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A Step for Improving

THE TRANSITION BETWEEN TRADITIONAL PROJECT MANAGEMENT TO AGILE PROJECT MANAGEMENT

Using a Project Management Maturity Model

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ABSTRACT: AGILE PROJECT MANAGEMENT (APM) IS SUPPOSED TO REPLACE THE TRADITIONAL PROJECT MANAGEMENT (TPM) IN THE SOFTWARE SECTOR AND ALSO IN MANY NON-IT SECTORS. IN THIS PAPER, WE PRESENT THE CONCEPT OF PROJECT MANAGEMENT 'AGILIFICATION' AS A SMOOTH TRANSITION FROM TPM TO APM. IN ORDER TO DEVELOP THEIR APM CAPABILITIES, COMPANIES NEED APM MATURITY MODELS AND SCENARIOS TO TRANSFORM THEIR PROJECT MANAGEMENT ROUTINES. WE DEFEND THAT A KEY INSTRUMENT OF THE TPM, WHICH IS THE PROJECT MANAGEMENT MATURITY MODEL (P3M), CAN BE ADAPTED TO APM. AFTER IDENTIFYING KEY PRINCIPLES IN BOTH TPM AND APM, THEIR CONVERGENCES AND DIVERGENCES, THIS PAPER PROPOSES A CONCEPTUAL AND PRACTICAL FRAMEWORK CONSISTING OF BEHAVIOR ONTOLOGIES AND TWO TOOLS THAT FACILITATE THIS AGILIFICATION: A MATURITY GRID AND A DIAGRAM DISPLAYING AGILIFICATION SCENARIOS. THESE PROPOSALS ARE APPLIED ON A CASE STUDY RELATED TO THE SCHEDULE MANAGEMENT AUDIT CARRIED OUT BY CONSULTANTS IN A LARGE COMPANY.

KEYWORDS: PROJECT MANAGEMENT, AGILITY, PROJECT MANAGEMENT MATURITY MODEL, ASSESSMENT.

1. Introduction

Traditional Project Management (TPM - also called heavy, linear or bureaucratic project management) (Charvat, 2003; Muller and Turner, 2010) is based on a sequential conception of the project dynamics. This temporary organization is then driven by fully defined requirements, deliverables, scheduling (Boehm and Turner, 2003), tools, mandatory roles and processes designed by experts belonging to the "techno structure" (Mintzberg, 1980). Project managers are expected to implement the processes as strictly as possible and auditors check whether their ways of managing projects comply with standards.
By contrast, Agile Project Management (APM) (Conforto, Amaral, da Silva, Di Felippo, & Kamikawachi, 2016; Dalcher, 2011) derives from an "adhocratic" and iterative conception of the project (Lee, Reinicke, Sarkar, & Anderson, 2015; Rose, 2010).

Project dynamics depend on teams or communities exhibiting daily reactivity, quick communication, creativity and flexibility. Project actors work autonomously by acting iteratively and by using a shared pool of resources or specific Information Technologies (IT) (Henriksen & Pedersen, 2017). Under APM, project managers play a key role as enablers facilitating the team work (Elonen & Artto, 2003).
APM and TPM are two opposite ways of conceiving and managing projects. Nevertheless, it is possible for organizations that wish to change their routines, to shift from one pole (TPM) to another (APM). We define 'agilification' as the process by which organizations make this shift effective. Agility being a buzz word qualifying the ability to behave quickly, with celerity, promptness, astuteness, reactivity, flexibility, dexterity, etc., we refer to the following definition (Conforto et al., 2016): "ability to change project plan as a response to customer or stakeholders needs, market or technology demands, in order to achieve better project and product performance". Agilification supposes then to improve team's ability to react.

Agilification may be conceived as a disruption. On the contrary, we assume that the shift from TPM to APM can be considered as an incremental process. One of the theoretical reasons explaining our conception comes from the work of theorists of "organizational ambidexterity" (Tushman & Nadler, 1978), who explain that organizations combine "exploitation of old certainties" and "exploration of new possibilities" (March, 1991). In the case of project management, ambidexterity has a specific meaning: this type of management balances the implementation of predefined processes (exploitation, as TPM highlights it) and the guidance of improvisation (exploration, as APM mentions it). Moreover, empirical works show the complementary between APM and TPM. For instance, whereas APM has a significant impact on projects' efficiency, stakeholders' satisfaction, and internal perceptions (Pedro Serrador & Pinto, 2015), it does not concern all "areas of the project management" (Whyte, Stasis, & Lindkvist, 2016). In large companies designing complex and potentially hazardous products, TPM remains thus dominant in risk or contract management. Therefore, an issue arises: What TPM principles can be either kept or reject to make agilification successful? We defend that a TPM's key instrument, which is the Project Management Maturity Model (P3M), is sufficiently generic and flexible to be adapted to APM. Nevertheless, existing P3Ms require some substantial improvements and changes that we will present in this article. We will illustrate our theoretical proposal by a case study related to the schedule management process agilification desired by the senior executives of a large company.

This paper is structured as follows: in section 2, we will present a brief view of TPM principles vs. APM fundamentals, with a focus on "Scrum" (Setpathy, 2016). In section 3, we will explain why existing TPM's P3M is not fully compliant with APM. In section 4, we will identify the blocking points to propose a conceptual model of a P3M consistent with both TPM and APM. In section 5, we will present three new tools facilitating agilification: a conceptual framework depicting the context of TPM and APM, a maturity grid, and an illustrative tool displaying agilification scenarios. Auditors evaluated the relevance of these tools. In section 6, we will discuss the results, before concluding the paper.

