

Please cite this paper as the publisher's version: [Stormi, K.](#), [Laine, T.](#) and [Korhonen, T.](#) (2019), "Agile performance measurement system development: an answer to the need for adaptability?", *Journal of Accounting & Organizational Change*, Vol. 15 No. 2, pp. 231-256. <https://doi.org/10.1108/JAOC-09-2017-0076>

Agile Performance Measurement System development: an answer to the need for adaptability?

Abstract

Purpose – The purpose of the study is to reflect upon the feasibility of agile methodologies, Scrum in more particular, to supplement the procedural design and implementation of performance measurement systems (PMS).

Methodology – The study is an interventionist case study that applied agile methodologies in the PMS development.

Findings – The study outlines an agile approach suitable for PMS development. The paper answers to topical needs for adaptability and agility in management accounting, by applying agile methodologies into PMS development. PMS development is not a project or process that systematically progresses from the measure selection to measure implementation. Instead, the requirements for the PMS change during the development project. Management rejects measures, new measures emerge as the understanding increases, and situations change. Agile methodologies are a methodological way to respond to the inevitable change and to enhance management accounting adaptability (MAA), not necessarily captured by processual PMS development frameworks.

Research implications – This study contributes to the PMS literature by proposing that agile development methodologies can advance organizational features that increase MAA. As a result, the study proposes a new approach for PMS development to supplement existing ones. The new approach applies Scrum principles in PMS development. By drawing from the theories of performance measurement (system) development and enabling PMS, the paper furthers academic understanding about agile development of accounting information systems.

Practical implications – Companies can utilize the proposed approach in PMS development, particularly after the initial system implementation in redesigning the system. The approach may increase the PMS impact in organizations and prevent PMS implementation failures.

Originality – The paper identifies the potential of using agile methodologies to enhance PMS adaptability and provides preliminary evidence of the potential of such approach in complementing processual PMS development frameworks that can disregard ambiguities in measure definition, representation and near-to-user operational linkages.

1 Introduction

This paper contributes to the ongoing discussions on management accounting adaptability (MAA) based on two starting points. *The first starting point* of this paper is that performance measurement systems (PMSs) need to be adaptive. This request has been long-standing (Scott, 1937). Indeed, previous studies show that performance measurement and control systems need to adapt to change in order to remain relevant over time. This need has been pointed out in the areas of production management (Wisner and Fawcett, 1991; Waggoner *et al.*, 1999; Bititci *et al.*, 2000; Bourne *et al.*, 2000; Kennerley and Neely, 2002; Kennerley and Neely, 2003), business management (Bourne, 2008; Kolehmainen, 2010) and accounting (Henri, 2010; Franco-Santos *et al.*, 2012; Korhonen *et al.*, 2013; Henri *et al.*, 2017; Yigitbasioglu, 2017).

The second starting point is that systematic, procedural approaches to PMS development can easily create a disconnection between the development activities and the PMS/key performance indicators (KPIs) under development (Korhonen, 2014). Far too often, the design and implementation of a PMS fail and the PMS does not meet the expectations (Bourne *et al.*, 2000; Neely *et al.*, 2000; Bourne *et al.*, 2002; Bourne *et al.*, 2003b; Van Camp and Braet, 2016). Even in a static environment, identification of the right measures is challenging. How can one identify KPIs that are critical for their company—KPIs that really help make decisions and manage the company's performance (Hall, 2010; Jordan and Messner, 2012)? Requirements for the PMS easily change as understanding about needs for performance measurement and management increases during PMS development. A development process that systematically proceeds from PMS design (measure selection) to implementation can produce a seemingly satisfactory PMS, but may yield ambiguities about the measures after the PMS implementation and even during the implementation (Englund *et al.*, 2013). Initially selected measures may be wrong or their implementation too challenging. Inconsistencies about the more general idea about measurement and specific operational situations are possible (Englund and Gerdin, 2015). One solution to this problem are the iterative and incremental, adaptive development and functional and visual accounting prototypes to support the development of a successful PMS (Earl, 1978; Wouters and Roijmans, 2011; Laine *et al.*, 2016b).

Such traits can be found from an interdisciplinary examination of adaptability. In software development, *agile methodologies* are a response to almost inevitable change and constant need for adaptability (Lindstrom and Jeffries, 2004). Agile methodologies respond to the fact that software requirements are not static. Instead, software requirements and features evolve during the development project. Strict adherence to the original requirements easily leads to unsatisfactory results. Agile methodologies stress iterative and incremental development process and trust on individuals and interactions over processes and tools. This is a huge contrast to procedural PMS development, and a potential supplementary contribution in this area of research. The agile methodologies, such as Scrum, constrain development efforts on the basis of time, not features: in a fixed time frame, i.e. so-called Sprint, an agile team can only carry out a certain amount of design tasks leading to focus on quick functionalities and elimination of irrelevant tasks (Sutherland and Schwaber, 2016).

In all, the two starting points prepare the foundation for the purpose of the study: to examine the suitability of agile methodologies, Scrum in more particular, to the development of performance measurement systems (PMS). A tentative answer to the need for adaptability and agility are the key ambitions and sources of novelty and originality in this paper. Organizational features, such as information system flexibility, top management team knowledge and team-based structures, increase organizational agility and drive MAA (Yigitbasioglu, 2016; Yigitbasioglu, 2017). As its key contribution, this study proposes that agile

development methodologies can advance such agility-supporting features of the organization (and thus its MAA), by supplementing or even complementing procedural PMS development frameworks.

To pinpoint the potential of agile methodologies in PMS development, this paper uses an interventionist case study (Suomala and Lyly-Yrjänäinen, 2012; Lukka and Suomala, 2014; Suomala *et al.*, 2014; Laine *et al.*, 2016b). In so doing, the paper takes advantage of the researchers' in-depth involvement in a PMS development project that used ideas of agile software development methodologies. Indeed, the researchers actively facilitated the case company's PMS development. As the longitudinal access to the case company's PMS development efforts proceeded, the researchers noticed that aspects of agile development started to emerge. In this case, the company is an industrial service organization that attempts to manage its performance and especially profitability better. The increased role of service business in the case company represents a major change that challenges the existing reporting practices, and therefore triggers the development of new KPIs. During the interventionist case study, the researchers and the company collaborated in this KPI development. The interventionist case study offers a particularly suitable dataset for studying management accounting adaptability because of the actual, dynamic user needs for performance measurement could be witnessed and answered to first hand. The close access to the studied case organization granted the researchers a real-life experience that could be reflected upon agile methodologies in software development.

Moreover, the paper also has a strong linkage to the servitization literature, as servitization efforts in the case company also put adaptation pressures upon management accounting and control (Laine *et al.*, 2012; Lindholm *et al.*, 2017). The case company's PMS development started in spring 2015 and is a long-continuing process. Regular meetings (more than 20 different types of interventions during one and a half years) facilitated the PMS-development process and laid the ground for in-depth analysis of MAA within servitization, based on agile software development ideology. As a secondary contribution, the paper is shows how companies dealing with servitization can acquire higher adaptability of their calculative practices to support their actual managerial work.

The rest of the paper is organized as follows. Section 2 reviews the relevant literature. We have chosen to review literature based on the understanding that not always PMS implementations do succeed (Bourne *et al.*, 2000; Neely *et al.*, 2000; Bourne *et al.*, 2002; Bourne *et al.*, 2003b; Van Camp and Braet, 2016). Section 3 presents the research method and research data. Section 4 goes through the case company's PMS-development process. Section 5 presents the discussion and conclusions and sets out a future research agenda for MAA research.

2 Literature review

2.1 Performance measurement systems

A PMS is a set of metrics that measure the performance of a company: "A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions" (Neely *et al.*, 1995). A PMS is multidimensional system, covering financial and nonfinancial, internal and external, backward and forward-looking measures in order to have an impact on the environment in which it operates (Bourne *et al.*, 2003a). Typically, PMS frameworks integrate measures related to a company's financial performance, customer satisfaction, operational efficiency, and ability to adapt to internal and

external changes (Silvi *et al.*, 2015). However most companies still use only traditional PMS methods, such as budgeting and financial measures (Silvi *et al.*, 2015), that are enabling only to a limited extent (Jordan and Messner, 2012). In this study, a performance measure (or KPI) refers to one single metric.

