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Dynamic Capabilities and Project Management in Small Software Companies

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Abstract

A small software company depends on its capability to adapt to rapid technological and other changes in its environment—its dynamic capabilities. In this paper, we argue that to evolve and maintain its dynamic capabilities a small software company must pay attention to the interaction between dynamic capabilities at different levels of the company—particularly between the project management and the company levels. We present a case study of a small software company and show how successful dynamic capabilities at the company level can affect project management in small software companies in ways which may have an adverse impact on the company's overall dynamic capabilities. This study contributes to our understanding of the managerial challenges of small software companies by demonstrating the need to manage the interaction between adaptability and flexibility at different levels of the company.

1. Introduction

Small and medium sized software companies (SW SMEs) with less than 50 employees comprise a significant part of the total number of software companies. According to US census data, more than 80% of US software companies belong to this segment and similar numbers have been reported from Scandinavia in the Copenhagen-Malmö region [1, 2]. SW SMEs operate in highly competitive and dynamic environments with rapidly evolving technologies and increasing demands for delivery speed, capability and quality of solutions [3-5]. Unlike larger companies, which can dedicate resources for learning and process development, the SW SME relies on the capability of developers and project managers and on flexibility, rather than structure and processes, to adapt to its constantly changing environment and survive [6-9]. However, as a small software company grows—particularly if it grows fast—it becomes increasingly difficult to maintain the flexible internal structures and processes needed to adapt to its environment and at the same time absorb (hire and train) new employees into its practices and culture [8].

Mathiassen and Vainio [7] have studied how SW SMEs can develop internal and external resources to improve their competitive advantage in highly volatile environments. Based on Haeckel's theory of *dynamic capabilities* [10, 11] they developed a set of specific principles for how to manage dynamic capabilities in small software companies. Schmidt and Mathiassen [12] further studied how dynamic capabilities at the company and project levels interact and contribute to the SW company's overall capabilities. We extend this work by studying how company-level dynamic capabilities affect a core group in SW SMEs: the project managers. Project managers are vital links between the dynamic environment of a company and the day-to-day practices of developing software. They are, however, overlooked in the research on dynamic capabilities in SW companies, which focuses mainly at the company level. Thus, we ask the following question

How do dynamic capabilities at the company level affect project management in small software companies?

Our findings suggest that the project managers in small SW companies are critical to the development and maintenance of dynamic capabilities in SW SMEs. It is their responsibility to translate company-level adaptations to changes in the company's environment—e.g. changing customer relationships—into viable project management practices. Constant change at the company level, however, exerts high pressure on the project managers in SW SMEs. In the absence of dedicated resources to develop, document and disseminate new processes, the project managers become responsible for adapting project management practices and models to changes at the company level in parallel with their primary task to manage projects. When a firm grows, the increasing project portfolio and the effort needed to hire and train new project managers intensifies the pressure even more. Therefore, the project managers are on the one hand instrumental in implementing change in SW SMEs,

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and on the other they are a potential obstacle for successful change due to time pressure and limited experience.

In this paper, we apply the framework developed by Mathiassen and Vainio [7] to analyze the Danish software company *Adapt's*[1] capability to sense and respond to changes in the company's environment. *Adapt* is a web-services company founded in 1998 with about 65 employees (2015).

The analysis shows how the project managers at *Adapt* struggled for a long time to adapt to rapid changes at the company level, but also how they managed to improve their dynamic capabilities by defining a small set of modular and flexible project management processes. Thus, we show how dynamic capabilities can vary among different levels in a company—and that the dynamic capabilities of software project managers are critical for an SW SME's ability to react to a volatile environment. From this, we draw implications for managing SW SMEs and for further research.

2. Theoretical Background

Software companies face rapid changes in their environment [4, 5, 13, 14]; this is particularly the case for start-ups [8] and small software companies [6]. The responses to changes in the environment for these software companies include both changing what they do and how they do it [15]. Considerable changes in the software market cause dramatic changes to existing practices, experimentation, and process adaptations [16].

Software start-ups and small software companies comprise a significant part of the software industry [1, 2, 6]. They are interesting because they exhibit very rudimentary internal processes, and they struggle to place appropriate effort into developing and adopting their processes. These companies are trying to cope with a dynamic and sometimes turbulent environment in which they are struggling to make a living and at the same time, they are trying to improve their professional practices [17]. There seem to be no simple answers to the challenges facing these software companies, but we know that the relationship between agile internal processes and the structure and management of the company as a whole is complex [18, 19].

