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Towards the development of a methodology for managing industrialization projects

Deborah Perrotta[a,*], Madalena Araújo[a], Gabriela Fernandes[a], Anabela Tereso[a], João Faria[b]

[a]*Production and Systems Department/ Centre ALGORITMI, University of Minho, Campus de Azurém, 4804-533 Guimarães, Portugal*
[b]*Bosch Car Multimedia Portugal, S.A., Rua Max Grundig, 35 - Lomar, 4705-820 Braga, Portugal*

Abstract

This paper proposes an approach for developing a project management methodology to be applied on the specific context of industrialization projects. This particular type of projects comprise the development of manufacturing lines for products, the quality of the product itself being assessed the whole way through using the well-known stage-gate system (quality gates). Project management should then support the technical activities, but its role is sometimes not so clear. In this sense, the proposed approach for developing the project management methodology is intended to solve this issue, comprising the required steps for performing a detailed characterization of the current scenario, allowing for inconsistences to be noticed and improvements to be identified.

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Keywords: project management methodology; project management practices; industrialization projects; project management value

* Corresponding author. Tel.: +351 253 510 340; fax: +351 253 510 343.
E-mail address: b7337@dps.uminho.pt

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1. Introduction

Industrialization projects can be described as projects that are related to the design of a manufacturing line to produce a certain product, aiming at reducing production costs and increasing manufacturing efficiency/efficacy. Sometimes, the company may receive a request to industrialize several products with small differences between them (e.g., product variants belonging to the same product line), which brings a great deal of challenges *per se*[1]. In any case, the industrialization process involves analyzing/understanding all product requirements, developing prototypes for increasing the maturity of the product itself before conceptualizing the manufacturing line. Usually, the clients (internal or external, depending on the origin of the request) participate on this process, receiving some prototypes to make their own evaluation, later providing feedback to the industrializing company, or even accompanying *in situ* testing of prototypes procedures. This feedback may cause alterations on the product, consequently originating new requirements to be satisfied for the product. New prototypes are then built and the process is repeated, until all client's requirements are satisfied, only then allowing the process of developing the manufacturing line to initiate.

Along the industrialization process, the quality of the product should be assessed, which can be performed using the logic of stage-gates[2], commonly applied in new product development projects. These stage-gates represent events (gate) where a thorough assessment of the product and process is performed, preventing the project to evolve to the next phase (or stage) in case the project fails in accomplishing the specific stage-gate requirements[3]. The stage-gate system is technically straightforward, where the project's efficacy concerns prevail over its efficiency, not worrying about how the process of achieving a result went but actually in passing the final gate. As such, it presents considerable room for improvement.

Project Management (PM) practices, therefore, arose from the necessity of manufacturing companies to essentially manage change, contrasting to the functional management, where the main purpose is to continue the production with minimum disruption. This also has consequences on the different profiles of managers, having the project manager a more pro-active attitude towards change while the functional manager a more reactive one[4]. The different management profiles may create problems inside a manufacturing organization when the need for a certain change arises, exacerbating the lack of synergy between the two approaches.

As a way to tackle the abovementioned issue, this paper presents an attempt to answer the following research question: How to develop a PM methodology specially devoted for industrialization projects?

Following the reasoning of "one size does not fit all"[5], this paper proposes the cornerstones towards a new PM methodology for industrialization projects. In addition, it is relevant to actually understand that even inside the context of industrialization projects, these may vary from company to company, being the idea here to propose a "generic" approach that each company would be able to implement/adapt to their specific case.

This paper is then divided as follows: Section 1 - introduction, presenting an overview of industrialization projects and the existing gap in literature; Section 2 – literature review, where the value of PM and the need for standardization of PM processes become clearer; Section 3 – research approach, describing how the new approach for developing a PM methodology for industrialization projects was created; Section 4 – results analysis, presenting the new approach itself; and finally Section 5 – conclusions and future work.

