Spring 6-10-2017

BALANCING ALIGNMENT, ADAPTIVITY, AND EFFECTIVENESS: DESIGN PRINCIPLES FOR SUSTAINABLE IT PROJECT PORTFOLIO MANAGEMENT

David Hoffmann
University of Duisburg-Essen, Essen, Germany, david.hoffmann@uni-due.de

Thomas Müller
University of Duisburg-Essen, Essen, Germany, thomas.mueller@uni-due.de

Frederik Ahlemann
University of Duisburg-Essen, Essen, Germany, frederik.ahlemann@uni-due.de

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Research paper

Hoffmann, David, University of Duisburg-Essen, Essen, Germany, david.hoffmann@uni-due.de

Müller, Thomas, University of Duisburg-Essen, Essen, Germany, thomas.mueller@uni-due.de

Ahlemann, Frederik, University of Duisburg-Essen, Essen, Germany, frederik.ahlemann@uni-due.de

Abstract

Environmental turbulence puts significant pressure on today's IT organizations, forcing them to proactively respond to changing strategic trajectories and thus to conduct a multiplicity of projects in order to capitalize on emerging opportunities. Although many organizations employ institutionalized IT project portfolio management (IT PPM), they often fail to achieve the desired throughput, struggle with projects that run late, and miss short-term alignment to strategic changes. Further, traditional IT PPM establishes a long-term horizon, which contradicts the organizational necessity to react at short notice. This calls for the refinement of traditional IT PPM towards an aligned yet more flexible dimensioning that is able to adapt to its environment's dynamism. We apply a design approach guided by activity theory (AT) to investigate a revelatory case, to explore an important phenomenon from a novel perspective. We then conduct a focus group, and perform an applicability check to evaluate and refine our suggestions. Finally, we propose three design goals and 12 design principles to address the issues that so often arise. Our research contributes to the nascent body of knowledge by providing a new analytical view on IT PPM and by suggesting recommendations for a significant problem in practice.

Keywords: IT PPM, adaptivity, alignment, sustainability, revelatory case

1 Introduction

In today's technologically driven business environment, organizations need to engage in an increasingly large number of projects. To ensure successful information technology project portfolio management (IT PPM), companies need to select, prioritize, and monitor multiple – often interdependent – projects that compete for scarce resources and vary considerably in size and complexity (Archer and Ghasemzadeh, 1999). Nowadays, rapidly evolving technologies that disrupt companies' traditional operating models and the dynamic nature of business demands cause uncertainty, ambiguity, and variability in the IT PPM function (Karimi and Walter, 2015; Lee et al., 2007), requiring flexible adjustment of IT project portfolios and pressuring organizations to deliver projects at an increasing and unparalleled rate (Lucas et al., 2013). Considering the short-term nature of today's markets, traditional IT PPM, which is often based on annual budget planning (Hope and Fraser, 2003), is not designed to execute beneficial projects swiftly or to adaptively refine the portfolio configuration (Daniel et al., 2014). The pace of change in the internal and external environments of the IT PPM function increasingly jeopardize the idea of alignment with long-term goals and objectives, which calls for a more sustaina-

ble approach that allows for the flexible re-prioritization and selection of projects as needed (Vessey and Ward, 2013). A nascent body of research claims that firms should simultaneously pursue organizational alignment and rapid adaptions to short-term opportunities in order to sustain a business (Gibson and Birkinshaw, 2004; Merali, 2016). This urges IT PPM to establish rigor and discipline in its task execution, while also building flexibility and agility to quickly sense important changes and to timeously respond to them (Lee et al., 2006; Mithas and Rust, 2016). While existing research has yielded a broad range of publications on optimization approaches and mathematical models for IT PPM (Kaiser et al., 2015), it had offered very little advice and virtually no design knowledge on how organizations can achieve a more dynamic approach to IT PPM (Daniel et al., 2014; Frey and Buxmann, 2012). Against this backdrop, we address the following research question: *Which goals and principles should guide an aligned and effective yet adaptive IT PPM?* Our research objective is 1) to empirically explore problems that often arise, 2) to derive requirements for IT PPM that are aligned and effective yet adaptive, and 3) to propose recommendations on how to design IT PPM to fulfill these requirements.

To address our objectives, we approached this multifaceted phenomenon in three cycles. We first investigated a revelatory case to develop an in-depth understanding of current IT PPM challenges to derive requirements for a more adaptive configuration. As recommended by prior researchers as a systematic approach to investigate complex problems in project-based organizations (e.g. Vakkayil, 2010), we employed activity theory (AT) (Engeström, 1987) as the investigative lens for our case study. Overcoming deficiencies of analytical power in traditional discourses, AT postulates that studies of human activity should consider not only the activity itself, but also the subjects engaging in particular activities, goals, motives, organizational history, applied tools, the norms and rules that guide interactions, and the social communities in which activities take place (Fuentes et al., 2004). After our case study, we evaluated our intermediate findings in a focus group with subject matter experts for further refinement. We then performed an applicability check (Rosemann and Vessey, 2008) on three design goals and 12 design principles to evaluate the importance and suitability of our propositions.

Our research provides several contributions to the fields of IT governance and business-IT alignment from a novel perspective. First, our AT-informed design goals and principles provide guidance for implementing governance mechanisms that allow to mitigate the tensions that so often arise in large IT project landscapes. Second, they may foster alignment, since they provide directions on how to enhance the fit between a project portfolio and the overall, constantly evolving business strategy. Finally, the design principles account for socio-economic sustainability by considering social impacts and ethical standards when allocating scarce human resources to projects.