Project management processes are traditionally set up to deal with uncertainty and complexity [20], but it is a challenge for project management to match the structure of the small and midsized companies [18, 21] including most software organizations facing a turbulent environment. There is a broad recognition that there is a genuine need for more agile internal processes for these companies to cope [22, 23] and agile project management processes are arguably part of a solution [24, 25]. These methods are widely known and have been influential also in practice, but their main thrust is directed at dealing with changing software requirements and they have little to say on other matters in coping with a turbulent environment [26].

Dynamic capabilities is a particular theoretical perspective that can be used to understand the often fragile and highly experiential processes in companies in rapidly changing markets [27]. A commonly used definition of dynamic capabilities is the ability to re-configure a company's resources and routines by its strategic leadership [28]. Several expositions of the theoretical perspective exist, but we shall rely on the central yet partly overlooked framework for small software companies developed by Mathiassen and Vainio [7]. We have chosen this framework because it is specific to the software industry and because it builds on a theoretical understanding of how companies sense their environment and respond accordingly.

Small software companies that are quick to sense their environment and respond to changes have particular dynamic capabilities [7]. It is theorized that small software companies should be able to "process information about demands and opportunities through continuous interaction with the environment" [7, p. 524], and in their original study Mathiassen and Vainio elaborate this argument and develop a new framework. Schmidt and Mathiassen then utilize and validate the framework in a later study [12].

The theoretical underpinning of the framework in [7] builds on the sense-and-respond framework by Haeckel [10]. The sense-and-respond framework involves the four activities: sense, interpret, decide, and act, and in that order; see Figure 1. The four activities are not just ad hoc problem-solving activities, but they are instead critical cyclical processes that address strategy, structure, and governance. Companies mastering this are adaptive and have the ability to translate the sensed signals from the environment into actions [11]. According to Mathiassen and Vainio [7] these companies "sustain a mode of operation in which they detect potentially relevant events, filter, and make sense of these events about their context, and initiate responses as deemed appropriate" (p. 524) while at the same time maintaining a focus on the ongoing activities.

The Mathiassen and Vainio framework [7] is directed specifically at small software companies, and it purports to be useful for (1) understanding dynamic

[1] The name of the company.

capabilities, and (2) managing dynamic capabilities. The framework consists of five principles. The five principles are distinct for small software companies (SW1-SW5) and are based on four generic principles for organizational sensing and responding (G1-G4); see Figure 1.

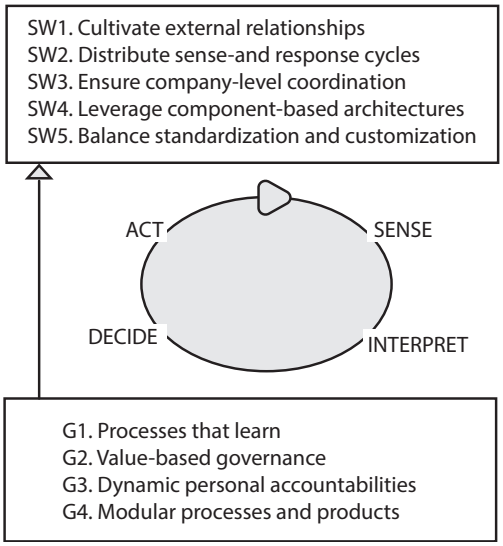

Figure 1: Dynamic capabilities framework for small software companies (adapted from [7]).

The framework describes the iterative process of sensing and responding as a central component. It emphasizes sensing of the environment and interpreting this sensory input. Based on the interpretation it becomes possible to decide and plan how to act through strategy, structure, and governance and then follow through with actually acting. This again can lead to renewed sensing and instantiate a new activity cycle. These sense-respond cycles have four general principles as underlying systemic management thinking [7]. The company processes need to learn from operating the sense-respond cycle (G1) and in pursuing this with autonomy requires shared values and value-based governance (G2). This governance is based on individuals that are accountable for enacting the sense-respond cycles and in a dynamic way commit and re-commit in their collective effort (G3). Modularization of both process and products is a company's primary mechanism to be efficient in adapting to changes with a reconfiguration of modular processes and producing results by reconfiguring products by modular parts (G4).

