DOI NUMBER: 10.19255/JMPM01402

PROJECT CHARTER

KEYWORDS
Project Charter • Project Mandate • Project Proposal • Roadmap • Project Mission Statement • Project Brief or Statement of Work

CHARTERS, MANDATES, ROADMAPS

and Other Artefacts at the Launch of a Project: Characteristics and Similarities

• ABSTRACT •

If the Abernathy-Utterback model about the innovation of technology was applied to the approaches and methodologies of project management, it would be clear that, five decades after the birth of modern project management, the domain would persist in a "fluid phase", where approaches are still numerous and no dominant design or particular methodology really emerged yet. Comparing the many standards and methodologies one by one would certainly be useful. However, the task is ambitious and can only reasonably be undertaken in bits and pieces. In this article, we are interested in the only artefact that initializes a project: according to the authors and obedience, this one takes different names: project charter, project mandate, project proposal, roadmap, project mission statement, project brief or statement of work (SoW). System engineering also promotes two additional types of documents: ConOps (concept of operations), replaced in 2010 by the OpsCon (operational concept) or OCD (operational concept document). First, we have tried to compare a few documents which reflect the main obedience, according to their temporal locations along a project life cycle, their managerial aims and their typical contents. In a second step, we propose a model of a 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 framework called openSE (www.cern.ch/openSE) to federate multidisciplinary contributions to the many programmes and projects on going at CERN.

PIERRE BONNAL, PHD
• CERN Eng. Dept.
• GSEM Univ. of Geneva
• *pierre.bonnal@cern.ch*

CHRISTOPHER RAUSER
• CERN Eng. Dept.
• Hochschule Ruhr West
• *chris.rauser@hotmail.de*

1. INTRODUCTION

If the Abernathy-Utterback **[1]** model of technological innovation was applied to the approaches and methodologies of project management, it would be clear that, five decades after the birth of modern project management, the domain persists in a "fluid phase", where approaches are still numerous and no dominant design or particular methodology really emerged yet. Some will argue that the concepts and artefacts promoted by the Project Management Institute (PMI) through its many publications give the tempo. Certainly! However, the rather recent arrival of agile approaches (RUP **[2]**, Extreme Programming **[3]**, Scrum **[4]**, Lean Kanban **[5]**), the influence of normative methodologies such as PRINCE2 (British) **[6]** or HERMES (Swiss) **[7,8]**, as well as approaches from engineering domains on the margins of conventional project management such as the development of new products, the development of new services or systems engineering, disrupt this edifice and sometimes create a generous confusion.

To illustrate this situation we are only interested in the artefact that initializes a project: according to the authors and obedience, this one takes many different names: project charter, project mandate, project proposal, roadmap, project mission statement, project brief, or statement of work (SoW). Systems engineering promotes two additional types of documents: ConOps (concept of operations, replaced in 2010 by the OpsCon (operational concept) or OCD (operational concept document) **[9]**. The concepts and concerns behind these few types of documents are practically the same. But how not to get lost?

In a small organization, the project team can easily agree on a single vocabulary by adhering to a single standard or methodology of project management. When the project is larger, it has some chances to involve several engineering trades, with some of them referring to their own practices and managerial habits. It is equally likely for more complex projects that involve several organizations in partnership or commercial relationships between a client (the project) and suppliers and contractors, with all of them coming with their own managerial practices. In the context of a project of this magnitude, it is more than legitimate for its contributors, in a concern to minimize managerial risk, to seek to promote the organizational practices experienced in their respective fields and sectors: Civil engineers will support the use of recognized managerial practices in construction and architecture; Computer scientists will do the same by extolling the proven merits and effectiveness of agile approaches

typically; system engineers will only swear on systems engineering practices that are kept in ISO, IEC and IEEE standards or those promoted by INCOSE in its Guide to the Systems Engineering Body of Knowledge (G2SEBoK) **[10]** for instance; While the project management team will highlight the unifying character of the Guide to the Project Management Knowledge Corpus (PMBoK) **[11]** of the US-based Project Management Institute. How to federate all these users?

Most of the projects that CERN conducts are based on a large number of technical disciplines and as many technologies, often involving vast collaborations, and are in many respects qualified as megaprojects. The LHC (Large Hadron Collider) project, whose feasibility took more than ten years (from the early 1980s to the mid-1990s) and was built over a dozen-year makespan, just incorporated in its Project Quality Assurance Plan **[12]** the major principles of project management as promoted by the Project Management Institute in its PMBoK. But the appearance of the approaches and methods cited above complicates the situation: the growing demand for a project management approach inspired by the principles of systems engineering calls for some clarification. A few well established references in project management (the Swiss methodology HERMES for example, op. cit.) tried to link the different approaches and standards. These initiatives certainly fail because of their lack of completeness; Links remain to be established between the approaches of project management and those of systems engineering. To our knowledge, this is a vast research exercise that remains to be done. In this article, we limit ourselves to the inventory of the different artefacts associated with the initialization of a project and to identify their main differences and points of convergence. To do this, we compare them to each other as well as to their temporal location along a project life cycle, their managerial purpose and their typical contents. Finally, we propose a unifying document template which could be satisfactory to all. In any case, it is this artefact that the CERN Engineering Department, in its mission of managerial support for projects and programmes, promotes through a system engineering reference framework called openSE (www.cern.ch /openSE).