Structural PMS frameworks provide structure to an existing PMS and overall guidance on what a comprehensive PMS comprises. They are the foundation on which a company builds its PMS. Structural PMS frameworks help companies understand what the current state of their PMS is. In addition, structural frameworks give guidance on what kind of elements a comprehensive PMS includes. Many studies introduce new PMS frameworks or concern existing frameworks – Taticchi *et al.* (2012) provide a comprehensive list of structural PMS frameworks. The BSC (Kaplan and Norton, 1996), performance prism (Neely *et al.*, 2001), and the extended framework provided by Ferreira and Otley (2009) are among the most famous ones.

Although structural PMS frameworks can provide useful tools for managers, ‘just starting to use’ a framework hardly leads to success automatically. Indeed, how a PMS is developed is not insignificant. Structural PMS frameworks are foundations upon which PMS development is built.

2.2 Drivers of PMS development failure and success

PMS development covers the (re)design and implementation of the PMS. The design identifies right measures, i.e. measurement scope (Korhonen *et al.*, 2013) or the controls subject to alteration (Henri *et al.*, 2017), whereas implementation brings the measures to life. Typically, a PMS requires a supporting (IT) infrastructure, which can include data acquisition, collation, sorting, analysis, interpretation, and dissemination (Franco-Santos *et al.*, 2007), which means that an implementation project needs to deal with all these aspects.

Whether PMS development has been purposeful or not, the estimated failure rate of PMS implementations varies from over 50 to 70 percent (Neely and Bourne, 2000; de Waal and Counet, 2009). A PMS development project may fail or succeed for many reasons. The development project almost inevitably fails if the PMS design quality is poor (Keathley *et al.*, 2014); that is, the company fails to define what, how, how much, and when to measure (Van Camp and Braet, 2016). Reasons for failure are often technical; companies do not have adequate information practices and capabilities to implement the PMS (Garengo and Bititci, 2007). Data is scattered in different sources, in different formats, and in different departments. Some of the data is hidden and duplicated. Information sources are not linked properly, and information is not available dynamically (i.e., near real-time) (Nudurupati *et al.*, 2011). In some cases, companies simply do not have enough time and resources to implement the PMS, or new initiatives may take precedence over PMS development (Nudurupati *et al.*, 2011).

Employee participation, in turn, promotes PMS development success (Eldenburg *et al.*, 2010; Groen *et al.*, 2012). However, senior management commitment is a key driver of success (Bourne, 2005; Van Camp and Braet, 2016). Managers must have enough time, interest, and motivation to develop the PMS (Bourne *et al.*, 2002; Van Camp and Braet, 2016). Altogether, PMS must fulfill the managerial need in terms of its both design and implementation. Companies still need to build and adapt their PMSs to fit the business context; that is, companies must design their unique PMS and finally implement the PMS. So-called *procedural frameworks* facilitate this PMS development project.

2.3 Procedural PMS implementation might work but not always

Procedural PMS frameworks guide the PMS design process one step at a time (Bourne *et al.*, 2003a; Kaplan and Norton, 1993; Neely *et al.*, 2000; Bourne *et al.*, 2000) and value systematized change (Kennerley and Neely, 2003; Kennerley and Neely, 2002). Procedural frameworks assume that the PMS development is a progressive process typically carried out by the top management and facilitated by, e.g. a consultant.

However, applying a PMSs in a very specific context might end up problematic. Managers can have problems in understanding the definition of a measure, how it represents the real life, and how causal dependencies between numbers and operations can be explained (Englund *et al.*, 2013). While actors make sense of the more generic mental models concerning a metric and the specific ones that concern measurement in a single operational situation, possible inconsistencies between these mental models can trigger further PMS modification (Englund and Gerdin, 2015). Both general and specific mental models are, indeed needed to understand a metric in a specific operational situation (Englund and Gerdin, 2015; Laine *et al.*, 2016a). In such cases it might be that procedural PMS implementation frameworks lack the capability to relate the PMS to the managerial work of individuals in an organization. To support this claim, there is evidence that the development of the PMS is a continuous and experimental process (Lohman *et al.*, 2004) and that different stages, design and implementation overlap (Wouters and Wilderom, 2008). A procedural framework to PMS implementation might well cover the systematic part of implementation at the general level, whereas a more individualistic adaptation of a system is fluid, not systematic and resonates with flexible use of the system and experimentation (Vaivio, 1999; Lukka, 2007; Kolehmainen, 2010; Yigitbasioglu, 2017).

2.4 Iterative PMS development frameworks could be needed to supplement procedural frameworks

Experimentation means that actual users can evaluate the feasibility, usability, and validity of measures prior to the final choices by using prototypes (Earl, 1978; Wouters and Roijmans, 2011). An accounting prototype helps employees perceive the features of the measures, such as the appearance and method of use (Laine *et al.*, 2016b). Prototypes ensure the effectiveness of the PMS and save time and money when a company implements only relevant measures (Wouters and Roijmans, 2011). Importantly, measure design, test, evaluation, and implementation go hand in hand rather than sequentially (Wouters and Wilderom, 2008) within the overall PMS design and implementation process. Therefore, iterative PMS development based on experience is one approach for attaining an enabling PMS (Wouters and Wilderom, 2008).

Consequently, procedural frameworks can work in many occasions but not always. Measures given by an outsider, that is, potentially copy-paste behavior and off-the-shelf metrics (Van Camp and Braet, 2016), and development carried out only by management and an optional consultant can in some cases result in a coercive¹ PMS instead of an enabling one (Wouters, 2009; Wouters and Wilderom, 2008). This is an important reminder: the rationale of PMS development is to offer better support for the managerial work in companies (Hall, 2010). A coercive PMS aims to force employee compliance while employees perceive an enabling PMS as a work enabler and enhancer. An enabling PMS gives employees feedback and helps them make right choices, that is, increases the efficiency and effectiveness of the work (Wouters and Wilderom,

¹ For enabling and coercive management-system characteristics, see Adler and Borys, 1996; Ahrens and Chapman, 2004; Jordan and Messner, 2012

2008), i.e. helps also the people that are being measured, not only the ones who measure others' performance (Englund and Gerdin, 2015).

In sum, we expect that procedural PMS design processes could be accompanied with, or supplemented by, processes that are more adaptive and iterative with regard to actual PMS use. Sections 2.1-2.4 can be summarized in the following way: PMSs need to be adaptive and such adaptability could be provided by procedural PMS frameworks that work sequentially. However, PMS development often requires iterative approaches in PMS design, such as prototypes (Wouters and Roijmans 2011; Laine et al., 2016b), which can be evaluated based on their usefulness for managerial work. Based on this background, in the next section, the paper will develop the basis for using *agile methodologies in PMS design*.

2.5 *Agile methodologies for software development*

Agile is the ability to create and respond to change in order to succeed in an uncertain and turbulent environment². Agile methodologies are based on values and principles expressed in the Manifesto for Agile Software Development³. Agile methodologies have roots in software development even if companies use them today in other contexts as well (Serrador and Pinto, 2015). In the 11th Annual State of Agile Report, 94% of respondents said their organizations practiced agile⁴. Agile methodologies respond to almost inevitable change and uncertainty with iterative and incremental work practices. The Manifesto for Agile Software Development declares the four main principles of agile software development:

1. Individuals and interactions over processes and tools.
2. Working software over comprehensive documentation.
3. Customer collaboration over contract negotiation.
4. Responding to change over following a plan.

Agile development is based on the idea that inevitable change and uncertainty cannot be controlled through a high degree of formalization (Nerur and Balijepally, 2007). Instead, a dynamic development process is a preferred way to manage uncertainty (Nerur and Balijepally, 2007). A dynamic development process is characterized by iterative and incremental cycles and the active involvement of all stakeholders. From a theoretical perspective, agile ideology relies on principles of action learning (Morgan and Ramirez, 1984), a distinction between organizational knowledge and organizational knowing (Cook and Brown, 1999), and organizational knowledge creation (Nonaka and Takeuchi, 1995). These theories share the common vision that practice, action, and interaction create new knowledge.

Before agile methods, the waterfall model was the most prevailing software development methodology (Royce, 1970). According to the waterfall model, software development is a process that consists of five phases: requirements, design, implementation, verification, and maintenance, in that order. The progress of the software development project steadily flows from requirements to the maintenance of a working piece of software so that the output of the preceding phase is the input of the following phase. Water does not flow up a waterfall (Laplante and Neill, 2004). Software development with the waterfall model is based on heavy documentation that ensures the quality and success of the development project.