While the generic principles apply to all successful adaptive companies, the five principles SW1-SW5 are distinct for small software companies [7]. For a software company, there is a particular need to understand users and customers because they are primary sources of software requirements. Interacting with external actors based on cultivating these relationships is crucial (SW1). The generic principles of value-based governance (G2) and personal accountability (G3) will for the software company additionally be enacted through distributed sense-respond cycles (SW2) otherwise they cannot work their sensing and responding at high speed [7]. There needs to be some key coordination present at the company level (SW3) to compensate for the distribution of effort and responsibility in SW1 and SW2. While the generic principles emphasize modular processes and products (G4), the specific principles for software companies directly express the modular design of software into reusable software components, and at a higher level it shows that software architectures must be designed to leverage the components (SW4).

In all software development, there is a tension between developing software to meet standardized requirements and specific customers' requirements and the small software company must in particular strike a balance between standardization and customization of the software products (SW5).

Mathiassen and Vainio [7] suggest that their framework must be further validated in key process areas such as requirements management, project management, configuration management, and quality assurance. We suggest that we with this study can contribute to such a validation and the detailing of the approach for project management in particular.

3. Research approach

The research design was based on the case study approach with a single case and interpretive use of qualitative data for discovery [29]. An interpretive approach is particularly useful when addressing problems with a dominant social or cultural dimension, such as dynamic capabilities [7]. The interpretive research approach allowed us to investigate dynamic capabilities and project management as socially constructed and, thus, open to several interpretations by organizational actors and us as researchers [30, 31].

Adapt is a small (65+ employees in 2015) software company specializing in complex web applications and websites for medium and large clients. The web applications range from elaborate web shop catalogs and e-commerce, over websites for car dealers with a high profile design, to mobile apps for a large sports club linking to dynamic websites for sports fans. *Adapt* was selected because it had demonstrated dynamic capability with a track record of quickly adapting to the market of web applications such as moving into mobile applications when that became attractive, and changing

from short-term spot contracts to a long-term collaboration with their customers.

A primary selection criterion was the company's proven flexibility and capability to reconfigure itself as a reaction to changes in its environment. Among others, the company managed to survive the dot-com crisis around 2001 through a timely (and early) downsizing and has over the years gradually reoriented itself from a technical provider of web solutions to a partner in business development for its customers. It has also managed a successful migration from a proprietary technical platform to *Drupal*, an open source content management system. The increasing effort required to maintain the proprietary platform, combined with customer interest in standard technological platforms dictated this change. *Adapt* was one of the first Danish web development companies to change to Drupal and considers itself a leader in this technology. The company is active in the Danish and international Drupal communities and contributes with code reviews and new modules. Recruiting and keeping Drupal specialists are key priorities in the company's business strategy.

Founded in 1998, *Adapt* has always been a profitable company with a top credit rating (AAA in the period 2009-2014). Initially a web-solutions development company with a focus on technology, *Adapt* has deliberately moved towards supporting the customers' business strategy, and today the company describes itself as a digital agency, which combines business understanding, design, and innovative technology in their solutions. Its customers include Danish retail businesses of various sizes as well as public and private organizations for which online functionality and visibility is a central part of the business.

At the time of our study, the company had four project managers organized into a separate group headed by the Head Project Manager. The back-end and front-end developers were in separate groups led by the CTO and the Head Design Manager, respectively. The back-end developers were loosely divided into teams, each team assigned to a project manager and working for several customers. The back-end developer team structure was loose and fluid, according to the CTO, to maintain high group coherence and minimal internal competition among the developers. Also, management frequently reassigned developers to other teams to balance resource demands among projects.

Adapt espouses "family values" (interview with CEO and company presentation), meaning a high level of commitment to the company and colleagues, flat structure, autonomy and self-organization, and several social activities. The company hosts a yearly seminar on a location somewhere in Europe, where everybody meets to socialize and discuss the company's situation and future development.