2. Literature review

2.1. The value of project management

PM value is often discussed and even proclaimed in consulting and practitioner literature, although the actual value resulting from investments in PM has been hard to define and measure[6]. One of the difficulties is to isolate the return from PM and return from other management concepts[7]. As a result, PM joins the long line of initiatives (e.g. TQM, information systems, training and human resources) struggling to prove their worth to organisations[8].

The PM value concept itself is really hard to be defined as a simple set of quantitative parameters, since PM can impact different levels of an organization. It would definitely require more breadth of data, time and research to begin to understand what PM value is, which can be interpreted differently by different project stakeholders[8].

In this sense, the existing literature interprets in different ways the value that project management can bring. Tangible and intangible benefits[9], management effectiveness[10] and project's success[11], among others, have been

suggested as ways to measure PM value. All those approaches point to a more qualitative analysis on the value that PM could bring to an organization.

Senior managers, however, have been demanding a more quantitative approach, where investments in project management systems, tools and practices should be justified financially, i.e., PM return of investment (PM/ROI)[12]. The thought behind this measure is that, more than delivering a project that is on time and on budget, PM must be profitable, delivering PM/ROI and thus becoming a strategic business asset[13].

Following this idea, Ibbs and Kwak[12] have presented a first attempt on developing a tool that would calculate the PM/ROI, analyzing 38 companies regarding their level of PM maturity (how broad the use of the PM toolset is in the organization) and correlating it to the typical project cost and schedule. However, they acknowledge that the size of the sample is too small, impairing the results of the statistical analysis performed and thus the results being insufficient to be generalized.

Cooke-Davies Crawford and Lechler[14], on the other hand, focused on the extent of value creation when considering how well the strategic drivers of an organization are aligned to its project management system. They criticize the unlimited use of PM practices regardless of the organizations' strategy and the specific characteristics of their projects, which ends up being a major source of project failure. The value of PM is a function of what is implemented and how well it fits the organizational context. PM value is created or destroyed depending on the extent of 'fit' or 'misfit' between the organization's strategic drivers and the characteristics of its PM system[14].

In a research study: "Researching the value of project management", sponsored by Project Management Institute, aimed to get the financial ratio PM/ ROI[6], they conclude that although it is reasonable to use financial ratios to measure the value of PM in the sense that financial results are important for all organizations, only considering the monetary return of PM is obviously not enough, since PM also brings intangible benefits to corporate culture, organization efficiency, and the satisfaction of clients[15,16].

The literature shows that the value of PM is still a controversial issue, which may vary for different stakeholders, by type of project, by type of industry, by the parameters considered and by value that can be translated into money or not, among other aspects[17]. For the scope of this paper, industrialization projects, it is considered that the value that PM could bring would be related not only to better manage this type of projects (on time, on budget, etc.), but especially to promoting a powerful set of tools that will work in synergy with a stage-gate system[2] (based on the assumption that it is implemented in industrialization projects to evaluate product/process quality), ultimately adding value to the role of the project manager in accomplishing the project's objectives.

2.2. The relevance of standardization of PM processes

The previous section presented a discussion on the value of project management, why should organizations put their limited resources focused on increasing PM maturity level? This section argues that a way to increase PM value is through the standardization of PM processes.

PM became an independent and standardized management model in the late 50s. The standardization of PM practices and tools was pushed by major construction industries back then, which perceived them as a way of rationalizing their efforts[18]. Nowadays, there are numerous so-called PM bodies of knowledge (BoK), developed by different organizations in the world, such as the Project Management Institute (PMI) and the Association for Project Management (APM), which may give guidance to organizations to develop their standardized PM processes. The worldwide renowned PMBoK[19] from PMI, being for instance, since its third (presently in the fifth) edition recognized as an international standard (IEEE Std. 1490-2003). However, applying a specific set of project management standards to develop the organization's standardized PM processes is not, by itself, a guarantee of a better PM that would lead to project success, despite the benefits for organizations in harmonizing PM terms, practices and tools[20].