² <https://www.agilealliance.org>

³ <http://agilemanifesto.org/>

⁴ <https://explore.versionone.com/state-of-agile/versionone-11th-annual-state-of-agile-report-2>

In theory, the waterfall model seems prominent. However, in practice it has some severe problems (Laplante and Neill, 2004). Typically, keeping the documentation up to date is a complex operation, resulting in hundreds of pages of outdated information. In addition, software programmers mostly work alone without the valuable cooperation of colleagues. Most importantly, the waterfall model is rigid. The model adapts poorly to the changes in requirements. However, requirements almost inevitably will change when a user gets hands-on experience with the software (Humphrey, 1995). Changes in functionality were a major problem for the waterfall model, since changes in the first phase of the model (requirements) required changes in all subsequent phases (design, implementation, verification, and maintenance).

Since the Manifesto for Agile Software Development, several agile development methodologies have emerged (Lindstrom and Jeffries, 2004). Scrum is probably the most famous. Scrum is a framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value (Sutherland and Schwaber, 2016). Scrum is founded on empirical process control theory, or empiricism. Empiricism asserts that knowledge comes from experience and making decisions based on what is known (Sutherland and Schwaber, 2016). *The Scrum Team* is responsible for the (software) development project. Team members have different roles: *the Product Owner* represents the customer; *the Development Team* is responsible for implementing the software; and *the Scrum Master* ensures that development follows Scrum principles. The work is organized in *Sprints*, a time-box of one month or less during which a “Done”, useable, and potentially releasable product increment is created (Sutherland and Schwaber, 2016). The Scrum Team inspects artifacts and progresses toward the Sprint Goal and adapts practices if needed in different events. Sprint starts with the *Sprint Planning* and ends with the *Sprint Review* and *Retrospective*. In the Sprint Planning, the Scrum Team selects feature(s) to be implemented during the Sprint. *Daily Scrum* is a short meeting that the Scrum Team organizes daily during the sprint implementation. In the Sprint Review, the Scrum Team presents the results of the Sprint to relevant stakeholders, typically to customer. Sprint Retrospective provides team members an opportunity to review and enhance their work. Two Scrum artifacts, *Product Backlog* and *Sprint Backlog*, provide transparency and opportunities for inspection and adaptation (Sutherland and Schwaber, 2016). Product Backlog is a list of features to be implemented during the development project. Team members and stakeholders review and update the Product Backlog regularly in the Sprint Events. Sprint Backlog is a list of tasks that the Sprint implementation requires, such as meetings, data gathering and coding.

In all, ensuring the fulfillment of the user needs and means for overcoming the emerging problems are the features of Agile software development that could be beneficial also for PMS development as understood in this paper. Combining these two research streams represent the starting point of the empirical part of this paper.

3 Method and data

The study is an interventionist case study of an industrial service company that aims to better manage its performance (Suomala and Lyly-Yrjänäinen, 2012; Lukka and Suomala, 2014; Suomala *et al.*, 2014; Laine *et al.*, 2016b). The research project started in spring 2015. The objective of the project was to improve the PMS and ultimately the performance of the case company, called AgileCo (pseudonym used because of confidentiality). The researchers actively participated in the PMS development. They facilitated the use of the Scrum principles and engaged in the selection and evaluation of KPIs. The interventionist research approach is desired for the research setting of this paper, as it provides access to the real-life business

phenomenon, i.e., processual evolution (see Lyly-Yrjänäinen *et al.*, 2017) of the PMS in this particular context and the interactions between the interventionist researchers and the managers (Laine *et al.*, 2016b). As discussed by Jönsson and Lukka (2006), the interventionist approach features continuous reflections between the business phenomena at hand and the related theoretical concepts and frameworks. Indeed, regarding agile PMS development, such continuous reflection is largely desired. Moreover, as described by Lukka and Suomala (2014) as well as Lyly-Yrjänäinen *et al.* (2017), interventionist research project may feature technical development (‘*techne*’) in addition to (or underlying) theoretical (‘*episteme*’) and societal (‘*phronesis*’). The involvement of the researchers in agile PMS development represented interplay between ‘*techne*’ and ‘*episteme*’ during the process.

The PMS development was organized as a project in AgileCo. The project organization had several members. Two interventionist researchers (the first and second author), the company’s general manager, operation manager, service manager, sales manager, product manager, controller, and development manager were actively involved in the project. In addition, important stakeholders, employees, participated in the development project in varying configurations. They gave valuable feedback on the applicability and feasibility of the measures. Generally, at AgileCo hierarchy is low and business culture is open. The management encourages open discussion and employee’s opinion is valuable. This provided a natural starting point for the interventionist researchers’ engaged scholarship (Van de Ven and Johnson, 2006).

The work began with three preliminary interviews in February 2015. Since then, the project has had more than 20 teleconferences (Type T in Table 1) and several face-to-face meetings (Interviews, meetings and workshops as described in Table 1). Table 1 lists all interventions from February 2015 to February 2017. Check-ups are regular information-sharing meetings that include what has been done, what problems have been encountered, and what will be done next. At the beginning of the project, the meetings and teleconferences were kept casual. However, when the work habit stabilized, members organized meetings more regularly so that a new meeting was agreed upon at the end of the previous contact. Researchers collected and analyzed comprehensive meeting notes in reflection of the objective of the paper.

[INSERT TABLE 1 HERE]

The role of the interventionist researchers is worth further reflections. As conveyed in Table 1, the role of the interventionist researchers varied naturally along with the project between the roles of ‘Observer’, ‘Active participant’, ‘Facilitator’ and ‘Expert and designer’. In line with the idea presented by Suomala and Lyly-Yrjänäinen (2012), there were both weak and strong interventions during the process. Indeed, there were meetings facilitated by the researchers in order to scrutinize the ideas of the PMS development. Besides, at certain stages, the technical capabilities of one of the researchers were required to enable certain features to the forthcoming PMS. Altogether, due to the “one of us” status of the interventionist researchers, it is fair to say that the researchers clearly affected the PMS development project. However, it is noteworthy that the deep involvement of the researchers is primarily desired due to the unique access, enabled by the interventionist approach, to the business phenomena. The interventionist research does not necessarily yield the best possible construction in response to the challenges at hand (see e.g., Kasanen *et al.*, 1993 for constructive research approach), but the interventionist research approach unveils the mechanisms relevant to this kind of processes, i.e., developing PMS that could support managerial work, and thus increases the validity and reliability of the findings.

4 Empirical findings

This section first introduces the case company, AgileCo. Second, the section goes through the PMS development project undergone by AgileCo, with its implications to the stakeholder managers.

4.1 Case company

AgileCo is an industrial service organization, part of a large multinational group. AgileCo serves equipment manufactured in other parts of the group. Industrial services are services required by manufactured products mainly in the business-to-business (B2B) context (Oliva and Kallenberg, 2003). Industrial services are supposed to ensure effective, uninterrupted, and durable use of industrial equipment. Installation, training, repair, maintenance, and spare parts are typical examples of these services. AgileCo's industrial service provision covers installation, training, periodic maintenance, updates, breakdown services, and spare parts. In this context, the installed base of the equipment in use by the customers is a central concept. The concept of the installed base means all the pieces of equipment sold by the original equipment manufacturer (OEM) to its customers and to be served by the OEM and other service providers during their lifecycle (Dekker *et al.*, 2013; Oliva and Kallenberg, 2003).

AgileCo's yearly service turnover is roughly 10 million euros covering spare parts and labor services. AgileCo has a few hundred industrial customers, of which around 300 are active yearly. The size of customers varies from small organizations to large multinational companies.

In the industrial services context, customer relationships are typically long, and sales are more relationship than transaction based (Oliva and Kallenberg, 2003). Consequently, the performance measures used are also different (Laine *et al.*, 2012). In this context, a customer or a project are natural units of analysis. In addition, the proportion of indirect costs, such as sales and marketing, is relatively high. However, AgileCo does not report and allocate indirect costs to customers.

4.2 Agile PMS development/findings

At the time of the study, the overall aim of the development project was to create a "dashboard" that would include all the relevant KPIs needed for managing the company's performance. However, the choice of measures was not self-evident. At that time, AgileCo used several company level financial measures that management monitors regularly, such as turnover, direct and indirect costs, EBITDA, customer and project contribution margin. However, indicators that would specifically support servitization and industrial services business development were lacking and therefore the existing PMS needs to be supplemented with new metrics.