More recently—and coinciding with our engagement with the company—*Adapt* experienced several challenges in its business environment as well as internally. First, the customer base was shifting from mainly small and medium sized companies with smaller projects, towards large customers with a high revenue potential and an interest in long-term collaboration about the development, operation, and maintenance of their websites. Second, *Adapt* was growing fast with many new hires, particularly among the project managers because some of the most experienced project managers had decided to leave the company. To meet the challenges in the changed business environment, *Adapt* needed to change its internal structures, development processes, and tools. The changes were handled well at the company level as well as among the software developers, but the project managers—among whom several were newly employed—lacked time and experience to revise project management processes and models at the pace needed to keep up with changes at the company level. These project management challenges reflected potential obstacles for the ability of the whole company to handle the changing environment. The project managers eventually overcame the challenges by introducing modular and flexible project management processes and adopting a common task and project management tool.

Our engagement with *Adapt* lasted from January to June 2014. We investigated the company's project management practice in its organizational context using open-ended qualitative interviews [32] and analyzed the company's organizational culture [33]. In the data collection we:

- Interviewed the four project managers
- Surveyed the four executive managers and four project managers using the organizational culture framework [33]
- Reviewed internal documents and systems for project management
- Conducted five meetings with the managers in different configurations

Audio recordings, notes and minutes documented the interviews and meetings; and all participants were sent the minutes for validation. Following each encounter, a debriefing meeting [34] was conducted by the researchers. Three university researchers with 8 to 30 years of experience in qualitative research of software development and project management carried out the data collection and analysis.

We studied *Adapt's* capability to reconfigure itself to a dynamic environment and how this affected

project management. We analyze the findings in two stages in the following section: The first stage is a sense-and-respond analysis of the changes that took place in the period. Based on this, we will use the framework from [7] to analyze the company's ability to manage its dynamic capabilities.

4. Case analysis

Together, the changes in the environment forced the company to rethink and revise internal and external relationships, processes and tools. Table 1 summarizes the three sense-and-respond cycles we identified during our engagement.

First, the changing composition of the customers towards larger companies wanting a long-term collaboration caused *Adapt* to change customer relationships and contracts. Previous contracts specified traditional development projects with limited duration and fixed cost and scope. Now, several customers wanted long term contracts based on time and material billing, often in the form of a service level agreement (SLA) specifying a set amount of hours to be delivered per month. Work to be completed under the contract— i.e., changes or additions to a system— would be decided and assigned during weekly meetings between the development team and the customer.

Table 1. Sense-and-respond analysis of *Adapt*.

Activity	Sensing	Responding	Outcomes
Transform customer relationships	Large customers requesting long-term relationships with the *Adapt.*	Change development organization and contract types	Customer oriented teams. Customer relationships based on service level agreements and time-and-material invoicing.
Standardize project management processes	Complex and time-consuming project management due to variations in customer relationships and process models. No standard project management practice	The head project manager worked to produce new and simplified project management process descriptions.	Short and simple process descriptions, distinguishing projects based on customer relationships.
Integrate tools	The diversity of tools used by the project managers caused redundant data entry, lack of oversight and coordination, variations in practices.	Implement project management checklists into JIRA and move all time reporting to the tool.	Simplified data entry, and improved oversight for both customers, project managers, and developers.

In response, *Adapt* wanted to replace the fluid team structure with stable teams comprising developers and a project manager assigned to a group of customers. This was not an easy transition since the back-end developers had become accustomed to shifting teams, which allowed them to maintain high cohesion within the group of developers.

The changes complicated the work of the project managers since the new team structure and customer relationships did not replace other types of contracts and customer relationships such as smaller clients with small projects and infrequent maintenance requests. Thus, the project managers had to manage clients, projects, and developers according to both the old and new ways of working. The small projects and maintenance tasks also increased the pressure on the project manager's time. Each task did not consume much time, but managing the total volume of small projects and maintenance requests required a full-time project manager and team, and complicated planning and management in general.

The second activity reflects *Adapt's* need to simplify the work of the project managers who juggled different co-existing project models for different customers. The changes had come over a period of about a year, and the project managers—the head project manager in particular—found it increasingly difficult to maintain the project management process descriptions. *"[The process] has been stable for several years. However, the last year has been chaotic*

... Each time I begin to describe the process, things change ... We grow so quickly and get so many new customers who want to work in a new way" (Head project manager).

