HOCHSCHULE RUHR WEST
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Project Charter, Mandate, Brief and other Artefacts that Initiate a Project: Characteristics, Similarities and their adaption in the OpenSE Methodology in use in the Accelerators & Technology Sector of CERN

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Abstract

The artefact that initiates a project is considered by the vast majority as one of the most important artefacts in the project management lifecycle. It is the artefact in which the aims, objectives and goals are specified, the project organisation structure may be indicated, it might set the foundation for a risk assessment and even sometimes proposes the solutions that are going to be pursued in the following phase. Usually such an artefact can be found at the end of the initialisation phase and functions as a “green light” to proceed to the study or planning phase. It sets the foundation and the baseline for future discussions about the scope of the project and is at the same time the best opportunity to develop strategies to avoid future mistakes and misunderstandings.

In the world of project management there are plenty of different methodologies and standards circulating that all promote such a document with different names such as: Project Charter, Project Mandate, Project Proposal, Roadmap, Project Mission Statement, Project Brief or even Statement of Work. Anyway, system engineering mainly proposes two different kinds of documents, the ConOps (operational concept document) which got replaced in 2010 by OpsCon (operational concept) or OCD (operational concept document) and furthermore the Agile movement, including the SCRUM framework, in which the artefact is expressed not in a document, but in the sprint planning meeting and the sprint backlog. All of them have more or less the same concepts and the same purpose. But how not to get lost and confused with all this different names?

The purpose of the thesis is to analyse all this artefacts and to outline the characteristics, convergences and differences in between them. This was done in a first step by comparing a few documents representative of the main obedience[1] according to their temporal locations along a project life cycle, their managerial aims and their typical contents. As a result and to give a better comparison, all of their chapters were clustered together in sections to stress out the main convergences and content of the documents and to give an overview from a different angle.

In a second step we propose a model for an unifying document that could be satisfying to all. In any case, it is this artefact that the CERN Engineering Department promotes through a system engineering reference called OpenSE (www.cern.ch/openSE) to federate multidisciplinary contributions to the many programs and projects in progress.

Keywords: Project Management, System Engineering, Agile, OpenSE, Project Charter, Project Mandate, Project Proposal, Roadmap, Project Mission Statement, Project Brief, Statement of Work, ConOps, OpsCon, Initialisation

[1] The selection of methodologies and standards in this thesis just represents the personal opinion of Pierre Bonnal and me

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Preface

This thesis was created in spring 2017 at the European Organization for Nuclear Research (CERN) in Meyrin/ Suisse as part of the studies in Mechanical Engineering and Management at the Hochschule-Ruhr-West in Germany. My acknowledgement goes to Dr. Pierre Bonnal who gave me the opportunity to write this exiting thesis and who inspired a big part of it.

1 Introduction

Over the years there were a couple of project management methods established. Some of them you can find in figure 1 general collection of different methodologies and standards. We can differentiate in between two different types of methods.

There are:

1. Standards, "A standard is a formal document that describes established norms, methods, processes, and practices." [1] They express how things should be done. Some of the most recognised ones in the field of project management are the PMBok and ISO 21500:2012.
2. Methodologies, „a system of broad principles or rules from which specific methods or procedures may be derived to interpret or solve different problems within the scope of a particular discipline." [2]. They teach you how things get applied. Well known methodologies are for example HERMES 5 and PRINCE2.

Figure 1 general collection of different methodologies and standards used in the fields of project managements and system engineering [3]

All this different Methodologies and Standards are treating Project Management or Systems Engineering with slightly different approaches. None of them yet stepped forward so far to be the unique to be used.

In this Thesis the focus is just on one artefact which mostly is the starting point of the phase *planning* and symbolise the end of the phase *initialisation* of a project. This document has various different names: Project Charter, Project Mandate, Project Proposal, Roadmap, Project Mission Statement, Project Brief or even Statement of Work. System engineering mainly propose two different kinds of documents, the ConOps (operational concept document) which got replaced in 2010 by OpsCon (operational concept) or OCD (operational concept document). All of them have more or less the same concepts and the same purpose.

In companies of a modest size the project management team can easily recall themselves on a single vocabulary and stick to a single standard or methodology of a project. As soon

as the company over exceed a certain size or the project include people from different sectors of engineering, different people get together and bring in their background, understanding and habit of managing projects. It is very probable that complex big projects involve different suppliers or subcontractors who come with their own way of managing projects. In projects of such a size it is more than legitimate that the different contributors of the project apply the management methods that proved to be the best ones in their sectors and domains in order to minimize the managerial risk.

So as a matter of fact, the civil engineers will stick to the their management practices recognised in the construction and architecture sector; the computer specialist will do the same by underlining the added value of agile approaches; the system engineers just trust their practices written down in standards as ISO, IEC and IEEE or the practices promoted by INCOSE in his *Guide to the System Engineering Body of Knowledge* (G2SEBoK) for example; finally there is as well the project management team who might value the *Project Management Body of Knowledge* (PMBoK) of the American Project management Institute of Standards. How to guide and lead all this different parties and participants?

A vast majority of projects done by CERN include a big spectrum of different disciplines as well as diverse collaborations from all over the world. They can be well defined as Megaprojects. The feasibility study of the LHC (Large Hadron Collider) took 10 years and his construction another 15 years, in which especially practices promoted by the PMBoK gave the main guide for assuring the systematic quality of the project. But in reality it wasn't as easy as that. The arriving of people with their different approaches and methods stated above complicated up things. There was the need for a development of a project management approach inspired by system engineering.

CERN is not the first one to face this problem and so there were already well-known methods of project management (as HERMES for example) trying to develop a methodology inspired by the different approaches and standards, but which were not enough suited to the needs of a scientific facility as CERN is. As a result the OpenSE methodology was established which should better meet the requirements of CERN.

In this thesis I tried to create an inventory of the different artefacts associated to the starting up of a project. The second step was to outline their different and common parts. For this I focused on the localisation along the lifecycle, their typical content and the parties included to create the document.

Finally there will be presented a common document that will be promoted in the Sector Accelarators and Technologies of CERN through the referential OpenSE (www.cern.ch/openSE) to guide and lead the different multidisciplinary contributions including numerous ongoing programs and projects. [4]

2 Objectives

This thesis has as its objectives to further investigate in the different artefacts that initiate a project of different methodologies and standards about the management of projects to clarify the differences and similarities and to build a foundation for further discussions about a unification of such artefacts.

The main ideas for this topic were the unification of vocabulary, to deliver an overview of existing artefacts and to open a discussion about a more synthetic document.

- A principal aim is to deliver an overview of existing artefacts from standards and methodologies that Dr. Pierre Bonnal and I evaluated as interesting. Reason for that is to create a common base on which comparisons can be made.
- Nowadays where different areas as mechanical, electrical, civil, software engineering etc. increasingly is collaborating and where a more global orientation with various people with different educational backgrounds work together on the same projects it gets very important to assure that a common vocabulary is used among the people. One of the objectives is to push the evolution of project management in a more synthetic direction.

Everyone going through this thesis should be aware of the fact that the reason for this thesis wasn't just to create another new document and to embed it in the landscape of existing ones, but moreover to really deliver a basis for further discussions and reflections about this topic. Probably there will never be the of-the-shelf solution, because Project Management documents in most cases will have to be adopted to the background of the different organisations and domains people are working in, but nevertheless can there be an effort done to standardize certain vocabulary and to push the development in a more narrow landscape where it will be easier to keep the overview.

3 Summary and Outlook

This thesis can be used as a guide that gives an overview of existing documents that initiate a project. It presents some examples of existing off the shelf solutions, but presents at the end as well the different sections out of which this documents are usually made which can help to better adapt or modify the artefact based on the needs of a company or domain.

Attention was payed to cover project management, system engineering and the agile framework, which are 3 major approaches widely used nowadays. The thesis starts with a brief explanation about what this 3 approaches are about and where they are used in. Following there had to be made a harmonization of the vocabulary used to describe the different roles and responsibilities within a project in order to get a common understanding when comparing the different sources.

Concerning project management there is presented the artefacts from sophisticated standards as the Project Charter of the Project Management Body of Knowledge (PMBoK) by the American Project Management Institute (PMI) or the Project Brief of the British methodology PRINCE2. Additionally there was some further research done in the different approaches proposed by textbooks as the *Project Overview Statement*, the *Project Scope* or the *Mission Statement* in order to give a broader spectrum.

The document widely used in systems engineering is the *OpsCon* which is derived from the obsolete *CONOPS* document. The OpsCon is described by an ISO standard and is explained further in this thesis, not only its content, but as well the approach that is intended by system engineering. There was decided not to go into too much detail about the CONOPS document because experience shows that the two artefacts CONOPS and OpsCon might confuse the reader. What is more essential is the approach the artefacts use, which is quite similar for both of them, than the specific content of each document.

The agile method is represented in the thesis by the SCRUM framework which is commonly used in the software engineering domain. There could have been some more research done in several different frameworks derived from the agile method as KANBAN, to just give one example, but again, it is more the approach that was payed attention to in order to give a broader picture and not the very specific content.

Finalized is the thesis with a comparison in between the project management documents and a final discussion about the 3 major approaches themselves with agile and system engineering. At the end there is also presented the current approach and methodology openSE which is used and developed at CERN with their artefact called *Project Proposal*, which after approval turns into the *Project Roadmap.*

4 Overview of different Standards and Methodologies

4.1 Introduction to Project Management following the PMBoK

The two current standards in the field of project management are the Project Management Body of Knowledge [1] and the ISO 21500:2012 standard [5]. Both of them are very generic and try to homogenize practices while not necessarily providing an approach on how to implement these standards in organisations. A complementary to this standards are the various methodologies which were established over the last decades such as PRINCE2 [6] or HERMES [7] to just mention two of them.

A Guide to the Project Management Body of Knowledge (PMBoK Guide) [1] is a recognized standard for the project management profession published by the Project Management Institute, Inc (PMI) who collects the different standards and guideline publications. The first version of the PMBoK was published in 1996 followed by a second version in 2000, third in 2004, fourth version in 2008 and the fifth version in 2013. There is a "Sixth Edition" foreseen to be published in 2017.

PMBoK's approach is process-based, as it can be seen in many other recognised standards and methodologies. This processes overlap and interact throughout a project or its various phases.

The Guide breaks down the different processes in:

- Inputs (documents, plans, etc.)
- Tools and Techniques (mechanisms applied to inputs)
- Outputs (documents, plans, etc.)

In total there can be found 42 different processes in the PMBoK which go along the lifecycle of a PMBoK project. The standard describes the nature of project management processes in terms of the integration between them, their interactions, and the purpose they serve. Project management processes are grouped into five categories known as Project Management Process Groups, they are going to be used throughout the thesis to build a foundation and common vocabulary for issues concerning the lifecycle of a project:

1. Initiating Process Group. Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase.
2. Planning Process Group. Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve.
3. Executing Process Group. Those processes performed to complete the work defined in the project management plan to satisfy the project specifications.
4. Monitoring and Controlling Process Group. Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes.
5. Closing Process Group. Those processes performed to finalize all activities across all Process Groups to formally close the project or phase.

The overview taken by the PMBoK fourth edition in Table1 contains the lifecycle, the knowledge areas and all the different processes.

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring & Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Execution	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Collect Requirements 5.2 Define Scope 5.3 Create WBS		5.4 Verify Scope 5.5 Control Scope	
6. Project Time Management		6.1 Define Activities 6.2 Sequence Activities 6.3 Estimate Activity Resources 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Estimate Costs 7.2 Determine Budget		7.3 Control Costs	
8. Project Quality Management		8.1 Plan Quality	8.2 Perform Quality Assurance	8.3 Perform Quality Control	
9. Project Human Resource Management		9.1 Develop Human Resource Plan	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management	10.1 Identify Stakeholders	10.2 Plan Communications	10.3 Distribute Information 10.4 Manage Stakeholder Expectations	10.5 Report Performance	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Monitor and Control Risks	
12. Project Procurement Management		12.1 Plan Procurements	12.2 Conduct Procurements	12.3 Administer Procurements	12.4 Close Procurements

Table 1 PMBoK Project Management Process Groups and Knowledge Areas Mapping [1]

The different knowledge areas are:

1. Project Integration Management; includes the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups.

2. Project Scope Management; includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully
3. Project Time Management; includes the processes required to manage timely completion of the project.
4. Project Cost Management; includes the processes involved in estimating, budgeting, and controlling costs so that the project can be completed within the approved budget.
5. Project Quality Management; includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken.
6. Project Human Resource Management; includes the processes that organize, manage, and lead the project team.
7. Project Communications Management; includes the processes required to ensure timely and appropriate generation, collection, distribution, storage, retrieval, and ultimate disposition of project information.
8. Project Risk Management; includes the processes of conducting risk management planning, identification, analysis, response planning, and monitoring and control on a project.
9. Project Procurement Management: includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team.

The PMBoK mentions in its Project Management Processes the fact that it is not in the spirit of the Standard that all the knowledge, skills, and processes described by it should be applied uniformly on all projects. It is up to the project manager to determine in collaboration with the project team which processes are appropriate, and the appropriate degree of rigour for each process.

4.2 Introduction to System Engineering and the openSE methodology

As defined by the International Council on Systems Engineering (INCOSE):

“Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems. It focuses on defining customer needs and required functionalities early in the development cycle, documenting requirements, and then proceeding with design synthesis and system validation while considering the complete problem: performance, cost & schedule, manufacturing, testing, operations, training & support, and disposal.

Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation. System Engineering considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs.” [8].

The short definition of a system by the NASA System Engineering Handbook is:

“A “system” is a construct or collection of different elements that together produce results not obtainable by the elements alone. The elements, or parts, can include people, hardware, software, facilities, policies, and documents; that is, all things required to produce system-level results.” [9]

In other words, everywhere where different disciplines come together, as machine engineering, electronic engineering, software engineering, civil engineering to just mention a view different branches, there is the need to keep the overview and to keep in mind the “big picture”. Nowadays lots of products require the interaction of different disciplines to create a functional product such as cars, mobile phones or mega projects as the International Space Station or Large Hadron Collider at CERN.