In the remainder of this paper, we first provide an overview of our analytical model informed by AT, followed by the presentation of our research design. In Section 4, we address our case analysis results and, in Section 5, our proposed design goals and principles. We then present our applicability check results and conclude by briefly discussing our findings and providing a future research outlook.

2 Background and Analytical Model

At a glance, IT PPM must ensure that all IT projects meet strategic objectives and that benefits can be realized at an acceptable cost. This encompasses not only ‘core’ IT projects (e.g. software development), but also other projects (e.g. change projects) in which IT artifacts are critical means to achieve desired organizational goals (Daniel et al., 2014). IT PPM faces internal and external challenges such as politically motivated project selections (Martinsuo, 2013), ‘pet projects’ (Beringer et al., 2013), disruption and uncertainty (Karimi and Walter, 2015), and outer portfolio projects (Buchwald and Urbach, 2012), resulting in cross-project resource conflicts, project delays, and overloaded employees (Jonas, 2010; Zika-Viktorsson et al., 2006). Historically, project-based organizations “have been man-

aged as technical systems instead of behavioral systems" (Belout, 1998, p. 22). Against this backdrop, we explore frequent challenges by employing Engeström's (1987, 2001) seminal work on AT to guide our analysis. AT overcomes the dichotomy between the individual, technical, and the social, considering the collective context of IT PPM actions (Kuutti and Arvonen, 1992). In contrast to the analysis of the 'whole' social system or an arbitrarily selected context, AT centers around an intermediate unit of analysis, the *object-oriented activity system*, which allows one to include analytical components that account for the organizational, technical, historical, environmental, as well as governance and task-related forces that influence IT PPM (Engeström, 2001).

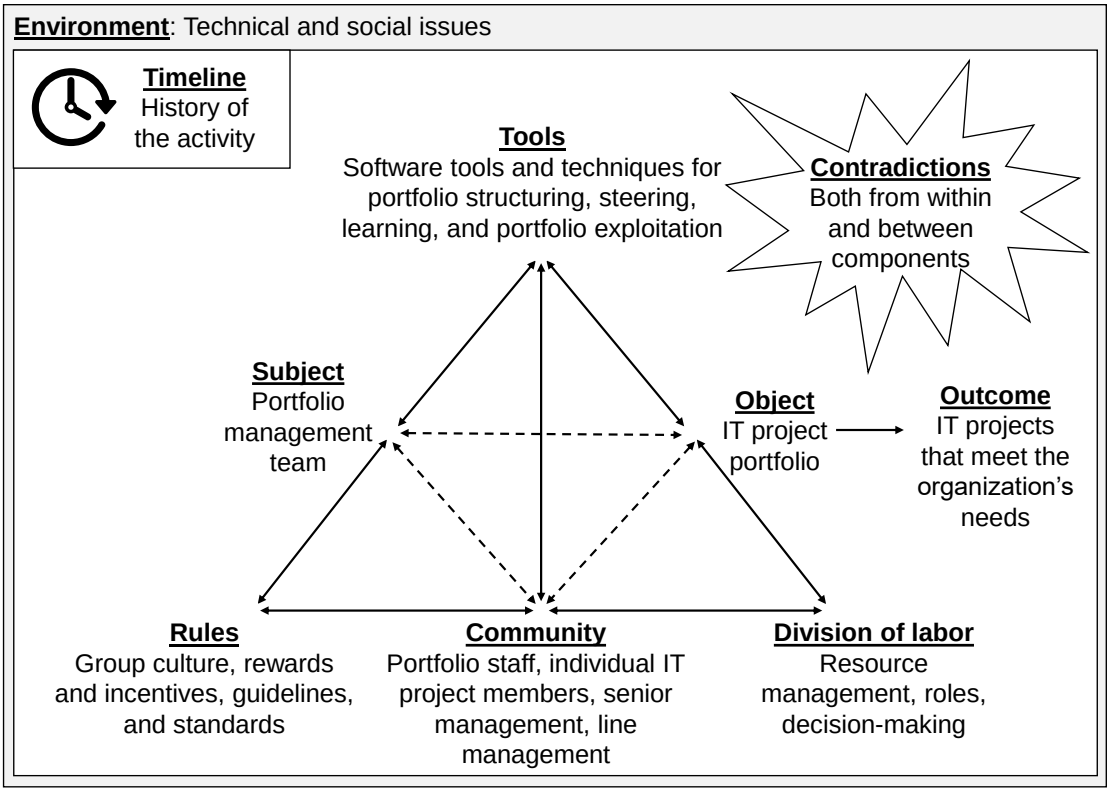

Figure 1. An Activity Theory Perspective on IT PPM (based on Engeström, 1987, p. 78).

We conceptualize IT PPM from an AT perspective by deriving the individual elements for each component from the large body of literature on IT PPM in Figure 1. An activity system consists of *subjects*, who exist in a *community*, that transform an *object* in order to produce a certain *outcome* – the overall purpose that motivates an activity (Vakkayil, 2010). The subject is the individual or a group engaged in the activity whose viewpoint is adopted during the analysis. In this view, the portfolio management team represents the activity's *subject*, which does not operate directly on the entire portfolio of IT projects an organization is engaged in (i.e. the *object*). Instead, AT applies mediators to establish a relationship between its different components (Mwanza and Engeström, 2005). *Tools* mediate the subject's actions on the object and can be both material or conceptual, and provide the subject with the historically collected experience of a community (Fuentes et al., 2004). Thus, the portfolio management team's actions in the portfolio are mediated by the application of certain technological tools such as planning software and instruments, as well as conceptual techniques such as portfolio structuring and steering to frequently evaluate, prioritize, and monitor IT projects (Jonas, 2010). The tools component further encompasses organizational learning approaches to re-evaluate results after project closure to assess benefits realization, and to secure and maintain relevant lessons learnt as well

as the utilization of this historical knowledge for future projects (Desouza and Evaristo, 2006). The portfolio management team is part of a broader *community* of individual IT project staff, senior management, and line managers who are involved through direct project participation, decision-making, or the provision of required resources. This community provides different guidelines and standards (i.e. *rules*) for the portfolio management team to follow. Rules further include formal rewards and incentives relating to completion of projects and the achievement of portfolio objectives (Barczak et al., 2009), as well as implicit norms influenced by organizational history and practices (i.e. group culture), which guide or constrain actions (Burke and Litwin, 1992).