2. TPM Principles vs. APM Maxims

2.1. *State of the art of TPM*

Principle 1.T (P1.T, and 'T' for 'Traditional): The achievement of Project Key Performance Indicators (KPIs) describe project success. This KPI is supposed to drive projects' reliability, efficiency, etc. **P2.T**: Project successes (vs. fails) are explained by the fact that project managers implement (or not) practices recommended by experts in project management (T. Cooke-Davies, 2002). **P3.T**: these practices are tasks producing well-defined outputs, e.g. Work Breakdown Structure (WBS), and by extension: working rules, e.g. create the WBS once the Product Breakdown Structure (PBS) is defined. **P4.T**: these tasks are parts of project management processes having also working rules. **P5.T**: when performing a mission, auditors assess whether the organization implements best practices or practices differentiating it from nearby organizations, e.g. competitors, followers, etc. **P6.T**: There is a scale of perfection dividing the maturity degree into levels from the lowest (no skill) to the highest (excellence). Process maturity depends on a Confucian vision of learning: without any predefined process, the project managers improvise harmfully, then they gain maturity by conforming to a pattern created by experts. Once this pattern is assimilated, they can create improved ways of performing processes. Moreover, maturity is an ordinal performance: to reach the maturity level N, it is necessary to master the level N-1. TPM aims at making it impossible to alter the attained maturity level, as in Deming's wheel. **P7.T**: project management concerns different separated domains (syn. areas). Project managers' work has then a wide scope; they must be aware of different aspects, implement various practices, e.g. technical specifications, team animation, cost reporting, etc., and produce several types of deliverables, e.g. bill of requirements, scheduling charts, scorecards, contracts, meeting reports, etc.

TPM has practical features explaining why it is the ground of different project management models, tools or methods. Thus, the Capability Maturity Model Integration (CMMI), created in the 1990s by the Software Engineering Institute, uses a process improvement (or perfection) scale with five **maturity levels** (or steps) (see P6.T). Other models have taken up this proposal (Andersen & Jessen, 2003; Lasrado, Vatrapu, & Andersen, 2015; Project Management Institute, 2016b). The second interesting tool is a **collection of project domains** (see P7.T). The PMBOK® identifies ten of them, as well as the Berkeley Process Management Process Maturity Model or (PM)2 (Kwak & Ibbs, 2002), e.g. cost, data integration, procurement, Human Resource, deliverables, risk (reliability), etc. The third tool is a **list of practices to check** (see P4.T). Kerzner's Project Management Maturity Model suggests a list of 183 items (Kerzner, 2017). The Project Management Solutions Project Management Maturity Model has a longer and more detailed list of items (Grant & Pennypacker, 2006). PMI's Organizational Project Management Maturity Model or OP3M (PMI, 2013) proposes about 600 best practices usable as benchmarks to achieve KPIs (see P1.B and P2.T). Once the practices belonging to different project domains checked, auditors can synthesize evaluation data in a fourth tool called a **maturity grid** (syn. matrix). The scored grid helps managers to formulate expectations in terms of practice improvement.

The TPM concerns many sectors and types of large organizations; it is then difficult to question its effectiveness. Nevertheless, does it remain relevant when organizations want to become agile? We will show how agile projects are based on a contrary conception.

2.2. *Scrum, APM Method Archetype*

Experts in software engineering have noted that some projects based on TPM sometimes fail to develop applications in a timely manner satisfying clients' needs or skills. Therefore, these experts have proposed a model which emphasizes agility (Conforto et al., 2016). Despite its very marked IT character, this agile feature is now recognized as a reference by many organizations, even if their core business is not software. (Dijksterhuis & Silvius, 2017)

There are different APM methods; the one we will focus on in this paper is "Scrum". Scrum creators propose a body of knowledge based on clear principles. The method they promote is "an adaptive, iterative, fast, flexible, and effective methodology designed to deliver significant value quickly and throughout a project [...] A key strength of Scrum lies in its use of cross-functional, self-organized, and empowered teams who divide their work into short, concentrated work cycles called Sprints" (Setpathy, 2016). Whereas Scrum targets the project, it is clear that its principles differ from those of the TPM. They can be pointed out in a mirror with what has been presented in section 2.1.

P1.A ('A' for 'agile'): agility drives to project success; especially in terms of customer's value (usability, price, etc.) and lead-time (syn. project reactivity). (Henriksen & Pedersen, 2017) **P2.A**: project successes are explained by the fact that project managers and teams implement collective, iterative and time-focused practices and working rules. Moreover, the project manager is not a conductor alone. Responsible for the "roadmap" definition and planning, s/he collaborates with the "product owner", who is the customers' spokesperson, and the "scrum master", who leads teams' meetings. Beyond the use of commonplace tools, project actors rely on a pool of shared resources consisting of working environments, e.g. rooms for stand-up meetings ("daily sprint"), visual management devices, e.g. "scrum board", rapid or virtual prototyping tools, etc. **P3.A**: agile practices enable teams to develop in short times intermediary prototypes satisfying prioritized requirements ("sprints"). Scrum is then based on the assumption that the bill of requirements that is called "product backlog" can be broken down into functional modules. **P4.A**: Scrum atom is not a task, but a loop occurring in a very constrained period ("time boxing"). The feature of this loop is not elaborated by Scrum's creators. Nevertheless, we can assume that it is made of "ad hoc processes" or explorations; it is based on the continuous collaboration between projects' actors, and its control is autonomous, i.e. made of self-organization and "mutual adjustments" (Mintzberg, 1978). **P5.A**: Scrum experts identify APM's best principles and resources. **P6.A**: there is no perfection scale of agility. Nevertheless, if every agile project requires "core roles" (e.g. project manager, scrum master and product owner), since an organization's portfolio reaches a certain size, APM also requires "non-core roles", e.g. "Scrum Guidance Body" and "Chief Scrum Master [who] is responsible to coordinate Scrum-related activities" (Setpathy, 2016). **P7.A**: there is no clear mention of the domains.

Once the agile pattern has been illustrated in the case of Scrum, it is now possible to compare TPM's principles about project management maturity vs. APM's ones.

3. Two Mirror Frames

P1.T vs. P1.A (Success definition) – the definition of KPIs corresponds to the first difference between TPM and APM. Under TPM, the process conformity (or compliance) should ensure to achieve high PKIs. Moreover, as part of the bureaucratic tradition, practices are supposed to be safer and more efficient since they are detailed as precisely as possible. By acting conformably, project managers reduce unwanted and time-consuming loops slowing down the planned progress of the project (P Serrador, 2013). This conception contrasts with APM, which is more

focused on customer's value, lead-time, and teams' dynamics than conformity with predefined processes. Under APM, projects are supposed to be extremely intensive; the project organization develops the most valuable deliverables that are produced as soon and as frequently as possible (Conforto et al., 2016).