Figure 2 Examples of System Engineering [10] [11] [12]

According to the NASA’s System Engineering Handbook, but also by ESA’s ECSS Standards [13] and many system engineering textbooks, a particular attention shall be paid to:

- Needs gathering; that consists of identifying who the stakeholders are, what their intentions are toward the systems and then to transform this needs into a valid set of technical requirements.
- Products/ system integration; that consists of transforming lower-level components into higher-level systems and making sure that the integrated systems function properly.
- Products/ system verification and validation; that consists of verifying and validating the different assemblies when they are put together, they are core parts of the V-Modell (figure 4).
- Solution finding and working out concepts; is a process that has to take place in parallel to needs gathering. In complex systems some needs can only be gathered if already ideas about the possible solution exists. [14]

The processes of integration and verification of the product or system are well pictured in the system engineering V-Modell (figure 4). The model describes the system development lifecycle. It summarizes the necessary steps of creating a breakdown structure, develop it in small sub categories and to test and verify it every time a unit is assembled together.

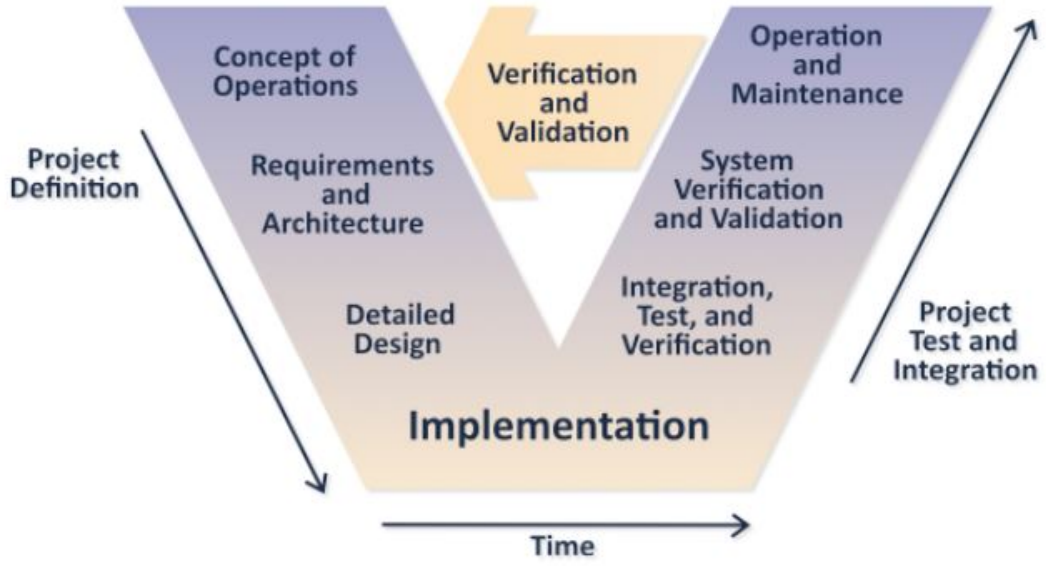


Figure 3 the system engineering V-Modell [14]

The openSE, http://opense.web.cern.ch/, is a system engineering framework or in other words a project management framework suited to projects that consist of developing complex technical systems. It is an outcome of the PURESAFE Initial Training Network Marie Curie Actions project. The aim in developing the openSE approach was to enhance project management and systems engineering practices for projects related to the development of scientific facilities emitting ionizing radiations or of systems intended to operate in environments with artificial ionizing radiation. It finds its application at CERN in the Engineering Group, the Radiation Protection Group and the Projects Support Office.

Inspired got this framework from existing practices of NASA (NASA's System Engineering Handbook), ESA (ECSS Standards) and from the HERMES Swiss project management methodology.

It was built with the thought to create a management system that pays a particular attention to the five aspects known as the ORAMS acronyms that stands for Operability, Reliability, Availability, Maintainability and Safety and to address them appropriately in an integrated way.

In Figure 4 the key project management deliverables, can be found of the project lifecycle in openSE including the related documentation and deliverables of every step. The lifecycle consists out of 6 different phases and every phase has an inter-phase decision point at the end and different project management key deliverables.

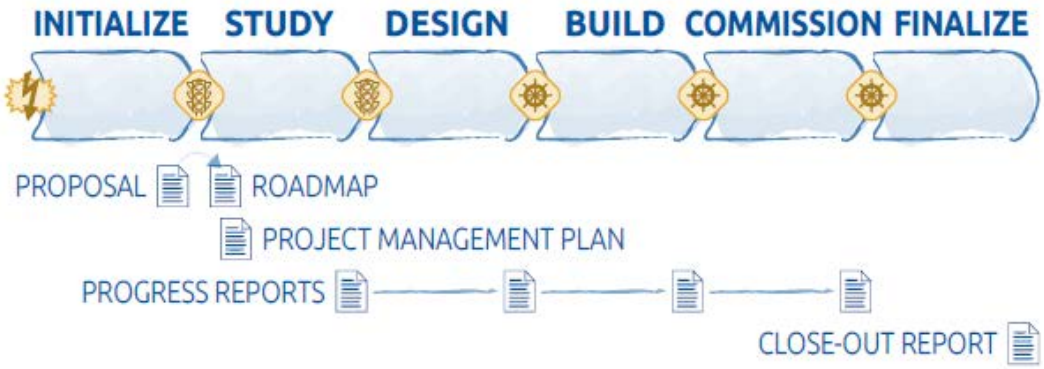


Figure 4 the key project management deliverables [15]

The Inter-Phase Decision Points

The different project phases are separated by gates called decision points. The lightning flash is an ignition point; the traffic light is a “go-no go” decision and the ship wheel features a drift decision.

The six project Phases and key deliverables

1. **Initialize**

The three key goals of this phase are to analyse the present situation and to define what is the “problem“ to solve; to propose some possible solution to the problem and formalizing the decision to perform the project.

The key deliverables of the Initialize phase are the Project Proposal that after being endorsed by a Project Board may become the Project Roadmap.

2. **Study**

The four key goals of this phase are to gather the needs (users’ requirements), to convert the gathered needs into requirements; to identify all possible solutions to the problem and to propose and demonstrate the preferred solution

The key deliverable of this phase is the Conceptual Design Report

3. **Design**

The five key goals in this phase are the finalization of the definition of the needs, the finalization of the list of requirements, to design the solution, to plan further the Build and Commission phases and if required to develop a prototype, proof-of-concepts, mock-ups.

The key deliverable is the Technical Design Report

4. **Build**

The three key goals are to perform the detailed design, to materialize the equipment, systems and the facility and to verify the conformity of the materialization.

5. **Commission**

The five key goals in this phase are a validation of the outcome of the project, to refine, getting rid of all the minor and not fully solved problems encountered during the previous phases, if required adapt the project to the evolving context to accommodate emerging needs from users or stakeholder, to train the users as the operations team and the maintenance teams and to release the operations & maintenance documentation.

The key deliverables are the Validation reports and the Operations & Maintenance Documentation.

6. **Finalize**

The only goal of the last phase is to capitalize the lessons learned all along the project phases. The key deliverable is the Close-out report. [15]

4.3 Introduction to the Agile Method following the example of the SCRUM framework

Due to new challenges the development of software's brought, a new need rose up for an alternative to "traditional" management approaches as Project Management or Systems Engineering. Underlying were arguments such as that a software shouldn't be developed like an automobile in an assembly line, where the one phase can only start if the phase before is finished. As an alternative the direction of a project should be assessed throughout the development of the lifecycle. In this sense two different approaches rose up, the SCRUM and the KANBAN approach. To give a short overview it should be said that SCRUM plans in short periods, so called sprints of 3 to 4 weeks and KANBAN is a more continuous process inspired by the Japanese principal called kanban were the cards find their way through the Kanban board by a pull system.

As described in the Scrum Guide by Ken Schwaber and Jeff Sutherland [16], "Scrum is a framework in which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value.

Developed in the 1990s, the framework consists of Scrum Teams and their associated roles, events, artifacts, and rules. Each component serves a specific purpose and is essential to the success and usage of Scrum."

4.3.1 The different roles of Scrum

The three core roles of Scrum are the Product Owner, the Development Team and the Scrum Master. The philosophy behind it is that Scrum Teams are self-organizing and cross-functional, so it is them who have all the competencies needed in order to fulfil the tasks and up to themselves to choose the right approach.

<u>The Product Owner</u>

The Product Owner is responsible for the product and therefore it is his responsibility to maximize the value of the product by managing the artefact *Product Backlog.* It is always just one person who is the product owner although he can represent a committee. In his

scope it is his responsibility to express product backlog items clearly, to prioritize the different items in the backlog and to ensure that the items in the Product Backlog are understood to the level needed.

The Development Team

The Development Team consists of a team of professionals who have the expertise to fulfil the different tasks needed to develop the product. It is them who do the work and them who have the authority to decide if an item can be labelled “Done”. They have characteristics as they are self-organizing without a hierarchy and that their team is cross-functional with all the skills needed.

Various sources claim the “optimal” team size from around 5 – 9 people. In the book *Scrum and XP from the Trenches – How we do Scrum* by Henrik Kniberg [17] there is agreed on the size although they claim from their best practices that just a size of 3 – 8 participants is sufficient.

The Scrum Master

The responsibility of the Scrum Master is to ensure that Scrum is properly understood by all the team members in terms of theory, practices, and rules. As well he advise people from the outside, which interactions with the Scrum Team might be helpful and which would be counterproductive.

Just some of his characteristics are:

- Helps the Product Owner for effective Product Backlog management
- Coaching the Development Team in self-organization and cross-functionality
- Facilitating Scrum events as requested or needed
- Planning Scrum implementations within the organization
- Leading and coaching the organization in its Scrum adoption

4.3.2 The different Artefacts of Scrum

Since Scrum is an easy method, it just has 2 artefacts to manage, the product backlog and the Sprint Backlog. The artefacts represent in this case a list of functionalities or tasks that have to be done and are written down in order to increase the transparency.

Product Backlog

What in other methodologies is the product requirements document or the performance specification is comparable in the sense of Scrum the Product Backlog.

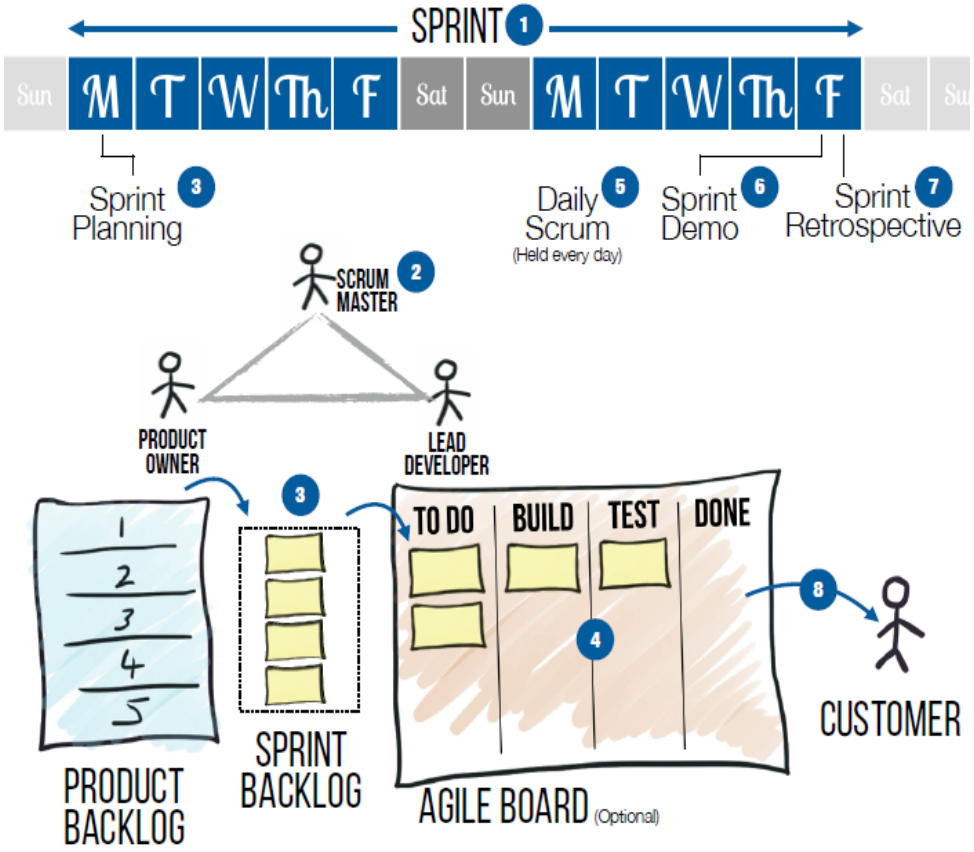
It is the only source of information about requirements and functionalities proposed for the product and it will be continuously enhanced over time. The responsible for this Product Backlog in terms of content, ordering and availability is the Product Owner. Multiple teams can work on one product and therefore on one Product Backlog.

Sprint Backlog

As soon as a Sprint will be planned, the Sprint Backlog will be created. It consists out of functionalities and requirements that are planned to be developed or to be fixed during the

sprint and which are taken from the Product Backlog. Additionally to that it consists out of a plan for delivering the product Increment and realizing the Sprint Goal.

Following in Figure 4 can be found a graphic determining the different steps of a Scrum process and its different artefacts.