Division of labor refers to the explicit and implicit organization as the subjects carry out the activity in the community, resulting in the horizontal distribution of tasks between community members, and in the vertical division of power and status of subjects (Bedny and Karwowski, 2004). IT PPM-related tasks are divided horizontally between community members through resource management and the assignment of roles, and vertically through lines of responsibility and authority, particularly relating to the extent of enforcement authority about portfolio decisions (Desouza and Evaristo, 2006; Mosavi, 2014). Finally, the desired *outcome* of the IT PPM activity system is projects that meet organizational needs (Reyck et al., 2005). Activities also develop *systemic tensions* (Barab et al., 2002): Such tensions may arise within each element of the activity (e.g. within rules), or between elements of an activity (e.g. between a community and rules) (Engeström, 2001). AT labels these systemic tensions *contradictions*. Since they indicate inefficiencies, contradictions reveal emergent opportunities for change and improvement, or potential breakdowns of activities (Engeström, 1999). Still, IT PPM is part of a broader context of its hosting organization, which is intertwined in an ever-changing environment (Müller et al., 2008). While components such as the community account for influences specific to the activity from within its confines, environmental influences are not necessarily activity-specific and may affect multiple activities differently (Chen et al., 2013). From the perspective of IT PPM, this might include issues such as regulatory changes, economic downturns, or technical disruptions (Frey, 2014). Further, we decided to extend the traditional model, similarly to Chen et al. (2013), by incorporating the components *environment* and *timeline* to allow for a comprehensive analysis of temporal aspects such as path dependence (Martinsuo, 2013).

3 Research Design

Owing to the outlined complex nature of IT PPM, we set out to develop an in-depth understanding of problems that occur at the IT PPM level. We apply our AT-informed IT PPM model to the analysis of a case organization to investigate systemic tensions that may arise within and between the components, and we elicit and evaluate recommendations for a more sustainable approach. For this purpose, we seek to develop design goals and associated design principles, which serve as abstract blueprint for achieving the stated goals (Gregor and Jones, 2007). Thus, we are able to systematically account for the phenomenon in a novel and empirical way, as called for by previous research, which called for a systematic and complete approach to the analysis of the different elements of IT PPM (Frey and Buxmann, 2011). Our research comprises three phases. Phase 1 comprises a revelatory case study in a German IT company to investigate tensions in the IT PPM activities. Phase 2 is a focus group conducted with IT managers to discuss and refine our results. In phase 3, we conducted an applicability check (Rosemann and Vessey, 2008) to evaluate our design goals and principles in 17 structured interviews with IT PPM experts.

In **phase 1**, we explored challenges faced by the IT PPM activities to derive requirements and principles for a more sustainable configuration. Despite some disagreement, scholars acknowledge that in-depth single-case studies are useful for understanding a complex real-world problem in the early research, since they promise the revelation of processes at work (Eisenhardt and Graebner, 2007; Yin, 2002). To this end, an organization with about 1,000 employees and a strong focus on software devel-

opment and that forms part of a larger group granted us access to its site. While this company had formally established IT PPM processes and structures, it nonetheless faced many employee complaints owing to a high workload, while top management criticized the insufficient portfolio throughput. The analysis of a provided portfolio report revealed that projects took on average 207% of their original time estimates. This is close to industry averages, which vary around 222% of the originally planned time (Standish Group, 2014). Thus, the company constitutes a well-suited revelatory case to achieve an empirically grounded understanding of frequent systemic tensions in IT PPM, and has the potential to inform other organizations (Yin, 2002). To collect our data, we conducted semi-structured interviews with 10 IT PPM-related stakeholders from the management board down to individual project managers so as to uncover tensions and potential causes. We also reviewed archival data, including project reviews and portfolio reports, to triangulate and cross-check the interview data's validity (Eisenhardt, 1989). Using ATLAS.ti 7, we started the analysis by deductively coding on the main themes of our analytical model presented in Section 2, and then inductively applied lower-level codes to narrow down each theme as detailed aspects emerged from the data (Miles and Huberman, 1994). To develop a shared conception and ensure intercoder reliability, coding results were discussed among multiple researchers and with the case organization in two workshops, and were then compared to the existing literature (Eisenhardt, 1989). In this stage, we arrived at three design goals and eight design principles.

In **phase 2**, we presented the design goals and principles to 15 mid-level to senior-level management IT PPM experts in a focus group session (Stewart and Shamdasani, 2014), with one author serving as a moderator. The session had two parts. First, we asked the participants to articulate their issues with IT PPM, and then asked for their ideas on addressing the challenges. The inputs were collected, synthesized, and consented to a general requirements list. In the second part, the moderator presented our initial set of design principles to the participants to stimulate further discussion. In total, 90 minutes of discussions with the participants yielded 14 suggestions. We used these insights to derive our final set of three design goals and 12 design principles by comparing and aligning the focus group's suggestions with our initial set.