P2.T vs. P2.A (Project Manager Role) – Both TPM and APM assume that projects are manageable entities, explaining why the implementation (or not) of certain practices leads to success (vs. failure) (Gillard, 2009; Ramazani & Jergeas, 2015). The current guidance of TPM and APM is not the same: exploitation and standardized process implementation for TPM vs. exploration and improvisation for APM. In both cases, experts and theorists build and improve, as the years pass, a body of knowledge, the Scrum BoK being currently less mature than the PMBOK®.

P3.T vs. P3.A (Target Outputs) – The temporal and spatial scales (granularity) TPM takes into account differ from those targeted by APM. Scrum has a finer granularity than TPM; it is focused on a weekly work, with sprints and scrums management, and even a daily work, with the animation of stand-up meetings. APM is therefore closer to its operational actors and its monthly, weekly or even daily project dynamics.

P4.T vs. P4.A (Processes) – TPM states that the best practices (and the working rules) are atoms, which are assessed independently and be replicated as parts of sequences. On the contrary, Scrum refers to loops which have more complex behavioral features. Furthermore, Scrum experts point out the key role of shared resources, IT included, and then organization's digital maturity (Schumacher, Erol, & Sihn, 2016). Another source of major cleavage concerns the conception of openness. Under TPM, it concerns the benchmarks of best practices to apply as such (see P5.T). PMBOK's maturity level 5 mentions another term referring to openness, which is innovation (see P7.T). Nevertheless, this word is reduced to incremental procedural improvements; above all, it is mentioned only once the lower maturity levels have been reached, and therefore project managers implement standardized process. APM is in contradictory with this conception: actors are creative and empowered individuals, improvisers, not agents executing mandatory detailed procedures.

P5.T vs. P5.A (Auditing) – Both TPM and APM explain a part of the organizations' capabilities by the way their projects are managed. However, the capabilities under study differ under these two types of project management. Under TPM, the capability concerns the ability to implement mandatory practices and processes. On the contrary, APM theorists are attentive to the stakes, to the opportunities, but also to temporal constraints or the ones derived from collaboration, creation, etc., referring then to organizational openness.

P6.T vs. P6.A (Perfection Scale) – The perfection scale in the case of TPM is based on a work initiated since the 1990s on Quality Management, and then process maturity assessment. The maturity of agility is clearly a point to develop, as we will see in section 5.

P7.T vs. P7.A (Domains) – Under TPM, tasks are atoms, i.e. organizational elements that can be distinguished and then checked separately, and processes' domains are a group of tasks of the same nature. Scrum does not mention domains.

This section has checked the differences between TPM and APM (defined under Scrum) concerning each principle (**Table 1**).

When reading Table 1, it is easy to note that we are in the case of an existing managerial tool (TPM) which is not fully consistent with a historical situation, i.e. expectations of managers in large companies in terms of agilification of the project management routines. This situation is not exceptional; the literature has still emphasized the importance of selecting a suitable model for each historical context (T. J. Cooke-Davies & Arzymanow, 2003; Jugdev & Thomas, 2002). The main issue is then to elaborate a reference framework for an agile P3M, based on one TPM's components, which is the Project Management Maturity Model (P3M).

TPM: Traditional Project Management, with a focus on the PMBOK®	**APM: Agile Project Management, with a focus on Scrum**
Processes are introvert entities that can be considered as mandatory and detailed procedures. They should be replicated as series products. Project managers are the core actors of the projects implementing these predefined processes (exploitation).	Agile projects involve actors with creative potential and empowerment. Processes have irreducible *ad hoc* features (exploration). Project management is realized by different individuals playing separated roles: project manager, scrum master, etc.
KPI is process conformity or compliance guaranteeing by itself projects' efficiency and reliability.	KPI is agility, with a focus on customer's value and lead-time (project reactivity).
The perfection scale ranges from improvised practices to standardize ones, then innovative ones improving processes (Confucian conception of learning).	There is nothing about this topic in the current literature about Scrum.
The practices to check are atoms, *i.e.* separated tasks with a single well-defined deliverable, and working rules expressed by a proposition (If… Then…).	The practices to check are loops with complex behavioral features: creativity, exploration, collaboration, autonomy, etc. These loops are controlled by lead-time (reactivity). The current literature about Scrum does not elaborate the content of the loops.
Process specialists are part of the techno structure; they are not involved in concrete projects. We have then a clear dichotomy between project design and project realization.	APM experts play a peripheral role: project operational and practical context is more important than the aboveground process.
Only resources for project managers are taken into account and IT plays a secondary role	Projects suppose a pool of shared or common resources, and IT is one a key advantage to APM.
TPM sometimes fails to produce in a satisfying lead-time acceptable deliverables. Moreover, it cannot be used to detail project's daily life.	APM fails to develop complex products. Its scalability is then questionable when the project is not just about the software sector.

Table 1. TPM vs. APM.

4. A Methodology to Assess Project Maturity from TPM To APM

In this fourth section, we will propose a Project Management Maturity Model (P3M) integrating some characteristics of TPM and APM defined above. The proposed P3M will be elaborated in three phases: set a specific ontology of the project management domain, which is a behavior ontology in our case, and then build the maturity grid, to conclude with the presentation of the roadmap for agilification.