2. INVENTORY OF ARTEFACTS

As stated in the introduction, the decision was taken to only investigate in a subset of artefacts associated with standards and methodologies that we consider reasonably representative of current professional practices. To the major standards and methodologies[1], we have supplemented this inventory with some artefacts extracted from a few general project management textbooks. The partial nature of this choice is clearly claimed by the authors of this article.

--- 2.1 Initialization of a Project According to the PMBoK ---

For the Project Management Institute, the starting point for any project is a project charter. Indeed, the Project Management Body of Knowledge (PMBoK) prescribes the elaboration of such a document as to give formal authorization to undertake a project on the one hand and on the other hand to record precisely the expectations of project constituents. This standard insists that it is not strictly conceived as a contract between a client: the organization represented by its management, and a a supplier: the project manager and the team that is built around her or him, but rather as a partnership agreement. There is a clear desire to understand the project as a complex and inherently risky process; its success depends only on the good collaboration that must be established between the constituents and the agents. The project has entered its initialization phase as soon as this document, drafted by the designated project leader, has been agreed and approved by the constituents. Two important things stand out: the project charter finds its substance in other documents prior to the formal launch of the project, namely the business case and the statement of work (SOW). While the project charter will be more prolix on the "how", business case and statement of work should focus on the stakeholder's needs and describe the outcomes the project will have to produce, in other words the "what". The project charter as prescribed by the PMBoK, and although it focuses on "how" rather than "what" remains a strategic document: while specifying the means available to the project manager and their team, it confirms the direction to be taken and specifies the course (or successive milestones) to be held. The PMBoK recommends that this document be validated by a person external to the project team, typically a project sponsor, a PMO manager or a programme manager.

The typical content of this document as prescribed by the PMBoK is the following:

- A reminder of the problem or need that is at the origin of the project and its reason of existence;
- The main objectives of the project and criteria for success;
- The main needs that the project will have to satisfy, but also what the project will not do;
- A description of the deliverables that the project team will have to produce;
- A brief analysis of project risks;
- The agreed date of completion of the project and its main milestones;
- The human, financial and material resources made available to the project manager and his team (i.e. the project budget), possibly supplemented by a calculation of the project's profitability;
- Details of an organizational nature such as the project manager name and the authority he or she will benefit from and, where appropriate, the names of a few key contributors;
- Information on the decision to launch the project, including the names and roles of the persons authorized to validate the project charter.

Compared to the requirements and recommendations of the other artefacts proposed in this section 2, it is reasonable to say that the project management charter according to the Project Management Institute covers a wide range of typical content of documents that initialize a project.

The only thing that seems disturbing is the temporalization of this document: must it be produced after a feasibility phase is conducted or before; or does it serve only to give a specific and clear mandate to a pre-project team to develop what may be the necessary or indispensable feasibility study.

--- 2.2 Initialization of a Project Using the HERMES Methodology ---

HERMES is a project management methodology developed in the early 1970s[2] within the Swiss Federal Administration to meet the growing challenges of computerization of federal and cantonal administrations. The reasons for its emergence are in many respects comparable to those of the PRINCE2 methodology in the United Kingdom. HERMES is the acronym for "Handbuch der Elektronischen Rechenzentren des Bundes, eine Methode für die Entwicklung von Systemen". Since its first publication, four major revisions have punctuated its existence: a new version every ten years approximately. The latest version is the fifth version (HERMES 5), made public in 2012, which has however undergone a minor revision in 2016 to incorporate an agile dimension into the general approach following a cascaded life cycle, SCRUM in this case (HERMES 5.1). The strength of HERMES lies in the eyes of the users and prescribers in its rigorous construction, at least all Germanic.

The HERMES 4 life cycle foresaw an initialization phase prior the project's formal launch decision was taken. The project initiators, in charge of this phase, had as their main task the drafting of a project proposal, which once submitted to those having authority to formally launch the project was converted and complemented in order to become the project mandate. A criticism of HERMES 4 was the voluminous nature of the formalism (a 300-page manual for the approach to the development of computer systems, a second guidebook equally thick for the approach applied to the adaptation of computer systems). The cure of thinness that led to HERMES 5 (a single manual of 180 pages all the same, however virtually more generalist: IT and organizational projects) reconfirmed the existence of this pre-phase! The associated processes have nevertheless been retained and are reflected in the "Project Initiation Order" milestone, and more specifically 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 about the operational steering of the project). HERMES 5 therefore prescribes the drafting of a project mandate, and here again this editorial task rests with the project manager; the resulting document is submitted to the piloting constitution who has the authority to validate it.

