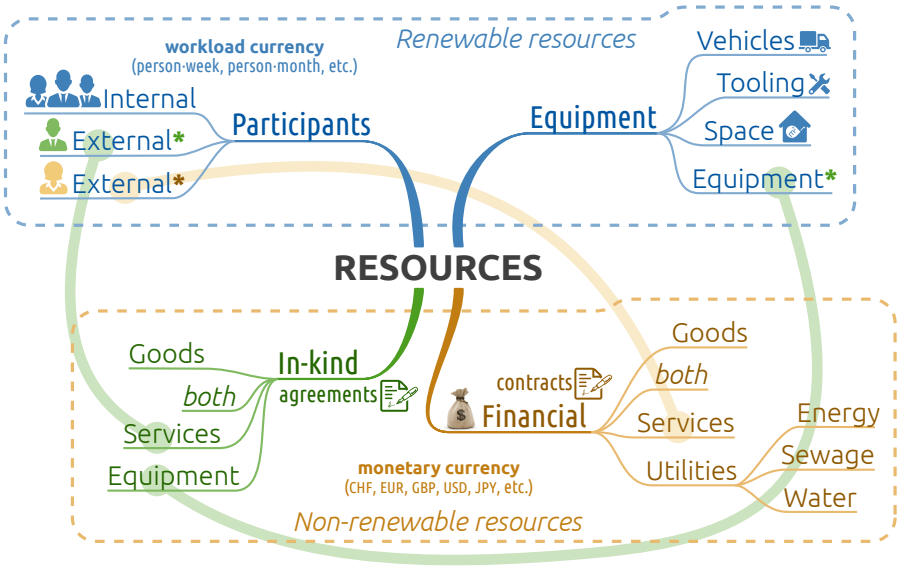
? Which **costs** (and incomes) to take into account?



## Project Costing

1 **Estimating** the resources required to perform the project

? Which **costs** to take into account?

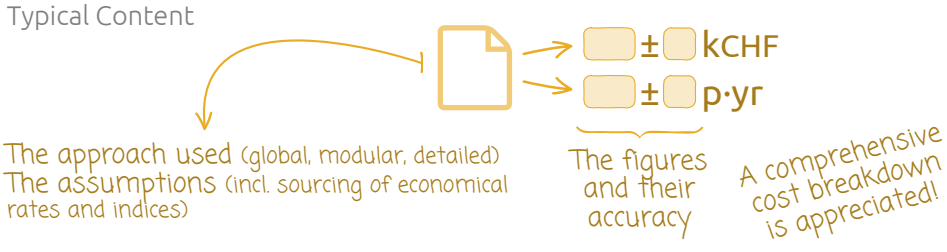



## Cost Estimate

Editorial Process

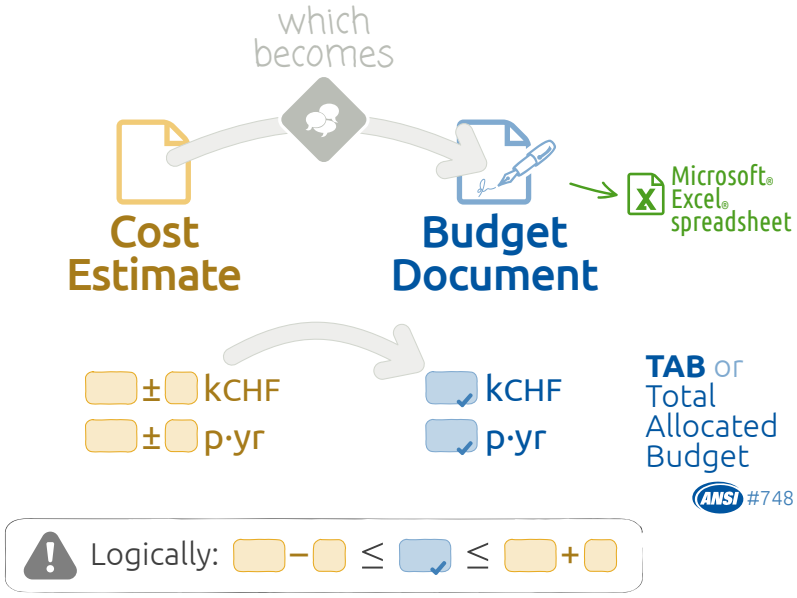
- **Authoring:** Study (or Project) Manager + a few Key Study (or Project) Participants
- **Verification:** Some other Key Study (or Project) Participants + some experts in the fields
- **Validation:** **Study** (or Project) **Manager**