The standardization of PM practices does not as well mean an increase in project effectiveness, as the weak correlation in Milosevic Inman and Ozbay[21] findings point out. Altogether, the increase on project effectiveness could be built on many foundations, such as project structure (related to the organization's operation), project systems (PM methods and metrics) and PM culture and leadership. On a later study, Milosevic and Patanakul[22] could take some interesting conclusions from a study performed with 55 project practitioners in high-speed companies (high-velocity computer and software industries) regarding factors related to standardized PM that may impact project's success. In summary, the standardization of PM practices in an organization may increase project's success when applied with a

certain level of flexibility and customized in order to fit the strategic purpose of the company. The innovation of this study resides on the importance given to the overall organizational orientation, on the management of projects collectively, and also on the identification of an inflexion point where a strong need for a certain level of variation in implementing standardized PM practices. As limitations of this study, it was pointed out the very specific industry sector, where the exploratory research design was carried on and thus limited the data sample.

However, later several studies have concluded the importance of standardize project management processes, for example Andersen and Vaagaasar (2009)[15], Shi (2011)[7] and Fernandes, Ward and Araújo (2014)[23] had identified the standardization of PM processes as one of the most important improvements that had the greatest impact on project performance.

3. Research Methodology

The results presented in this article are based on a case study. The case study is assumed as one of the most used research methodologies by researchers following a qualitative approach[24]. Using case studies the researchers can focus in a particular phenomenon and discover crucial knowledge[25].

3.1. The case study background

The company in analysis was founded in the late 1800s, having nowadays 390,000 employees worldwide. Sales volume in 2016 was 73 billion euros, investing almost 10% of this amount in research and development. The case study presented is held in a plant belonging to one of this company's division, responsible for developing and manufacturing integrated solutions for navigation, telematics and entertainment for private vehicles according to customers' request, and thus being considered as first-tier automotive company.

A project starts with a request from the customer to either develop a new product or make changes to an existing one, being this new project called global project. The global project then starts by collecting requirements from the customer, to further develop the product's concept. Once the concept is approved by the customer, the plant where the industrialization process will be held is involved, and thus the industrialization project begins. After the initiation phase, where high level risks and some requirements can be identified, a planning phase is held, developing documents like the WBS and time schedule respecting the customer's deadlines.

Industrialization projects in this case study follows a stage-gate system, using quality gates to assess the product, and apply PM practices to account for a better project performance, aiming at promoting the synergy among the project team, a good pace of work and the accomplishment of deadlines. Nowadays, despite the many already existent PM directives and standards developed for that end, there is a lack of synergy with the stage-gate system in place for a much longer time.

3.2. Research Methods

During the case study conduction, the main research method applied was the unstructured focus groups, where the group discussion is freer flowing, in order to discuss the suitable approach for developing a standardized PM methodology customized to a particular organization involved in industrialization projects. The focus groups were conducted between August and December 2016, with different project stakeholders, project sponsor, industrialization project managers and the researchers (authors) involved in the study.

4. Results analysis

The proposed approach to develop a PM methodology customized to each organization, since as abovementioned "one size does not fit all"[5], uses the phases of process mapping, and consequently process re-engineering, comprising three phases as follows[26,27]:

- As-Is: how processes happen here and now. Identify, describe and map how the processes involved in industrialization projects inside the organization happen;

- To-Be: how processes should happen in the future. Based on the results of the "As-Is", the future process is developed;
- Bridging the gap: how to mitigate problems that may arise with the changes in processes.

This paper focuses on the first two phases, describing how to map the processes that are currently performed in the organization (As-Is), and what should be done to develop the new/improved processes in the future (To-Be). It is relevant to mention that the "Bridging the gap" phase, which is related to how the implementation of the "To-Be" model is performed (e.g., through a "Change Management Program"), is not part of the scope of this paper. The process of implementation and its implications, tends to be a lengthy subject and almost impossible to report on a single paper; thus the next sub-sections focus on the steps required to develop the As-Is and To-Be models.