4.1. Phase 1. Set a Project Management Behavior Ontology

Our first assumptions that every P3M should be based on an ontological basis, i.e. an explicit conception of the project's domain made of specific entities (projects, actors, process, practices, deliverables, resources, etc.), properties (conformity, agility, reactivity, maturity, etc.) and descriptive (is a, is part of, etc.) or causal relations (the maturity level explains project successes or fails, etc.). We suggest that these ontological fundaments can be based on a generic entity called 'behavior'; project management ontology is then a type of behavior ontology. The behavior is an entity with the following characteristics: (1) It is labelled with an action verb describing what is done. (2) It is related to an individual or collective actor with a well-defined role in an organizational structure. (3) It is triggered when a given event occurs (stimulus). (4) It produces an observable output (response). (5) It occurs in a given context made of alters and resources. (6) It drives by internal variables (goal-oriented). (7) It follows some given modalities, maturity included. This general conception of the behavior has different instances depicting different natures of the project that is going to be assessed.

Figure 1 displays the instances of the behavior. The grey T defines TPM's instances of interest. The first instance we can derive from the behavior ontology is the perfection scale. Made of maturity levels (see P6.T), it refers to modalities of the behavior to check. A level of the perfection scale qualifies how project managers should behave. Do they improvise? Do they conform to an existing pattern? Do they improve the ways of performing processes? We have also instances of the behavior when we mention project domains (see P7.T). Any of them defines the content of the behaviors projects managers realize: operations vs. transactions, e.g. PBS (Product Breakdown Structure) definition vs. procurement. The domains also mention the results of their behaviors, e.g. deliverables, contracts, interpersonal relationships, etc. The behavior has a third instance referring to the types of roles individuals play. They exhibit specific behaviors by managing organizational structures, managing projects, auditing processes, etc. The usual notion of levels of decision refers to the behavior. The strategic level concerns the development of the organizational structure's capability; the tactical

level refers to process maturity improvement; the operational level corresponds to the way projects are led, and the practical level concerns the way tasks are performed in projects. The right side in figure 1 shows who is concerned by the ability to implement best practices defined by experts (Project Manager, Process Auditor, Team). In addition, this figure is useful to understand the evaluation process as it displays how maturity evaluation is driven by process conformity and KPIs.

We can elaborate the previous figure by detailing the content of the project management process (P7.T). As mentioned previously, we conceive each project's domain as a package that clusters specific behavioral instances. Thus, a first package contains the **results** of project managers' activities, either the outputs, e.g. projects deliverables, or the outcomes, e.g. new tasks considered as best practices. Other packages are made of **requirements** guiding project managers' awareness (project goals, KPIs, etc.), **social configurations** with communication and resources (data integration, logistics, Human Resource, etc.), and **interfaces** with stakeholders, particularly suppliers.

Furthermore, any project can be then described following a chronology made of three momenta: (1) Prepare (ex-ante) concerns tasks performed before the start of the project and updated at each milestone to schedule the work during the next phase(s). (2) Monitor (in process) corresponds to tasks performed during the project execution to enable and supervise its progress. (3) Valorize (ex-post) concerns tasks performed at least at each milestone, and in the closing of the project to communicate and to increase the value of the present project.

Another behavior's properties concern the details of the activities: the activity granularity (G: At what level of detail?), the resource involvement in the activity (R: who?), and the activity frequency (F: when, how many times?). Activity Granularity (G) concerns the level of detail that may be used to describe the results of project management activities. Resource involvement (R) concerns the actors (for instance, the project manager, the team, the stakeholders) and tools necessary to complete the PM activities. Frequency (F) concerns the temporality of the PM activities: Is there a unique execution of the activity? Is it repetitive? This includes time plans, cycles, deadlines, etc.

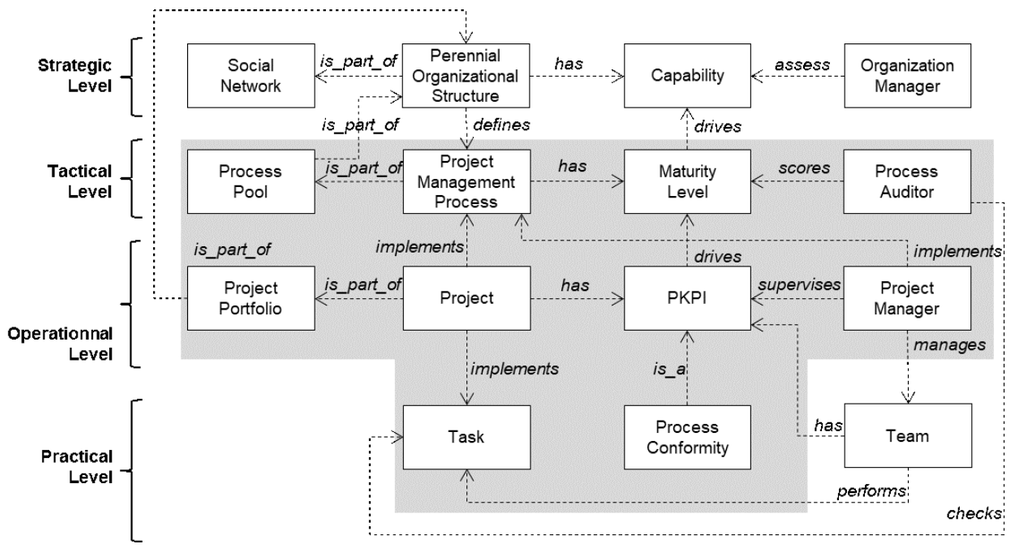

Fig.1. Behavior Ontology of TPM Maturity Model.

4.2. *Phase 2. Build the Maturity Grid*

Project deliverables have their own interest; they can be used as past behaviors' output traces. Thus, the collection of project deliverables could be stored in a warehouse and then auditors could verify if project managers produce or not the checked and stored items. **Figure 2** displays an example of a TPM maturity grid that auditors can use to perform their mission.