Typical Content



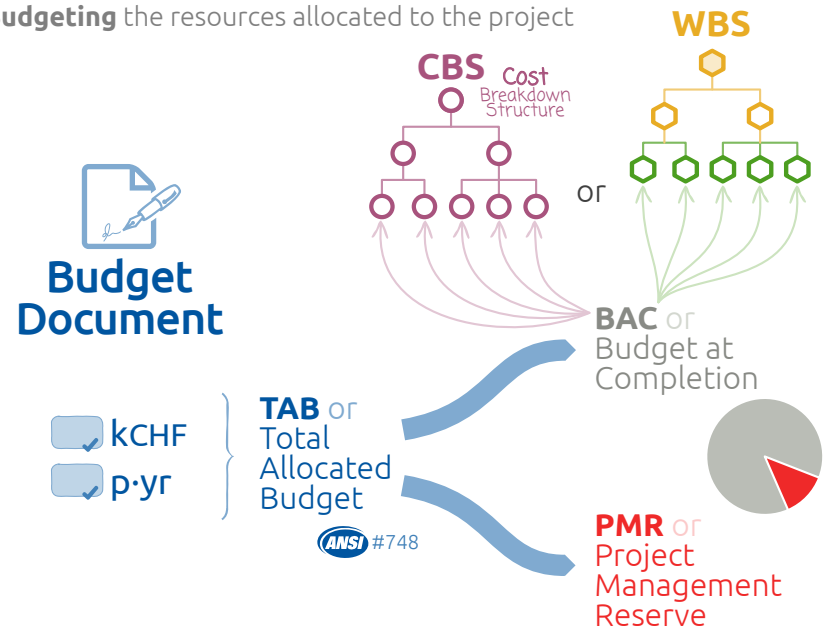
## Project Costing

2 **Budgeting** the resources allocated to the project




## Project Costing

2 **Budgeting** the resources allocated to the project



## Budget Document

Editorial Process

- **Authoring:** Study (or Project) Manager + a few Key Study (or Project) Participants
- **Verification:** Some other Key Study (or Project) participants + some experts in the field
- **Validation:**
  - Project Board
  - Study Manager
  - Project Manager