In addition, AgileCo's PMS had implementation challenges. Field staff reported direct costs (labor, material, and travel expenses) and allocated them to customers, projects and products. However, sales and marketing neither reported nor allocated customer service cost (e.g. marketing, offer preparation and order processing). AgileCo had a global reporting system. However, due to technical reasons, the reporting system was not regularly used. Instead, a controller created ad-hoc spreadsheet-based reports. Finally, accounting data was available in many different systems that were not necessarily compatible. In particular, installed base information was scattered across different systems and databases. Field staff maintained a maintenance log. In addition, AgileCo had a group-level installed base database. However, the database was not fully updated and consistent, which could create ambiguities about measurement (cf. Englund *et al.*, 2013; Englund and Gerdin, 2015). In short, the database gave an overview of the installed base but

based on the database, managers could not make reliable estimates about customer potential, for example. This hampered how accounting information supported their managerial work (Hall, 2010).

Due to the aforementioned uncertainties and challenges, the project organization decided to proceed one KPI at the time in PMS development – in other words, they would not create a new PMS from scratch but supplement existing metrics with new ones, by PM dynamism and change (e.g., Henri 2010; Korhonen *et al.*, 2013; Henri *et al.*, 2017) to provide MAA (Yigitbasioglu, 2016; Yigitbasioglu, 2017). In addition, KPI feasibility assessment would proceed the actual implementation. Such KPI feasibility assessment would consist mainly of visual and functional accounting prototypes that would clarify the relevance of the KPI. This feasibility assessment took place outside any procedural PMS development framework that had initially lead to AgileCo's PMS of that time.

Finally, AgileCo's development process consisted of three phases, i.e. three different Sprints. Each Sprint was its own independent entity. However, PMS development did not follow a predefined plan. Instead, the organization rejected KPI candidates and new KPIs emerged as the project progressed and understanding increased. Next, the three development phases are discussed in more detail.

4.2.1 Customer net profit: Sprint 1

Although, servitization is not a new phenomenon, reporting practices and management controls in servitization have not yet stabilized (Laine *et al.*, 2012; Lindholm *et al.*, 2017). In the industrial service business, customer relationships are typically long, and sales are more relationship than transaction based. In addition, the profitability of industrial services depends on the customer and the installed base of the customer. Therefore, the customer is at least as important and common accounting object than product. Consequently, AgileCo management had identified *the customer net profit* as the first potential KPI. Managers should see all customers, their net profit and their net profit ratio. The customer net profit is customer turnover less all costs incurred by the customer. These costs cover direct costs (material and labor) as well as customer service costs (e.g. marketing, delivery, offer preparation and order processing). AgileCo's managers saw the net profit as a particularly interesting metric since customers required varying amounts of services regardless of their turnover. Based on a customer net profit metric, AgileCo could further divide customers into profitability segments and manage the profitability of each segment.

The KPI evaluation covered several tasks. First, AgileCo's controller fetched customers' contribution margin (turnover less direct costs) in 2014 from the ERP system. Second, the project organization evaluated customer service costs in 2014. It was noticed that AgileCo did not report and allocate service costs to customers. Consequently, identification of service costs required several interviews with AgileCo's employees. Third, the interventionist researches implemented a spreadsheet-based functional prototype (Earl, 1978; Wouters and Roijmans, 2011; Laine et al., 2016b), a customer profitability tool.

However, AgileCo's project organization decided not to implement the customer profitability KPI to full extent. This abandonment had several reasons. The amount of service costs were based on estimates. Hence, calculating customer net profit on a regular basis would have required major changes in AgileCo's reporting practices and IT systems. In addition, the customer profit is a backward looking indicator; past profits do not guarantee future profits. Finally, not everybody considered the KPI useful for their managerial work. As a sales manager said, the customer net profit is unnecessary information since customers' contribution margins are already available from the ERP system.

As the work progressed, the similarity of the PMS development to software development became clear and the researchers noticed that aspects of agile development started to emerge. PMS requirements like software requirements are not static. In AgileCo's case, PMS requirements evolved throughout the development project as software requirements do change during a software development project. AgileCo's project organization rejected KPI candidates and new candidates appeared as the knowledge increased. In addition, individuals and interactions will contribute to finding purposeful KPIs, not processes and tools. Structural and procedural PMS frameworks could assist PMS development, but the company still had to identify KPIs (that purposefully support management and are technically feasible) outside any processual PMS development framework.

As the interventionist researchers had earlier experience in software development, quite naturally, the development project followed Scrum principles to some extent. First, the project organization split the PMS development to smaller pieces; the project proceeded one KPI at a time. Similarly, Scrum organizes software development in Sprints (Sutherland and Schwaber, 2016). In addition, researchers promoted regular meetings, open discussion, prototyping and appropriate documentation; as in Agile methodologies. Meetings were organized roughly every two weeks and the next meeting was agreed upon at the end of the previous meeting. In conversations, the project organization stressed the potential users of the KPI, the impact of the KPI on management and the benefits of the KPI in relation to the implementation costs. Visual and functional prototypes clarified the appearance and relevance of the KPI. Finally, the researchers wrote short notes for each meeting.

4.2.2 Customer potential: Sprint 2

After rejecting the first KPI candidate, the customer net profit KPI, the development project followed Scrum principles to an increasing extent and researchers presented the principles of agile development to the managers. KPI evaluation and prototyping (Sprint implementation) followed KPI selection (Sprint Planning). After rejecting the customer profitability KPI, the researchers organized the first planning session in December 2015. In the planning session, the sales manager presented the idea of a new KPI: *the customer potential* (Sprint 2). The customer potential is the ideal amount of industrial services that a customer could order on a yearly basis. In the industrial services context, customers' installed base is one key driver for customer potential (Stormi *et al.*, 2018). Installed base size, type, age, and the mode of use determine theoretical boundaries for service demand. AgileCo's managers, account managers in particular, should be able to review customers, their installed base, service potential, and industrial services accomplished and offered so far.

The KPI evaluation started with a visual prototype that represented the appearance, not the functionality of the KPI (Figure 1). Customer potential, that is potential revenues from a given customer during one year, covers in this case revenues from maintenance and renewals. In Figure 1, AgileCo has utilized the 'used' potential i.e. there are actual revenues from maintenance and renewal activities. Potential is 'offered', if AgileCo has submitted an offer regarding maintenance and renewal activities, which the customer has not yet approved. 'Unused' potential is still untapped. At the beginning of a fiscal year, all customer potential is unused. Within a year, AgileCo makes renewals and maintenance and the proportion of the unused potential decreases while the proportion of used potential increases. At the end of the year, the proportion of the unused potential should be as small as possible.

[INSERT FIGURE 1 HERE]

Everybody agreed with the potential usefulness of the KPI. However, the actual implementation of the customer potential KPI was challenging since the calculation of the KPI required that the company would maintain an installed base database, that is, records the type, delivery date, location, and customer information from every piece of equipment sold. AgileCo maintained a partial installed base database whose content was not up to date. Altogether, a comprehensive installed base database would require changes in reporting practices and heavy IT investments.

4.2.3 Campaign tool: Sprint 3

An incomplete installed base database changed the PMS development direction again. In spring 2016, AgileCo identified another way to utilize installed base information: *equipment-type-based customer segmentation*. As an example, intermittently AgileCo wanted to reach all their customers with a particular type of equipment, for instance when the equipment support ends. Coincidentally, one type of equipment was at the end of its lifecycle and the company was preparing a campaign to reach customers who still used this equipment. Against this background, AgileCo decided to implement a tool that follows the progress of the campaign, that is, the proportion of obsolete equipment reached. Simultaneously, AgileCo would evaluate and test the installed base database. AgileCo could implement the customer-reaching campaign, even if their installed base database would not be complete. In fact, the campaign would be an opportunity to supplement the database, since the renewal would require reviewing the installed base of each customer.

The implementation of the campaign tool was challenging. Therefore, the team decided to concentrate on the tool (third Sprint). The implementation included several tasks. First, development team collected data from internal IT systems. The actual implementation covered several phases and user tests. However, at the end of 2016, AgileCo started the campaign and released the tool. Altogether, the development of the tool was fast, and took only four months. Competent team members and regular interactions and discussions within the development team and with stakeholders enabled the fast delivery. Initially, the development team made a rough design of the tool. However, in particular a development manager and a product manager had an important role: they jointly designed the visual and functional features of the tool. The product manager implemented the tool and the development manager organized tool testing and user training. The development team regularly followed the progress of the tool.