1. **Scum** Teams work in a series of **Sprints** of 1, 2 (most common), 3 or 4 weeks duration.
2. It is the job of the **Scrum Master** to help the *Product Owner*, the *Lead Developer* and the *Development Team* to develop and maintain good habits.
3. Each Sprint it proceeded by a **Sprint Planning Meeting** - run by the *Scrum Master* and attended by the *Product Owner* and the *Development Team* and (optionally) other *Stakeholders*. Together th select high priority items from the **Product Backlog** that the *Development Team* believe it can commit to delivering in a single Sprint. The selected items are known as the **Sprint Backlog**.
4. The *Development Team* work on items in the Sprint Backlog ***only*** for the duration of the Sprint. In all but exceptional circumstances, new issues must wait for the next Sprint.
5. The **Daily Scrum** (aka Daily Huddle, Daily Standup) is a short standup meeting attended by the *Scrum Master*, the *Product Owner* and the *Development Team*.
6. Features developed during the sprint are demonstrated to *Stakeholders*.
7. An examination of what went well, what could be improved, etc. Aim: to make each Sprint more efficient and effective than the last.
8. At the end of the sprint, completed items are packaged for release to live. Any incomplete items are returned to the Product Backlog.

Figure 5 Summary of main functionalities of Scrum [18]

5 Roles and Responsibilities in the spirit of OpenSE

The issue that many different Methodologies use artefacts with similar purpose doesn't only happen with documents, but as well with the different *roles* and *responsibilities*. Since it is an important issue who has to edit the document, who has to approve it and who has to check it, this chapter should clarify the vocabulary that is going to be used for this roles in order to avoid misunderstandings.

For this purpose there are presented the roles and responsibilities as defined in the OpenSE methodology since there was already a differentiation made and it got widely inspired by the methodologies of HERMES and PRINCE2 which will be part of this thesis as well.

5.1 The OpenSE Key Roles

Figure 4 visualize the different Key Stakeholders of the project and their relation to each other.

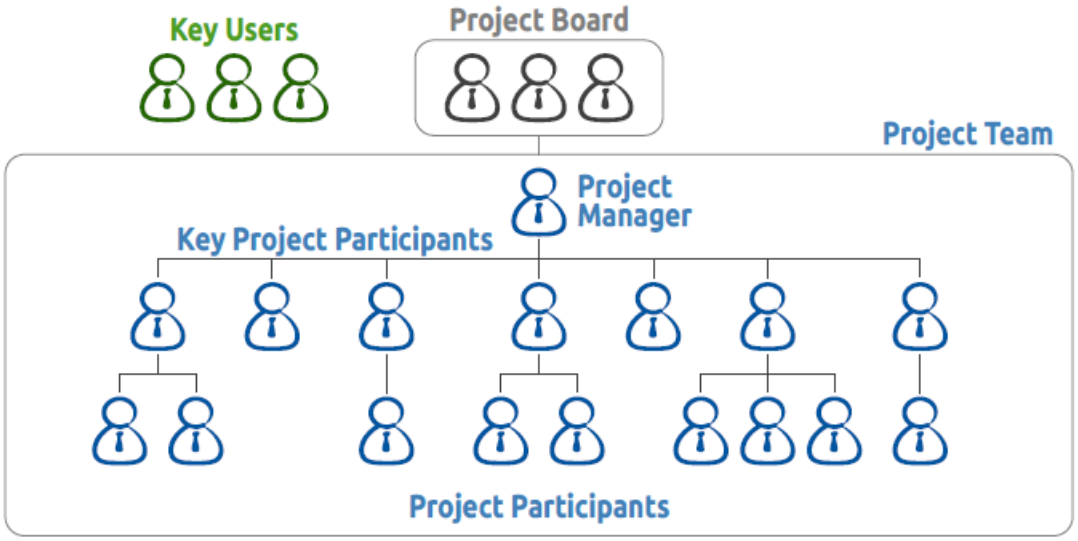


Figure 6 OpenSE Key Project Stakeholders [15]

5.1.1 The Project Board

The Project Board governs the project and has the duties to

- Ensure the strategic management of the project;
- Guaranteeing the acquisition and availability of resources, in importance and in due time;
- Because of the latter, being ultimately responsible for the successful completion of the project;
- Validating the gates between the phases, but also within phases when such gates are considered;
- Arbitrating in case of conflicts.

Project Board is the OpenSE preferred term. As citied of the OpenSE Framework, alternative terms which have a similar definition exist and are: Strategic Board, Steering Board, Strategic Committee, Steering Committee, Project Owner, Product Owner, System(s) Owner or Project Sponsor.

In order to become a member of the Project Board, OpenSE propose that following conditions should be satisfied:

- To be a major resource provider to the project
- To be in the supervision line of several Key Project Participants
- To be a major beneficiary of the outcome of the project
- To be importantly impacted by the outcome of the project

5.1.2 The Key Users

The Key Users are the end users of the outcome of the project, their responsibility consists of providing needs to the Project team in order to guarantee a proper outcome of the project.

5.1.3 The Project Manager

The Project Manager is mandated by the Project Board in order to manage the project. His/her duties are to

- Ensure the operational management of the project
- Being responsible toward the project board for the organization of the project and its coordination.

Project Manager is the OpenSE preferred term. Alternative terms which have a similar definition exist and are: Project Leader, Project Coordinator or Project Director. The Project Manager is often seconded by a deputy.

5.1.4 The Project Team

The Project Team is the team formed with all the individuals mandated to participate to the project, either part-time or full-time. Normally it consists out of the Project Manager, the Key Project Participants and the other Project Participants.

Project Participant is the OpenSE preferred term. Alternative terms with a similar definition exist and are: Project (Team) Member or Project Contributor.

5.1.5 The Key Project Participants

The Key Project Participants are seen as experts in a given technical or technological field who are asked to oversee Work Packaged or Activities. Their responsibility includes the operational supervision of some Project Participants.

Key Project Participant is the OpenSE preferred term. Alternative terms with a similar definition exist and are: Lead (Project) Participants, Lead (Project) Member, Key (Project) Member, Lead (Project) Contributor, Key (Project) Contributor, Work Package Leader, Activity Leader, Work Package Holder or Activity Holder. [15]

6 Different Artefacts

6.1 Artefacts from Textbooks

6.1.1 Project Overview Statement (POS) by Wysocki and McGary

In their book “Effective Project Management, third edition”, Robert K. Wysocki and Rudd McGary [19] give an overview and their personal advises for traditional, adaptive and extreme Project Management practises. In their book in the part “Scoping the project” they talk about a document so called Project Overview Statement. In there they distinguish in between four different kind of projects; Type A, B, C and D. Projects of Type A are projects with a very high complexity and business value and projects of Type D projects with minor changes of a rather simple nature.

Project Management Process	Project Classification			
	A	B	C	D
Define				
Conditions of Satisfaction	R	R	O	O
Project Overview Statement	R	R	R	R
Approval of Request	R	R	R	R
Plan				
Conduct Planning Session	R	R	O	O
Prepare Project Proposal	R	R	R	R
Approval of Proposal	R	R	R	R
Launch				
Kick-off Meeting	R	R	O	O
Activity Schedule	R	R	R	R
Resource Assignments	R	R	R	O
Statements of Work	R	O	O	O
Monitor/Control				
Status Reporting	R	R	R	R
Project Team Meetings	R	R	O	O
Approval of Deliverables	R	R	R	R
Close				
Post-Implementation Audit	R	R	R	R
Project Notebook	R	R	O	O

R = Required O = Optional

Figure 7 the use of required and optional parts of the methodology by type of project [19]

As shown in figure 8, the Project Overview Statement appears in the Define phase of a project, which equals the *Initialisation* phase of the PMBoK as described in chapter 4.1.1.PMBoK. The remarking point about this document is that it is one of the only documents that is required in no matter which type of project.

The document is defined by them as follows: “The POS is a short document (ideally one page) that concisely stated what is to be done in the project, why it is to be done. And what business value it will provide to the enterprise when completed.”

In their point of view, the main reason of the POS is to secure senior management approval and to ensure the resources needed to develop a detailed project plan. It serves as well as a general statement that can be read by any interested party in the enterprise and becomes the reference document for questions or conflicts regarding the project scope and purpose.

As noted by Wysocki and McGary, the traditional project management lifecycle (TPM) consists out of five phases.

1. Scope the project
2. Develop the project plan
3. Launch the plan
4. Monitor/ control project progress
5. Close out the project

Interesting in our case is to have a closer look at the phase „Scope the project“, it is split up into five parts again:

- State the problem/opportunity
- Establish the project goal
- Define the project objectives
- Identify the success criteria
- List assumptions, risks, and obstacles

The Project Overview Statement forms in this case the deliverable of this phase. In it there are all the 5 parts listed and the outcomes documented that have been determined in the phase “Scope the project”. In their book they underline the high importance of this phase by recalling themselves on a study that has shown that planning reduces risk and can increase productivity by as much as 50 percent[2]

According to them many organisations use the POS as a method to propose ideas that can higher productivity, efficiency or opens new business opportunities. As a result everyone is allowed to create a POS. Reviewed is the POS by the managers who are responsible for setting the priorities and who are deciding what projects to support which would be in the spirit of OpenSE the *Project Board*.

The POS has five component parts:

- Problem/ opportunity
- Project goal
- Project objectives
- Success criteria
- Assumptions, risks, obstacles

A template for the Project Overview Statement, given in the book, can be found in the Annex A.

[2] Joseph W. Weiss and Robert K. Wysocki, *5-Phase Project Management: A Practical Planning and Implementation Guide* (Reading, Mass.: Perseus Books, 1992), ISBN 0-201-56316-9.

6.1.2 Project Scope by Larson and Gray

The book managerial process – fifth edition by the two professors Erik W. Larson and Clifford F. Gray is intended to be designed in a way to provide project managers and prospective project managers with the knowledge and skills that are transferable across industries and countries. It got widely inspired by PMI's Project Management Body of Knowledge (PMBOK).

In their approach the first stage for developing a project plan is to define the project scope. It is a definition of the end result or mission of the project and its primary purpose is to define as clearly as possible the deliverable(s) for the end user and to focus project plans. They themselves stress out the high importance of such a definition of scope by mentioning a study, made by Larson and Goebli, that was involving more than 1400 project managers from several countries and showed that approximately 50 percent of the planning problems relate to unclear definition of scope and goals.

In their book, the Project Scope is part of the Phase "Defining the Project" which is comparable to *Initialisation* phase from the PMBoK standard[3]. This Phase is consisting of five steps;

1. Defining the Project Scope
2. Establishing Project Priorities
3. Creating the Work Breakdown Structure
4. Integrating the WBS with the Organization
5. Coding the WBS for the Information System

It is in the duty of the project manager and customer to develop the scope. The project manager should ensure an agreement with the customer on project objectives, deliverables at each stage of the project and technical requirements for example. The *project manager* in terms of Larson and Gray stays the same as in our definition of OpenSE, to the customer can be referred as *key users*. The document will be published and used by the project owner (*project board*) and project participants to plan and measure the project success. The scope should be defined in specific, tangible, and measurable terms.

Larson and Gray give a "Project Scope Checklist" in order to ensure that the scope definition is complete. The checklist was chosen quite generic and it was mentioned that companies and different industries will develop their unique checklists and templates to fit their needs and specific kinds of projects. It contains:

1. Project objective, as a definition of the overall objective to meet the customer's need(s). It should answer the questions what, when and how much.
2. Deliverables, expected outputs over the life of the project.
3. Milestones, major segments of work that are showed in a milestone schedule. It represents first, rough-cut estimates of time, cost and resources for the project. It is build, using the deliverables as a platform to identify major segments of work and an end date. Milestones should be easy for all project participants to recognize.
4. Technical requirements
5. Limits and exclusions, in order to set limits to the scope to not to give false expectations and to avoid expending resources and time on the wrong problem.

[3] See chapter 4.1.1.PMBoK

6. Reviews with customer, to ensure an understanding and agreement of expectations

A big attention was payed to avoid scope creep because in their point of view scope creep leads in most cases to negative effects as higher costs and delays. For them current practices as project charters and statements of work were too generic. By focusing on risk limits, customer needs, spending limits etc. the scope itself would be mentioned too brief and this would lead to the danger of scope creep.

An example of a Scope Statement given in the book can be found in the Annex B.

6.1.3 Mission Statement by Ulrich and Eppinger

In their book Product Design and Development [20], Ulrich and Eppinger present their approach on how to develop and design new products from scratch by giving of the shelf step-by-step procedures for completing the different tasks. A clear line can be drawn to the entrepreneur activities of a company, but as well to project management since this process of developing a new product contains the collection of needs and their translation into requirements or prototyping and manufacturing the new product.

After giving tips and tricks about how to identify opportunities Ulrich and Eppinger dedicate a chapter to the *product planning process*. It consists of a five-step planning process beginning with the identification of opportunities and resulting in the mission statement for the project team. Although the phase indicates the word *planning* it can still be associated in a wider sense to the phase *Initialisation* from the PMBoK, because this processes more serve to define the new projects. The planning in this context doesn't refer to the planning of a single product, but moreover on creating a portfolio of products to be developed and their timing of introduction to the market. To this portfolio of products is referred to as product plan. In there, opportunities are vague descriptions about the product which have to be further developed in the *product development* process.

In order to develop the product plan there is a five-step process proposed:

1. Identify opportunities
2. Evaluate and prioritize projects
3. Allocate resources and plan timing
4. Complete pre-project planning
5. Reflect on the results and the process

A proposed opportunity evolves over this five steps to the mission statement. In the first step there will be some *opportunity statements* proposed which then will be evaluated and prioritized under the four basic perspectives of: competitive strategy, market segmentation, technological trajectories, and product platforms. After the prioritization of the different opportunities resources and plan timing get allocated. Once this has been done and the project gets approved the pre-project planning phase sets in as step 4.