The typical content of this document is the following:

- A description of the initial situation: problems or needs justifying the project;
- The definition of the objectives to be achieved;
- A (rather succinct) description of the chosen solution;
- A description of the human, financial and material resources made available to the project;
- Elements of planning and scheduling (scenarios, phasing, milestones) and organization;
- Expectations in terms of results and efficiency;
- Details of the relationship between the strategic objectives of the organization and the requirements for the project manager and their team;
- A brief inventory of the risks incurred and the arrangements made to protect them;
- Finally, and to conclude, an inventory of "consequences".

On this last point of content, the manual of HERMES 5 is not very verbose. Nevertheless, the users' interpretation suggests that it is necessary to understand "consequences" from two points of view: a reminder of the benefits that should be consequential to the realization of the project, and of the consequences the project would have for the organization.

Again, compared to the requirements and recommendations of the other artefacts proposed in this section 2, it is reasonable to say that the HERMES project proposal/mandate, in terms of reference, covers a wide range of the standard contents of project initiation documents.

--- 2.3 Initialization of a Project Using the PRINCE2 Methodology ---

PRINCE2 is the British counterpart of the very Swiss HERMES methodology. It was introduced under the name PROMPT in the 1970s to offer a standardized approach to project management. Some changes underwent over the years: enriched with a first feedback and renamed PRINCE then PRINCE2 (PRoject IN Control Environments) in the 1980–1990, updated in 2002, 2005 and 2009. Like HERMES, PRINCE2 is intended to be a general project management methodology that does not attempt to deal with technical aspects related to the trade nor with soft skills. Unlike HERMES, PRINCE2 has nevertheless succeeded perfectly in breaking down the computer connotation that hits HERMES. Feedback is in the heart itself of PRINCE2; it is one of its seven founding principles. So we can easily see in the plethora of initial artefacts of this methodology, some answers to protect themselves from scabrous authorizations of project launches, which certainly participate in the poor performances and failures of far too many projects.

The document PRINCE2 which formalizes the formal launching of a project is the project brief. Not only does it formalize the launch of the project, but it also aims to ensure that all project contributors have assimilated the expectations of the executive to the project, as well as the objectives to be achieved and the results to be produced. The drafting of this document is based on is based on a few pre-existing documents: the product description, the lessons log and especially, the business case.

As the project develops, the project brief will become the project initiation documentation (PID). This documentation, at the end of the initialization phase, should replace the project brief which becomes obsolete.

PRINCE2 also proposes a document known as a project mandate, but this document is external to the project and aims only to launch the project initiation process and does not prejudge in any way the future reality of the project. As such, it cannot be assimilated to the artefact of initialization of project as it is conceptualized in this article.

1. In this paper, the distinction between standard and methodology is the one generally accepted, namely that a standard makes rather an inventory of the practices to be implemented, the "what" (Project Management Body of Knowledge of the Project Management Institute is rather to be classified as a standard), whereas the methodologies are predominantly more interested in the way forward, the "how" (the PRINCE2 and HERMES approaches are definitely classifiable among the methodologies of management of project).

2. Therefore, HERMES is perhaps the oldest of the comprehensive methodologies of project management.

As for the drafting of the project brief, again it is a task for the project manager. The validation of this document is carried out by the pilot triumvirate of a PRINCE2 project, namely the executive, senior users and senior suppliers.

The typical content of this document is the following:

- A description of the initial situation: problems or needs justifying the project;
- A (rather succinct) definition of the project;
- A summary of the highlights that emerge from the business case of the project;
- A summary of the highlights from the product description associated with the project;
- elements relating to the project approach that will be pursued to completion, including elements of planning, estimates and budgetary elements;
- An organization chart clarifying the relations in between the authorities;
- A definition of the main roles involved in the project, its operational management and strategic steering;
- Finally, an inventory of all the pre-existing documents that served as the basis for the drafting of the project presentation and its validation.

From a deontic point of view, PRINCE2 relies on six aspects (not the only three traditional ones of the famous Barnes' triptych, quoted by Weaver **[13]**), namely costs, delays, quality, perimeter, risks and profits. Surprising as it may seem, the typical content of a project presentation does not include all six aspects that contribute to the relevance of this methodology in a structured way.

It will not have escaped anyone that the methodology PRINCE2 in its principles is not lean! It requires the production of numerous management documents, the contents of which overlap, and it is not always easy to recognize this. It follows that to cover the perimeter of the standard contents of the project charter of the PMBoK and project mandate of HERMES it is necessary to take information in several documents which have at a given moment neither the same levels of maturity nor the same validation chain.