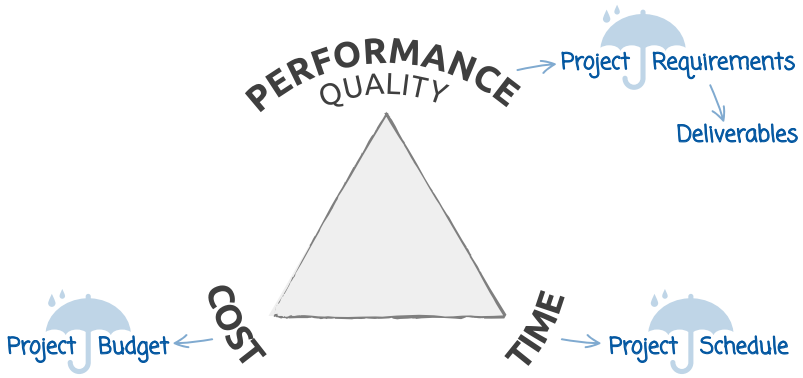
at Work Package level

at Cost Center level

# 8. Project Risk Management

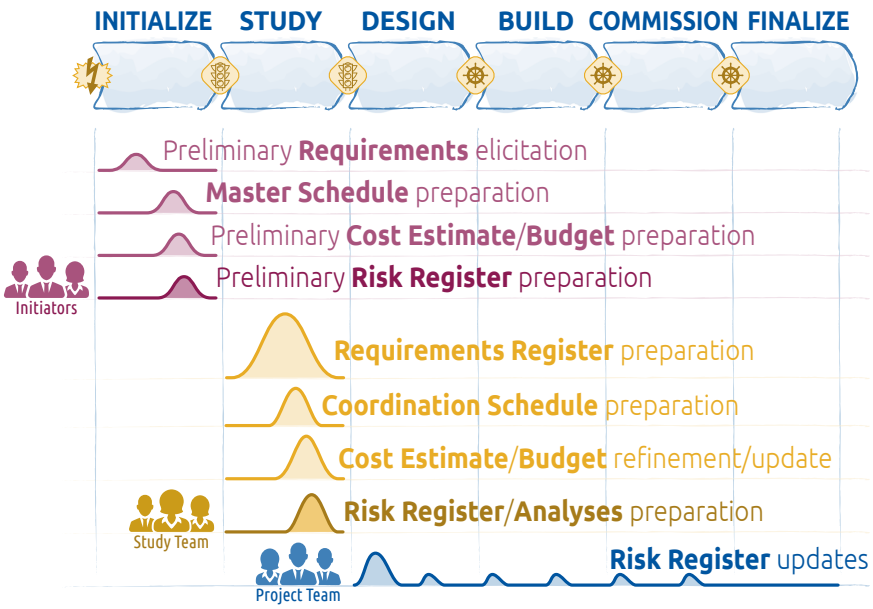
## Project Risk Management

"Project triangle"



## Project Risk Management

When and which effort?




## Risk

Definition

The effect of uncertainty on objectives.

ISO 31000:2009 § 2.1

Can be seen as:

- **Threats**, i.e. with negative impact → common/regular meaning
- **Opportunities**, i.e. with positive impact → often forgotten!

## Risk
Etymology

- From ancient Latin: *risicare* = reef ⇢ ***risk-snag***
- From (ancient) Greek: *ρίζα* = root ⇢ ***risk-snag***
- From (ancient) Latin: *rixa* = quarrel, brawl ⇢ ***risk-action***
- From ancient Greek: *ριζικόν* = soldier's pay ⇢ ***risk-action***

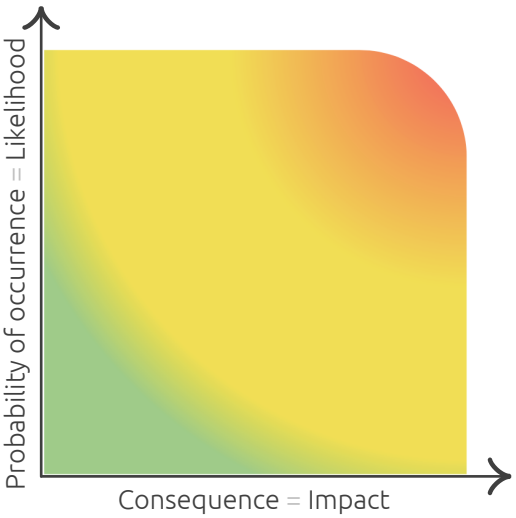
*Risiko, Risiken* in German

***risk-snag***
VS.
***risk-action***

Fabio Sabelli (mars 1999) Les risques de l'économie, l'économie des risques. Le point de vue de l'anthropologue. présentation donnée lors du 7e Congrès de la Société suisse de management de projet à Lausanne, Suisse

## Risk
Heatmap

Likelihood × Consequences



## Risk Management

Enterprise RM vs. Project RM

**ERM**

Strategic risks
Operational risks
Financial risks
Reputational risks
Safety risks
Environmental risks

**PRM**

Technical risks
related to the **system/product** being developed, incl. technical **reqts.**
Programmatic risks
related to the **project**: on schedule, on budget
External risks
for which the project team has no real control

## Project Risk Management

The 'very basic toolbox'

**SIMPLE** approach

Simplified **Risk Register**

Bullet list consisting of risk statements:

- ⟨risk⟩, *however* ⟨response⟩

*examples*

- Unsufficient funding, *however* initial investigations have shown that stakeholders are likely to fund this proposed project
- Unrealistic master schedule, *however* discussions in conferences and workshops have shown that one year to have an experimental setup in operation is realistic
- Technical problems with instrumentation, *however* according to a few interviewed experts, the solutions considered are totally feasible
- Enhanced experimental setups by other labs, *however* our scientific watch shows that this set-up will be very competitive

## Project Risk Management

The 'intermediate toolbox'

INTERMEDIATE approach

Regular
**Risk Register**

Spreadsheet table consisting of **risk scenarios**:

| RISK SCENARIO | RISK MAGNITUDE | RISK RESPONSE |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

## Project Risk Management

A 5-step process

INTERMEDIATE approach

1. Agreeing a risk management approach for the project ✓
   ↖ risk management planning
2. Identifying risk scenarios
   ↖ risk searching
3. Evaluating their magnitude
   ↖ risk sorting
4. Defining responses to these risk scenarios
   ↖ risk treatment or risk planning
5. Following up the risks as the project progresses
   ↖ risk monitoring

## Generic Response Types

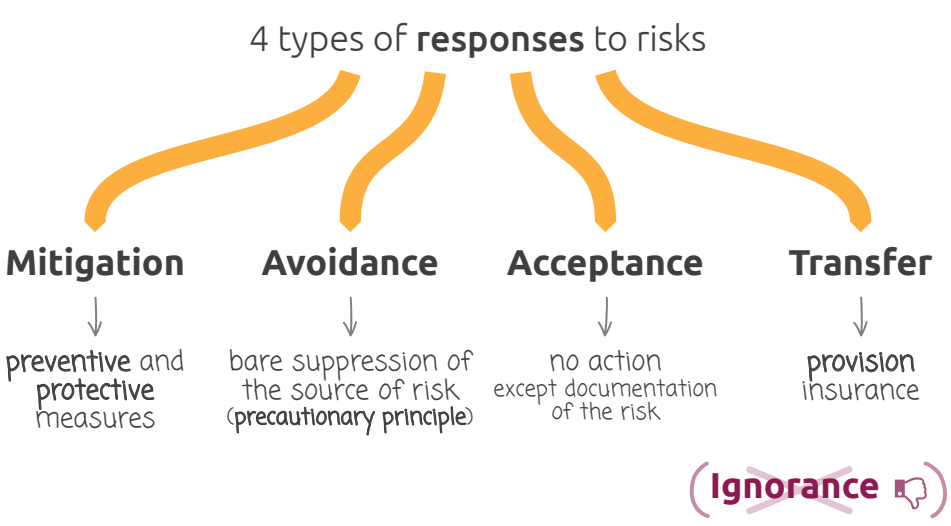
| Type of response | Method of handling |
|---|---|
| Modify objectives | Reduce or raise performance targets; change tradeoffs between objectives |
| Avoid | Plan to avoid specified sources of risk/uncertainty |
| Influence probability | Change the probability of potential variations, i.e. prevent |
| Modify consequences | Modify the possible consequences of variations, i.e. protect |
| Transfer consequences | Transfer consequences to another party, e.g. contract provision, insurance |
| Develop continuity plans | Set aside means or make other plans to provide a reactive ability to cope |
| Keep options open | Delay choices and commitments, choosing versatile options |
| Monitor | Collect and update data about sources of uncertainty |
| Accept | Acknowledge and accept uncertainty |
| Remain unaware | Ignore uncertainty, take no action to identify, evaluate or handle it |
| Optimize all the above | Explicitly recognise the value of selecting an optimal combination |

Stephen Ward, Chris Chapman (2011) How to Manage Project Opportunity and Risk: Why Uncertainty Management can be a Much Better Approach than Risk Management (3 ed). Wiley