An example opportunity statement given by Ulrich and Eppinger coming from a project that is presented in the book called the Lakes project is:

> Develop a new black and white, digital, networkable, document center platform for the office market, including scanning, storage, fax, distribution, and printing capabilities. [20]

Before substantial resources are applied, a cross functional team of people, known as *core team* should formulate a detailed definition of the target market and the assumptions, under which the development team will operate. By doing this the *opportunity statement* gets reformulated into a *vision statement*. Following a vision statement that was given as an example by Ulrich and Eppinger, and that evolved from the previous given example:

> Develop a networked, mid-range, digital platform for imaging, marking, and finishing. [20]

This statement is still quite general and will be turned into the *mission statement* which should consist in the sense of Ulrich and Eppinger of:

- Brief (one-sentence) description of the product, which identifies the basic function of the product but avoids to imply a specific product concept. It is the same principle under which the product vision statement is developed, which can be put in here instead as well.
- Benefit proposition, which is a reflection about the critical few reasons why a customer would buy the product.
- Key business goals that include goals for time, cost and quality.
- Target market(s) for the product which can contain out of several target markets. They should be classified in primary and secondary market.
- Assumptions and constraints. Reason for that chapter is to maintain a manageable project scope. Additional information about the assumptions may be attached to the mission statement.
- Stakeholders. This should contain all the product stakeholders that may be affected by the product's success of failure. It acts as a reminder in the team to consider the needs of everyone who will be influenced by the product.

An example of a Mission Statement building up on the two examples given before can be found in Annex C.

Authored is the Mission Statement by the core team which could be in the spirit of OpenSE the *project team*. A characteristic of this statement that distinguishes it from other kind of artefacts presented in this thesis is that it is not mentioned if this statement has to be approved by someone, and if, by whom.

6.2 Initialisation of a project following the PMBoK

The book *A Guide to the Project Management Body of Knowledge (PMBoK Guide) – Fourth Edition* is published as an American national standard by the American National Standard Institute (ANSI).

The Project Charter is defined by the PMBOK as "a process of developing a document that formally authorizes a project or a phase and documenting initial requirements that satisfy the stakeholders' needs and expectations. It establishes a partnership between the performing organization and the requesting organization. The approved project charter formally initiates the project." [1]

As in other methodologies and standards, the project charter represents an artefact that is mandatory for every type of project. It documents the initial requirements and forms the baseline for further efforts to be done, such as to collect requirements, define the scope, identify the stakeholders and to develop the project management plan. A flow chart about the inputs and outputs of the develop project charter process can be found in figure 9.

It is stressed out that the charter should be developed by the project manager, because the charter gives him the authority to allocate resources to the different activities. The approval is done by someone external of the project such as a Sponsor, a Project Management Office or the Portfolio Steering Committee, which is the equivalent to the *Project Board* of the OpenSE methodology.

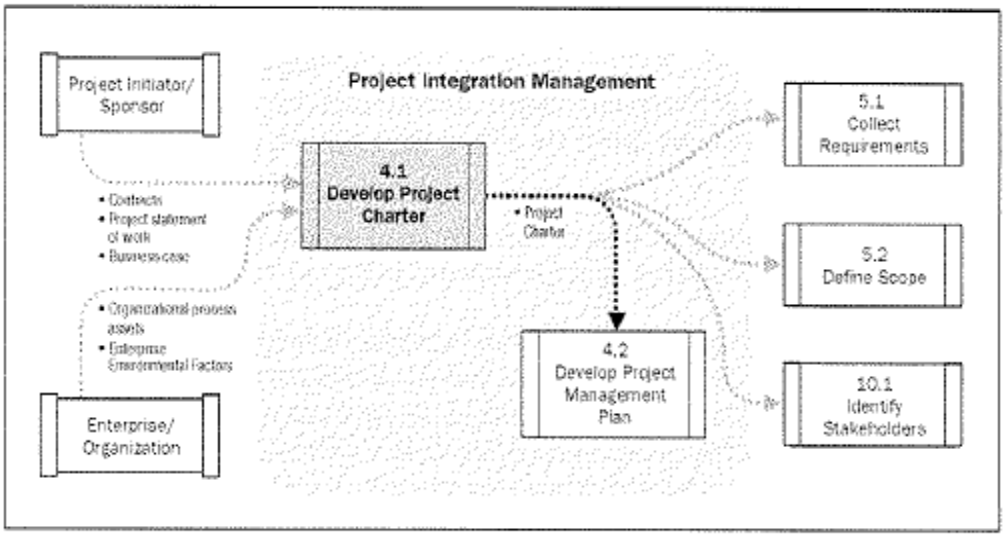


Figure 8 Develop project charter data flow diagram [1]

The approach of PMBoK is to give for all their processes the inputs, the tools and techniques and the outputs. In their opinion, in order to develop the Project Charter, following fundamental inputs should be taken into account.

1. The Project Statement of Work, which is a narrative description of products or services to be delivered by the project that references the *Business Need,* the *Product Scope Description* and the *Strategic Plan*.
2. The Business Case or a similar document that provides the necessary information from a business standpoint to determine whether or not the project is worth the required investment.
3. The Contract in case the project is being done for an external customer
4. The Enterprise environmental factors that can influence the process of developing the project charter as *governmental* or *industry standards*, *organization infrastructure* or *marketplace conditions* for example.
5. Organizational process assets that can influence the process of developing the project charter as *organizational standard processes, templates* or *historical information* and *lessons learned knowledge base*

To assess the inputs used to develop the project charter there should be taken in consideration the judgment and expertise provided by an expert. As the PMBoK describes it in the

tools and techniques this knowledge can be provided by any group or individual with specialized knowledge or training and is available from many sources.

The final result of the process, the project charter as a document, should then contain following content:

- Project purpose or justification
- Measurable project objectives and related success criteria
- High-level requirements
- High-level project description
- High-level risks
- Summary milestone schedule
- Summary budget
- Project approval requirements (what constitutes project success, who decides the project is successful, and who signs off on the project)
- Assigned project manager, responsibility, and authority level, and
- Name and authority of the sponsor or other person(s) authorizing the project charter

6.3 Initialisation of a project following PRINCE2

PRINCE2 was published in the 70s under the name PROMPT to offer a standardised approach for project management. Since this days it went through some evolutions from PRINCE to PRINCE2 (Project IN Control Environments) in the years 80-90, and updates in 2002, 2005 and 2009.

It sees itself as a very general methodology and doesn't seek for treating technical aspects related to specific technical fields or soft skills. PRINCE2 is structured with four integrated elements of principles, themes, processes and the project environment.

All in all there are 26 management products that have to be managed as baselines, reports and records within a PRINCE2 project. The Project Brief is one of them.

6.3.1 Project Mandate

The trigger for the project is called the *Project Mandate*. The Project Mandate can vary in many forms from a feasibility study or just a verbal instruction given by the authority commissioning the project. There is no specific form proposed for this document since it is an external product and therefore can't be influenced by the project team. The only restrictions it has are that it should contain enough information to identify the terms of reference for the project and the prospective executive of the project board. It falls out of scope of this thesis since it triggers the project but does not formally initialise it.

6.3.2 Project Brief

The actual document that finalize the "starting up of a project" phase and builds the baseline for the "initialisation of a project" phase is the *Project Brief*. The purpose of the Project Brief is to ensure that the project has a well-defined starting point that is well understood by all the participants. It is therefore part of processes that are performed to define the new project and one of its goal is to obtain authorization to proceed to the next phase to start the project,

this let assume that it can be part of the initiating phase in terms of the PMBoK. Here can be found a big discrepancy in vocabulary since for PRINCE2 the phase initialisation of a project is more close to the *planning* phase in the PMBoK. This makes it very prone to misunderstandings in between project participants with different project management backgrounds.

According to PRINCE2 it is in the responsibility of the *project manager* to create the Project Brief. It will be revised by the project assurance, potentially as well by the senior user and the senior supplier. The *project board* decides whether to initiate the project, and states the levels of authority to be delegated to the project manager for the initiation stage. The approval of the project board ensures that it is worthwhile to invest money and resources by proceeding to the next project phase.

In order to develop the project brief there are various inputs such as the project mandate, the programme management, the lessons log and the discussions with potential stakeholders. In term of quality concerning the document it is mentioned that it should be kept 'brief' as the name already indicates. Reason for that is that the purpose of the project brief is to provide a solid base on which the project can be initiated and anyway will be redefined more explicit in the *project initiation documentation*.

A special attention should be given that the document reflects the project mandate as well as the requirements of the end users and the business.

The Project Brief consists in the spirit of PRINCE2 of:

- **Project Definition** that should explain why the project needs to be achieved. Additionally to that it contains the background, project objectives[4], desired outcomes, project scope and exclusions, constraints and assumptions, project tolerances, the user(s) and any other known interested parties and potential Interfaces.
- **Outline Business Case** that should give reasons why the project is needed and should contain the business option selected. During the Initiating a Project process it will be developed into a more detailed Business Case.
- **Project Product Description** that should tell what the project should deliver in order to succeed, including the customer's quality expectations, user acceptance criteria, and operations and maintenance acceptance criteria.
- **Project approach** that defines the choice of solution that will be used within the project. For the approach several solutions should be taken into consideration and the most appropriate selected.
- **Project management team structure** that should show who will be involved in the project.
- **Role descriptions** for the project management team and any other resources identified at this time.
- **References** to any associated documents or products.

After the project brief gets approved by the project board, a phase starts in which the feasibility of the project will be shown and a plan for developing the plan will be created. In this

[4] PRINCE2 recommends to set the project objectives in a Specific, Measurable, Achievable, Realistic and Time-bound (SMART) way and as well consistent with the organization's corporate social responsibility directive.

phase the project initiation documentation will be created and the project brief no longer maintained.

6.4 Initialisation of a project following HERMES

The HERMES methodology is a project management methodology which was developed in the beginning of the seventies under the Federal Administration of Switzerland in order to respond to the growing challenges of informatics systems of the federal and cantonal administrations. The reason for its creation are relatively the same as that one's of the PRINCE2 methodology from the United Kingdom.

HERMES is an acronym for "Handbuch der Elektronischen Rechenzentren des Bundes, eine Methode fuer die Entwicklung von Systemen". Since its first publication 4 major revisions have been done and published roughly every 10 years. The most recent is the fifth one (HERMES 5), published in 2012 that was supplemented by a minor change in 2016 in order to integrate the spreading Agile approach in its lifecycle that occurs as SCRUM (HERMES 5.1).

The lifecycle of HERMES 4 foresaw a Pre-Initiation phase in which the initiators of the project had the main task to create a project proposition, which after being approved was formally launching the project. This decision point they called Project Mandate which was based on the project proposition, the project manual and the project plan. A reproach people made to HERMES 4 was that its formal character (There was a manual about 300 pages for the application on the development of informatics systems and another book of as well 300 pages about the adaption of the informatics systems). [21] For HERMES 5 the two books were melted together to a 180 pages thick general manual. Anyway, the processes in there were kept and were now called "Project Initiation Order" and more specified in the tasks "Commission and Steer the Initiation" (a task about the strategic steering of the project) and the document Project Charter, more specified in the task "Create a Project Charter" (a task aiming for the operational orientation of the project).

6.4.1 Project Initiation Order

The lifecycle of HERMES 5 foresees an Initialisation phase at the very beginning of its lifecycle. The phase is starting with the ignition point *Project Initialisation Order.* A template for it can be found in the Annex D: Example Project Initiation Order.

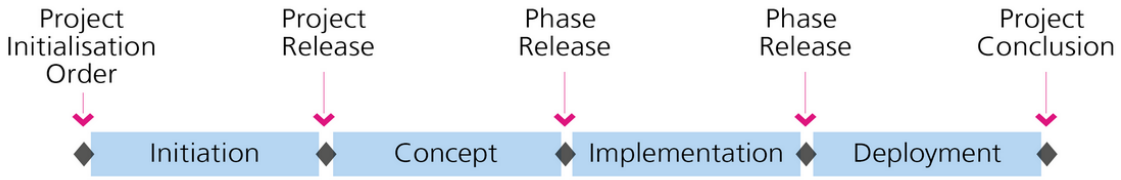


Figure 9 Project lifecycle in the sense of HERMES5 [7]

The documents main purpose is to bond and form the basis for the release of the Initiation phase. It documents the current understanding of the project and brings together the project sponsor (project board in the sense of OpenSE) and the project manager to agree on the upcoming phase. It contains:

- **Background**, why the project should be initiated
- **Objectives**, in where the aims of the initiation phase are formulated
- **Parameters** of the Initiation phase as requirement for carrying out the project (e.g. budget, key deadlines, etc.)
- **Outcomes and Deadlines** which indicated the deliverables from the phase
- **Outlay** where an estimation on required human resources should be given
- **Costs** with an estimation about the costs for the phase
- **Resources** where required resources are listed
- **Communication** which indicated in which time laps there will be reporting done to whom
- **Risks** of the Initiation phase

The Project Initiation Order initiates the initiation phase of a project. Therefore it falls out of the scope of this thesis since the focus is on documents that initiate a project. In other words, documents that are on the transition point of the initialisation phase to the planning or concept phase.

6.4.2 Project Charter

The decision if the conceptual design phase should be initiated is done based on the document Project Charter that is worked out in the phase Initiation. This document, as already his predecessor did, is representing an agreement in between the project sponsor (*Project Board* in OpenSE) and the project manager. It acts like a contract and forms the basis for the project release (see Figure 9 Project lifecycle in the sense of HERMES5 [7]). An example of a HERMES 5 project charter can be found in Annex E: Example Project Charter.

It contains the following chapters:

- **Background** which builds the reference to the study and the option chosen.
- **Objectives** that can be subdivided in system goals, procedural goals, parameters and delimitation.
- **Description of solution** which describes the option chosen and gives a reference to the feasibility study that has been done on it.
- **Financial requirements** that gives a rough estimation on the costs for the next phase
- **Planning and organization** as deadlines, milestones and a list of roles in the project organization and their associated counterparts.
- **Efficiency** that is weighing up the costs and time required for project and operation and formulates if the benefits are quantifiable or not.
- **Relationship to strategy and requirements** where there is evaluated if the requirements and objectives of the project are well aligned with the company's strategy.
- **Risks** were identified for the next phase.
- **Consequences** that is weighing up the what if the project is continued and the what if the project won't be continued scenarios.