We then performed an applicability check by using an evaluative interview study in **phase 3** (Carlsson et al., 2011). We asked subject matter experts from a range of industries in a series of structured interviews to rate our design goals' appropriateness. We also asked them to quantitatively rate each design principle according to the three applicability dimensions accessibility, importance, and suitability (Rosemann and Vessey, 2008) on a five-point Likert scale. Further, we discussed the ratings with the experts to further understand their assessments. However, the applicability check is not intended to replace a large-scale quantitative survey; thus, we only derived basic key figures to assess our recommendations via descriptive statistics. We applied the t-test to examine the responses, and then determined the acceptance of each design goal and principle. As noted by De Winter (2013), the one-sample t-test offers acceptable statistical power for small sample sizes, provided that the effect size according to Cohen's (1992) convention is large.

4 Case Findings: How Systemic Tensions Trigger Vicious Circles

In this section, we demonstrate how we applied AT in research phase one to identify systemic tensions from our collected data to later extract requirements for our design principles. As we learnt from our interviews, our case organization faced several organizational and cultural challenges at the IT PPM level. Table 1 summarizes our key findings.

Owing to rapid growth over the past years, our case firm experienced several issues in the process of *"going from a garage company to a professional, process-driven enterprise"* (a project portfolio manager). Some informants stated that the organization implemented several new IT PPM-related structures and processes in a fairly short timeframe. However, the organization's cultural mindset retained

its entrepreneurial spirit, often resulting in employees surpassing portfolio standards and guidelines. A line manager said: *"'I can quickly take care of that!' and 'Could you quickly do this for me?' remain a part of our culture. Much of this remains and still occurs."* This has led to severe problems in resource management, since several bootlegging initiatives and unenacted projects were carried out without official IT PPM oversight. Similarly, senior executives maintained a startup attitude in managing the firm and its project portfolio by constantly interfering in portfolio structuring decisions and force-ranking projects. As several informants reported, many projects were initiated in a top-down way at short notice outside established evaluation processes, rendering existing portfolio plans void.

Component(s)	Identified tensions
↯ ⟳ ***Community*** ↔ ***Tools***	• Senior management mistrusts sophisticated project evaluation and selection techniques, overrules established project evaluation and selection processes, and enforces project initiations • A high approval rate of long-running and parallel projects leads to multitasking and frustration on the part of line managers and project staff, resulting in further project delays
↯ ***Rules***	• Personal goals related to project achievements leads to projects starting with insufficient resources, or premature closure of unfinished projects, which are completed in unenacted projects • Many employees view formalized processes as unnecessary bureaucracy, resulting in bypassing of processes, bootlegging of initiatives, and unenacted projects
↯ ⟳ ***(Tools ↔) Division of labor ↔ Community***	• Since many projects are initiated at short notice, the cross-project resource planning cannot resolve resource dependencies, allocating employees to > 100% of their capacity, resulting in high multitasking rates, overloaded employees, delayed projects, and defective software (technical debts) • Accumulation of technical debts require additional efforts to be addressed in official or unenacted projects, reinforcing multitasking and causing further overloads • By overruling portfolio decisions, senior management jeopardizes established portfolio accountabilities, which undermines employees' trust in IT PPM's power and value
↯ ***Environment ↔ Tools***	• Addressing regulatory requirements late and constantly striving to defend market leadership by frequently seizing short-term market opportunities strongly impacts on project selection, resource allocation, plan quality, and software quality. Since portfolio plans and resource allocations are made far in advance without considering buffers, IT PPM is unable to absorb these short-term initiatives
↯ ***Timeline ↔ Division of labor***	• A high share of custom software development, high time pressures, and frequent technical workarounds in the past have led to path-dependent IT architectures (technical debts) and workforce (single key resources), which must then be addressed through additional, often unenacted projects
↯ ***Timeline ↔ Rules***	• Transition to a professional, process-driven company without changes in the organizational culture leads to a rejection of new standards

Table 1. Summary of Systemic Tensions at the IT PPM Level (circle arrows = vicious circles)

While regulatory projects were often initiated too late in the already densely configured long-term portfolio planning, success-related variables (e.g. number of started or completed projects per quarter) were instituted in the personal targets and objectives of upper management and linked to monetary incentives. This led to further increased pressure to start more projects on below-board management levels as managers try to fulfill their personal objectives. This project approval and prioritization practices led to a high number of parallel projects, of which almost 50% were rated top priority. While the organization constantly initiated new, high-priority projects without completing preceding initiatives, running projects were prolonged or even stopped far beyond their initial schedules. Many informants claimed that lower-ranked projects thus lacked resources when employees were shifted from running projects to more important initiatives as new opportunities emerged. The situation was aggravated by

the fact that portfolio planning focused on maximum resource utilization, with no emphasis on unforeseen events. A line manager said: *"We are allocating people to more than 100% of their capacity on projects. We don't consider any buffers in our portfolio plans, so that delays accumulate if only one project is behind schedule."* Thus, the organization had a considerable number of long-running projects, which were mostly continued for political reasons, and which were justified based only on a rudimentary assessment of business cases and intended benefits during the proposal process. A line manager said: *"Projects that are still unfinished after two planning cycles should be terminated. Currently, I must review several projects, and some are already up to two years old. Honestly, I don't think the assumptions taken at the outset are still valid."*