The campaign tool itself was not a KPI. Instead, the tool included several measures. The first measure monitored *the sales potential* and *success* of a single sales person. This potential was the number of devices requiring renewal which are under the responsibility of a particular sales person. The success was the number of actual renewals. Similarly, the second indicator measured the sales potential and success at the company level. The company level indicator aggregated sales person level indicators. The third measure, *pipeline*, monitored the progress of the campaign. During the campaign, each piece of equipment would have several states (Table 2).

[INSERT TABLE 2 HERE]

The pipeline tool, as conveyed in Figure 2, shows the share of equipment in different states during the campaign. In the campaign, a certain type of device in use at AgileCo's customers were targeted, because a need for renewal was identified (100 % equipment fleet means total number of those selected devices in use at the customers). Initially, every piece of equipment are in the potential state, meaning that sales persons have not contacted the customers who use those devices. As the campaign would progress, the

equipment would move from one state to another. The aim would be to maximize the share of renewed equipment at the end of the campaign.

[INSERT FIGURE 2 HERE]

AgileCo's case gave encouraging insight about the applicability of the Agile methodology in PMS development, in particular regarding designing and implementing relevant KPIs and therefore supplementing an existing PMS, and consequently providing MAA (Yigitbasioglu, 2016; Yigitbasioglu, 2017). The initially structural idea of the dashboard was sought to be tackled as a PMS development project. However, by involving relevant stakeholders in the project, the users included, the project team could identify and reflect upon the most relevant KPIs for this particular context. This is in line with the ideas of Agile software development (Nerur and Balijepally, 2007), and extends the current understanding about enabling PMSs (Wouters and Wilderom, 2008; Wouters, 2009; Jordan and Messner, 2012; Englund and Gerdin, 2015) and PMS development procedures (Wouters and Wilderom, 2008; Englund and Gerdin, 2015). By not only allowing, but also encouraging the iterative 'Scrum' approach for PMS development, the PMS could become supportive and thus valuable to the user organizations. AgileCo's case provides preliminary evidence on the possibilities for such agile PMS development. The key finding was that Agile methodologies can support PMS development by creating a way to organize PMS developers for replying to the need for MAA, and therefore supplement procedural PMS development frameworks.

5 Discussion and conclusions

5.1 Agile methodologies supplementing procedural PMS development

The purpose of the study is to reflect upon the suitability of agile methodologies, Scrum in more particular, to the development of performance measurement systems (PMS). The study suggests that to supplement the procedural design and implementation of PMS, agile methodologies represent means to respond to the inevitable change and to enhance management accounting adaptability (MAA) (Yigitbasioglu, 2016; 2017), not necessarily captured by processual PMS development frameworks (e.g., Bourne *et al.*, 2000; Bourne *et al.*, 2003a; Kaplan and Norton, 1993; Neely *et al.*, 2000;; Kennerley and Neely, 2003; Kennerley and Neely, 2002). The Scrum framework stresses iterative and incremental development. Thus, releasing software in small, time-constrained, cycles (Sprints) is more adaptable than making one big release.

Earlier studies propose that external environment force (Korhonen *et al.*, 2013) and organizational features enable MAA (Yigitbasioglu, 2017). However, this study suggests that agile PMS development could result in PMS that holds MAA as its feature, thus resulting in a functioning practice that embeds MAA. In other words, agile PMS development is realized by being continuously informed by the forthcoming PMS users. Therefore, an agile PMS development project may result in a practice of using PMS in a reflective way, featuring reflections on the performance measures regarding a current managerial task as well as reflections on the fit between the PMS in use and the changing use context regarding forthcoming managerial tasks. Such observation is unique in the sense that no previous evidence have been provided about the potential of particular agile methodologies in PMS development. The findings of this paper rely on the idea of the accounting development and enactment as a shared resource of action in a given organization (Ahrens and Chapman, 2007), that serves as a dynamic platform for managerial decision-making based on an increased understanding about the evolving business context.

In this vein, agile methodologies could provide adapted, topical and purposeful measures for different uses, especially after initial PMS implementation phase. Focused initiatives that maintain and extend a PMS framework can facilitate using the PMS as an actual support in various types of managerial work (Hall, 2010), and possibly overcome some ambiguities concerning PMSs in particular operational situations (Englund *et al.*, 2013; Englund and Gerdin, 2015). In the present interventionist study, servitization had changed the business logic of the company, which increased the importance of the customer relationship profitability considerations with some emerging peculiarities. An agile approach for PMS development provided possibilities for developing a PMS that could better support managerial work in this context.

More broadly, as a research implication agile development methodologies can advance organizational features that increase MAA. Moreover, this study contributes to the PMS development literature and especially to the development of an enabling PMS (Cinquini *et al.*, 2013; Laine *et al.*, 2016b; Wouters and Roijmans, 2011; Wouters, 2009; Wouters and Wilderom, 2008) by presenting a new approach for the PMS development. The approach applies the principles of agile software development methodologies, Scrum in more particular, in PMS development. Indeed, the study suggests that agile methodologies can supplement procedural PMS frameworks by offering the elements of adaptation and iteration to the level of measurement selection, and thus using agile methodologies provide new means for ensuring desired PM dynamism (e.g., Henri, 2010; Korhonen *et al.*, 2013). In short, procedural frameworks can provide a clear structure to implementing a whole PMS, whereas agile methodologies offer structure for enabling PM dynamism by providing adaptability close to system users. This is in line with the overall ideas of enabling PMS promoted in the recent management accounting literature (e.g., Ahrens and Chapman, 2004; Wouters and Wilderom, 2008; Wouters, 2009; Jordan and Messner, 2012; Englund and Gerdin, 2015; Jordan and Messner, 2012; Englund and Gerdin, 2015). To strengthen the line of argument of the paper, the interventionist case study showed similarities between the agile software development and the presented PMS development process, regarding the dynamics of the changing user requirements and the power of different individuals and their interactions during the development project. Changes in software requirements are almost unavoidable during the development project. Similarly, PMS requirements will almost inevitably change during the development project as knowledge about PMS needs and technical constraints increases. In addition, individuals (managers and employees) and interactions (discussions and regular meetings) may support finding the right measures.

As a managerial implication, companies can apply the proposed approach during PMS (re)development projects. The agile approach helps managers find answers to the fundamental questions of PMS design: what to measure, how to measure, when to measure, and what the right metric is. Naturally, the approach does not give direct answers to the aforementioned questions. Instead, the approach acknowledges that PMS development is an iterative process that requires time and commitment, individuals and interactions, and often finding the right indicators requires evaluation of a number of KPI candidates. However, the agile method focuses operations to quick prototyping and developer response to PMS user feedback. Visual and functional prototypes help managers quickly evaluate the relevance of proposed KPIs and feed their evaluations back to those who technically develop the KPIs (Earl, 1978; Wouters and Roijmans, 2011; Laine *et al.*, 2016b).

5.2 *Outlining an agile PMS development approach*

As result, to add to the extant understanding about PMS development, the study proposes a supplementary approach for PMS development. The agile approach primarily can support the further development of

existing PMSs, to support flexibility (Ahrens and Chapman, 2004), adaptability (Henri *et al.*, 2017; Yigitbasioglu, 2016; 2017, PM dynamism (Henri, 2010; Korhonen *et al.*, 2013) and the characteristics of the enabling formalizations (Adler and borys, 1996; Ahrens and Chapman, 2004; Wouters, 2009; Wouters and Wilderom, 2008; Englund and Gerdin, 2015) regarding PMSs.

The approach applies Scrum principles to PMS development, but cannot be used in isolation of the procedural approaches of overall PMS development (cf. the overall PMS of the case company) or overall business development initiatives (cf. the servitization initiative of the case company). The purpose of the agile approach is to ensure the relevance of the PMS and to prevent unnecessary investments. The approach (as Scrum) organizes development work into smaller parts (Sprints):

- A Scrum Team carries out the development project. Every member has a clear role.
- Every Sprint has clear start (Sprint Planning), implementation and end (Sprint Review and Retrospective).
- Each Sprint produces appropriate artifacts.