4.1. Developing the As-Is model

Before even considering the implementation of new processes in an organization, regardless of the activity sector, it is of utmost relevance to actually know how the company works, how processes are carried out and which players are involved. It is assumed that meetings with the organization's PM leader for a debriefing about the PM functioning within industrialization projects was held before. Therefore, the proposed steps to map the As-Is processes presented in Fig. 1 can be followed. By accomplishing them, it is expected that a deep knowledge of all processes related to the industrialization projects in the organization are identified and registered in detail, allowing their further mapping in a logical fashion, and that their inputs and outputs are identified, including relevant organizational assets .

The first two steps are related to the organization's documents identification and analysis, being such documents related to the organization's specific set of rules for PM or templates to be used along the project lifecycle, such as the project charter. The third step is complementary to the first two, where the idea is to directly observe PM "happening" in the organization, the activities performed by the project managers, their difficulties, their dynamics with the project team, communication barriers, etc. The last step then presents a way to assess the organization awareness of PM, gathering the point of view of the industrialization project sponsor, as well as identifying how much support to PM practices the sponsor provides. Finally, the project managers are interviewed in order to validate the As-Is model to the best of their knowledge, possibly helping on identifying improvements useful for the To-Be model.

First and foremost, the organization's project lifecycle and its phases must be defined, so that the PM processes identified can be mapped accordingly. For instance, if the organization follows guidelines of the PMBoK[19], the PM lifecycle would be composed of five major process groups: initiating, planning, executing, monitoring&controlling and closing. Fig. 2 presents an example of how to map the process involved in a theoretically created 'Phase 1'. The rectangles represent process activities while the diamonds represent milestones. Moreover, the example depicts a process that has both sequential and parallel process activities, which might happen is most cases.

Once the process activities for each project management phase are defined and mapped, each one must be described in terms of process activities ID, purpose, inputs, outputs and the organizational assets necessary to accomplish the process activities' purpose. Those assets can be organizational standards, procedures or templates, previously identified in the first step of Fig. 1. In addition, Table 1 presents an example of how to register the process activities details.