6.5 Initialisation of a project following system engineering

The system operational concept (OpsCon) or as it can be found sometimes the OPSCON is a document of the System Engineering that has as objective the description of the characteristics of a future system (a system that is intended to be developed) from the point of view of the users of this future system. This includes the point of view of future operators, the people who will have to ensure the maintenance or the users that will have to ensure the conformity of this system. The international standard ISO IEC IEEE 29148:2001 [22] gives a normative definition for this document. All the different standards as the System Engineering Handbook of the NASA [9], the G2SEBoK [23] or even the Handbook of System Engineering of Sage and Rouse [24] reference to this document, but under a different name, the concept of operations, ConOps or sometimes written CONOPS.

This document specifies the future system from a point of view of the future users and is used to communicate to the developers, suppliers, and the users all the characteristics quantity and quality that will be expected of this future system. Included are the operational aspects as the education of the operators and people responsible for the maintenance and the type of use. Even though the normative document isn't very explicit due to the timing of the document, it is evident that the first version has to be created even before the decision that this project will be launched is formally taken. As soon as the process of the development of this system evolves, the document has to evolve with it and always being kept up to date.

The International Standard ISO IEC IEEE 29148:2011 delivers us a normative content of the OpsCon:

Title page
Revision chart
Preface
Table of contents
List of figures
List of tables

1. Scope
- 1.1 Identification
- 1.2 Document overview
- 1.3 System overview

2. Referenced documents

3. Current system or situation
- 3.1 Background, objectives, and scope
- 3.2 Operational policies and constraints
- 3.3 Description of the current system or situation
- 3.4 Modes of operation for the current system or situation
- 3.5 User classes and other involved personnel

4.2 Description of desired changes
- 4.3 Priorities among changes
- 4.4 Changes considered but not included

5. Concepts for the proposed system
- 5.1 Background, objectives, and scope
- 5.2 Operational policies and constraints
- 5.3 Description of the proposed system
- 5.4 Modes of operation
- 5.5 User classes and other involved personnel
- 5.6 Support environment

6. Operational scenarios

7. Summary of impacts
- 7.1 Operational impacts
- 7.2 Organizational impacts
- 7.3 Impacts during development

8. Analysis of the proposed system
- 8.1 Summary of improvements
- 8.2 Disadvantages and limitations
- 8.3 Alternatives and trade-offs considered

To answer the question, if the document is complete in terms of questions a project management team has in order to fulfil their mandate, the answer is definitely negative. In fact, although the document is precise in the description of what the future system has to deliver, the OpsCon is not really in the spirit of the project development itself. Milestones, its organisation and steering, the various resources that should be contributed to the system are missing. In order to be conform with good project management practices this document should be accompanied by a more systematic document that the system engineering doesn't really outline.

6.6 Initialisation of a project following the Agile approach

The Agile framework represents a different approach apart from the classic Project Management and System Engineering Standards. It goes away from the waterfall approach which can appear rather "stiff", to an approach where there is a continuous improvement and development process in theory.

Nevertheless although the agile approach appears very different than the "classic" methods there has to be an initialisation of the project.

6.6.1 Product Backlog in the SCRUM framework

While in Project Management and System Engineering things are written down and documented very accurate, Scrum intends to have just a view sources of information.

All the requirements collected are kept in the *product backlog* which represents a list of prioritized requirements, stories, features etc. described in the terminology of the customer.

As in the good practices of Kniberg [17] this backlog items can contain:

- ID – unique identification
- Name – short, descriptive name of the story
- Importance – product owner's importance rating for this story
- Initial estimate – how much work is needed to implement it
- How to demo - high-level description of how this story will be demonstrated at the sprint demo
- Notes – any additional information

PRODUCT BACKLOG (example)					
ID	**Name**	**Imp**	**Est**	**How to demo**	**Notes**
1	Deposit	30	5	Log in, open deposit page, deposit €10, go to my balance page and check that it has increased by €10.	Need a UML sequence diagram. No need to worry about encryption for now.
2	See your own transaction history	10	8	Log in, click on "transactions". Do a deposit. Go back to transactions, check that the new deposit shows up.	Use paging to avoid large DB queries. Design similar to view users page.

Table 2 Example of a Product Backlog [17]

6.6.2 Sprint Backlog in the SCRUM framework

The second artefact that can be found in the Scrum framework is the *sprint backlog*. This sprint backlog is defined in the so called sprint planning meeting, taking place at the very beginning of a sprint and should have the outcome of:

- Describing the sprint goal
- A list of team members
- The sprint backlog
- A defined sprint demo date
- A defined time and place for the daily scrum

In the meeting all the parties should be present, the Product Owner, the Development Team and the Scrum Master. This Sprints last usually from 1 – 4 weeks and for this the goals are defined in this meeting.

The sprint backlog itself is a set of product backlog items that are selected for the sprint. An example can be found in Figure 10 Example of a sprint backlog [17]. In the columns the *not checked out* represents a list of requirements/ tasks that has to be done during the sprint, *checked out* represents tasks that people work on that day and *done* represents finished tasks. The overall description of the project can be found in the Sprint Goal. The Burndown chart represents a chart where work process is documented, *next* represents tasks that have

to be done for the next sprint and *unplanned items* represent tasks that have to be done but weren't foreseen.

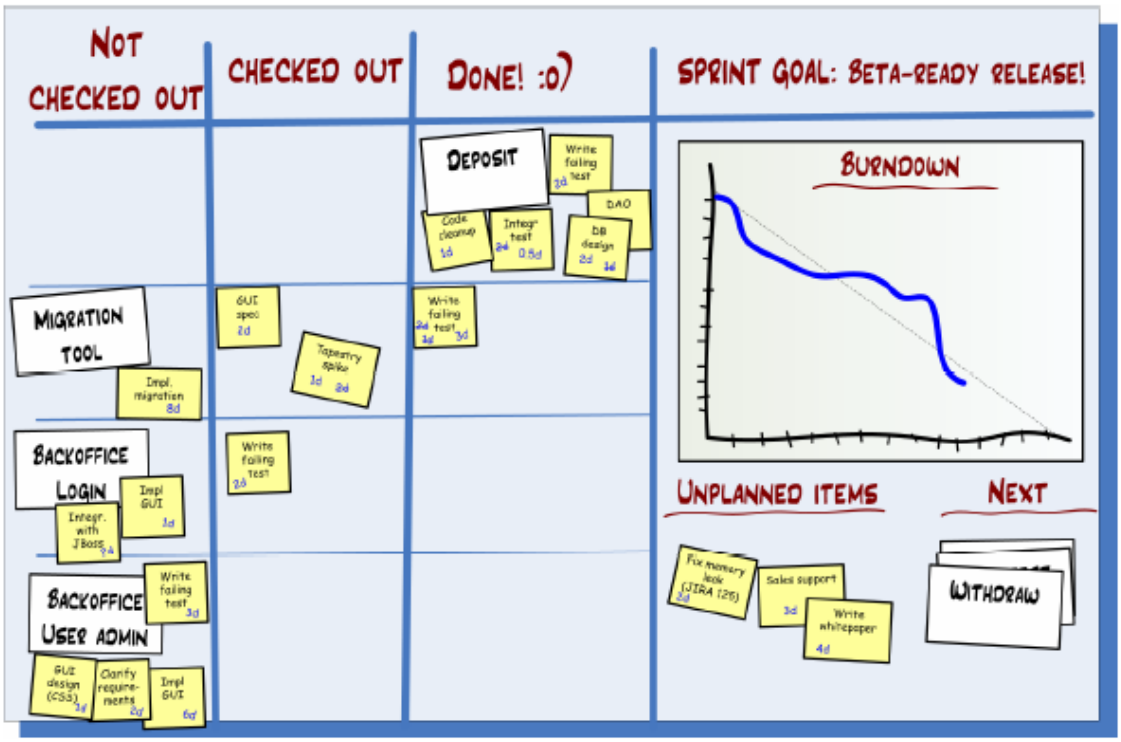


Figure 10 Example of a sprint backlog [17]

6.6.3 Product-, Sprint Backlog vs. Project charter, mandate and other "classic" artefacts

While in the Project Management Standard the Initiation phase is more aiming on authorizing a new project and the next project phase, the agile methods are more focusing on identifying the business needs for new product development. [25]

I turns out not to be that easy to draw a clear line in between the artefacts that were presented so far in this thesis (project brief, mandate, etc.) and the artefact we are looking at in the Scrum framework. What could be observed is that the "classic" artefacts are mainly documenting;

- Description of what has to be solved
- Description of aims, goals and objectives
- Sometimes proposed solutions
- Customer Requirements
- etc.

These different information that are captured in documents appear in Scrum in the product backlog. It contains:

- A list of items that represent a description of aims, goals and objectives
- The customer requirements that are the description of the item at the same time, and
- The description of what has to be solved, which should be the improvement of the product, the backlog is about.

The Sprint Backlog represents the second artefact in the framework and shows as well many similarities to the “classic” artefacts. In this sense there can be found milestones, solutions and a duration. Due to the fact that sprint teams are very small (maximum of 9 people for the development team + product owner + scrum master) the roles are clear and are not specifically documented.

7 Comparative Analyse

The one thing the different standards and methodologies about System Engineering, Project Management and Agile have in common is that all of them stress out the importance of taking the time just for the initialisation of the project and to document the supposed outcome. It was mentioned several times that the better things are defined from the very beginning on, the higher the rate of success.

They agree and insist on the importance of having a document that initialize a project, just about the document itself and its content they don't. Some have the opinion that a document should be just one page, pinning down the most important points, others are asking for a document as specific and complete as possible and Agile brings in a new approach by not making only one document, but lots of small tickets on which there are written just the problems or new features with a time estimate and the responsible on it.

Quite a few methodologies see the document as a form of contract, an agreement in between the client and the project leader on requirements and aims of the project which can be very problematic since often at the beginning of projects there is a big uncertainty on how the result of the project will look like. Moreover the document should deliver a base for further discussions and exchange in between the project team and the client. It could happen that a too strict definition of the project could more harm than help since it is just not possible to evaluate all the risks and uncertainties in an early stage and on top of that it would harm any creativity or motivation of the project participants to bring valuable input into the solution finding process.

As such extremes the OpsCon or the CONOPS can be seen, which appear very heavy and long and might be hard to understand for all the project participants. On the other hand there can be found the Project Overview Statement or the Project Scope which are kept very short and bring therefore the disadvantage of being too particular on the one hand and missing out important points on the other. In the end the choice is still very pending on the type of project that has to be executed and about how things are adapted in the company.

7.1 Project Management

Following there can be found a table in which the key points of the artefacts of Project Management are shown. The chapters were grouped together in *sections* in order to provide a quick overview of the different contents and differences in between the different documents.

Despite sections, it was documented at which point in the lifecycle of the project the document appears. What should be kept in mind is that for this the definition of the PMBoK was used. Underlying for this decision is that the different sources use their own lifecycle, which are quite similar to each other, but carry other labels and by using the definition of the PMBoK a common vocabulary was tried to introduce that makes a comparison possible. Another point that was evaluated as important was by whom the document is being authored

and who has to approve it, which can be found in table 3 as well. In this case it was influenced by the vocabulary of the OpenSE methodology in order to introduce a common vocabulary.

Term	Project Overview Statement	Mission Statement	Project Scope	Project Charter	Project Brief	Project Charter
Methodology	Wysoci, McGary	K.Ulrich, S. Eppinger	Larson E.	PMI	PRINCE2	HERMES5
Point in Lifecycle	Initialisation	Initialisation	Initialisation	Initialisation	Initialisation	Initialisation
Authored by	Everyone	Project Team	Project Manager	Project Manager	Project Manager	Project Manager
Approved by	Project Board	N/A	Key Users	Project Board	Project Board	Project Board
1. Section (description/ background/ justification of the project)	X	X	X	X	X	X
2. Section (Describes the aim, goals, objectives)	X	X	X	X	X	X
3. Section (Solutions)				X	X	X
4. Section (Stakeholder Requirement)		X		X	X	
5. Section (Risks)	X			X	X	X
6. Section (Milestones)			X	X		X
7.Section (Budget)				X		X
8.Section (Organigram/ administrative roles)	X			X	X	X

9. Section (Chapters that couldn't be associated to the other sections)		Benefit proposition; Target market(s) for the product; Assumptions and constraints that guide the development effort	Reviews with Customers			Efficiency; Strategy reference and implementation of requirements; Consequences; Legal framework

Table 3 Overview of the different artefacts in Project Management and their content

One major line that can be drawn in table 5 is in between the documents of the textbooks which include the documents Project Overview Statement, Mission Statement and Project Scope and the methodologies and standards including the Project Charter and the Project Brief. That one's of the textbooks appear rather short and specific while the ones of the Standards and Methodologies have a broader approach by trying to cover many topics. What has to be taken in consideration is that the Mission Statement by Ulrich and Eppinger is more aiming on the process of designing and developing a product and this might be the reason that the Mission Statement contains relatively much content that didn't match with that one of the others.

Fact is, and that is what the textbooks try to do better as the standards and methodologies, that writing a document is seen as a burden by many project participants. Often they appear too complex, too long, the vocabulary used in it is complex and it takes time to author the document, which people rather spend on operational things. An approach to encounter this would be a more *lean* approach, in where it is tried to reduce the documents that have to be written to a minimum in order to reduce *waste* such as that of time. So does it happen that the Project Brief of PRINCE2 is one of 26 documents, the Project Charter of the PMBoK even one of 42 artefacts that have to be handled throughout the lifecycle of the project.

What was observed in Project Management is that this kind of artefact mainly serves as a deliverable at the end of the phase Initiation. It is part of the outcome and ensures that sufficient time was spent to think the project through in terms of aims and objectives, risks, obstacles, customer requirements, the organisation structure of the project etc. One of the main reasons why this artefact is contributed such a high importance is that things that were approved in the Initiation phase are about to be conceptualised and as a consequence, depending on the flexibility of the project an unexpected change of scope can seriously impact the time/ cost factors of the project.

Of course not everything can be foreseen in such an early stage of a project, but to lower uncertainties, in some of the documents was asked to list the risks of the project.