## Generic Response Types

In practice

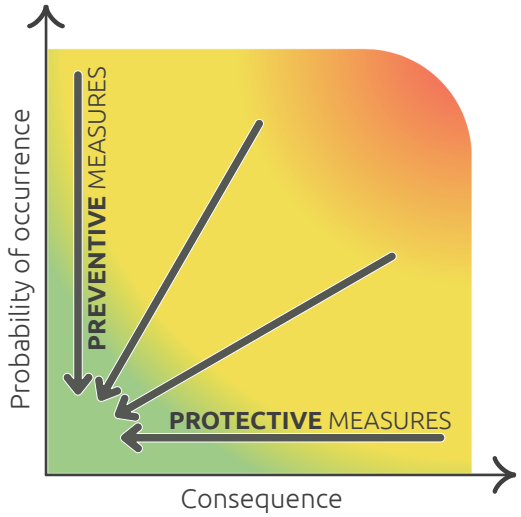
INTERMEDIATE approach



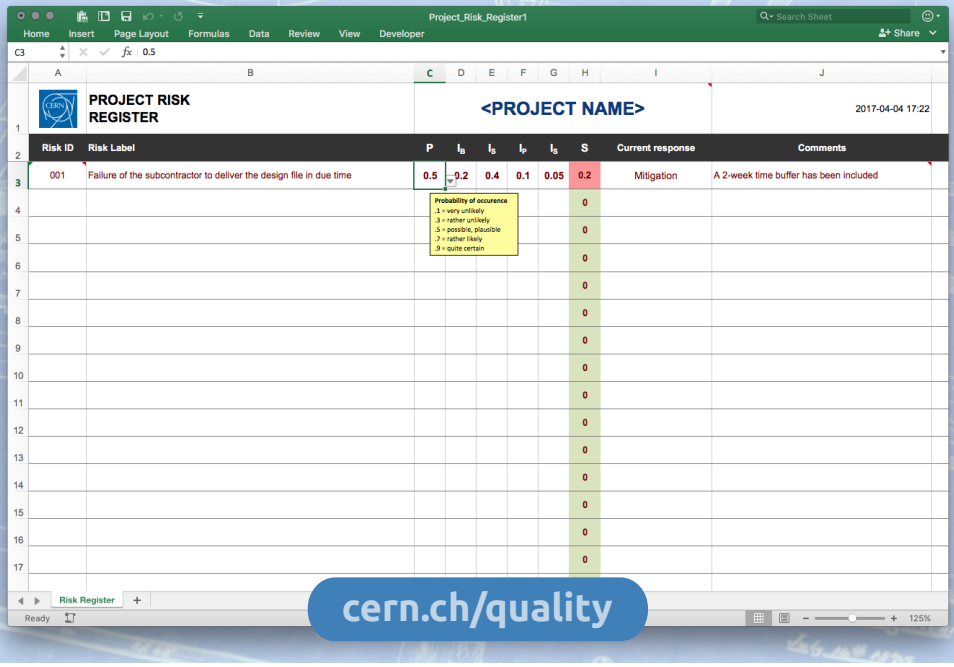
## Risk

Heatmap

### Prevention vs. Protection



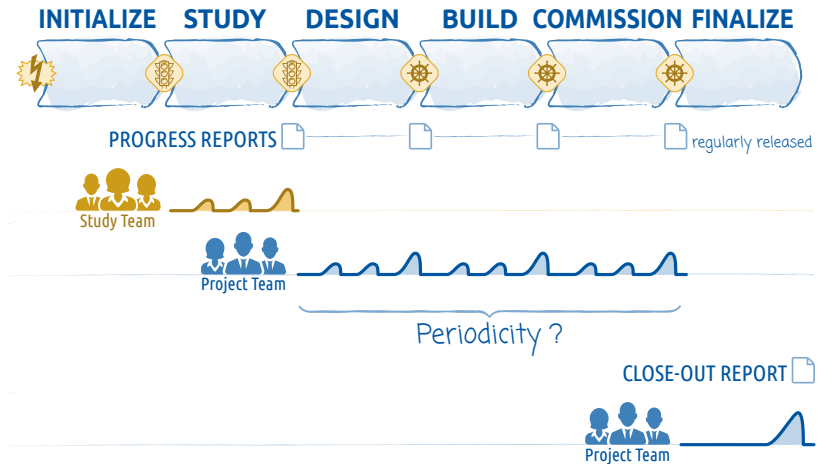

## At CERN (in the A&T Sector)



# 9. Project Progress Reporting

## Project Control and Follow-up

When and which effort?