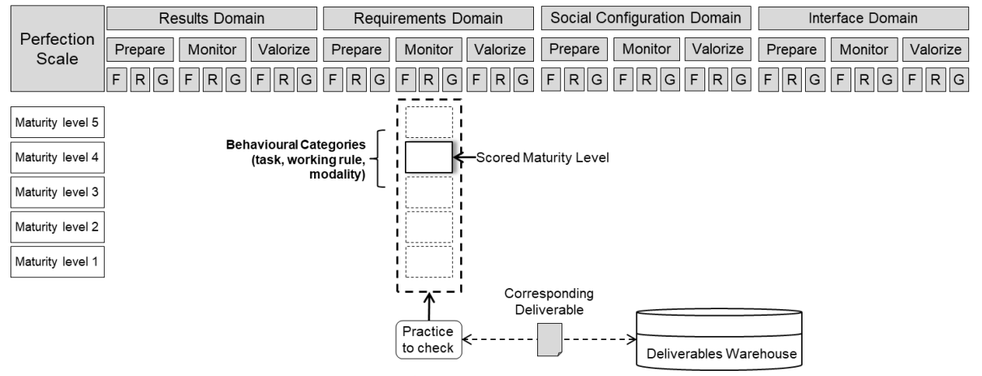

Fig.2. Example of a Maturity Grid Framework.

4.3. *Phase 3. Define the Roadmap for Agilification*

The behavior ontology described above concerns TPM. What happens in the case of APM? If the conception of agilification as an incremental process is accepted, then parts of the TPM pattern can be reused. Hence, we have derived the behavior ontology of APM maturity models that is displayed in **figure 3**. In comparison with figure 1, for example, we note that: new individuals are added (scrum

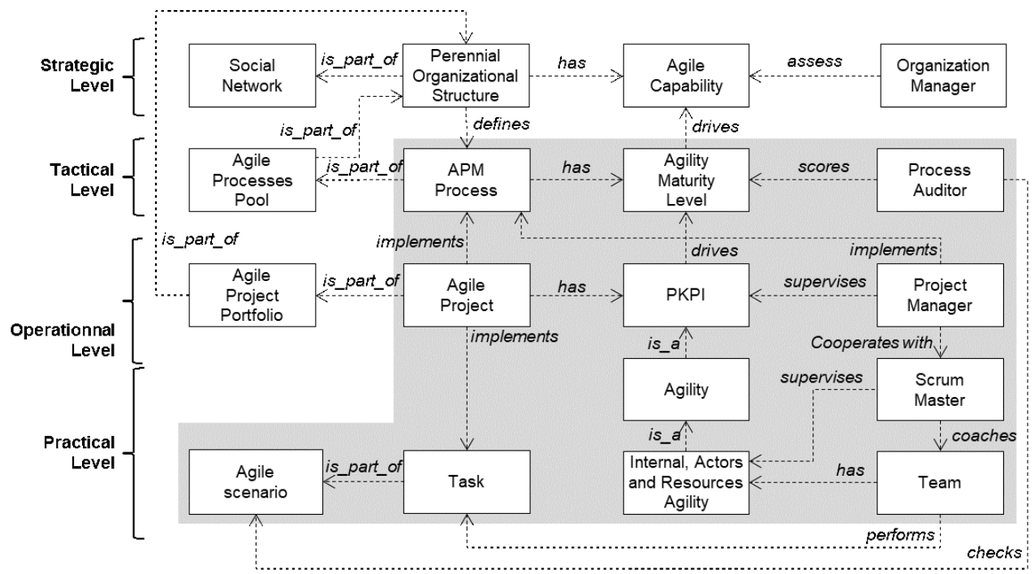

Fig.3. APM Maturity Process Behavior Ontology.

master, product owner) (see P2.A), KPIs are not the same since they concern agility (see hereafter) (see P1.A), and the bottom of the diagram is elaborated, corresponding to finer granularity by which APM describes the projects (see P3.A). The practice to check is not a separated task, but a collective and time-constrained iteration or loop, that is, an agile scenario (see P4.A). Finally, the shade square indicates the instances of interest under APM.

Finally, the perfection scale has a specific content since it refers to agility. We propose then five maturity levels in agility inspired from Wysocki's work (2006). These steps are: absent agility, i.e. TPM monopole (lack of agility, maturity level 1). Adaptive agility inducing variations of an existing well-defined framework (maturity level 2). Proactive agility creating a new project scope (maturity level 3). Complex agility taking into account different projects (maturity level 4). Global agility characterizing all projects belonging to the organizational structure's portfolio (maturity level 5). Agilification is implemented by individuals or small teams exhibiting the project managers' astuteness. Under level 3, the project scope or roadmap is redefined after the sprints. The organizational impact of agile decisions is then stronger than in level 2. Under level 4, this type of agility concerns not only a single project, but also interdependent agile projects; Scrum Chief Masters are usually required. Finally, in maturity level 5, agility is a key capability of the organizational structure; no more processes are hierarchical. The organization has achieved its agilification in the field of project management.

Our presentation of TPM and APM was conceptual; the next section will illustrate the types of tools required to implement project management agilification in a real scenario.

5. Agilification in Practice: The Case of the Scheduling Process

We have based our case study on an analysis of several missions realized by auditors belonging to the consultants' subsidiary of a large IT company. This subsidiary accompanies the digital transformation of large firms or public institutions of various sectors, it employs 2,000 consultants.

In 2017, we interviewed, with open-ended questions, ten experts specialized in project management audits, with 6 to 20 years of experience. We collected their knowledge about the way they and their clients conceive TPM, APM, and agilification. We explored their consulting missions and results. Most of the consultants and their clients know and put into practice the PMBOK®; they consider TPM as a reference even though they have an overview of APM.

In the present case study, we will focus on one project management process, which is schedule management. A part of our data materials came from an audit mission realized for a department of a large company in charge of the development of complex capital goods, e.g. steam generators.

The consulting mission was based on a panel of 20 critical past or current projects. Over the duration of the mission (24 months), two experts, with more than twelve years of project management experience, three senior project managers, with more than six years of experience, and five consultants used the proposed project management maturity framework. The team has written many documents that we have read and analyzed for this research.

5.1. *Phase 1. A Behavior Ontology of Schedule Management*

Starting from this rough material, we instantiated the APM framework as displayed in figure 3. This diagram was presented to the experts and made their ideas clear. Hereafter, they validated the fundamentals of the ontologies displayed in figures 1 and 3. In the right column **figure 4** displays who are the members concerned by APM, i.e. Scrum Master. It also shows how these actors can acquire an agile capability, such as doing the "agile task" which is going to be the basis of the agilification scenario. This instantiation is useful for the auditor to identify how to implement the new agile capability, e.g. how to score the agility maturity level? How define the agilification scenario?