More customers and project also resulted in increased pressure on the project managers, which again caused delays in solving smaller tasks.

The project managers did not have established routines for knowledge sharing and learning, nor did *Adapt* have a separate function responsible for process maintenance and improvement. This resulted in variations in daily practices among the project managers who would be using old descriptions, templates, and checklists in their own separate ways. Furthermore, high turnover among project managers meant that the head project manager spent much time training and monitoring new hires. The new project managers, on the other hand, felt that they had to define their processes on their own while was under high pressure to deliver from day one. *"I was thrown right into it all from the very beginning... I learned it the hard way. Especially what not to do"* (Junior project manager).

In revising the project management processes, the head project manager initially took a contingency approach, distinguishing project types along three dimensions: agile vs. waterfall process, fixed time and budget vs. time-and-material, and project vs. maintenance tasks. This was not a simple undertaking, and might eventually have led to a complex and unmanageable set of process descriptions. She realized that it would be sufficient to distinguish between three types of projects based on the type of customer relationship. The three types were: projects with fixed cost and time, long-term service level agreements, and small support tasks. Each type was described in short checklists of project management activities. The resulting document was seven pages long, and its format—short checklist—made it easy to adapt to changing conditions and context by—e.g., adding a new item or customer relationship to the document.

In the third cycle the project managers used several tools—including their personal spreadsheets—for planning, resource allocation, time reporting, and billing. This resulted in redundant data entry and less overview of project status and resource allocation. *Adapt* wanted to integrate project management support into a single tool. The company had already at that time begun using JIRA as a task allocation and tracking tool in the development team. JIRA's advanced customization features made it suitable for other types of ticketing systems (work orders, help desks), as well as managing even large-scale software development [35]. At *Adapt*, however, the tool was used only to manage development tasks. The company eventually intended to use the system to support project and resource management as well. However, use of JIRA for project management was not mandated, nor were there any guidelines to support it. This led to infrequent and non-standard use and did not solve the problems caused by poor tool integration.

"We were told to [use JIRA] in our way... How does that support the developers and the process? It is far too difficult for someone else to take over from me if I do everything my way instead of everyone doing it the same way" (Junior project manager).

The head project manager undertook the task to begin using JIRA as an integrated platform for task and project management, by defining the activities and checklists in the project management processes as JIRA tasks and subtasks. Tasks were developed into templates to be instantiated in JIRA at the start of a new project. To support this effort, it was further mandated that time reporting should use data from JIRA only, thus motivating the use of JIRA for project and activity tracking.

The definition of a new project management process and its incremental integration into JIRA contributed to creating common management processes and practices in *Adapt*.

"We need to develop both our method and its supporting tools. I have mistakenly tried to rely on a method and then put in the tools afterward. The problem is that we barely finish before there is a new direction. Now we are doing it in a leaner way with a little bit of method concurrently with a little bit of tool and so forth. That has proven to run better in the past six months." (Head project manager)

A senior project manager with five years of experience in *Adapt* furthermore expected the integration of project management into JIRA to increase knowledge sharing and stability in the company:

"A lot of things are changing, and we need to know what to communicate. I think we now have a method that is scalable enough to give us stability even though we continue the growth." (Senior project manager)

4.1. Managing dynamic capabilities at *Adapt*

The sense-and-respond analysis of *Adapt* allows us to assess the company's ability to manage its dynamic capabilities. Table 2 summarizes the analysis using the general principles of Haeckel [10] and the specific principles for small software companies proposed in [7]. The table contrasts the dynamic capabilities at the company level with those of the project managers.

Adapt espouses and enacts 'family values'. A cultural analysis [33] positioned the company in the