The parallel execution of multiple and often high-prioritized projects have impacted on project execution as well as employees' motivation and wellbeing. Although the company has a very low turnover rate, many employees felt overwhelmed in light of the plethora of tasks, ultimately falling into an inconspicuous 'work-to-rule' mode. A departmental head reported: "*Employees feel overwhelmed and frustrated, and project progress is much slower. Constant task-switching and familiarization with a different project context require additional resources that are not considered during project or portfolio planning."* Thus, the projects are often unable to meet predetermined delivery dates. Owing to high workloads, tight deadlines, and fostered by much custom software development, employees tend to carry out activities in 'quick and dirty' ways, with easily achievable results but with flaws or unwanted side-effects on legacy architectures. Several interviewees emphasized that these legacy issues or *technical debts* (Allman, 2012) resulting from budgeting and resourcing constraints often need to be solved in unenacted projects as a precondition to implementing subsequent projects, but without being considered during portfolio planning, leading to further schedule delays. This has resulted in *vicious circles*: chains of events in which one problem leads to new difficulties that mutually reinforce each other, leading to an inflexible organization (Platje and Seidel, 1993). Once a custom-developed architecture is based on workarounds, all subsequent activities tend to fall back to workarounds, accumulating further technical debts resulting in 'software entropy' (Bianchi et al., 2001), and increasing declines in understandability, quality, and maintainability of architectures. In turn, this reinforces the overload of key resources familiar with the architecture as they carry out unplanned re-factoring and maintenance activities. While single key resources often complained about excessive workloads, they were reluctant to share their knowledge with other employees, partly owing to cultural issues, and partly owing to high workloads, leaving no room to train other employees.

Moreover, uncoordinated project approval, resulting from ad hoc prioritizations by executives, leads to another vicious circle of overloaded resources with unrealistic deadlines. Owing to the lack of time available for knowledge-sharing, key resources remain under this pressure. Although its focus on custom software development over the past years has been viewed as a strong competitive edge concerning innovation and differentiation, a board member identified it as major cause of the firm's key resource problems: *"By doing it all ourselves, we are limited by the scopes of the resources we have, not only financially, but also human resources and knowledge."* Our data strongly suggests that, in this complex situation, overloaded key resources are a primary cause of ineffective IT PPM performance and low software quality. Since planned efforts were already invested upfront to solve legacy issues, the company often decided to deliberately integrate untested software into productive environments in order to rapidly exploit new opportunities, which sometimes caused serious errors in clients' operations.

Taken together, the firm's cultural development, much custom software development, a high number of parallel and high-priority projects associated with a high multitasking rate, and much technical debt reinforced single key resource problems and led to quality problems.

5 Towards Sustainable IT Project Portfolio Management

5.1 Purpose and Scope

To identify the purpose and scope of a sustainable IT PPM approach, we reflected on the systemic tensions revealed by our case analysis. Clearly, the surrounding internal and external environments affect multiple IT PPM components. For instance, social environmental concerns (e.g. market opportunities and regulatory requirements) may shape strategic planning and resource allocation processes, while technical environmental concerns (e.g. new technologies) may affect project implementation procedures. While being able to capitalize on short-term opportunities represents a competitive edge, there is little guidance on how portfolio managers should handle uncertainty from the internal and external environments that affect their project portfolio (Drouin et al., 2013). In order to be able to sustain, even under strong environmental turbulence, we propose three design goals (DGs) for flexible yet effective IT PPM activities. The confluence of *alignment*, *adaptivity*, and *effectiveness* under the umbrella of *sustainability* has been investigated in prior research (e.g. Baker et al., 2011; De Haes and Van Grembergen, 2009; Vessey and Ward, 2013). Analogously, we regard *IT PPM as sustainable if it is aligned to the organization's goals, effectively exploits the IT project portfolio by utilizing scarce resources, and can swiftly adapt to changing conditions*.

Our first premise is that an organization and its IT project portfolio are aligned when the project portfolio supports the organization's goals (Meskendahl, 2010). This especially refers to the alignment of project objectives and resource allocation, and to the extent to which the portfolio reflects the overall strategy (Beringer et al., 2013; Heising, 2012). In our case, some informants thought that long-running projects, which were assessed in terms of projected strategic contribution only at the outset, had lost their strategic legitimacy. Further, forced or ad hoc project initiations continuously led to situations where new emerging opportunities drew resources from other projects, resulting in schedule overruns and projects no longer aligning with the business strategy. Thus, we propose our first design goal for sustainable IT PPM:

DG1: Alignment: *IT PPM must align the project portfolio with the overall strategic objectives.*

Our second design goal, adaptivity, refers to organizational flexibility and resource agility, which are facilitated to integrate, build, and reconfigure the portfolio, to effectively respond to changes in the dynamic environments in which IT PPM operates (Gibson and Birkinshaw, 2004). As the analysis of our case demonstrated, traditional IT PPM that solely plans on a long-term horizon and focuses on maximum resource utilization is unable to integrate short-term initiatives without risking vicious circles of project delays, postponements, and negative impacts on the workforce and the IT architecture. Alignment and adaptivity are distinct yet interdependent and mutually supportive, which typically leads to positive correlation between them (Cassiman and Veugelers, 2006). To ensure portfolio adaptivity in light of entirely new strategic trajectories, an effective *go/kill* decision-making process, flexible evaluation and prioritization criteria as well as dynamic resource re-allocation capabilities must be established (Hunt et al., 2008; Killen and Hunt, 2013). Owing to a lack of short-term focus and flexibility in traditional IT PPM activities, we seek to increase adaptivity so as to enable organizations to benefit from the realization of short-term opportunities; thus:

DG2: Adaptivity: *IT PPM must be able to alter its operations swiftly and responsively to allow for dynamic adjustments to changing strategic trajectories.*