--- 2.4 Initialization of a Project as per Three Project Management Textbooks ---

As mentioned above, standards and methodologies are the result of collaborative and consensual development processes. As much the collaborative character can bring wealth to the approach, as much the requirement of consensus can be harmful to it since the latter can act on the underlying constitutional concepts which should be indisputable! We have also decided to look at what some authors of project management textbooks recommend in terms of project initialization artefacts. Out of the many books published on this topic, we have selected three of them: Wysocki and McGary **[14]**, Larson and Gray **[15]**, and Ulrich and Eppinger **[16],** the latter with a stronger connotation of new product development.

--- 2.4.1 The Project Overview Statement of Wysocki and McGary ---

For Wysocki and McGary (op. cit.), the Project Overview Statement (POS) shall be drafted and used as a project initialization document. For these authors, this is a document that shall be concise, typically one page, and shall be focused on what the project team shall do, the motivations that justify the project, and on the benefits that the project hall bring to the organization once it has reached its end. It is expected that this document be prepared by the project team during the project definition phase; it is definitely a document of a strategic nature that must allow and guarantee the proper allocation of the resources necessary for the realization of the project. Once validated by the constituents, the POS provides the project team with the elements required for operational planning of the project.

In their approach, Wysocki and McGary conceive the project overview statement as a major vector for communicating the project's rationale (some would say project marketing). Because it collects all the expectations of the protagonists, it has the virtue of being read all involved in the project so that they fully understand the expectations and contributions of each one. They therefore suggest that this document should be discarded from any specific or technical jargon that would not be used regularly within the organization.

These authors report that many companies also use the POS as a means of collecting ideas to identify these initiatives that could lead to efficiency, improve productivity and bring new business opportunities. In this spirit, the POS is definitely a steering document: it makes it possible to identify project opportunities, decide which ones deserve to be realized, and to formalize the existence of a project. It is a kind of merger of the project proposal and the project mandate of the HERMES methodology, two-in-one: the index of validity of the POS (validated or not by the constituents), a project proposal (not yet validated) or a project mandate (POS approved by the management of the organization). To bring all the benefits that can be expected from this approach, it is important to create a favourable context for the initiative: every employee of the organization should be able to initiate a POS; this artefact being a sort of "idea box". As a result, only a portion of them can justify and benefit from a conversion into a project. For the management principle to be sustainable, it is important that the organization creates a propitious state of mind and that the non-validation of POS proposals is not perceived as a frustration for those who would not see their project ideas realized. Even if a certain initiative belongs to the employees of the organization, such a steering framework can only function if the prerogative to validate or even revise a POS, and therefore to launch and reframe a project, belongs to the management of the organization.

For Wysocki and McGary, the typical content of the POS is made up of five blocks:

- A description of the problem(s) and/or opportunities;
- A description of the purpose of the project;
- An inventory of objectives to be achieved;
- A set of success criteria for the project;
- Some details about the assumptions, risks and other obstacles that could disrupt its successful realization.

As the text of the document translates it well, the project overview statement is meant to be a synthetic document aimed at providing a global vision of the project, focusing first and foremost on aspects of a truly strategic nature. Stewardship considerations, much more tactical such as coordination planning, budgetary breakdown, and so on are relegated to being treated in ad hoc documents managed within the project team.

--- 2.4.2 The Project Scope of Larson and Gray ---

In Larson and Gray's project management treaty, it is still another "type of document" that is proposed to account for the formal initialization of a project: the project scope. For both authors, this document aims to give a definition of the end result to produce, typically, the product or service to be delivered to the client at the end of the project, and, to some extent, the approach taken to permit such delivery. For the sake of efficiency, they recommend formulating the results to be achieved as well as the approach in a specific, tangible and measurable way, in a true customer logic. While it is intended to be concrete, this document must be able to serve as a reference in the relationship between principal and mandatary; it must maintain a certain practicality to measure the progress of the project and at the end of it, endorse its successful completion. In one way or another, the criteria for success of the project must be clearly stipulated.

As for the editorial process, the project scope differs from other types of similar documents: the drafting of the document is the joint responsibility of the project manager and the client[3]. Once validated by the client , this document becomes the reference from which the operational planning and the monitoring of the progress of the project is carried out.

Finally, Larson and Gray also propose a checklist of typical content for the scope project:

- The project's objectives;
- Description of the results to be delivered;
- Key milestones;
- Technical requirements;
- Limits and exclusions;
- Review process with the client.

The approach of Larson and Gray is resolutely pragmatic. To promote it, they refer to a study carried out by one of these co-authors, pointing out that half of the problems encountered in the planning phase are partly or totally the result of a lack of clarification of goals, outcomes, and the scope of the project. Because it is these last aspects that are detrimental to the smooth running of a project, Larson and Gray have decided to put in a second plan these other aspects that are as much emphasized by other standards, methodologies and authors as the possible solutions and the recommended solutions, the benefits that should be generated by the project or the risks involved, or specific organizational arrangements. It is indeed a choice.