Table 2. Managing dynamic capabilities at *Adapt*

Principle	Company level	Project managers
G1. Processes that learn	The CEO initiates collective learning activities such as the yearly strategy seminar based on his assessment of the company's situation.	There was no time for reflection and learning due to time pressure and the need to introduce and train new project managers.
G2. Value based governance	Top management espouses and enacts 'family values' and a clan culture.	The diversity of customers and the high autonomy of the sales department results in market rather than clan values.
G3. Dynamic personal accountabilities	The CEO expects dedication to the company and independent decision-making regarding both existing customers and new business opportunities.	Accountabilities to the diverse customer types are continuously under internal and external pressure for re-negotiation.
G4. Modular processes and products	The dedication to a free open-source technology (Drupal), enables mass-customization with tailored yet low-cost services to customers.	Variations in *processes* across projects and customers challenge the ability to adapt project management processes to changing circumstances.
SW1. Cultivate external relationships	Active engagement with the international Drupal community.	The project managers are engaged with the customers' business processes but not with the Drupal community.
SW2. Distribute sense-and-respond cycles	Management, sales, and developers show sensitivity and respond-ability towards changes in technology and the overall market.	Changes at the company level outpaced the project managers' ability to maintain process descriptions and support technologies.
SW3. Ensure company-level coordination	The yearly strategy seminar defined a common direction.	Coordination among project managers was limited to resource management but included many diverse and conflicting responsibilities.
SW4. Leverage component based architectures	A growing market for Drupal based applications allowed the company to exploit current capabilities in new business offerings.	The descriptions and guidelines for project management were outdated and incomplete on exploiting the new, yet frequently similar customer relationships.
SW5. Balance standardization and customization	Business success resulted in a growing focus exclusively on Drupal. Activities related to mobile technology was separated in a spinoff company with that particular focus.	The many new project managers combined with the limited codification of process knowledge resulted in little standardization of project processes and practices.

'clan' quadrant with some elements of 'adhocracy', and an orientation towards flexibility and discretion. This—combined with a flat organizational structure—ensured a working environment open to debate and learning on a day-to-day basis. Reflection and learning at the company level was institutionalized at the annual strategy seminars, where all employees went away for a long weekend to discuss the company's status and strategy for the coming year. The company had also successfully managed to respond to and exploit changes to the technological base as witnessed by the shift to the Drupal platform, and its position as one of the more prominent national and international members of the Drupal development community. This

was also supported by the developers' strong group culture and close working relationships. Thus, at the beginning of our engagement, *Adapt* was both open to, and in many ways also able to successfully enact sense-and-respond cycles.

The project managers, however, had not been able to establish robust and sustainable structures and processes for learning. Because of the high turnover among project managers, the head project manager had to spend much time training and mentoring the new project managers, leaving little time for reflection and improvement. Regardless of this, the other project managers felt that they had to learn how to manage projects themselves, leading to differences in project management practices and tool use. Furthermore, the head project manager was the one responsible for revising the process description, but she and the other project managers struggled with an increasing number of projects, customers, and frequent changes to project types and customer relations, leaving little time for this task. With regard to the project managers, sense-and-respond cycles were, therefore, not distributed as recommended in [7], but concentrated around the head project manager, and heavily impeded by a high workload.

This situation had changed somewhat towards the end of our engagement with *Adapt*. The changes that had taken place had improved the project managers' ability to manage and evolve their dynamic capabilities: Using the customer relationship to distinguish between project types was easy to communicate and understand, and the short checklist based descriptions of project management created a basis for standardization but were also easy to modify as needed. Finally, the integration of project management and developer tools into JIRA supported process standardization. All in all, are these changes expected to ease the tasks of the project managers and allow them to increase their ability to exchange and reflect upon experiences.

5. Discussion

The *Adapt* case describes how time pressure and repeated changes resulted in the loss of ability among the company's project managers to adjust their processes and practices in accordance with changes in the company's environment. The project managers eventually resolved the situation by introducing a set of brief, simple process descriptions and tool integration.

In the following, we will discuss three main lessons learned from the *Adapt* case and their implications for management and research.

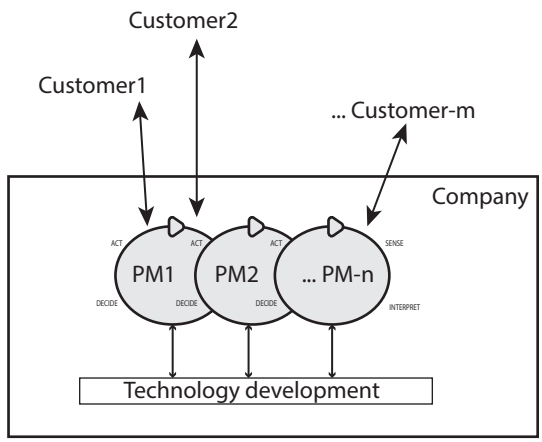

Figure 2: Interacting sense-and-respond cycles

5.1. The centrality of the project manager

Our analysis of *Adapt* shows how the sense-and-respond cycles at different levels of the company interact as illustrated in Figure 2. Much of the sensing and responding is performed by project managers (PM_1, …, PM_n) who are the prime liaisons with the customers ($Customer_1$, … $Customer_m$). The project managers' sense-and-respond cycles interact because they operate within the company's strategic area of customer-relationship management and because they are competing for the same developers' time and attention, and the developers working on the underlying technical platform.