Together, alignment and adaptivity provide a basis for the effective exploitation of IT projects and associated resources (Gibson and Birkinshaw, 2004). Adaptivity becomes the primary means by which IT PPM achieves improved project delivery capabilities that are aligned to uncertainty and changing business demands (Ness, 2005). The assumption is that the appropriate mixture of rigor and flexibility

induced by alignment and adaptivity allow IT PPM activities to better grasp resource needs and limitations. Adaptivity enables IT PPM to activate additional resources or to timeously transform existing resources if these resources are already understood and are in close proximity to the locus of change (Kock et al., 2014; Tallon and Pinsonneault, 2011). As our case shows, inadequate resource allocations or withdrawals often led to budget and schedule overruns, as well as poor project results. Applied workarounds led to an accumulation of technical debts, which could only be addressed by an increasing number of single key resources in unenacted projects. IT PPM's effectiveness includes the goal-oriented distribution of technologies, knowledge, and resources among the portfolio, as well as the management of interdependencies between projects (Belout, 1998; Jonas, 2010; Teller et al., 2012). However, as our study demonstrates, meeting stakeholder expectations and delivery dates via maximum resource utilization often negatively impacts the workforce in terms of multitasking and staff overload. We adopt a more contemporary perspective on effective and sustainable project delivery (Mishra et al., 2011) by proposing:

DG3: Effectiveness: *IT PPM must support projects to meet business requirements and quality, attain target dates, and complete within budget, while observing social impacts and ethical standards.*

In sum, alignment refers to coherence among all the IT PPM activity patterns, working towards the same outcome. Alignment-enabled adaptivity seeks to respond rapidly to changes in the task environment, such as the ability to timeously utilize emergent technologies and new strategic trajectories. Alignment and adaptivity facilitate effectiveness, which refers to supporting the successful execution of IT projects, while maintaining the current overall direction (Gibson and Birkinshaw, 2004; Vessey and Ward, 2013).

5.2 Principles of Form and Function

In the previous section, we identified three design goals based on tensions in the IT PPM activity system. For research phase two, we drew on extant literature and the insights from our focus group discussions to cultivate design principles(DP. These provide an abstract blueprint for achieving the stated design goals (Gregor and Jones, 2007).

First: How can IT PPM sustain alignment? In line with prior findings, we observed the tendency to schedule IT projects with durations of nine months or longer. Research has demonstrated that many large and long-running projects tend to be executed with no strong link to the business strategy (Alsudiri et al., 2013). Also, the risk of underperforming increases dramatically as project duration increases, while short projects typically have a higher likelihood of success (Sauer et al., 2007) (→*DP1*). Further, benefits realization in longer projects is significantly lower, since projects approved for a long timeframe are based on assumptions that are potentially no longer valid as projects progress (Doherty et al., 2011). We propose decreasing complexity and uncertainty by decomposing large-scale projects into distinct subsequent projects with separate benefits realization and evaluation plans, where possible, to avoid binding resources for more than only one portfolio cycle (→*DP2*). Further, common reporting approaches don't account for phenomena such as resource multitasking or portfolio-level buffer use (Ben-Zvi and Lechler, 2011) (→*DP3*). Over the past two decades, organizations have increasingly used business cases to evaluate IT investment decisions' profitability (Ward et al., 2008). However, since many traditional approaches lack a distinct benefits realization perspective, most anticipated benefits are simply not achieved (Doherty et al., 2011), while recent research suggests integrating benefits management practices into portfolio management as important mechanisms for the successful implementation of business strategies (Ashurst and Doherty, 2009) (→*DP4*). Moreover, economic and strategic potentials are not regularly re-assessed or scrutinized once projects have been approved and

initiated. To avoid unjustified resource binding, organizations should continuously monitor progress towards delivering the intended benefits (Serra and Kunc, 2015) (→*D5*).

DP1: Only approve short projects: *To increase average project success and ensure project alignment, IT PPM should minimize project durations as much as possible and should break down longer projects into several smaller ones with clear benefits.*

DP2: Only approve projects when they are scheduled to start in the next portfolio cycle: *To account for ever-shorter strategic planning cycles, IT PPM should approve a project only if it starts in the next portfolio cycle.*

DP3: Establish agile reporting: *To operatively monitor the achievement of strategic objectives, portfolio reporting should consider aspects such as multitasking, project variance, and buffer usage.*

DP4: Use structured benefits analysis as a basis for project selection and prioritization: *To ensure benefits-oriented project selections, IT PPM should create a benefits dependency network for each project proposal in the business case preparation.*

DP5: Completely (re-)assess benefits in each portfolio planning cycle: *To ensure strategic and economic contributions of running projects, IT PPM should (re-)evaluate all projects and project proposals at the start of every planning cycle.*