7.2 System Engineering

System engineering whereas has a kind of different approach. Most of them recall themselves on the OpsCon Document which replaced the obsolete ConOps document. Rather than spending too much time in explaining the difference of the two documents there is to say that the concept behind both of them stayed the same. They are trying to capture future interactions of the key users with the system and to describe them. It is aiming, as in Project Management as well, to create a common consensus among all stakeholders, and tries additionally to that to reveal possible bottlenecks, problematics and requirements of the future system. Key questions that this document answers are the actual functionalities of the product for all live-cycle stages, and the interactions of both nominal as well as off-nominal situations with the key users. [26]

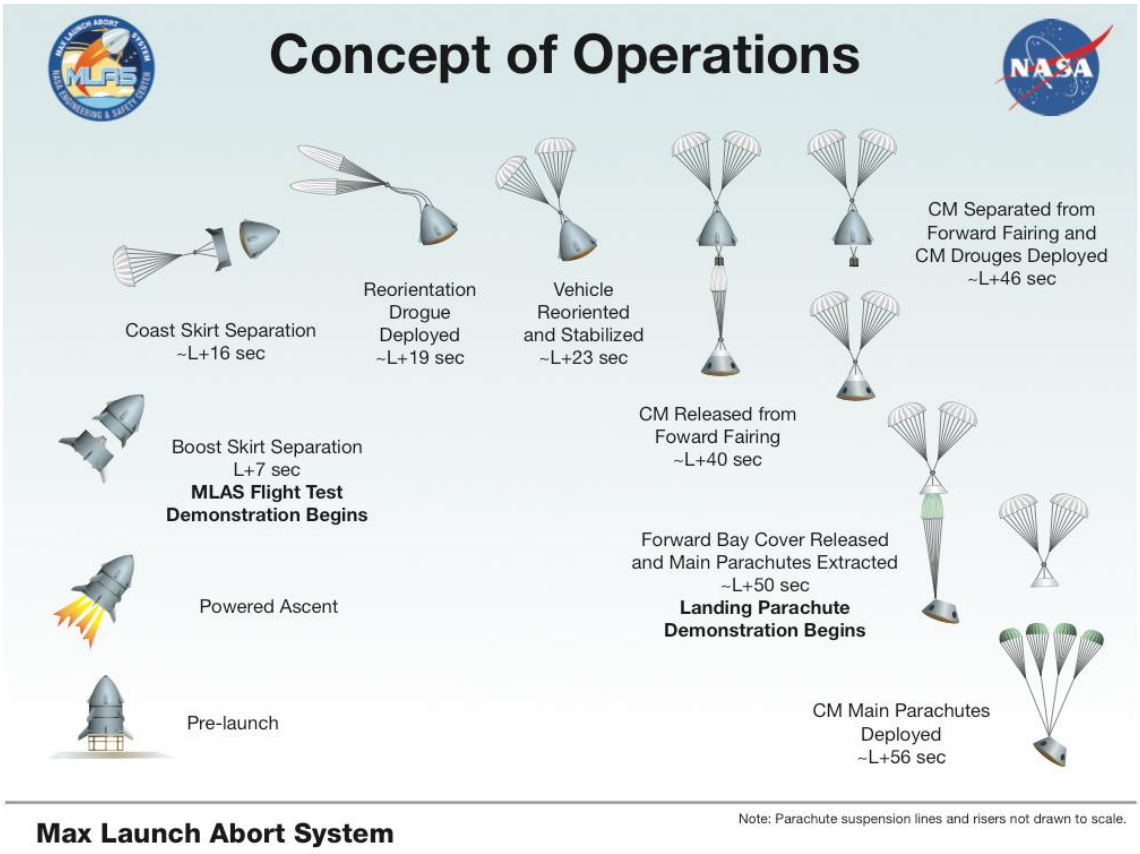


Figure 11 Max Launch Abort System test vehicle concept of flight operations [27]

Reason for this different approach is the complexity of the future system. Whilst in project management the outcome of the project can already be well defined and the way to get there is well understood, in system engineering the first step is to try to understand the outcome of the project, the “to-be” system, after that a feasibility study follows in order to prove that this future system is capable of fulfilling its’ purpose and can be built without over exceeding the time, cost and quality scope.

7.3 Agile Framework

The third approach which deviates from that one of System Engineering and Project Management is that one of the Agile framework. Whether *Kanban* or *Scrum*, both times there is the process of initializing a project brought down from having one “document” to multiple backlog items (which can be imagined as little post-its) where just the description of the problem, the new feature or improvement, an assignee and in best case a time estimate is written on.

This is rounded up by the *sprint planning meeting* where there is decided what the scope of the upcoming Sprint period is, which tasks should be fulfilled and what will be the overall Sprint Goal. If we compare Scrum with the sections that were presented for the project management artefacts in table5 following assumptions could be made:

Section 1 (description/ background/ justification of the project); is partly fulfilled. We can assume since in most cases it is a software the people are working on, all the people are aware about the software. Nevertheless this point isn’t included necessarily nor written down somewhere.

Section 2 (Describes the aim, goal, objectives); is fulfilled. On the backlog item can be found a description of how the outcome of the task should look like.

Section 3 (Solutions); is not fulfilled. In Agile they assume that it is the developer himself who knows best how to solve the problem and how s/he might solve it is totally up to the developer and is not documented anywhere beforehand.

Section 4 (Stakeholder requirements); is fulfilled. All the backlog items represent requirements of the customer.

Section 5 (Risks); is not fulfilled. Nothing was found about risks.

Section 6 (Milestones); optional. There can be milestones defined, by grouping together the backlog items and rating their importance.

Section 7 (Budget); not defined. Reason could be that Scrum and Kanban are continuous processes and therefore don’t have an exact starting and ending point. Moreover duration of sprints are defined, but the work on the product in total is not. On top comes that the size of the team’s usually do not change and mostly in software development it is rare that unexpected expenses occur.

Section 8 (Organigram/ Administrative roles); is partly fulfilled. In Agile the teams are comparably small and the roles within the teams are clearly distributed. So are there only 3 roles to be found; the Product Owner, the Scrum Master and the Developers.

To the point in the lifecycle; Agile doesn’t follow the “classic” waterfall approach, but does follow short, iterative build and release cycles where a clear start can’t be easily distinguished. But even though it can be said that at least in Scrum when it comes to the sprints, they have a strict timeframe of 2-4 week and on the first day of the sprint there has to be the *sprint meeting*. In a wider sense this can be seen as the authoring and validating of such an

artefact as we looked at in project management, with all the developers, the product owner and the Scrum master together.

What has to be kept in mind is that the Agile framework, and as part of it Scrum, works well in small teams of people working on a very low-level base without big hierarchies. It is a method to manage software development processes and also arose from such kind of projects.

Project management methodologies started quite recently to think about how to implement some of the approaches partly into project management practices as the update of HERMES5 to HERMES5.1 in July of 2015 shows. Project management has to deal with being more flexible in scale by bringing a methodology that suits for small project teams as well as for big projects with a big number of participants. The type of projects project management is treating differs as well in terms of being less flexible and reacting less dynamic on sudden changes of requirements.

Finally when it comes to system engineering, it is suited for very big complex projects with a top level view and with lots of uncertainty in it, as it was the case for the LHC or some NASA missions in where the engineers had to find solutions for problems they didn’t face before.

8 Proposal for a more synthetic Document

Instead of reinventing the wheel and just add another document to the landscape of already existing ones, the idea was to create a pool of chapters of existing documents and to group them together in a way that everyone can assemble his own project charter that suits to the needs of his/her company or projects. The standards and methodologies as well stress out that the documents they offer have to be adapted to the culture of the organisation and projects. All the following reflections are based on table 5 that was presented in the previous chapter.

8.1 Section that describes what has to be solved, gives the current situation or justifies why the project is needed

All the documents that were looked at had a section describing the initial situation and the problem that has to be solved (see table 5). It helps all the project participants and outsiders to better understand what the project is about. In several sources it was explicitly mentioned not to use metier specific vocabulary, but to keep it simple so that outsiders as well can understand the document if they show interest in the project.

Problem/opportunity (POS)	Brief description of the product (Mission Statement/ K. Ulrich, S. Eppinger)
Project Purpose or justification (PMI/ Project Charter)	Background (Project Charter/ HERMES5)
High-level project description (PMI/ Project Charter)	Project objective (Project Scope/ Larson E.)
Project definition (PRINCE2/ Project Brief)	Problem Statement and Goal (Project Proposal/ OpenSE)
Outline Business case (PRINCE2/ Project Brief)	

Table 4 Chapters related to the description of the project

A more synthetic document should definitely imply one of these chapters or a chapter similar to them. It helps people to understand what the project is about and even for the project team itself to clarify again in which frame the project is set in. It shouldn't be underestimated the added value of assuring that every team member has a proper understanding of the project itself and the context they work in, in order to give probable input in the solution finding and implementing process.

The consequence of not having such a chapter included in the artefact could be that someone could read the document and would be confused by not knowing what the project is about.

8.2 Section that describes the aim, objectives and goal

It was stressed out the importance to make clear the objectives and goals of the project in the document. The better the departure is defined the higher are the chances of success is a sentence that was mentioned in this context several times. Pending on the type of project it is required to document the aims of it in a "SMART" way; Specific, Measurable, Achievable, Realistic and Time-bound [6]. Chapters as the Project definition by PRINCE2 can be found in here, as well as in the previous section. Reason for that is that sub chapters of the chapter are, Project objectives, desired outcomes, project scope, exclusions, constraints and assumptions, and project tolerances.

Project goal (POS)	Limits and exclusions (Project Scope)
Project objectives (POS)	Problem Statement and goal (Project Proposal)
Success criteria (POS)	Project definition (Project Brief)
Measurable project objectives and related success criteria (Project Charter/ PMI)	Key business goals (Mission Statement)
Deliverables (Project Scope)	Objectives (Project Charter/ HERMES5)
Technical requirements (Project Scope)	

Table 5 Chapters related to aims, objectives and goals of the project

This section is indispensable for an artefact that initiates the project and is part of the major outcomes and goals of the phase initialisation. A major effort has to be contributed to clarify the objectives which then sets the baseline of what should be achieved in the project. Based on this baseline the validation will be done at the end of the project if the outcome is rated as successful or not successful. On top of that it sets the foundation for all future discussions about the aim and objectives of the project.

Although this information is kept in a *static* document, it is an information that evolves or should evolve over time and has to be reviewed frequently. Based on the fact that requirements can change, the objectives might have to be adjusted as well. This configuration, after a validation process, should then be applied to the baseline.

8.3 Section that gives/ proposes solutions

In some, but not all of the documents can be found a section that indicates proposed solutions and as an enhancement to that even preferred solutions. Which is an interesting approach in terms of abandon the idea of just initialising the project by setting the frame and the aims of a project and indicating information that were seen as static in the past, rather to a new document in which the borders get blurred in between the two phases planning and initialising by introducing a section that identifies and suggests possible solutions in order to fulfil the indicated aim/ goal and objectives.

High-level project description (Project Charter/ PMBoK)	Description of Solution (Project Charter/ HERMES5) Project approach (Project Brief)

Table 6 Chapters that gives/ proposes solutions

The reflection if such a section should be part of this artefact or not should be begun by the context the document is set in. At first it is in most of the cases validated by the project board and acts often as kind of a barrier in between the initialisation phase and the planning phase. The approval of the document gives the green light to pursue the project and therefore there has to be discussed what the next steps for the project are. Although the artefact is of a more strategic nature it could be an enrichment to add a tactical dimension to it, by presenting not only what should be solved; but as well trying to suggest different paths on how it could be solved.

HERMES5 and PRINCE2 applied it already in their methodologies, just the standard PMI did not agree on it as it seems. The explanation for that might be that PMI follows a more conservative approach as being a standard by clearly drawing the line in between the phase initialisation which they define as “Within the initiating processes, the initial scope is defined and initial financial resources are committed.” And for the planning phase “…those processes performed to establish the total scope of the effort, define and refine the objectives, and develop the course of action required to attain those objectives.”

To include such content in a document that initiates a project underlies already the fact that there was quite some effort done in reflecting how to solve the problem, going away from the approach of PMI to just focus on defining the initial scope.

To do it in a lean way and as the latest adaptions of the methodologies shows there is an added value in proposing first reflections about how solutions to the problem might look like. Like this the project board is not only informed about the problem that has to be solved, but has already different approaches that can be evaluated.

8.4 Section that gives the High-Level Stakeholder Requirements

This section can be seen as an addition to the goals aims and objectives that were already indicated and as a tracking of where the goals aims and objectives come from. The section includes i.e.: customers’ quality expectations, user acceptance criteria, and operations and maintenance acceptance criteria, as it does in the Project Brief of PRINCE2.

High-level requirements (Project Charter/ PMI) Stakeholders (Mission Statement)	Project Product Description (Project Brief)

Table 7 Chapters that gives the stakeholder requirements

This section is implied in the document by just a view standards and methodologies, although all of them stress out the importance of collecting the stakeholder requirements. Although it is part of the initialisation of a project phase it could be discussed if it should be included. One of the main contra points might be that the communication with the stakeholders is an ongoing process and doesn't finish after publishing the document. Because of that the collected requirements can evolve over time and change and if they are kept in a "static" document it could hold back people from giving creative input. It is rare that at the very beginning of a project the outcome is already very clear and so the project participants and stakeholders should be kept encouraged to always rethink the aim and the requirements of the stakeholders.

On the other hand, if the document serves as a way of contract in between a company and a customer, it might be seen as useful to write down the requirements at the given moment time to have a way to prove afterwards that there was an agreement on the requirements done. Another one could argue that the objectives and aims of the project that were agreed on already indicate the collected stakeholder requirements.

8.5 Section that treats risks

An important part that just appears in some of the documents are sections about risks. These chapters show the kind of risk analysis pursued by the project management team.

High-level risks (Project Charter/ PMI)	Project definition (Project Brief)
Assumptions, risks, obstacles (POS)	Risks (Project Charter/ HERMES5)

Table 8 Chapters related to risks

To include the risks in such a document can have several advantages and disadvantages. The one disadvantage is to put something in a document that should be updated frequently and does not replace a proper assessment of the risks. Especially a short chapter as indicated in the POS "assumptions, risks, obstacles" which dedicates just a view lines to the topic is very minimalistic.