## Project Control and Follow-up

The 'basic toolbox'

SIMPLE approach

**Progress Status**

**Progress Reviews**

1. **Major achievements** (as bullet points)
2. **Problems encountered**
3. **Cost and schedule statuses**
   - 3.1 Cost status
     **Table** (actuals vs. budgeted)
   - 3.2 Schedule status
     **Milestone Trend Chart**
     (gdpm **Milestone Plan** )
   - 3.3 Physical progress status
     **Dashboard**
4. **Work laying ahead** (as bullet points)
5. **Risk Register update** (limited to changes)

## Project Costing

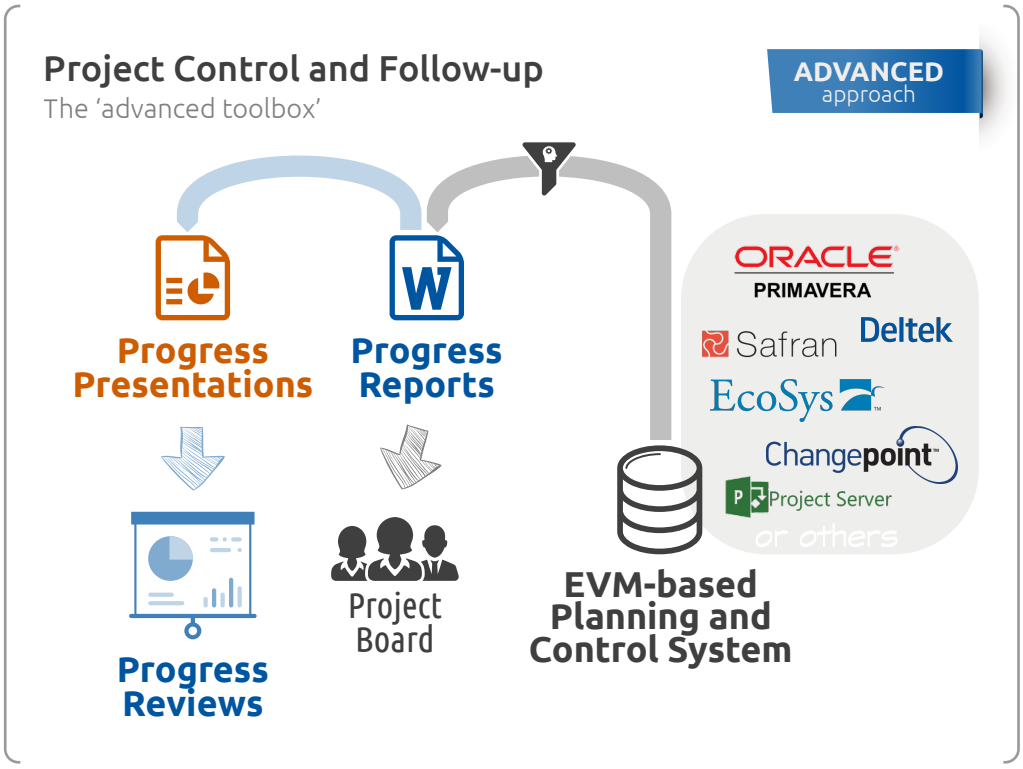
3 types of **resources**

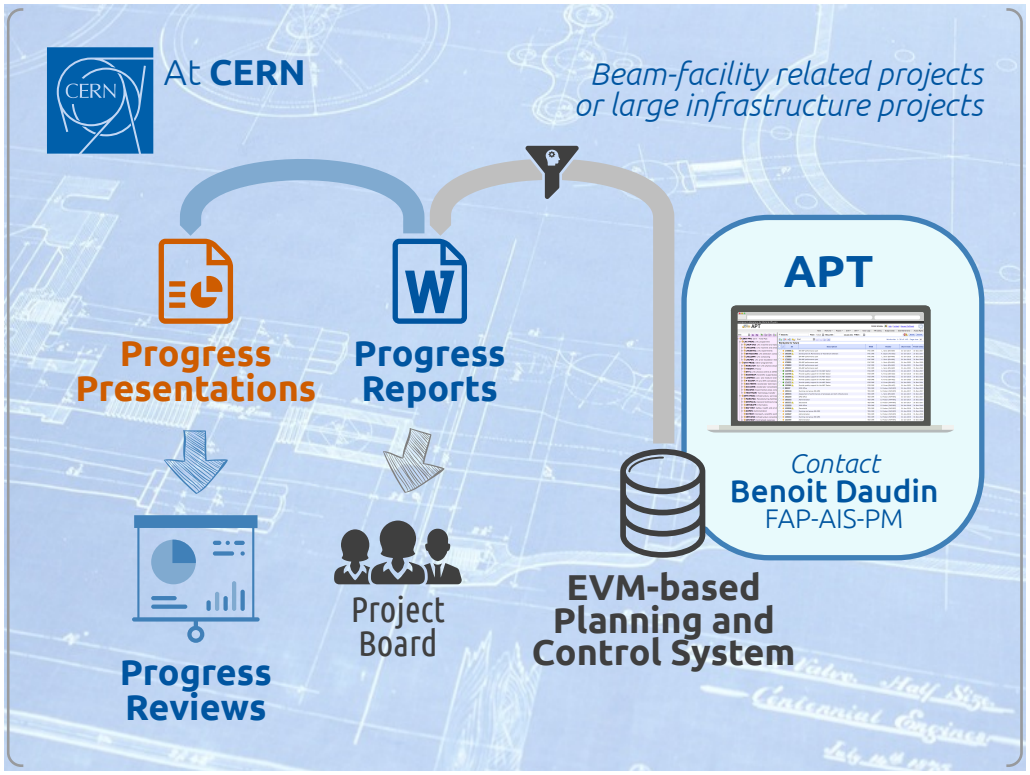
| | **Manpower** (project participants) [workload currency] | **Financial** resources [monetary cur.] | **In-kind** contributions [various cur.] |
|---|---|---|---|
| planned | manpower budget | financial budget | agreement figures |
| actuals | **time spent** | **expenses** | ( = planned ) |
| data | **timesheeting system** ⚠ | **accounting books** ✓ | ∅ |

## At CERN Project Costing

3 types of **resources**

| | **Manpower** (project participants) [workload currency] | **Financial** resources [monetary cur.] | **In-kind** contributions [various cur.] |
|---|---|---|---|