Second: How can IT PPM sustain adaptivity? We see that prioritization criteria are defined only once a business or IT strategy is formally approved, or even less frequently. Most often, project portfolios are planned and prioritized during the annual budgeting process based on a stable set of selection criteria derived a priori from the business strategy (Cooper, 2008; Hope and Fraser, 2003; Rajegopal et al., 2007). However, static criteria do not reflect short-term business opportunities and operational needs when ex ante business cases no longer properly reflect opportunities to realize benefits, inhibiting an adaptive approach to assess the current states of IT projects (Eisenhardt and Zbaracki, 1992; Unger et al., 2012) (→*DP6*). Similarly, while the research points out that the rigorous termination of troubled projects is vital to strategic fit and overall project portfolio success (Unger et al., 2012), often leading to a continuation of 'sick pet projects' (Beringer et al., 2013). This not only points to a diligent selection of projects, but also to the establishment of mechanisms to early detect and abandon projects that are projected to no longer deliver their initially intended benefits (→*DP7*). Common portfolio management approaches, as in our case company, usually employ traditional task order and scheduling techniques to allocate staff at full effort levels to minimize idle times, causing a cascading effect on all projects initiated later in the planning period (Ben-Zvi and Lechler, 2011). Recent research into IT PPM that draws on the notion of critical chain project management advocates the introduction of safety margins to manage slack time and to better leverage project resources (Yaning, 2011). Researchers have demonstrated that portfolio buffers might yield "substantially higher value and throughput than a full 100% allocation of the resources" (Ben-Zvi and Lechler, 2011, p. 6) (→*DP8*). It is also common practice to plan the project portfolio far in advance, mostly as part of the annual budgeting process (Hope and Fraser, 2003). Once the portfolio schedule has been planned and the budgets have been approved, there are no opportunities to flexibly respond to upcoming strategic opportunities, since there are usually no stipulations in place to re-allocate budgets within the year (Hope and Fraser, 2003) (→*DP9*).

DP6: If strategic priorities change, adjust project selection and prioritization criteria during each portfolio planning cycle: *To maximize IT's contribution to current strategic objectives, IT PPM should regularly derive and update the relevant prioritization criteria from the strategy as well as operational necessities.*

DP7: Immediately terminate projects that are no longer beneficial: *To avoid pursuing deprecated trajectories, IT PPM should abandon projects with insufficient projected benefits realization.*

DP8: Establish a portfolio buffer: *To account for organizational and environmental disruptions, IT PPM should establish a resource buffer at the portfolio level that allows for flexible planning even when the average project duration is longer than the portfolio cycle.*

DP9: Plan and/or re-configure the portfolio in short cycles: *To respond to strategic adjustments, IT PPM should re-plan the entire project portfolio after a short cycle (e.g. three months)*.

Third: How can IT PPM sustain effectiveness? We saw that IT projects are often scheduled and staffed without the appropriate consideration of key resources. Multitasking and frequent overload of single key resources associated with task-switching can severely impact on project throughput, portfolio performance, and employee wellbeing (Pearson, 2008). However, since the replication of knowledge held by single individuals is an often a lengthy to impossible process (Fontaine, 2010), IT PPM must acknowledge such realities by considering these resources during cross-project resource planning and allocation (→*DP10*). As our case demonstrated, a high parallel demand for specific key resources is a primary cause of limited project throughput, leading to longer average project durations. Further, informants highlighted that having many interdependent projects started in parallel often leads to situations where dependencies are only identified once projects have progressed too far to adequately resolve resource conflicts (→*DP11*). Our case showed that top management often enforces resource shifts to very urgent and important projects, resulting in cascading project delays. Since many IT PPM decisions are based on politics and the self-interests of individuals or groups (Martinsuo, 2013), such biased decisions will likely not contribute to effective project deliveries, often leading to vicious and path-dependent circles of overloaded resources, excessive costs, schedule overruns, and major quality deficiencies (Zika-Viktorsson et al., 2006) (→*DP12*).

DP10: Consider single key resources: *To avoid single key resource usage overload, IT PPM should postpone superfluous projects to the next portfolio cycle and should ensure that there are no unenacted project activities that bind project resources.*

DP11: Execute projects sequentially to minimize multitasking: *To increase execution speed and minimize coordination efforts, IT PPM should sequentially execute interdependent projects.*

DP12: Never postpone projects or withdraw resources from projects: *To ensure uninterrupted project completions, IT PPM should not stop projects or revoke any necessary resources they might require.*

6 Applicability check

To evaluate the applicability of our design principles, in research phase three, we conducted 17 structured interviews with IT experts. We discussed our recommendations with the informants based on the three applicability criteria proposed by Rosemann and Vessey (2008): 1) **Accessibility:** the design principle is easy to understand. 2) **Importance:** the design principle meets the needs of practice and addresses a real-world problem. 3) **Suitability:** the design principle is complete and provides useful guidance. As rejection criteria for our design principles, we based our decision on an acceptance value below 50% and the one-tailed t-test results. If Cohen's (1992) convention for a large effect ($d = 0.8$) was fulfilled and the p-value was less than the significance level of 0.05, the null hypothesis H_0: $\mu \leq 3$ would be rejected, meaning that the null hypothesis is accepted when the mean would be 3 (neutral) or smaller (Spatz, 2010). Thus, we sought to accept only design principles with above-average agreement on applicability. Overall, the design goals and principles obtained positive evaluations from our informants. All our design goals obtained high agreement with low variation. Interviewees considered all our design principles as accessible, and most principles received high agreement and consensus