On the other hand it supports the role of the document to initiate the project, by giving a decision aid in supplying risks that have been identified at the given moment in time. Another plus point is that for general people who don't have a background in project management it serves as a reminder to think about risks and list them. Anyway, if the risk register is not frequently updated it does not serve much, but it definitely helps the project board to reflect about their decision if to proceed with the project or not.

8.6 Section that indicates the milestones

To agree on milestones with the customer or even just within the project team can have multiple positive impacts on the project in terms of project control or a boost in motivation for the project team themselves by breaking down a big project in smaller achievable steps.

Summary milestone schedule (Project Charter/ PMI) Milestones (Project Scope)	Planning (Project Charter/ HERMES5) Outcomes and Deadlines (Project Initialisation Order)

Table 9 Chapters that indicate milestones of the project

To agree with the key users on milestones and deliverables throughout the project has the added value that by breaking it down in small steps it might boost the motivation of the project team and it ensures that the project steers in the right direction. In addition to that it makes it easier to estimate possible delays in the master schedule the more the project advances.

On the other hand the question is, if such a content should be implemented in this artefact. To indicate milestones and deliverables in some cases there must have been already a fundamental solution be chosen that is pursued. As well as indicating milestones and deliverables is nice, but requires some planning in order to create the master schedule and can turn into an uncomfortable commitment with the customer if the estimation fails.

For the project the artefact should be the baseline throughout the lifecycle for any verification if the project steers in the right direction. This it does through the objectives it contains and as part of it, it should contain the milestones as well. The objectives represents the aim the project tries to meet and the milestones the time axis and how to get there. But in both cases it is a challenge not to have outdated data in the document. To avoid the issue it is required to either review and to update the document throughout the lifecycle or as other methodologies does it, to replace the document by another artefact at the end of the following phase planning which contains the latest information.

8.7 Section that indicates required resources

The documents proposed by the Project Management Institute (PMI) and HERMES5 contain a Section about an estimate of budget and resources that will be required for the project.

Summary budget (Project Charter/ PMI)	Resources required (Project Charter/ HERMES5)

Table 10 Chapters that indicate a budget

To integrate the estimation of a budget can make sense, but when implementing this chapter in the document there should be discussed to whom this document is addressed to. Some methodologies and books mentioned that the document should be accessible to everyone within the project and whoever is interested in the project. This aspect should be considered by putting the information in the document. On the other hand to keep the landscape of documents lean and to store all the strategic information at the same place it would be to recommend to have all the three part of the project triangle (Quality expectations, budget and schedule) included.

8.8 Section that indicates the project organisation structure

In order to give a clear structure to a project some of the methodologies recommend to include chapters to assign the different roles in the project to the people.

Project approval requirement (what constitutes project success, who decides the project is successful and who signs off on the project) (Project Charter/ PMI)	Project management team structure (Project Brief)
Assigned project manager, responsibility and authority level (Project Charter/ PMI)	Role descriptions (Project Brief)
Name and authority of the sponsor or other person(s)s authorizing the project charter (Project Charter/ PMI)	References (Project Brief)
	Organization (Project Charter/ HERMES5)

Table 11 Chapter that indicates the project organisation structure

Roles and responsibilities within projects should be well defined and because of that the Project Management Institute, PRINCE2 and HERMES5 dedicate an extra chapter to this topic. The big advantage is that it ensures the different roles and responsibilities to be well distributed and everyone is aware of them in terms of his own responsibility, but as well in terms of whom to contact if issues occur.

The risk by not including this information could be that either there were no roles and responsibilities defined or the information is stored somewhere else. In this case it could be questioned if it would be in a *lean* spirit to store such a central information in another separate document.

8.9 Section with chapters that did not overlap with other sections

Following chapters present in the table did not show sufficient coherence with other chapters to group them together in a section.

Reviews with customer (Project Scope)	Communication (Project Initiation Order)
Benefit proposition (Mission Statement)	Efficiency (Project Charter/ HERMES5)
Target market(s) for the product (Mission Statement)	Strategy and implementation of requirements (Project Charter HERMES5)
Assumptions and constraints that guide the development effort (Mission Statement)	Consequences (Project Charter/ HERMES5)
	Legal framework (Project Charter/ HERMES5)

Table 12 Chapters that did not overlap with others

Chapters listed above can be considered as rather exotic, but could be still worth to have a closer look at to collect some ideas for possible parts of the artefact. First of all which ones are indeed special are that ones from the Mission Statement of Ulrich and Eppinger. Their book *Product Design and Development* deviates from classic project management methodologies and requires therefore special chapters as target market(s) for the product and might be too special for more generous documents.

The document Project Scope from Larson and Gray contains a chapter called reviews with customer. It is listed by them as a chapter but could be as well just the customer that signs the document in order to have the mutual agreement in between the project manager and him. It serves to build the foundation for future discussions concerning scope and customer requirements. As argued earlier in the section stakeholder requirements there should be payed attention that collecting the requirements and to communicate the result of the project should not be finished after the phase initialisation, but should be rather a continuous process.

A chapter called Communication can be found in the Project Initiation Order by HERMES5. It indicates a table including headers as Person to be informed, Person responsible for the communication, content, objective, medium and deadline. Reason for that is to ensure a proper communication throughout the initiation process (See Annex D). Pending on the size of the project it can be very useful to set up a plan on how and when to report to the various stakeholders, but it could be questioned if this should be part of a document that initiates a project.

That ones left over are from the document called Project Charter by HERMES5. There are the chapters *efficiency*, that evaluates the trade-off of the project and quantifies if it is worth to further pursue the project, *strategy and implementation of requirements* which should give an evaluation if the requirements of the project are aligned with the strategy of the company, *consequences*, that is weighing up the two scenarios what if the project is continued what if not, and finally the *legal framework* which represents the conclusion of the analysis of the legal framework.

8.10 The Project Proposal/ Roadmap following OpenSE

8.10.1 Context of the integration

CERN, as well as other big laboratories running complex scientific installations haven't have the time to wait for the project management methodologies to correspond to their needs and to propose a rational approach suited to them. For this reason CERN proposed already in the 1960s a resource allocation method [28]. The conclusion to pursue an own approach is the result of the fact that within decades certain habits have been taken and were deeply rooted in the culture of the organization. Because of this it became very difficult to adopt the standardized methodologies to the culture and even done so, the added value would be marginal.

A simple example to illustrate this: CERN projects can be divided into two main phases:

- The *study phase*, that has the purpose to develop and demonstrate the feasibility of a concept and its' deliverable is the document, conceptual design report, CDR.
- The *project phase* which has as objective the development of the project itself.

The first phase is repeatable in the sense that it can lead to the delivery of several conceptual design reports before one gets selected and triggers the project phase.

The second is made up of three main phases:

- *Design phase* leading to the writing of *technical design reports* which then define the *technical baselines*, used as a basis for outsourcing parts of the work and for the construction
- *Build phase* which includes detailed studies, the construction of technical infrastructure and the manufacturing and assembling of the components and their installation.
- *Commission phase* during which the equipment is tested first without, then with the beams of particles.

This lifecycle is very different from everything that was promised by the standards and methodologies. Nevertheless, this is an approach deeply rooted in the DNA of the stakeholders of these projects. Even though methodologies contribute parts of themselves to the *tailoring,* to adjust their implementation to specificities of an organization and its projects and hence their acceptability; the question arises quickly to which extent a methodology can be configured until it gets denaturalised? This question rose up at CERN. The conclusion was taken not to choose a particular methodology, but instead to promote an approach that relies heavily on the strong cultural elements of the laboratory in terms of project management on the one hand, and some essential bricks constituting these methodologies on the other hand [29].

In this spirit, a System engineering approach called OpenSE was produced as part of a research project funded by the European Union[5] (ww.cern.ch/OpenSE). The CERN Engineering Department in its mission of managerial support to projects and programs has been promoting this framework already for three years to all their services involved in managing projects or taking part in studies and development of scientific or technical equipment or facilities.

8.10.2 The Project Proposal/ Roadmap following OpenSE

Following OpenSE, the trigger for any project is a *project proposal.* From a practical point of view, this document prepared by project initiators, that is to say, anyone duly mandated by its management to write such a document, but also engineers or scientists "self-appointed" can author such a document in order to justify a self-proposed project. The purpose of the

[5] OpenSE is one of the results of the PURESAFE research project financed by the European Union under the Actions Marie Sklodowska Curie of the program FP7 (G.A. nr. 264336). The purpose of this research project was to prevent human interventions in scientific installations presenting ionizing radiation through the use of remote controlled ways and robotics at one part and to take in consideration a better tele operability of such installations through a conceptual design phase. (http://webhotel2.tut.fi/iha/puresafe/)

project proposal is to provide CERN management (more specifically at the appropriate managerial level) with tangible elements to make a documented decision if to launch or not a study.

This document is definitely strategic in its nature, as it exposes a situation, a problem posed or a need felt or expressed, and proposes objectives that could be set for a project. It also includes a tactical dimension by briefly identifying possible solutions and identifying a preferable one. Finally it gets its official character by suggesting it to the management who then can validate the initiative and set the baseline for the following steps of the project. This acknowledges the results of the comparative analysis in chapter 8.

By validating the project proposal the prospective approver can have three attitudes:

- The project proposal is a relevant response to the situation, a problem that rose up or a need expressed and, if they have the means, can make the decision to launch the project, or at least give their "green light" to conduct a study. With a few adaptions, the project proposal can then be converted into the ***project roadmap***.
- The project proposal, although relevant, is not sufficiently elaborated or convincing for a duly justified decision to be taken. Project initiators receive an "orange light" and are invited to improve the document by taking into account the comments of prospective nominees and then re-submitting the revised project proposal to the same constituents or other potential constituents.
- The proposal is not admissible for reasons to be explained and therefore does not justify the launching of a possible project. The prospective contractors then issue a "red light" to the project proposal, which means that it got rejected.

From a practical point of view the project proposal and the roadmap form a single document that exists under two different designations depending on its stage of development in its life cycle. Two characteristics distinguish them:

- The maturity of the content on the one hand: which applies more to the roadmap and,
- Whether or not the document is validated: a project proposal is a non-validated; a roadmap is a validated project proposal.

This project management document is not the only one to change type according to its state. It is also true for the *change request*, which typically turns into a *change order* once it is validated.

From an editorial point of view, the typical content of a project proposal is as follows:

Executive summary

1. Initial situation
2. Objectives
3. Possible solutions
4. Preferred solution
   - 4.1 Description of the preferred solution
   - 4.2 Identification of stakeholders and project sponsors
   - 4.3 Project phasing, planning and organization
   - 4.4 Project costing and funding requirements
   - 4.5 Benefits, i.e. return on investment, created by the preferred solution
5. Consequences and Risk Assessment

Traceability of changes

Once validated, the project proposal turns into a project roadmap and its content type is very similar, but especially augmented by a sixth section which aims to record decisions of the validators:

Executive summary

1. Initial situation
2. Objectives
3. Possible solutions
4. Preferred solution
   - 4.1 Description of the preferred solution
   - 4.2 Identification of stakeholders and project sponsors
   - 4.3 Project phasing, planning and organization
   - 4.4 Project costing and funding requirements
   - 4.5 Benefits, i.e. return on investment, created by the preferred solution
5. Consequences and Risk Assessment
6. Decision
   - 6.1 Decisions for the Study phase
   - 6.2 Decisions for the Design phase
   - 6.3 *Etc*.

Traceability of changes

By doing so, the desired lean spirit is respected. It is thus the only two-in-one document associated with the piloting of the project. The writing of several documents of a strategic nature is economized and through this the need to read several different documents which contain more or less the same information and which end up exasperating all those who crumble under the infobesity is also saved.

The critics and request by i.e. Larson and Gray [30] or as mentioned by several other methodologies to keep the document short and brief was faced in the Project Proposal/ Roadmap by introducing the executive summary. In it, the content of the whole document should be summarized briefly. By doing so it does the link in between a “long” explicit document and keeping it brief at the same time. The idea is to open the opportunity, after reading the executive summary, to jump to the chapters that concerns or interests the reader to go into more detail.

In a further comparison with the documents listed in Table 13, Overview of the different artefacts in Project Management and their content, it can be observed that in the Proposal/ Roadmap there can be found, as in others, a section that describes the Initial Situation (description of what has to be solved, justification of the project) as well as a Section dedicated to the objectives (aims, goals) of the project.

The section solution found in the Proposal/ Roadmap can be found as well in the Project Charter of the HERMES methodology or PRINCE2 but got in addition to that for sure partly inspired by the System Engineering documents OpsCon from the International Standard ISO. A significant new approach in this context is that several solutions get listed but only the preferred one is written down more explicit. From an editorial point of view this brings the advantage that the person authoring the document has to give several solutions to the one problem, which doesn’t only help the people that have to approve the document, who might get to choose another approach or to request to specify one of those more, but it also forces the author to actively think about backup solutions and looking at the problem from a more out-of-the-box point of view by not only listing the first obvious solution to the problem,

but to step back and think other possible solutions through which might not be obvious on the first view.

Within the preferred solution there can be found more of the sections that other artefacts contained as well, as the identification of stakeholders and project sponsors i.e., which is related to the section Stakeholder requirements, not fully, since it is not explicitly ask for the requirements itself, but to list who are the stakeholders. Furthermore there has to be given the project phasing, planning and organization which suits to the sections seen before as Milestones, used as well in the PMBoK, HERMES5 and by Larson E. and the organigram/ administrative roles that were observed as well in quite a few of the compared methodologies. Project funding and costing requirements which was seen in the section called budget in the PMBoK and HERMES5 and finally the Benefits which is an equivalent to the chapter efficiency in the HERMES5 artefact project mandate and was more evaluated as an “exotic” chapter since nothing similar could be found in comparable artefacts.