--- 2.4.3 The Mission Statement by Ulrich and Eppinger ---

The field of new product development is definitely associated with the entrepreneurial activities of the organizations, and as such is the responsibility of the project management in terms of its management. What contributes to the specificity of these projects is the dual nature of their results. Indeed, the latter are of two types: a precise descriptive dossier of the new product (artefact that the PLM[4] world calls the "article") on the one hand, and the tangible industrial system allowing the supply of raw materials, manufacture and assembly of future products and, where appropriate, their distribution on the other hand. In addition, and taking into account the specificities of these projects, business aspects are included in the processes: gathering needs and translating them into elements of product specification, generating, selecting and evaluating concepts, product architecture and industrial design, as well as aspects of prototyping, manufacturability, or patentability. To our knowledge, there is no formal methodology to support professionals in the development of new products in their project approaches. Of all the works written on the subject that of Ulrich and Eppinger seems to be very successful with practitioners of the development of new products; so we have retained it to complete our inventory of project initialization artefacts.

For these authors, it is the mission statement that acts as a formal element in launching a project to develop a new product, whether it is a radically new product for the organization, a new product line (new platform), a derivative product, or even a simple improvement to an existing product. This document originates in the product planning of the organization; the purpose of which is to pilot the projects in a strategic and tactical way: to ensure that new products will be placed on the market timely while making the most efficient use of development resources and means of production and distribution available to the organization. As a result, the mission statement includes, clarifies and formalizes elements that are already included in the organization's product planning document. For Ulrich and Eppinger, the typical content of the mission statement is as follows:

- A brief description of the product that the project team will have to develop (the basic functionalities of the product, it being understood that the actual product specification is included in the development process);
- A brief description of the incentives that purchasers of this product would have to acquire this product rather than another (product offered by a competitor or as part of an internal cannibalization);
- Key business goals, which include cost, time and quality aspects;
- Primary and, where appropriate, secondary markets;
- Key assumptions and constraints (dates of marketing, unit selling prices, production volumes, development costs, etc.) that led to the decision to launch the project;
- The stakeholders identified, in particular to ensure that the collection of needs with regard to the product and its development will be properly inclusive.

3. Something that conjectures us because in their textbook, Larson and Gray are not very verbose about the process of validating the project scope document.
4.PLM: Product Lifecycle Management.

In terms of temporality, this document is produced early in the pre-project phase, even before a product concept is developed, even before the requirements engineering work is undertaken. It follows that constituents and agents must admit and accept the necessary evolving nature of the document, which must reflect and endorse evolutions specific to the development itself and its external environment (changes in the market and technologies).

--- 2.5 The Initialisation of a Project as in System engineering ---

An important part of CERN's activities in Geneva consists of studying and sometimes building scientific installations of undeniable technical and technological complexity and in many respects unmatched (http://home.cern). This essential feature means that the only implementation of general project management approaches (e.g. PMBoK, HERMES or PRINCE2 to name just a few) is insufficient to ensure the success of CERN's studies and development projects. Also, adopt managerial approaches in system engineering, such as those described in the NASA's Systems Engineering Handbook (SEH) **[17]**, the ESA's ECSS M and Q fascicles **[18]** or the G2SEBoK (op. cit.), or at least draw inspiration from them, is an essential complement to the generalist approaches to project management. However, in many aspects engineering systems and project management overlap, as examples: Chapter 3 of the SEH deals with the lifecycle of programs and projects and is definitely a problem of project management; Chapter 4 deals with gathering needs, formulating requirements, or even decomposing the product, and these are still project management issues; Section entitled Crosscutting Technical Management deals exclusively with themes that can also be found in projects or references for project management (technical planning, WBS, interfaces management, Risk management, configuration management, etc.). While NASA's SEH is very precise about phasing and its associated processes, it is much less prescriptive about the documents that punctuate these processes. The same applies to the ECSS and G2SEBoK. However, system engineering practitioners have an ISO IEC IEEE standard (op. cit.) which aims to regulate the typical content of an artefact that in many respects is comparable to that looked at in this article. These are the OpsCon and ConOps which, according to the references, are the same document.

The system operational concept (OpsCon, sometimes OPSCON) is a systems engineering document whose purpose is to describe the characteristics of a system to be developed (i.e. a future system) from the point of view of those who will use it, whether they are future operators, in charge of maintaining it, or responsible for ensuring its compliance. The ISO IEC IEEE standard gives a definition and proposes a typical content for the OpsCon (ISO IEC IEEE 29148: 2011, Annex A). The NASA's SEH (op. cit.), the G2SEBoK (op. cit.) or the Handbook of Systems Engineering of Sage and Rouse **[19]** refer to this same document, but under another name: the concept of operations (ConOps, sometimes CONOPS)[5]. All sources support its importance.

This document is clearly intended to specify a future system from the point of view of the operator and should be used primarily to communicate to developers, suppliers and future users all the quantitative and qualitative characteristics expected of the future system, such as training of operators and maintenance agents, operating modes, etc. Although the normative document is not very explicit about the temporality of the document, it is clear that it is a document whose first drafting must take place before the decision to formally launch the project is taken; this document must evolve as the process of system development evolves.