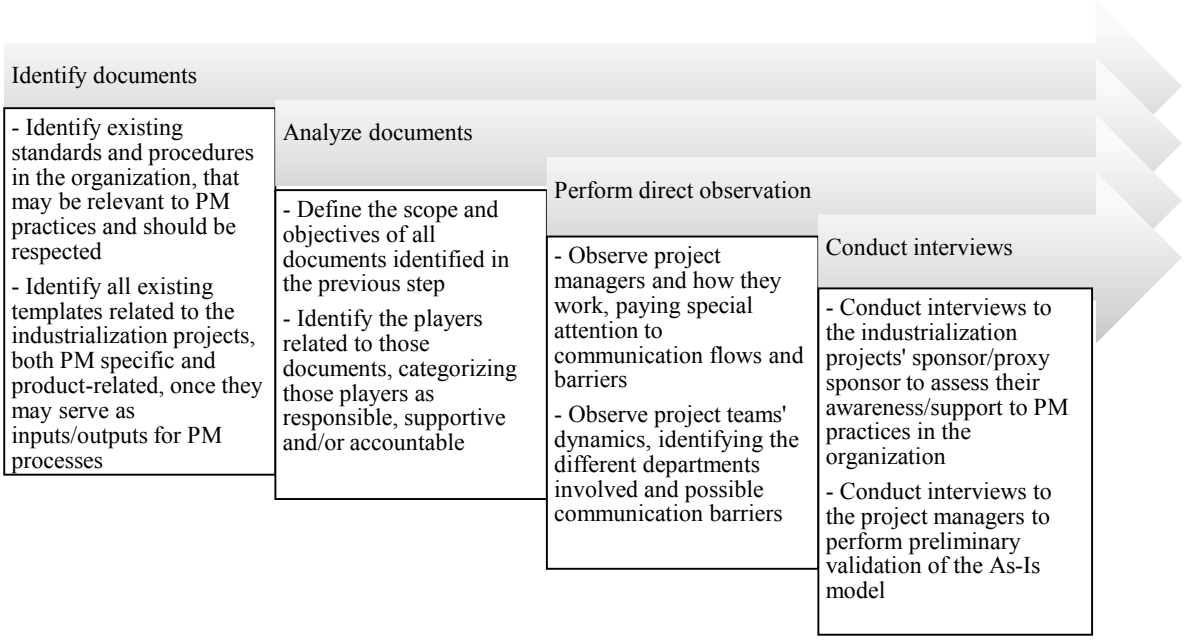

Fig. 1. Required steps to map the As-Is model

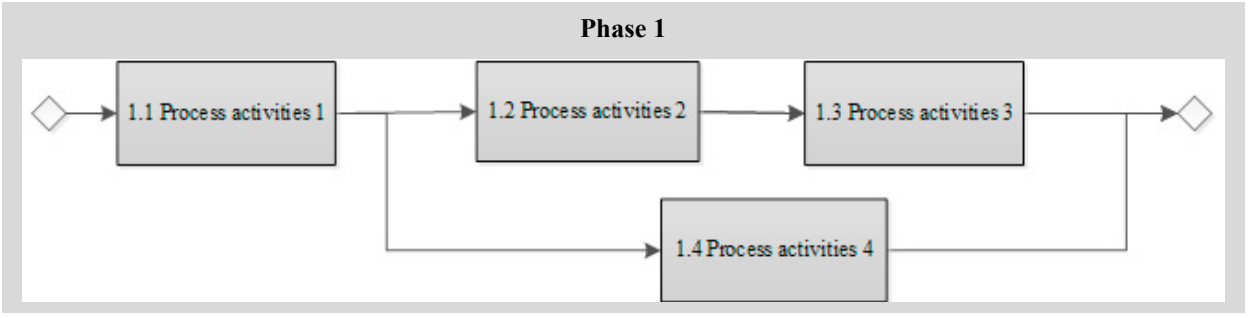

Fig. 2. Mapping format example

Table 1. Process activities descriptive table example

ID	Name	Purpose	Inputs	Outputs	Organizational assets
1.1	Process activities 1				
1.2	Process activities 2				
1.3	Process activities 3				
1.2	Process activities 4				

In the specific case of identified templates, in order to allow their thorough assessment and recording of relevant information, the format presented on Table 2 might be used:

Table 2. Templates recording format (example: Project Charter)

Objective	Project phase	Responsible	Support	Approver
To provide understanding of the project in the organization among the project sponsor, stakeholders and team.	Initiating	Project manager	Project team	Project sponsor

4.2. Developing the To-Be model

The proposed As-Is mapping allows for an integrated and visually appealing representation (workflows, tables, or by other representations) of PM processes in industrialization projects inside the organization. A well performed As-Is mapping, not only makes the PM processes better known but also makes inconsistences more evident, and that is the starting point for being able to develop the To-Be model. Some sources of inconsistency could be:

1. Process activities without inputs and/or outputs;
2. Process activities whose designations do not clarify their objectives;
3. Process activities that are not executed at all by choice or by lack of evidences that could confirm their execution;
4. Process activities, inputs or outputs that do not have impact for project own purposes and therefore should not be considered in PM's scope;
5. Process activities whose responsibility is not clear or does not involve the appropriate actors for their successful completion.

By analyzing the As-Is model regarding these possible sources of inconsistencies, it becomes clearer the actual scope of PM processes in industrialization projects, where it could be easily confused with the (assumed) stage-gate system in place. This is actually an improvement by itself, defining exactly what the role of the project manager is and assigning responsibility to those who are accountable for it. The next step on building the To-Be model involves research about PM best practices, from the PMBoK of choice. Although, the recommendation is the organization to select a PMBoK, benchmarking on other ones can be useful. At this point, it would be interesting to have PM certified professionals (ensuring their expertise in PM) involved in order to perform the evaluation of the best practices that could be applied as improvements to the current process, allowing the review of the As-Is model to be made. At last, the final step in building the To-Be model would be to assure the PM methodology or general PM practices' integration with the stage-gate system in place used for the process development, contributing to a better definition of the work, and a better understanding of the phases to be performed to ensure deadlines accomplishment.