A section risks, called in the Proposal/ Roadmap consequences and risk assessment is listed, as it is as well broadly used by other different methodologies and standards that were presented earlier in the thesis. After the proposal gets approved and turns into the roadmap there can be found an additional chapter decision, which includes additional information to the decisions that were taken and a dedicated chapter for the review after every finished stage of the project lifecycle.

9 Conclusion

As mentioned in the introduction; this thesis is just a modest attempt to open a discussion that could perhaps push the field of project management to a more mature state and raise up thoughts about harmonising the too many standards and methodologies that are circulating. The Project Proposal/ Roadmap itself represents a small “architectural innovation” that tries to make the first step towards this direction.

It was not intended to invent a new artefact that initialise a project, but to reassemble from the arsenal of existing ones in order to increase the efficiency of governing the portfolio of projects. A major focus was set on the decision-making process for launching a project and to keep it in a lean spirit by transformation the project proposal to a project roadmap and to try to capture all the strategic aspects in one document in order to reduce the amount of documents that have to be managed in total.

The key in this case is that instead of issuing new documents that put the artefact in an obsolete state rather to review and to update the project roadmap accordingly. Because the baseline of the document might change, a configuration process has to be put in place that assures that all the changes are approved by the project board.

A future prospect of the artefact would be to move away from the artefact as a “document”, a rigid artefact on paper that does not keep itself up to date, to an artefact in in example a cloud based web solution where instead of having chapters there should be links pointing directly to the other artefacts which are accordingly updated. Instead of having a risk analysis in the Project Roadmap that has to be reviewed and updated frequently which is done outside of the document, the chapter should instead point directly to the risk analysis and always show the current status of the actual point in time.

Same could be done for the other chapters as the description, stakeholder requirements and especially for the project phasing, planning and organization section which by nature changes. As the artefact captures all the important cornerstones of the project in order to decide whether to move to the next phase or not, it should throughout the project act as the artefact where all this cornerstones can be looked up, including the latest changes.

Nevertheless there are commonly no doubts that the artefact that initiates a project is one of the most important ones throughout the lifecycle of a project. The reason for it might be that it has the greatest impact on the project. It represents a bottleneck before the project is brought to the next phase in which still things can be adjusted, whereas afterwards in the ongoing project things only can be corrected. On top of that it delivers the future baseline for discussions concerning the aims and goals, budget and/ or the schedule of the project, which might be representative to the so called *Project Management Triangle*[6]. Therefore the artefact provides a strong foundation to the project on which the project team can build up.

[6] The Project Management Triangle is a model of constraints of project management. It is a graphical representation of the three constraints within a project has to be managed that have been listed as “scope”, “time”, and “cost”.

Annex A: Example Project Overview Statement

Example of a Project Overview Statement taken by the book “Effective Project Management” by R. K. Wysocki and R. McGary [19]

PROJECT OVERVIEW STATEMENT	Project Name	Project No.	Project Manager
Problem/Opportunity			
Goal			
Objectives			
Success Criteria			
Assumptions, Risks, Obstacles			
Prepared by	Date	Approved by	Date

Annex B: Example Scope Statement

Example of a Scope Statement taken by the book “managerial process – fifth edition” by Erik W. Larson and Clifford F. Gray. [30]

SNAPSHOT FROM PRACTICE Scope Statement

PROJECT OBJECTIVE
To construct a high-quality, custom home within five months at cost not to exceed $350,000.

DELIVERABLES
- A 2,200-square-foot, 2½-bath, 3-bedroom, finished home.
- A finished garage, insulated and sheetrocked.
- Kitchen appliances to include range, oven, microwave, and dishwasher.
- High-efficiency gas furnace with programmable thermostat.

MILESTONES
1. Permits approved—March 5
2. Foundation poured—March 14
3. Drywall in. Framing, sheathing, plumbing, electrical, and mechanical inspections passed—May 25
4. Final inspection—June 7

TECHNICAL REQUIREMENTS
1. Home must meet local building codes.
2. All windows and doors must pass NFRC class 40 energy ratings.
3. Exterior wall insulation must meet an “R” factor of 21.
4. Ceiling insulation must meet an “R” factor of 38.
5. Floor insulation must meet an “R” factor of 25.
6. Garage will accommodate two large-size cars and one 20-foot Winnebago.
7. Structure must pass seismic stability codes.

LIMITS AND EXCLUSIONS
1. The home will be built to the specifications and design of the original blueprints provided by the customer.
2. Owner responsible for landscaping.
3. Refrigerator is not included among kitchen appliances.
4. Air conditioning is not included but prewiring is included.
5. Contractor reserves the right to contract out services.
6. Contractor responsible for subcontracted work.
7. Site work limited to Monday through Friday, 8:00 A.M. to 6:00 P.M.

CUSTOMER REVIEW
John and Joan Smith

Annex C: Example Mission Statement

Example of a Mission Statement taken by the book “Product Design and Development – fifth edition” by Karl T. Ulrich and Steven D. Eppinger [20]

Mission Statement: Multifunctional Office Document Machine	
Product Description	• Networkable, digital machine with copy, print, fax, and scan functions
Benefit Proposition	• Multiple document processing functions in one machine • Connected to office computer network
Key Business Goals	• Support Xerox strategy of leadership in digital office equipment • Serve as platform for all future B&W digital products and solutions • Capture 50% of digital product sales in primary market • Environmentally friendly • First product introduction 4th Q 1997
Primary Market	• Office departments, mid-volume (40–65 ppm, above 42,000 avg. copies/mo.)
Secondary Markets	• Quick-print market • Small “satellite” operations
Assumptions and Constraints	• New product platform • Digital imaging technology • Compatible with CentreWare software • Input devices manufactured in Canada • Output devices manufactured in Brazil • Image processing engine manufactured in both the United States and Europe
Stakeholders	• Purchasers and users • Manufacturing operations • Service operations • Distributors and resellers

Annex D: Example Project Initiation Order

Example of a Project Initiation Order taken from the website of the HERMES Methodology [31]

Project Initiation Order

Project Sponsor	
Project Manager	
Author	
Classification	Not classified, internal, confidential, CLASSIFIED
Status	Pending, approved

List of Changes

Date	Version	Changes	Author

List of Contents

1 Background

Reasons for initiating project

2 Objectives

Objectives of Initiation phase

3 Parameters

Parameters of Initiation phase

- Use of HERMES
- Requirements for conducting the Initiation phase

Parameters of Initiation phase

- Requirements for carrying out project (e.g. budget, key deadlines, etc.)

4 Outcomes and Deadlines

Outcomes of Initiation phase

No.	Outcome	Deadline
1	*Stakeholder list*	
2	*Study*	
3	*Analysis of legal framework*	
4	*Protection needs analysis*	
5	*Decision about choice of option (with checklist)*	
6	*Project management plan*	
7	*Project charter*	
8	*Decision about project charter (with project release checklist)*	

5 Outlay

Estimated human resources required

6 Costs

Estimated costs of Initiation phase

Phase	Estimate
Initiation	*10,000*

7 Resources

Human Resources

Role / Person	Month 1	Month 2	Month 3	Month 4	Month 5	Total	Approval of Direct Superior
Name							
Name							

Other Resources

Rooms, IT infrastructure, specific software, etc.

8 Communication

Reporting during Initiation phase, informing project sponsor, informing those involved as well as stakeholders

Person to Be Informed	Person Responsible for Communication	Content	Objective	Means/ Medium	Deadline
Department Head	*Project sponsor*	*Project initiation objectives and planning*	*The departments know the project assigned to the project manager*	*Department meeting*	*12.3.2015*

9 Risks

Risks of Initiation phase

Annex E: Example Project Charter

Example of a Project Charter taken from the website of the HERMES Methodology [32]

Project Charter

Project Sponsor

Project Manager

Author

Classification Not classified, internal, confidential, CLASSIFIED

Status Pending, approved

List of Changes

Date	Version	Changes	Author

List of Contents

1 Background

Reference to study and option chosen.

2 Objectives

System Goals

No.	Category	Description	Measure	Priority
1	*Market positioning*	*Reduction of process flow time from receipt of order to delivery*	*Reduced from currently four days to three days; from one month after launching operation*	*M*

Explanation: Priority: M=must /1=high, 2=medium, 3=low

Procedural Goals

No	Category	Description	Measure	Priority
1	*Quality of project handling*	*Feasibility to be established by means of a test installation*	*Error-free handling of a predefined business case*	*2*

Parameters

Text

Delimitation

Text

3 Description of Solution

Description of option chosen, reference to study.

4 Strategy Reference and Implementation of Requirements

Reference to strategy

- Reference of project objectives to the core organization's strategy

Implementation of requirements:

- Compliance with the requirements of the core organization

5 Legal Framework

Conclusions from analysis of legal framework

6 Resources Required

COSTS (CHF)

Phase	Planned
Initiation*	
Concept	
Implementation	
Launch	
Total	

*Advance (Actual)

HUMAN RESOURCES REQUIRED

Phase	Planned
Initiation*	
Concept	
Implementation	
Launch	
Total	

*Advance (Actual)

Other Resources

Rooms, IT infrastructure, specific software, etc.

7 Efficiency

According to the core organization's requirements: Usually costs and time required for project and operation; benefit (quantifiable or not quantifiable)

8 Planning

MILESTONES AND DEADLINES

Milestone	Planned
project release	*12.12.2015*

9 Organization

Role in the Project Organization	Name	Ref.	Function/Organizational Unit
Project Sponsor	*Kurt Müller*	*muk*	*Head of xyz Department*
Steering committee			
Project Manager			
ISDP manager			
Specialist: User representative			
Specialist: Business process owner			

10 Risks

No.	Risk Description	PO	LI	RN	Measures	To be Handled by	Deadline
R1	*IT system does not perform well enough*	*2*	*3*	*6*	*Performance Tests*	*PM*	*01.01.01*

Explanation: PO=probability of occurrence: 1 low / 2 medium / 3 high; LI=level of impact 1 low / 2 medium / 3 high, RN=risk number

11 Consequences

If project is released

Text

If project is not released or if it is released at a later date

Text

Annex F: Example Project Proposal/Roadmap

Example of a Project Proposal/ Roadmap taken from the CERN Document Server [33]

PROJECT MANAGEMENT DOCUMENT

[STUDY/PROJECT NAME]

PROJECT PROPOSAL/ROADMAP

ABSTRACT:

In order to [global objective], [organic entity] needs to [do something]. To do so, [what the entity owns, how the entity proceed, etc.]. So far, [unreliable system description, ineffective process description, etc.]. This document summarizes the present status of [system description, process description, etc.] and draws a project-oriented approach to improve the situation by [upgrading the system, improving the process, etc.].

DOCUMENT PREPARED BY:	DOCUMENT TO BE CHECKED BY:	DOCUMENT TO BE APPROVED BY:
[Author 1 Name] [Author 2 Name]	TBD	TBD

DOCUMENT SENT FOR INFORMATION TO:

[List of persons to whom the document is sent]

HISTORY OF CHANGES

REV. NO.	DATE	PAGES	DESCRIPTIONS OF THE CHANGES
0.0	201X-XX-XX	n	

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

[A few lines to summarize the content of this Project Proposal/Roadmap to the attention of the decision makers (who may not read the full document).]

2. PROBLEM STATEMENT AND GOALS

[In this section, the problem(s) or need(s) that are at the origin of the initiative (Project Proposal stage) or of the project (Project Roadmap stage) are recalled; rationale and justifications are provided. A description and an analysis of the present situation might also be provided.]

3. POSSIBLE SOLUTIONS

[It is very likely that there are several solutions to address the problem(s) or ways to satisfy the need(s). This section aims at surveying the several possible solutions that may be considered and at highlighting the preferred one—or the very few ones—that may be the best answer to the problem(s) and/or need(s) and for which a particular attention should be paid in the next phase for evaluating their effective opportunity and feasibility.]

[If the possible solution has already been studied or developed, at CERN or somewhere else, links to existing study or project documentation shall be referred to].

a. SOLUTION No. 1: [XXXX]

b. SOLUTION No. 2: [XXXX]

4. PREFERRED SOLUTION

a. DESCRIPTION OF THE PREFERRED SOLUTION

[In this sub-section, the preferred solution is further described to provide some more tangible arguments to decision makers.]

Table 14 — Goals vs. objectives mapping. [This table is optional]

Goals	Objectives

b. IDENTIFICATION OF STAKEHOLDERS AND PROJECT SPONSORS

[This sub-section lists who are the identified stakeholders and who might be (Project Proposal stage) or are (Project Roadmap stage) the sponsors of this project.]

[Key project stakeholders and sponsors are typically:

- Major resource providers to the project (financial resources and man-power)
- Line management of key project participants
- Major beneficiaries/users of the outcome of the project.]

c. PROJECT PHASING, PLANNING AND ORGANIZATION

[This sub-section shall feature a “preliminary working summary schedule” or “master-plan” for the project. The **various phases** (study phase, design/build/com-mission phases) shall clearly be shown; if specific reviews are necessary, they shall also be shown.]

d. PROJECT COSTING AND FUNDING REQUIREMENTS

[This sub-section shall provide a cost estimate for the project and provide insight on its funding. A particular attention might be paid on the manpower availability.]

e. BENEFITS CREATED BY THE PREFERRED SOLUTION

[This sub-section is somehow a conclusion to section 4 and shall summarize what will be gained once the project will be completed.]

5. CONSEQUENCES AND RISK ASSESSMENT

[The decision to go ahead with the project shall be risk-based. This section shall provide means to appraise the consequences of not performing the project on the one hand, and on the other hand shall list the key risks that may jeopardize the project and its out-come(s) and shall identify responses to avoid, mitigate or transfer these risks.]

Glossary

Project: A project is a temporary organization that is created for the purpose of delivering one or more business products according to an agreed Business Case. [34]

Project Management: Project management is the planning, delegating, monitoring and control of all aspects of the project and the motivation of these involved, to achieve the project objectives within the expected performance targets for time, cost, quality, scope, benefits and risks. [34]

Needs: Needs are synonymous for user requirements or stakeholder requirements

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