PMS development divided into Sprints is easier to conquer than developing the whole PMS at the same time. A Sprint can include, for example, KPI evaluation or implementation. As required, companies can apply other sharing criteria as well. However, every Sprint has a goal and duration. A clear goal enables quick feedback on the progress and results of the work. The approach accepts changing PMS requirements. However, the Sprint goal does not change. A Sprint's short and predetermined duration will speed up feedback reception and increase effort exerted on PMS development. Simply, short development cycles keep the project going. Typically, the duration of a Sprint is one month or less. However, typically, a Scrum Team develops PMS besides normal work and a tight schedule can be challenging. Therefore, a Scrum Team needs to find schedule that best support their needs.

A Scrum Team has three main actors: a Scrum Master, a Product Owner and a Development Team. The Scrum Master manages the Scrum process. She organizes meetings and ensures that the project follows Scrum principles. The Product Owner ensures that the product meets customer, end-user and stakeholder needs. In software development, the customer is usually unambiguous: an entity, typically a company that has subscribed to a service and pays for the software. The Product Owner works in the software company and represents internally the customers, end-users and stakeholders. She combines, filters and conveys software requirements to the Scrum Team. In PMS development, management typically orders and uses the PMS, i.e. management is the customer and end-user of the PMS. In addition, the management is typically involved in the development of a PMS. Consequently, the Product Owner is superfluous as end users (managers) are members of the Scrum Team. In PMS development, there are two important stakeholders: The one person or role whose work indicator(s) are measured and the one who collects and maintain data for the measures. Such employees must agree that the selected indicators properly measure the efficiency of the work. In addition, a too laborious collection process increases distraction and leads to poor data quality. Measures built on unreliable data are useless. In all, in addition to users, the opinion of employees and data collectors is important and they should be part of the Scrum Team.

In the Sprint Planning session, the Scrum Team sets target for a specific Sprint: for example it selects the KPI candidate that the team evaluates during the particular Sprint. If needed, the Scrum Team can divide the Sprint into smaller parts. For example, the team might implement visual and functional prototypes in their own Sprints. After the planning session, the Development Team identifies task needed for Sprint

implementation. For example, the implementation of a functional prototype typically requires collecting data from different sources, interviews and the actual KPI implementation. After implementation, in the Sprint Review session, the Scrum Team and stakeholders evaluate the results of the Sprint. For example, does the prototype confirm the relevance of the KPI? And based on the prototype, what kind of IT investments and changes in data collection processes does the KPI implementation require? Does everybody agree on the KPI relevance? Eventually, the Scrum Team decides on implementing the KPI. One of Scrum's goals is to get the Scrum Team work as efficiently as possible. Members of the team support and learn from each other. However, there is always room for improvement. The Scrum Team discusses and evaluates the success of the team during the Sprint Retrospective. Everyone reflects on what has gone well, which practices should be improved or even abandoned. In software development, the Scrum Team organizes a short (10 – 15 minutes) meeting daily (Daily Scrum). However, organizing a daily meeting on PMS design and implementation might be challenging since the team members would probably be involved in the PMS development besides their regular responsibilities.

Scrum acknowledges that documentation is important. However, excessive documentation is frustrating and after all, documents do not guarantee a working software or PMS. Accordingly, Scrum development produces only two artifacts: a Product Backlog and a Sprint Backlog. The Product Backlog lists all technical and functional features of the software. In the PMS development, the Product Backlog would list all identified KPIs and their associated user stories (Table 3). A User story is a simple story that crystallizes functional requirements. A User story could describe use cases, i.e. how different managers use the KPI. A User story identifies the user and specifies how the indicator affects the work of the user. As an example: "The general manager uses the customer potential KPI to monitor the unused potential during a year. There might be several reasons explaining the a large unused potential, such as incorrect calculation method of the potential, a limited service offering or sales inefficiencies." It is important to identify how the measure furthers managerial work and eventually the performance of the company. A User story is only a simple description of the functionality; it does not describe, for example, the visual design of the KPI. The Scrum Team creates these user stories. However, the Scrum Master ensures that the log is up-to-date. Requirements are revised as the project proceeds. Existing stories are updated and new KPIs emerge during the project. In addition, it is advisable to document why the team abandoned a particular indicator. For example, AgileCo abandoned the customer net potential metric, since the implementation would have required major IT investments and changes in reporting practices. In addition, the relevance of the KPI was not clear. The Sprint Backlog is a list of tasks that the team carries out during the sprint implementation (Table 4). For example, KPI evaluation typically requires collecting data from different sources: interview, visual and functional prototypes. The Scrum Team creates Sprint Backlog at the beginning of each Sprint.

[INSERT TABLE 3 and 4 HERE]

This case study is in no way exhaustive. However, a similar development process is likely in other companies as well. PMS development is a complicated task and many PMS development projects fail since companies fail to define what, when and how much to measure. In addition, PMS must adapt to the changes in the operating environment of a company. Relevant and feasible KPIs are revealed as the development work progresses and changes in PMS requirements are likely. The Scrum methodology helps to meet these challenges of change. The Scrum methodology divides development into small parts (incremental) and the requirements are revisited after every sprint (iterative). Indeed, based on this paper, the conditions for the application of agile methods, Scrum in particular, do exist in PMS development. PMS must adopt to the

changes in the operational environment of the company. Despite the changes in the environment, choosing the right meters is challenging. Agile methods respond to change and support adaptability. However, PMS development is not the same than software development and companies can take advantage of Scrum principles as appropriate. The purpose of the development is not applying an approach but a PMS that meets company needs.

5.3 Conclusion and future research

Overall, the procedural PMS development frameworks and agile methodologies, excel in different aspects. While procedural frameworks might better provide a purposeful view to measurement as a whole, agile methodologies could better allow drilling down to single management situations and measurement uses. Recently, management accounting literature has recognized a growing need for agility and adaptability in performance measurement (Henri, 2010; Henri *et al.*, 2017; Korhonen *et al.*, 2013; Yigitbasioglu, 2017).

The key finding of the study is that PMS development is not a project that steadily progresses from the measure selection to measure implementation. Instead, the requirements for the PMS under development may change during the development project. Indeed, the choice, refinement and demand of KPIs and the overall role of the PMS in different managerial tasks may evolve during a PMS development project, requiring ad-hoc responses (Korhonen *et al.*, 2013). A potential benefit of an agile PMS development project, as examined in this paper, is that such incremental and iterative evolution is enabled (or even encouraged) due to different stakeholders' involvement.

Structural PMS frameworks (Kaplan and Norton, 1992; Kaplan and Norton, 1996; Neely *et al.*, 2001; Ferreira and Otley, 2009) help companies understand the overall structure of their performance measurement. Procedural PMS frameworks, in turn, guide the PMS design process one-step at a time (Bourne *et al.*, 2003a; Kaplan and Norton, 1993; Neely *et al.*, 2000). In spite of the frameworks, PMS development can easily create a PMS that does not meet the complex and ever changing needs (Hall, 2010; Korhonen, 2014). Far too often, the design and implementation of PMS fails (Bourne *et al.*, 2000; Neely *et al.*, 2000; Bourne *et al.*, 2002; Bourne *et al.*, 2003b; Van Camp and Braet, 2016). As a contrasting and potentially supplementary approaches, experience-based and experimental development processes could result in an enabling PMS (Eldenborg *et al.*, 2010; Wouters, 2009; Wouters and Wilderom, 2008). Both employees and managers have an active role in the development of an enabling PMS (Cinquini *et al.*, 2013; Wouters, 2009; Wouters and Wilderom, 2008; Englund and Gerdin, 2015). Accounting prototypes and iterative development can support identifying appropriate KPIs (Earl, 1978; Laine *et al.*, 2016b; Wouters and Roijmans, 2011).

This study contributes to studies of management accounting adaptability (Yigitbasioglu, 2016; 2017), by pinpointing the theoretical implications of using agile methodologies in PMS development and showing some initial evidence of the applicability of those methodologies. Extant literature has identified the benefits of iterative, incremental, and inclusive PMS development processes (Wouters and Wilderom, 2008; Wouters and Roijmans, 2011), but the suitability of agile methodologies has not yet been evaluated. The iterative, incremental and inclusive approach of this paper stems from agile software development ideology that stresses 1) individuals and interactions over processes and tools; 2) working software over comprehensive documentation; 3) customer collaboration over contract negotiation; and 4) responding to the need for change over following a plan.