After developing the conceptual clarification, we focused on one of the points of projects' management process, namely schedule management. Both TPM and APM mention it. They use standard tools like the Gantt chart, but the content of the chart changes: it is a single task under TPM vs. a sprint under APM. We began the elaboration of a maturity grid consistent with the TPM. To achieve this task, we used the generic framework displayed in Fig.2 to depict properties concerning the project schedule, i.e. for frequency (F, how often the planning is updated or changed?), for resource involvement (R, who is updating the planning?) and for activity granularity (G, what has been done to elaborate the planning?).

5.2. *Phase 2. Define the Maturity Grid of Schedule Management*

Next, we elaborated a specific perfection scale derived from CMMI (see P6.T). This scale has the following steps: maturity level 1, not-implemented or absent project management processes; maturity level 2, defined project management process, but only at a local level, e.g. in a given project area; maturity level 3, analyzed project management processes; maturity level 4, managed interdependencies in project management process; level 5, capitalized process. The refinement and validation of the proposed framework and the content of the following maturity grid were performed with meetings with the interviewed consultants. The grid displays the tasks to be achieved to obtain higher levels of maturity in agile schedule management. (**Table 2**)

5.3. *Phase 3. Define the Roadmap for Schedule Management Agilification*

During the mission, consultants and their client detected several challenges, e.g. the requirements were continuing to change due to the concurrent design; and the obsolescence of the schedule was accelerating. It was decided to "agilify" the schedule management. Several derived challenges occurred then, e.g. How to reorganize teamwork? How to train personnel in APM, especially in terms of sprints implementation (see P3.A) and resources sharing (see P2.A)? How to align sprints to the PBS, defined before the realization of the project, and then to prioritize the requirements in monthly backlogs (see P3.A)? How to convince and involve top managers in this first APM experience disrupting with organizational routines, i.e. TPM?

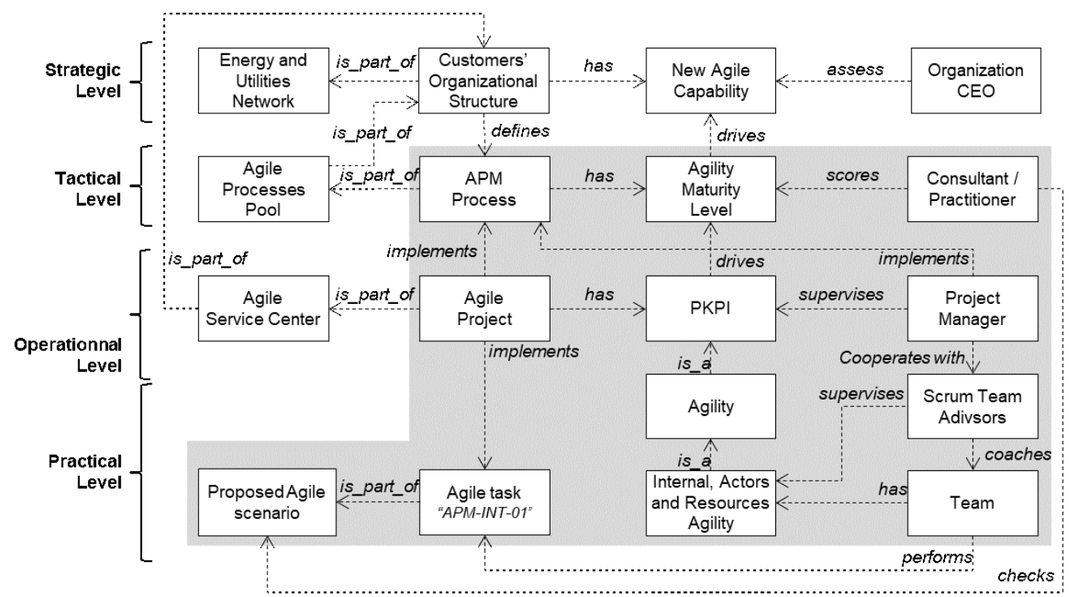

Fig.4. APM Conceptual Framework applied to the Case Study.

SCHEDULE MANAGEMENT		Level 1		Level 2		Level 3		Level 4		Level 5	
		Absent agility, i.e. TPM monopole		*Adaptive agility inducing variations of an existing well-defined framework*		*Proactive agility creating a new project scope*		*Complex agility taking into account different projects*		*Global agility characterizing every projects belonging to the organizational structure's porfolio*	
Preparation	Frequency										
	Resources Involvement	Make a list of resources	APM-INT-01	Build the user stories by agile team: link ressources and activities	APM-INT-02	Build a flexible schedule by agile team	APM-INT-03	Build the schedule by agile team consistent with all organization strategy	APM-INT-04	Improve cycles of co-building stories with all stakeholders	APM-STK-5
	Activity Granularity	Make a list of activities				Define a prioritized product backlog measure and analyze its activities	APM-QUA-03			Improve schedule preparation in whole organization each sprint	APM-INT - 5
Monitor, Control & Follow	Frequency			Update burdown chart in the end of several sprints	APM-SCH-02	Update burndownchart several times in the sprint	APM-SCH-03	Update the burndown every inter project milestone	APM-SCH-04	Capitalize and improve the burndown chart for evolving with the	APM-SCH-05
	Resources Involvement			Follow the sprint review involving scrum master	APM-RH-02	Follow the sprint review involving scrum master, product owner and customer	APM-RH-03	Follow the sprint reviews in coherence with other projects' schedule	APM-RH-04	Manage sprint reviews at the managerial and operational levels	APM-RH-05
	Activity Granularity			Identify planning gap and schedule risks in user stories	APM-RIS-02	Build a Risk Burndown chart	APM-RIS-03	Take corrective actions according to inter project schedule risk	APM-RIS-04	Capitalize lessons learned from actions: risk predictions	APM-RIS-05
Valuation and Share	Frequency			Communicate product backlog every sprint	APM-COM-02	Communicate sprint review results	APM-COM-03	Communication actions according to the gaps and risks	APM-COM-04	Do real time communication with a sharing tool in whole organizational structure	APM-COM-05
	Resources Involvement	Present the schedule to stakeholders	APM-INT-01	Communicate the schedule to the scrum master and team		Communicate the planning to the teams of the other projects (inter projects)		Communicate actions according to gaps to all stakeholders	APM-STK-04		
	Activity Granularity	Identify customer contract milestones	APM-SCO-01	Define minimum viable product and main constraints	APM-SCO-02	Define and record minimum viable product and deliverables	APM-SCO-03	Establish deliverables and constraints of different levels: contractual, method; and interface with other projects	APM-SCO-04	Improve the process of generating deliverables for whole organization	APM-SCO - 05