The ISO IEC IEEE 29148: 2011 standard provided normative content for the OpsCon:

5.The ISO IEC IEEE 29148: 2011 standard actually refers to two types of documents, the operational system concept (OpsCon) described for the normative purpose in Annex A and the concept of operations (ConOps) described for informative purposes in Annex B. While the first is clearly aiming on specifying a system from an operational point of view for its development, the second is more strategic in nature for an organization in the sense that it describes one or more systems with the objective of confirming the coherence of the latter or the latter with the mission, goals and objectives of the organization that owns them. The ConOps following this standard is a much more general document from which to extract descriptive elements from the OpsCon.
For unclear reasons, the three standardization associations have decided to call OpsCon a type of a document that was previously known as ConOps, and to give a new definition to the latter. Some will recognize that this unclear change is largely confusing. For the time being, the main works and system engineering references retain the name ConOps.

To answer the question whether the standard content of this document is comprehensive to meet the expectations of a project team on its mandate, the answer is certainly negative. Indeed, as much as the document is precise on the description of the system to deliver, as much as it is not really on the development of the project itself: its phasing, its timetable of realization, its organization and its governance, the resources of various natures which are or will be allocated to its development. To be consistent with good project management practices, this document should be accompanied by a more programmatic document that systems engineering does not really explain.

3. COMPARATIVE ANALYSIS

All approaches, be they standards, methodologies or textbooks dealing with project management, emphasize the importance of a project initialization document, and this whatever the nature of the project. Some advocate the publication of a succinct document (which should be on a single page), others the drafting of a more substantial document by seeking to make it comprehensive and detailing precisely what the deliverable of the project should be.

However, the relationship between the project engineer and the stakeholders shall not be conceived as a commercial relationship between a customer and a supplier: the nature of the project itself, its intrinsic complexity, the uncertain nature of its implementation requires the establishment of a relationship conducive to exchange and to collaborate in between the stakeholders and the project team. At the very beginning of the project, the stakeholders who make up the project (the business, the users and the suppliers to paraphrase PRINCE2, but also the "regulators") cannot claim to know what must precisely be the final result of a complex system development project. No more than the project managers and the project team members. Therefore, the initialization of such a development project must give a way to a form of collaboration between stakeholders at large, so that the true definition of the project takes shape "along the way" or "along its way", as proposed by Marie-José Avenier **[20]**.

Indeed, an overly precise definition of the project would be detrimental to all parties: stakeholders who would be forced to make choices in the absence of sufficient information, the agents who, in order to guard against the effects of the inherent uncertainty of a project would be tempted to take provisions for technical risk perhaps, and programmatic risk certainly, too significant; Provisions that would likely mitigate the benefits that the project could or should create for the organization that could jeopardize the very existence of the project!

The contradiction thus lies in an insufficiently motivated and formalized "green light" and an overly formal contract. The systems engineering's OpsCon/ConOps can be perceived as excessive, the project overview statement from Wysocki and McGary or the project scope from Larson and Gray a little too light to serve as a serious basis for the initiation of a development project of a complex system. To these arguments may be added the desire to produce a managerial framework of project management in a lean spirit. But what is this spirit in a project initialization context? Some will say that a notorious source of waste in so-called high value-added activities is the excessive thickness and multiplicity of documents that must be written, verified, validated and read! Not to mention the efforts to keep them up to date. From these points of view, PRINCE2 may not be the best methodology; HERMES is closely following it.

As for the aspects to be dealt with in this initialization document, with the exception of the OpsCon/ConOps, which predicts even before the project is launched that operational aspects are firmly defined, it is clear that the points to be addressed must be far-reaching:

- Strategy: the problems or opportunities to be met, the purpose of the project, the benefits the project shall produce, and on these points the seven types of document are relevant;
- Tactics: the possible solutions and the one (which can be chosen intuitively) that is perceived by the initiators as the most relevant, and there, it is rather the methodologies that have the advantage;
- High level organizational: governance and steering of the project.

A quick question which comes up is the temporality of this document: too early and too precise and it is the creativity of the project team that is liable to be mitigated, too late and it is the existence and the sustainability of the project which may be jeopardized. A project exists only if it has a "formal green light"; this is a certainty. Even if the PMBoK leaves some doubt about the inclusion of the preliminary studies in the project itself, HERMES, PRINCE2 but also Ulrich and Eppinger in their textbook are formal: the phases of preliminary analysis (HERMES 4) or project initialization (HERMES 5), the initiation stage (PRINCE2) or the concept development phase of Ulrich and Eppinger are well included in the project. Therefore, this initialization document shall pre-exist. Knowing that requirements engineering is a process to be carried out in these phases/stages, it is understood that a formalization of needs (business requirements) and even more so of product/system requirements does not really have a place in the initialization document.