concerning importance. However, we regarded four design principles as *challenged* and will subject them to future revision. While experts agreed on their importance, they drew some criticism concerning their suitability. Informants frequently mentioned cultural challenges, such as admission of failure, concerning the termination of projects that are no longer beneficial (DP7). High organizational pressure to execute many projects as quickly as possible is deeply rooted in the business side, leading to a necessity to simultaneously execute many projects to fulfill expectations, rendering sequential execution (DP11) almost impossible. From an operational perspective, unforeseen events, such as ad hoc management decisions and resource fluctuations, are practical challenges to sequential project execution. Further, experts see problems in assigning responsibility for portfolio buffer management (DP8) and associated reporting mechanisms (DP3), since they expect lower responsibility from individual project managers for adhering to schedules and the potential need to justify unused buffers. To implement a sustainable IT PMM activity, our interviewees consider a climate of trust and prudence, as well as strong assertive capabilities on the part of decision-makers, to be necessary. Two design principles (DP1, DP5) were *rejected*, since they did not pass the applicability check regarding the importance and suitability criteria, mostly owing to common budgeting practices. Since budgets and resources are often allocated a priori annually, informants stated that executing only short projects (DP1) could lead to a situation where IT budgets are consumed before the last quarter, potentially leading to a "shutdown situation". However, this design principle's suitability was the most controversial among interviewees. Some stated that a full re-assessment per planning cycle (DP5) would not be suitable, since budgets are regarded as spent as soon as they are allocated to projects. Considering several hundred new project proposals every year, experts see missing assessment capabilities to judge intermediate project results in a qualitative manner, holding individual project managers responsible instead. While some design principles passed the applicability check unconditionally (i.e. DP2, DP4, DP6, DP9, DP10, DP12), the challenged DPs can be refined in future iterations, highlighting their overall tentative nature.

7 Discussion and Conclusion

The results from our revelatory case are in line with prior research, which found that alignment to business strategy and resource allocations between projects represent major challenges in the context of IT PPM (Stettina and Hörz, 2015). Consistently with our design recommendations, previous studies consider approaches such as frequent portfolio reviews, iterative planning, and avoidance of multitasking as suitable measures to address alignment and resource overload issues (e.g. Rautiainen et al., 2011; Stettina and Hörz, 2015). Our case showed that common prioritization practices resulted in a high presence of parallel projects, leading to cascading project delays. Here, evidence from prior research supports the relevance of our design recommendations on sequential project execution, dynamic prioritization, and the focus on short-running projects (e.g. Daniel et al., 2014). However, while some warn of an "exploitation trap" when primarily favoring short-term and low-risk projects (Killen and Hunt, 2010), incremental projects aimed at rapid delivery tend to prevent progress from becoming too stale (Steindl, 2005; Thomas and Baker, 2008). Moreover, recent studies indicate that even projects subjected to high uncertainty and centered around fast-paced innovation should be carried out in small-sized iterations (Cooper, 2013). Some researchers conclude that avoiding frequent priority changes increases transparency and stability (Rautiainen et al., 2011), whereas our recommendations draws on research that advocates that prioritization criteria should be able to vary over time to respond to changing business conditions and thus maintain in-flight alignment (Steindl, 2005; Yang et al., 2015). Moreover, prior findings support our assumption that the iterative assessment of a portfolio must be accompanied with thorough cancellation of unnecessary projects (Krebs, 2008). Extant research has emphasized that stopping projects depending on business and organizational changes increases alignment and benefits realization, and reduces complexity and risks (Unger et al., 2012).

While we generally agree with the idea of re-allocating resources between projects as needed (Daniel et al., 2014), re-allocation should not be arbitrarily practiced at the expense of existing initiatives. According to our case findings, this frequently leads to overloaded employees and an accumulation of prolonged, resource-poor projects. Although our applicability check revealed that an iterative budgeting process is only regarded as fairly suitable by informants, prior research has discussed the necessity for dynamic budgeting approaches in order to be adaptable to fast-changing operational environments (Hope and Fraser, 2003; Stettina and Hörz, 2015). Thus, our design principles focused on continuous portfolio reconfigurations require organizations to shorten their strategy formulation horizon from annual planning to multiple iterations throughout the year.

Since project management is a practice-oriented domain, research in this field is traditionally said to lack a theoretical basis and deficiencies in concepts (Shenhar and Dvir, 1996; Söderlund, 2004). We answered calls by scholars (e.g. Floricel et al., 2014; Söderlund, 2011) to facilitate theoretical frameworks to better make sense of project-related issues and proposed solutions. To this end, our paper sought to demonstrate AT's utility by employing this underexploited and promising theoretical lens to systematically investigate IT PPM tensions in a case study, and subsequently derived design goals and principles to sustain alignment, adaptivity, and effectiveness. While previous studies have provided suitable insights into the manifold challenges of project organizations, we still lack general design recommendations (Frey and Buxmann, 2012) and explicit prescriptions for designing a more flexible IT PPM that account for the characteristics of today's disruptive environment. To our best knowledge, our research is the first attempt to provide design recommendations that holistically focus on the confluence among the goals of alignment, adaptivity, and effectiveness. Thus, our paper contributes to research in that it provides a novel approach to shape a more sustainable IT PPM that is aligned and effective yet is able to swiftly adapt to technological disruptions and new strategic trajectories. Further, this topic promises interesting avenues for future research. Based on our findings, researchers can instantiate more sophisticated recommendations for sustainable IT PPM, such as reference models and frameworks. Our AT perspective on project organizations also allows to conduct further empirical studies to uncover and address systemic tensions beyond the ones identified in our revelatory case. Researchers might also apply the model to identify additional tensions at a theoretical level based on extant literature. Further, researchers might seize the materiality perspective offered by AT to particularly investigate IT-enabled tools' moderating roles in the socio-technical milieu of IT PPM. Finally, we have contributed to practice by describing how to systematically identify frequent issues and subsequently configure IT PPM more sustainably and thus increase responsiveness, enhance alignment, and improve project success rates. However, our research has limitations. Our results are derived from a single yet revelatory case and a focus group, from which we derived our design goals and principles. Future research might assess our design principles in different research settings. While our design principles provide a general blueprint for a IT PPM approach oriented towards sustainability, our applicability check revealed, notably, that instantiation in an organization depends on certain mutual factors (e.g. flexible budgeting processes), necessitating extension and adjustment to changing contextual conditions of their use (Gregor and Jones, 2007).

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