As a limitation, this paper did not apply the approach to full extent since the adaptability of agile methodologies emerged during the interventionist PMS development. Examining other applications of the agile PMS development is therefore an obvious future research need. To what extent, for example, can the agile approach be applied in the PMS development process? What should be the composition of the “PMS Scrum” Team? How often should the team meet? What kind of accounting prototypes should be used in “PMS Scrum”? Despite the aforementioned limitations, the interventionist approach of this paper provides several relevant possibilities for examining agile PMS development in practice. An interventionist research process (for accounting development) typically represents an interplay between theoretical and practical considerations. Similarly to the agile approach outlined in this paper, balancing the overall PMS framework and timely idiosyncrasies of the use context, the interventionist research approach with researchers’ deep involvement enable reflections between overall theoretical frameworks and their timely limitations and/or potential extensions (see e.g., Lukka and Suomala, 2014; Lyly-Yrjänäinen *et al.*, 2017).

Finally, this study concentrates mainly on the design phase of a PMS development process, that is, the finding of relevant KPIs. However, companies have major challenges in the implementation phase, as well (Neely and Bourne, 2000). These challenges are related to collecting and combining data that is needed in the calculation of KPIs. Future research should address this implementation challenge, asking questions such as how to get identified KPIs to work, what kind of data is needed, what are the related IT system changes required, and consequently, how should organizations ensure the reliability of KPIs. Answering these questions would further the knowledge on how accounting systems interact with actors in PMS development (Laine *et al.*, 2016b; Nørreklit *et al.*, 2016).

References

- Adler, P.S. and Borys, B. (1996), "Two types of bureaucracy: Enabling and coercive", *Administrative Science Quarterly*, Vol. 41 No. 1, pp. 61-89.
- Ahrens, T. and Chapman, C.S. (2004), "Accounting for flexibility and efficiency: A field study of management control systems in a restaurant chain", *Contemporary accounting research*, Vol. 21 No. 2, pp. 271-301.
- Ahrens, T. and Chapman, C.S. (2007), "Management accounting as practice", *Accounting, organizations and society*, Vol. 32 No. 1, pp. 1-27.
- Bititci, U.S., Turner, T. and Begemann, C. (2000), "Dynamics of performance measurement systems", *International Journal of Operations & Production Management*, Vol. 20 No. 6, pp. 692-704.
- Bourne, M. (2005), "Researching performance measurement system implementation: the dynamics of success and failure", *Production Planning & Control*, Vol. 16 No. 2, pp. 101-113.
- Bourne, M. (2008), "Performance measurement: learning from the past and projecting the future", *Measuring Business Excellence*, Vol. 12 No. 4, pp. 67-72.
- Bourne, M., Mills, J., Wilcox, M., Neely, A. and Platts, K. (2000), "Designing, implementing and updating performance measurement systems", *International journal of operations & production management*, Vol. 20 No. 7, pp. 754-771.

- Bourne, M., Neely, A., Mills, J. and Platts, K. (2003a), "Implementing performance measurement systems: a literature review", *International Journal of Business Performance Management*, Vol. 5 No. 1, pp. 1-24.
- Bourne, M., Neely, A., Mills, J. and Platts, K. (2003b), "Why some performance measurement initiatives fail: lessons from the change management literature", *International Journal of Business Performance Management*, Vol. 5 No. 2-3, pp. 245-269.
- Bourne, M., Neely, A., Platts, K. and Mills, J. (2002), "The success and failure of performance measurement initiatives: Perceptions of participating managers", *International journal of operations & production management*, Vol. 22 No. 11, pp. 1288-1310.
- Cinquini, L., Mitchell, F., Norreklit, H. and Tenucci, A. (2013), "Methodologies for managing performance measurement", in Mitchell, F., Norreklit, H. & Jakobsen, M. (Eds.), *The Routledge Companion to Cost Management*, Routledge, Abingdon, Oxon (UK), pp. 360-380.
- Cook, S.D. and Brown, J.S. (1999), "Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing", *Organization science*, Vol. 10 No. 4, pp. 381-400.
- de Waal, A.A. and Counet, H. (2009), "Lessons learned from performance management systems implementations", *International Journal of Productivity and Performance Management*, Vol. 58 No. 4, pp. 367-390.
- Dekker, R., Pinçe, Ç, Zuidwijk, R. and Jalil, M.N. (2013), "On the use of installed base information for spare parts logistics: A review of ideas and industry practice", *International Journal of Production Economics*, Vol. 143 No. 2, pp. 536-545.
- Earl, M.J. (1978), "Prototype systems for accounting, information and control", *Accounting, Organizations and Society*, Vol. 3 No. 2, pp. 161-170.
- Englund, H., & Gerdin, J. (2015). "Developing enabling performance measurement systems: on the interplay between numbers and operational knowledge", *European Accounting Review*, Vol. 24 No. 2, pp. 277-303.
- Englund, H., Gerdin, J., & Abrahamsson, G. (2013). "Accounting ambiguity and structural change", *Accounting, Auditing & Accountability Journal*, Vol. 26 No. 3, pp. 423-448.
- Eldenburg, L., Soderstrom, N., Willis, V., & Wu, A. (2010). "Behavioral changes following the collaborative development of an accounting information system", *Accounting, Organizations and Society*, Vol. 35 No. 2, pp. 222-237.
- Ferreira, A. and Otley, D. (2009), "The design and use of performance management systems: An extended framework for analysis", *Management accounting research*, Vol. 20 No. 4, pp. 263-282.
- Franco-Santos, M., Kennerley, M., Micheli, P., Martinez, V., Mason, S., Marr, B., Gray, D. and Neely, A. (2007), "Towards a definition of a business performance measurement system", *International Journal of Operations & Production Management*, Vol. 27 No. 8, pp. 784-801.

- Franco-Santos, M., Lucianetti, L. and Bourne, M. (2012), "Contemporary performance measurement systems: A review of their consequences and a framework for research", *Management Accounting Research*, Vol. 23 No. 2, pp. 79-119.
- Garengo, P. and Bititci, U. (2007), "Towards a contingency approach to performance measurement: an empirical study in Scottish SMEs", *International Journal of Operations & Production Management*, Vol. 27 No. 8, pp. 802-825.
- Groen, B.A., Wouters, M.J. and Wilderom, C.P. (2012), "Why do employees take more initiatives to improve their performance after co-developing performance measures? A field study", *Management Accounting Research*, Vol. 23 No. 2, pp. 120-141.
- Hall, M. (2010), "Accounting information and managerial work", *Accounting, Organizations and Society*, Vol. 35 No. 3, pp. 301-315.
- Henri, J. (2010), "The periodic review of performance indicators: an empirical investigation of the dynamism of performance measurement systems", *European Accounting Review*, Vol. 19 No. 1, pp. 73-96.
- Henri, J., Journeault, M. and Brousseau, C. (2017), "Eco-control change and environmental performance: a longitudinal perspective", *Journal of Accounting & Organizational Change*, Vol. 13 No. 2, pp. 188-215.
- Humphrey, W.S. (1995), *A discipline for software engineering*, Addison-Wesley Longman Publishing Co., Inc., Boston.
- Jönsson, S. and Lukka, K. (2006). "There and back again: doing interventionist research in management accounting", *Handbooks of Management Accounting Research*, Vol. 1, pp. 373-397.
- Jordan, S. and Messner, M. (2012), "Enabling control and the problem of incomplete performance indicators", *Accounting, Organizations and Society*, Vol. 37 No. 8, pp. 544-564.
- Kaplan, R.S. and Norton, D.P. (1992), "The balanced scorecard: measures that drive performance", *Harvard business review*, Vol. 70 No. 1, pp. 71-79.
- Kaplan, R.S. and Norton, D.P. (1996), *The balanced scorecard: translating strategy into action*, Harvard Business Press, Boston.
- Kaplan, R. and Norton, D. (1993), "Putting the balanced scorecard to work", *Harvard business review*, Vol. 71 No. 5, pp. 134-140.
- Kasanen, E., Lukka, K., and Siitonen, A. (1993). "The constructive approach in management accounting research". *Journal of Management Accounting Research*, Vol. 5, pp. 243.
- Keathley, H., Van Aken, E. and Letens, G. (2014), "PERFORMANCE MEASUREMENT SYSTEM IMPLEMENTATION: SYSTEMATIC REVIEW OF SUCCESS FACTORS", in *Proceedings of the International Annual Conference of the American Society for Engineering Management*, pp. 837-846.