STA: Stakeholders	**HR:** Human Resources	**RIS:** Risk	**INT:** Integration	**SCO** Scope	**COM:** Communication	**QUA:** Quality	**COS:** Cost *(not present)*	**SCH:** Schedule	**PRO:** Procurement *(not present)*

Table 2. Example of APM Schedule Management Maturity Grid.

Under TPM, project management tasks belong to separated areas (see P7.T). On the contrary, we found that this disaggregation is harmful: tasks, processes, and then areas are interdependent and clustered. We proposed then to break down these silos; auditing one project area (in this case, schedule management) requires to audit another connected areas, e.g. scope management, integration management, quality management, etc.
The conceptual framework and the maturity grids are descriptive tools. They are therefore useful to guide the diagnosis, which is an upstream phase of an audit mission. This matrix tool reduces the number of items to check from 220 to 44, reducing then the audit time (6 to 2 weeks). It enables the consultants to act then in accordance with P1.A. This concludes with technical and managerial recommendations to improve project management maturity. In the present case, the issue was: what actions should be performed to agilify Schedule Management? Answering this question needs action-focused tools. The first we developed is a two axes map combining: (1) the criticality of the tasks under study (axis Y), that is, the expected impacts of the task on the results of the project, and (2) their accessibility (axis X), that is, the difficulty in performing this task. Usually, when auditors and their customers conceive an improvement plan, they should take into account the risks, challenges and opportunities to execute each task. The evaluation of these criteria for each task was performed by the interviewed project management consultants. The resulting map is correlated with the fact that upper level maturity tasks (level 05) have more impact on the whole organization (high criticality). The more the task is on the left, the more difficult it is to perform it.

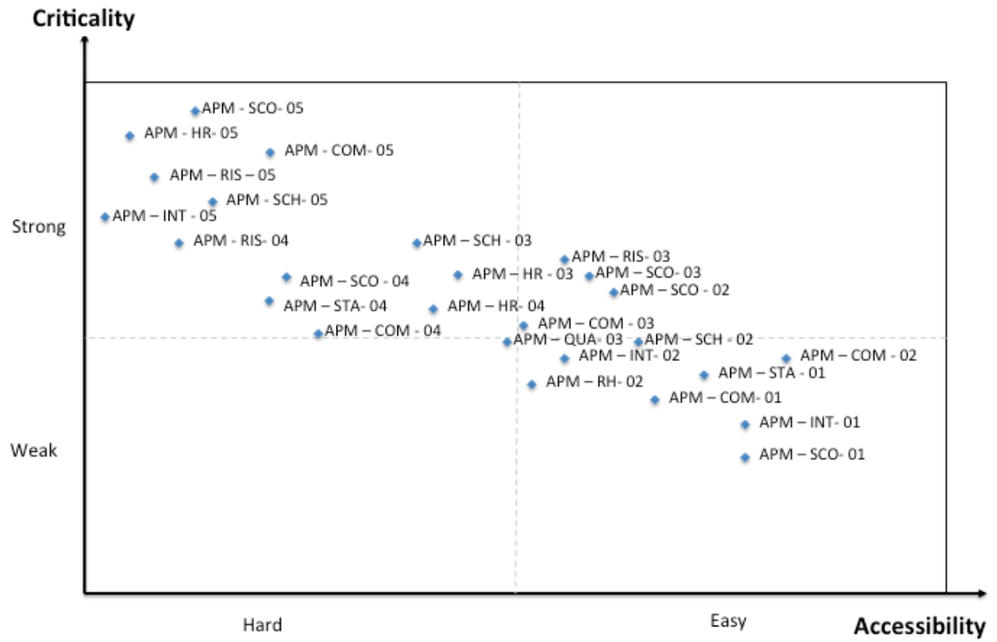

Fig.5. Candidate Tasks Distribution for Agilification.

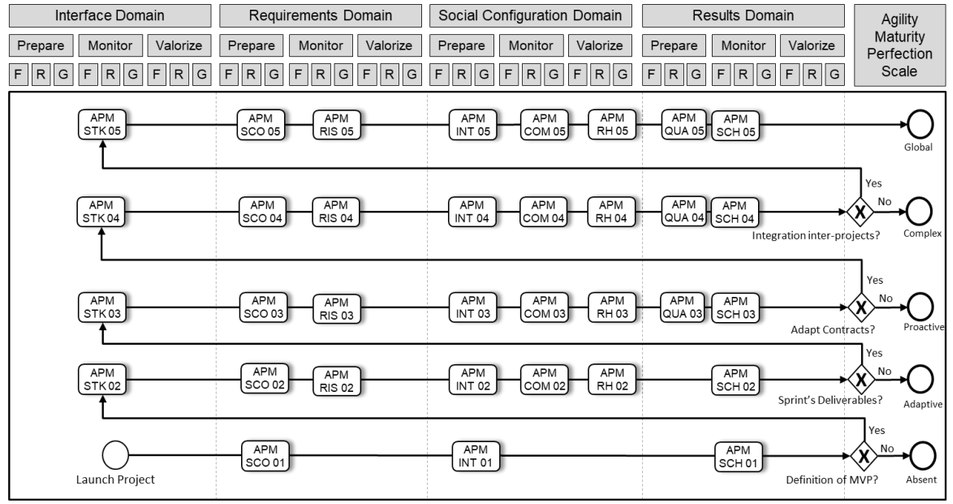

Fig.6. An Agilification Scenario of Schedule Management.