Thus, we suggest that the role of the project managers in small, agile companies such as *Adapt* extends beyond managing software projects towards including the implementation of changes to the company's customer relationships and ISD project management practices.

5.1. Variations in dynamic capabilities

We observe that *Adapt* has the capability to respond to changes in the company's environment and manage its company-level dynamic capabilities as shown in Table 2. But Table 2 also reveals how the frequent changes at the company level challenged the project managers' ability to respond effectively to company-level changes. These frequent changes to customer relationships and different project types, in combination with an increasing number of customers and projects, left less and less time for the project managers to reflect upon and adjust practices. New project managers were at the time less trained in adapting on their own, and the head project manager was struggling to revise the descriptions of project management processes. The outcome was varying and

less efficient project management practices, reduced oversight and coordination, and ultimately a reduced capability to adapt project management processes and practices in response to changes at the company level. This would have potentially negative implications for *Adapt's* overall dynamic capabilities—had the company not begun adapting in a more concerted manner.

We therefore suggest that when a small software company such as *Adapt* responds to changes in its environment in ways that require changes to its project management processes and practices, then the company-level changes depend on the dynamic capabilities of the project managers. The project managers may not, however, have the resources, responsibilities and dynamic capabilities needed to respond effectively to company-level changes.

Managers in SW SMEs should, therefore, take the dynamic capabilities at different levels of the company into account. They should be aware of how company-level dynamic capabilities affect dynamic capabilities at other levels—i.e., whether frequent changes at the company level increase pressure on project managers to the degree that the company as a whole cannot respond effectively to changes in its environment.

5.3. Simple but sufficient change

Adapt's challenges are common to many SW SMEs with limited resources. Particularly in small software start-ups, the company focuses entirely on the bottom line, cutting away all activities not contributing directly to revenue creation, such as a process or standards department or responsible [6], or informal learning networks and mentors [15]. Other organizations, like *Adapt*, can be financially robust, but may face other constraints, such as increasing customer demands, staff turn-over, or growth [8, 9, 36, 37]. In such cases, finding adequate ways to improve the dynamic capabilities at the project management level without putting too much strain on an already strained organization, may be a challenge in itself. The experiences from *Adapt* indicate that a focused change—in this case on the project management processes and tools—can contribute to unlock an apparently frozen situation. The improvements of project management practices were also simple (hence efficient) yet sufficient (hence effective) and it was a deliberate principle for the CEO and the project managers.

5.4. Implications for research and practice

The relationship between company structure and internal project management is complex, and fast moving SW SMEs struggle to match their structures and practices to a turbulent environment [18, 19, 21, 26]. Our study of *Adapt* shows how dynamic capabilities at the company level can lead to increased pressure on the project managers in a small software company, which ultimately challenges the company's ability to respond to changes in the company and its environment.

The study has implications for the research and practice of dynamic capabilities in SW SMEs. Previous research has focused on principles for managing dynamic capabilities at the company level, but our research shows a need to modify and extend those principles to manage interacting sense-and-respond cycles at different levels of the company. The lessons can be followed by managers of SW SMEs as principles:

- Utilize the centrality of the project managers
- Understand the variations of dynamic capabilities between company and project levels
- Implement simple yet sufficient improvements of dynamic capabilities

More research is also needed to further validate and expand on these principles.

6. Conclusion

This paper analyses dynamic capabilities in a fast moving SW SME. The analysis shows how company-level dynamic capabilities can negatively affect project management and the project managers' ability to respond to company-level changes. This, in turn, can have an adverse effect on company-level dynamic capabilities, since the project managers are essential to successful implementation of new project management processes and practices.

Our study confirms the utility of the sense-and-respond framework to analyze the management of dynamic capabilities in small software companies.

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