4. PROPOSAL OF A MORE SYNTHETIC DOCUMENT

--- 4.1 Context of Integration ---

CERN, like many other large laboratories with highly complex scientific facilities, did not wait for the introduction of project management methodologies to apply a rational and rigorous approach to its projects. In the 1960s, CERN already had a computer program for project planning under resource constraints **[21]**. It follows that, in a few decades, habits have been taken, deeply rooted in the organization's culture, and it would be very difficult to justify the adoption of standardized methodologies when their added value might be marginal.

A simple example to illustrate this: CERN projects are divisible into two major phases:

- the study phase, which is concerned with the elaboration and demonstration of the feasibility of a concept and the deliverable of this phase which is a document, the Conceptual Design Report (CDR), and;
- the project phase whose objective is the development of the project itself.

The first phase is repeatable in the sense that it can be repeated several times; it can lead to the delivery of several CDRs before reaching the one that will trigger the project phase. The second is made up of at least three main sub-phases (still referred to as "phases"):

- the design phase (engineering phase) leading to the drafting of Technical Design Reports (TDRs) and defining the technical baselines used as a basis for outsourcing construction, manufacture or assembly;
- the build phase, which includes detailed studies, construction of technical infrastructure, manufacture and assembly of components and their installation, and;
- the commission phase during which the equipment is tested, first in the absence and then in the presence of particle beams.

This approach is deeply rooted in the DNA of the stakeholders of these projects. Even if the methodologies give a place to adaptation (tailoring) to adjust their implementation to the specificities of an organization and its projects and thus their acceptability, a question quickly arises: to what extent can the methodology be configured so that it would be retained without distorting it? This question arose at CERN. The choice was cautious not to choose a particular methodology, but 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 on some essential bricks constitutive of these methodologies on the other **[22]**. With this in mind, a system engineering repository called openSE was produced as part of a research project funded by the European Union[6] (www.cern.ch/openSE). The CERN Engineering Department, in its mission to provide project management support to projects and programs, has been promoting this reference system for three years for all services involved in managing projects or taking part in studies and projects for the development of equipment or scientific or technical facilities. In 2016, more than one hundred engineers and scientists were trained.

-- 4.2 The following project proposal / roadmap 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 who duly mandated by its management to write such a document, but also engineers or scientists "self-appointed" in this mission, considering it justifies such an entrepreneurial approach. The purpose of the project proposal is to provide CERN management (more specifically at the appropriate managerial level) with tangible elements to make a documented decision whether to launch a study.

This document is definitely strategic in nature because it exposes a situation, a problem posed or a need felt or expressed, and proposes objectives that could be fixed for a project. It also includes a tactical dimension by briefly identifying possible solutions and identifying a preferable one, and then for it, by providing some pre-feasibility elements. Finally, by suggesting to the management that could validate the initiative the proposal of a steering framework for the possible project. This is recognized in the comparative analysis in section 3.

Upon review of the project proposal, prospective nominees may have three attitudes:

- The project proposal is a relevant response to the situation, a problem that arises or a need expressed, and if they have the means to make the decision to launch the project, or at least give their "green light" for the purpose of conducting a study. With some adaptations, the project proposal can then be converted into a 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 constituents and re-submitting the revised project proposal to those prospective constituents or other potential constituents.
- The proposal is not admissible for reasons to be explained and therefore does not justify the launching of a project. Prospective stakeholders (i.e. "prospective project board members") then issue a "red light" to the project proposal, which becomes some kind of "rejected project proposal"!

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 things distinguish them:

- the maturity of the content: necessarily more successful for the roadmap;
- the validation of the document or not: a project proposal is an uncommitted roadmap while a roadmap is a validated project proposal

This project management document is not the only one to change type according to its state. This is also true of the change request, which becomes a change order once it is validated.

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

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

6.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. no. 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/)

Once validated the project proposal becomes a project roadmap and its typical content is very similar, but it is also augmented by a sixth section which aims to record the successive decisions of the constituents:

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. Decisions
- 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. This is the only two-in-one document associated with project management. The writing of several documents of a strategic nature is economized; the need to read several different documents containing more or less the same information and which end up exasperating all those who crumble under some kind of "infobesity".

5. CONCLUSION

As announced in the introduction, this is certainly only a modest "architectural innovation", but that could perhaps push the field of project management a bit to mature and use a form of parsimony to federate the too many standards and methodology circulating. In our approach, we tried not to invent a new artefact of the initialization of a project, but to take from the arsenal of existing ones the adequate content in order to make the task of governance of a portfolio of projects more efficient by making the decision-making process essential for launching a project. ◆