| planned | manpower budget | financial budget | agreement figures |
| actuals | **( = planned )** | **expenses** | ( = planned ) |
| data | ∅ | **accounting books** ✓ | ∅ |


Project Control and Follow-up
The 'advanced toolbox'
ADVANCED approach
Progress Presentations
Progress Reports
Progress Reviews
Project Board
EVM-based Planning and Control System
ORACLE PRIMAVERA
Safran
Deltek
EcoSys
Changepoint
Project Server
or others


At CERN
Beam-facility related projects or large infrastructure projects
Progress Presentations
Progress Reports
Progress Reviews
Project Board
EVM-based Planning and Control System
APT
Contact
Benoit Daudin
FAP-AIS-PM

# Project Management

What are we going to see together?


Inspired from Hermes

## Lifecycle


## Processes

- Launching a project
- Ensuring quality
- Defining requirements
- Planning & scheduling
- Costing
- Managing risks
- Reporting progress
- Handling issues
- Finalizing a project

openSE

## Roles

- Initiators
- Project Board
- Project Manager
- Project Team
- Study Team
- Study Leader
- Project Stakeholders

## Artefacts

- Project Proposal
- Project Roadmap
- Project Mngt Plan
- Project PBS & WBS
- Project Schedule
- Project Budget
- Reqts. Register
- Risk Register
- Progress Report(s)