Once the 'tasks cloud' displayed, the last step is to sort them and to elaborate agilification scenarios. We used the graphical notations of BPMN (Business Process Model and Notation, 2006) specified by OMG (Object Management Group). Figure 6 displays an agilification scenario of Schedule Management. In the studied case, project management consultants guided the scrum team managers through this agilification scenario,

task by task. They followed the proposed path until getting the desired maturity level for the concerned organization.
Following the proposed agilification scenario of scheduling, design updates were planned and implemented with additional sprints rather than handling each one separately; teams' members improved their ability to anticipate sprint backlogs; the implementation of daily review meetings increased schedule reactivity; parallel teams gained understating on the importance of software integration to coordinate their schedules, etc. Finally, the successful implementation of local and short time experiences in APM was a good way to convince top managers to adopt this type of project management and extend its uses for future projects, the whole organization developing a new capability in terms of agility.

6. Discussion

The models and tools proposed in the two previous sections are supposed to satisfy both "theoretical goals" (How to use a behavior ontology to model the field of project management? etc.), and "practical goals" (how to facilitate agilification?). Our work suggests then two types of discussions, theoretical and practical.
From the theoretical perspective, prior work documented the importance of project management maturity models (Grant & Pennypacker, 2006; Kerzner, 2017; Kwak & Ibbs, 2002; PMI, 2013; Software Engineering Institute, 2006). These models focused on Traditional Project Management (TPM) only. However, the irruption of Agile Project Management (APM) makes obsolete the mentioned maturity models according to surveys and testimonials concerning project managers (Conforto et al., 2016). Therefore, in this study, we have identified and compared TPM and APM principles (P1.T-P7.T in section 2.1 and P1.A-P7.A in section 2.2). The existing literature emphasizes the differences between them (Pedro Serrador & Pinto, 2015).
Nevertheless, our results are much less clear-cut; there are both divergences and convergences between these two conceptions of the project management (Section 3). These findings extend current literature (Dijksterhuis & Silvius, 2017; McClory, Read, & Labib, 2017; Silvius & Schipper, 2015) demonstrating where it is possible to establish a common framework of project management assessment.
In the present paper, the second theoretical contribution concerns a common conceptual framework using behavioral categories shared in both project management types (TPM vs. APM). We noted that existing project management maturity models often lack a clear conceptual framework (T. J. Cooke-Davies, Crawford, & Lechler, 2009; Pasian, Sankaran, & Boydell, 2012). This contribution helps to bridge this gap.
From the practical perspective, the analysis of the common framework led us to propose managerial tools to measure maturity in project management. In this way, our theoretical work became the starting point of practical contributions. Those tools were tested by experts in project management audits, contributing to extending the limitations of P3M literature such as described by (Görög, 2016). Practical contribution of this paper relate to a maturity grid that complies with APM fundamentals (Table 2) and the candidate tasks distribution for agilification (Figure 5). Practitioners need to classify the importance of each task for choosing the most critical and accessible tasks that will enhance agilification. The third practical contribution is the conception of an agilification scenario, where practitioners create the order of tasks they have to implement for reaching the agile maturity level (Absent, Adaptive, Proactive, Complex, Global) that is required by the organization depending on the industry's needs, projects' uncertainty levels, duration, complexity, etc.
Referring to the limits of our work, we did not take into account all the literature about TPM P3M and agile methods. We only referred to the CMMI for conceiving maturity and Scrum for APM. Our choice was to go further, using few concepts, rather than aiming at a comprehensive panorama concerning the comparison between TPM and APM. The auditors pointed out that these conceptual models are more heuristics than ready-to-use tools. The definition of the content of the boxes in the maturity grid can give rise to infinite debates. Even if the idea of process interdependence is mentioned, reasoning by task clusters is an interesting way of not being focused on the precise content of each cell, but on a global picture. We have focused our work on the practical and operational levels as shown in the grey area of Figure 4. Consequently, the strategic level is outside of the scope of this paper, for example, the research did not explore why TPM are hierarchical while APM organizations become more horizontal, or which are the roles in charge to facilitate this change.

7. Conclusion

Agility seems the horizon of project management; the new Agile Project Management (APM) quickly replaces the Traditional Project Management (TPM). Whereas TPM and APM are based on contradictory statements, project management in large organizations requires ambidexterity, i.e. exploitation (process conformity) vs. time and value-constrained improvisation (APM), future project management tools should combine these two facets. This paper gives an example related to a TPM key issue, which is the process maturity evaluation, with a focus on schedule management. The same conceptual framework is proposed to describe and evaluate the process maturity under TPM and under APM; project management agilification being conceived as a smooth transition from this former type of project management to APM. Finally, three tools, validated by consultants, were proposed: a conceptual framework depicting the TPM or APM domain, a process maturity grid consistent with TPM and APM, and a BPMN diagram displaying agilification scenarios.
Whereas the results may be of interest to the project management community, there are at least two weaknesses to bear in mind: the conceptual basis may be incomplete (only the CMMI, the PMBOK® and Scrum are mentioned) and there is no data-driven approach implemented by consultants auditing project management processes.
Agilification is not completed; further research should then concern it. The APM ontology we sketched should be elaborated more formally. Moreover, according to the contextual characteristics of the project, the required maturity level should not be the same. Some projects will require higher maturity to improve their performance and others are 'good enough' with a lower agile maturity level. These characteristics concern the impact of the project under study on the strategy. Existing models do not take into account these key characteristics. Finally, under TPM P3M, the levels of the perfection scale are defined by setting "yes or no" rules related to the assessment of the practice execution or not. Nevertheless, there is no practical way to measure whether it is necessary to stop in one level of maturity for a specific project and for a specific organization, or if it is necessary to keep improving up to level n+1, or n+2 in order to get maximal project performance.

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