Once the To-Be model is built, it should be validated by the stakeholders that are directly affected by it, namely project managers, and those that will be of great relevance to help on the implementation, project sponsors. The steps described to build the To-Be model are presented in Fig. 3.

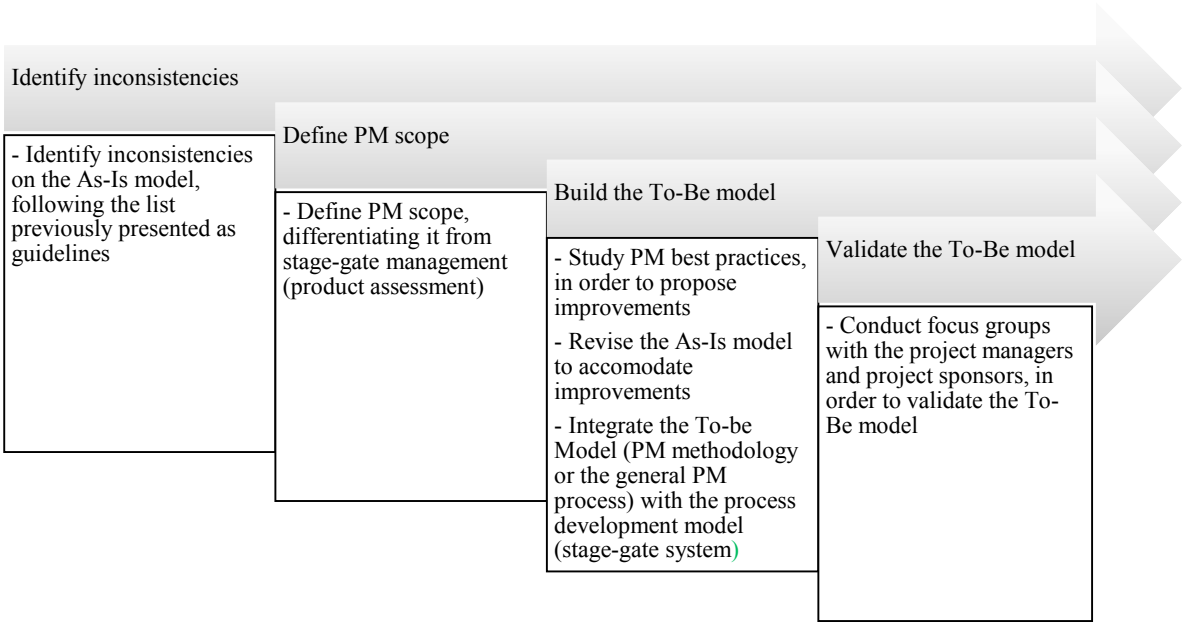

Fig. 3. Required steps to map the To-Be model

5. Conclusions and future work

Industrialization projects account for a very specific context, where sometimes the role of PM practices may not be as evident as it should. This paper presents a proposal towards the development of an approach to facilitate the development of a standardize PM methodology that would help in solving this issue. The proposed approach was based on the detailed definition of the current state of PM practices applied at an organization's industrialization projects (As-Is model) and further development of the future scenario (To-Be model), considering identified inconsistencies and PM best practices improvements, and bridging the gap, by mitigating problems that may arise with the changes in processes. There are also some suggestions on which formats to present the mapped PM process, such as the workflow on Fig. 2 and the table for registering existing templates (Table 2). This approach is intended to work as a guideline for developing a standardized PM methodology, understanding what exactly the PM role is in industrialization projects, aiming at supporting the project managers and their teams in ultimately achieving projects' success.

For future research, it would be useful to apply the approach for developing a PM methodology to other real case studies. The application of the approach to other case studies would allow to discuss mainly the mechanisms that may be used to mitigate resistance when implementing the new PM practices, the previously mentioned "bridging the gap", as well as to indicate improvements to the proposed approach developed based on a single case study.

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