• AUTHORS •

DR. PIERRE BONNAL holds engineering degrees in mechanical engineering from the l'École nationale d'ingénieurs de Tarbes, France, and in industrial engineering from the École centrale Marseille, France, a M.Sc. in project management from the University of Quebec at Trois-Rivières in Canada and a Ph.D. in industrial management from the Institut national polytechnique de Toulouse, France. Pierre claims a solid industrial background including work with Airbus Industrie (F); Fatigue Technology Inc. (USA); Doris Engineering (F), Areva-SGN (F) as well as more than eighteen years with CERN (CH) mainly involved with the LHC project management and project management and systems engineering support. In 2008, he benefited of a two-year sabbatical to join the University of Applied Sciences of Western Switzerland-Geneva as a professor and dean of the Department of Business Administration. As from September 2010, he is back to CERN, involved in quality and project management support to the many studies and projects on-going at CERN; and as from January 2014, he is the head of the Quality and Organizational Processes Section. Pierre was also the CERN's scientist-in-charge of the PURESAFE ITN Project: a European funded initiative that aims at developing enhanced means (processes, hardware systems and software) for preventing human intervention for increased safety in infrastructures emitting ionizing radiation. Pierre is a former chairperson of the IPMA affiliated Swiss Project Management Association of Western Switzerland, a founding member of the EVM Europe Association. He is also a senior lecturer in project management and R&D management with the business schools of the Universities of Geneva, Lausanne and Neuchâtel in Switzerland. In addition, Pierre is a regular reviewer for a few academic journals (Project Management Journal, International Journal of Product Lifecycle Management, Journal of Modern Project Management and IEEE Transaction on Engineering Management) and is regularly invited to give keynote speeches in project management conferences all over the world.

CHRISTOPHER RAUSER was a technical student at CERN from 2016 to 2017. As part of this studentship, he wrote, under the supervision of Dr. Pierre Bonnal, his bachelor's thesis related to the article published. In 2017 he graduated from the Hochschule-Ruhr-West in Germany and started in the same year his Master Degree at the Universitat Pompeu Fabra Barcelona.

• REFERENCES •

[1] W. J. Abernathy, J. M. Utterback (1978). "Patterns of Innovation in Technology", Technology Review, 80 (7), pp. 40–47.

[2] Ph. Kruchten (2004). The Rational Unified Process: An Introduction, Addison-Wesley.

[3] Kent Beck (2000). Extreme Programming Explained: Embrace Change, Addison-Wesley.

[4] K. Schwaber, J. Sutherland (2001). The Scrum guide.

[5] D. J. Anderson (2010). Kanban: Successful Evolutionary Change for Your Technology Business, Blue Hole Press.

[6] OGC (Office of Government Commerce) (2009). Managing Successful Projects with PRINCE2. The Stationery Office, London, UK.

[7] Unité de Pilotage Informatique de la Confédération (2003). HERMES. Conduite et déroulement de projets dans le domaine des technologies de l'information et de la communication. Développement de systèmes, Bern, Switzerland.

[8] Unité de Pilotage Informatique de la Confédération (2016). HERMES 5.1 Méthode de gestion pour tous les projets. Manuel pour manager, Bern, Switzerland.

[9] ISO IEC IEEE 29148:2011 (E). Systems and Software Engineering – Life Cycle Processes – Requirements Engineering, ISO, Geneva, Switzerland.

[10] INCOSE (2004). Guide to the Systems Engineering Body of Knowledge (G2SEBoK), International Council on Systems Engineering, San Diego, California, USA.

[11] Project Management Institute (2008). A Guide to the project management body of knowledge (PMBoK Guide), 4th Ed., Newton Square, Pennsylvania, USA.

[12] M. Mottier (Ed.) (1997). The Large Hadron Collider Project Quality Assurance Manual (LHC QAP), CERN, Geneva, Switzerland [http://lhc-proj-qawg.web.cern.ch/lhc-proj-qawg/LHCQAP].

[13] P. Weaver (2007) "The Origins of Modern Project Management", Fourth Annual PMI College of Scheduling Conference, 15–18 April 2007, Vancouver, Canada.

[14] R. K. Wysocki, R. McGary (2003). Effective Project Management, 3rd Ed., Wiley.

[15] E. Larson, C. Gray (2013). Project Management: The Managerial Process, 5th Ed., McGraw-Hill Irwin.

[16] K. Ulrich, S. Eppinger (2012). Product Design and Development, 5th Ed., McGraw-Hill.

[17] S. J. Kapurch (Ed.) (2007). NASA Systems Engineering Handbook (Corporate Standard). NASA Headquarters, Washington DC, USA.

[18] European Coordination for Space Standardization (ECSS), www.ecss.org Noodwijk, The Netherlands.

[19] A. P. Sage, W. B. Rouse (Eds.) (1999). Handbook of Systems Engineering and Management, Wiley-Interscience.

[20] M.-J. Avenier (coord.) (1997). La stratégie chemin faisant, Economica.

[21] J. C. Pollock (1966) Project Resource Allocation Method, CERN, Geneva, Switzerland.

[22] Ø. Husby (2013). Conceiving a Lean and Participative Project Management Framework Suited to Large-Scale Scientific Projects: How to Adapt Existing Systems Engineering and Project Management Best Practices to CERN's Projects? M.Sc. thesis, Norwegian University of Science and Technology (NTNU), Trondheim, Norway.