- Kennerley, M. and Neely, A. (2002), "A framework of the factors affecting the evolution of performance measurement systems", *International journal of operations & production management*, Vol. 22 No. 11, pp. 1222-1245.
- Kennerley, M. and Neely, A. (2003), "Measuring performance in a changing business environment", *International Journal of Operations & Production Management*, Vol. 23 No. 2, pp. 213-229.
- Kolehmainen, K. (2010), "Dynamic strategic performance measurement systems: balancing empowerment and alignment", *Long Range Planning*, Vol. 43 No. 4, pp. 527-554.
- Korhonen, T. (2014), *Performance Measurement Dynamism in Product Development; Publication 1218*, Tampere University of Technology.
- Korhonen, T., Laine, T. and Suomala, P. (2013), "Understanding performance measurement dynamism: a case study", *Journal of Management & Governance*, Vol. 17 No. 1, pp. 35-58.
- Laine, T., Korhonen, T., & Martinsuo, M. (2016a). "Managing program impacts in new product development: An exploratory case study on overcoming uncertainties", *International Journal of Project Management*, Vol. 34 No. 4, pp. 717-733.
- Laine, T., Korhonen, T., Suomala, P., Rantamaa, A. and Nørreklit, H. (2016b), "Boundary subjects and boundary objects in accounting fact construction and communication", *Qualitative Research in Accounting & Management*, Vol. 13 No. 3, pp. 303-329.
- Laine, T., Paranko, J. and Suomala, P. (2012), "Management accounting roles in supporting servitisation: Implications for decision making at multiple levels", *Managing Service Quality: An International Journal*, Vol. 22 No. 3, pp. 212-232.
- Laplante, P.A. and Neill, C.J. (2004), "The demise of the waterfall model is imminent", *Queue*, Vol. 1 No. 10, pp. 10.
- Lindholm, A., Laine, T.J. and Suomala, P. (2017), "The potential of management accounting and control in global operations: Profitability-driven service business development", *Journal of Service Theory and Practice*, Vol. 27 No. 2, pp. 496-514.
- Lindstrom, L. and Jeffries, R. (2004), "Extreme programming and agile software development methodologies", *Information Systems Management*, Vol. 21 No. 3, pp. 41-52.
- Lohman, C., Fortuin, L. and Wouters, M. (2004), "Designing a performance measurement system: A case study", *European Journal of Operational Research*, Vol. 156 No. 2, pp. 267-286.
- Lukka, K. (2007), "Management accounting change and stability: loosely coupled rules and routines in action", *Management Accounting Research*, Vol. 18 No. 1, pp. 76-101.
- Lukka, K. and Suomala, P. (2014), "Relevant interventionist research: balancing three intellectual virtues", *Accounting and Business Research*, Vol. 44 No. 2, pp. 204-220.
- Suomala, P., Lyly-Yrjänäinen, J., Laine, T., and Mitchell, F. (2017). *Interventionist Management Accounting Research: Theory Contributions with Societal Impact*. Routledge.

- Morgan, G. and Ramirez, R. (1984), "Action learning: A Holographic Metaphor for Guiding Social Change", *Human Relations*, Vol. 37 No. 1, pp. 1-28.
- Neely, A., Adams, C. and Crowe, P. (2001), "The performance prism in practice", *Measuring business excellence*, Vol. 5 No. 2, pp. 6-13.
- Neely, A. and Bourne, M. (2000), "Why measurement initiatives fail", *Measuring business excellence*, Vol. 4 No. 4, pp. 3-7.
- Neely, A., Gregory, M. and Platts, K. (1995), "Performance measurement system design: a literature review and research agenda", *International journal of operations & production management*, Vol. 15 No. 4, pp. 80-116.
- Neely, A., Mills, J., Platts, K., Richards, H., Gregory, M., Bourne, M. and Kennerley, M. (2000), "Performance measurement system design: developing and testing a process-based approach", *International journal of operations & production management*, Vol. 20 No. 10, pp. 1119-1145.
- Nerur, S. and Balijepally, V. (2007), "Theoretical reflections on agile development methodologies", *Communications of the ACM*, Vol. 50 No. 3, pp. 79-83.
- Nonaka, I. and Takeuchi, H. (1995), *The knowledge-creating company: How Japanese companies create the dynamics of innovation*, Oxford university press, New York.
- Nørreklit, H., Mitchell, F. and Raffnsøe-Møller, M. (2016), "A pragmatic constructivist approach to accounting practice and research", *Qualitative Research in Accounting & Management*, Vol. 13 No. 3, pp. 266-277.
- Nudurupati, S.S., Bititci, U.S., Kumar, V. and Chan, F.T. (2011), "State of the art literature review on performance measurement", *Computers & Industrial Engineering*, Vol. 60 No. 2, pp. 279-290.
- Oliva, R. and Kallenberg, R. (2003), "Managing the transition from products to services", *International journal of service industry management*, Vol. 14 No. 2, pp. 160-172.
- Royce, W.W. (1970), "Managing the development of large software systems", in *proceedings of IEEE WESCON*, TRW, pp. 1-9.
- Scott, D. (1937), "Trends in the Technique and Tools of Management", *Accounting Review*, Vol. 12 No. 2, pp. 138-145.
- Serrador, P. and Pinto, J.K. (2015), "Does Agile work?—A quantitative analysis of agile project success", *International Journal of Project Management*, Vol. 33 No. 5, pp. 1040-1051.
- Silvi, R., Bartolini, M., Raffoni, A. and Visani, F. (2015), "The practice of strategic performance measurement systems: Models, drivers and information effectiveness", *International Journal of Productivity and Performance Management*, Vol. 64 No. 2, pp. 194-227.
- Suomala, P. and Lyly-Yrjänäinen, J. (2012), *Management accounting research in practice: Lessons learned from an interventionist approach*, Routledge, New York, NY.

- Suomala, P., Lyly-Yrjänäinen, J. and Lukka, K. (2014), "Battlefield around interventions: A reflective analysis of conducting interventionist research in management accounting", *Management Accounting Research*, Vol. 25 No. 4, pp. 304-314.
- Sutherland, J. and Schwaber, K. (2016), "The Scrum Guide", available at: <http://www.scrumguides.org/scrum-guide.html> (accessed 1 August 2017).
- Stormi, K., Laine, T., Suomala, P., & Elomaa, T. (2018). "Forecasting sales in industrial services: Modeling business potential with installed base information", *Journal of Service Management*, Vol. 29 No. 2, pp. 277-300.
- Taticchi, P., Balachandran, K. and Tonelli, F. (2012), "Performance measurement and management systems: state of the art, guidelines for design and challenges", *Measuring Business Excellence*, Vol. 16 No. 2, pp. 41-54.
- Vaivio, J. (1999), "Exploring anon-financial'management accounting change", *Management Accounting Research*, Vol. 10 No. 4, pp. 409-437.
- Van Camp, J. and Braet, J. (2016), "Taxonomizing performance measurement systems' failures", *International Journal of Productivity and Performance Management*, Vol. 65 No. 5, pp. 672-693.
- Van de Ven, A. H., & Johnson, P. E. (2006). "Knowledge for theory and practice", *Academy of management review*, Vol. 31 No. 4, pp. 802-821.
- Waggoner, D.B., Neely, A.D. and Kennerley, M.P. (1999), "The forces that shape organisational performance measurement systems: An interdisciplinary review", *International Journal of Production Economics*, Vol. 60-61, pp. 53-60.
- Wisner, J.D. and Fawcett, S.E. (1991), "Linking firm strategy to operating decisions through performance measurement", *Production and inventory management journal*, Vol. 32 No. 3, pp. 5-11.
- Wouters, M. (2009), "A developmental approach to performance measures—Results from a longitudinal case study", *European Management Journal*, Vol. 27 No. 1, pp. 64-78.
- Wouters, M. and Roijmans, D. (2011), "Using prototypes to induce experimentation and knowledge integration in the development of enabling accounting information", *Contemporary Accounting Research*, Vol. 28 No. 2, pp. 708-736.
- Wouters, M. and Wilderom, C. (2008), "Developing performance-measurement systems as enabling formalization: A longitudinal field study of a logistics department", *Accounting, Organizations and Society*, Vol. 33 No. 4–5, pp. 488-516.
- Yigitbasioglu, O. (2016), "Firms' information system characteristics and management accounting adaptability", *International Journal of Accounting and Information Management*, Vol. 24 No. 1, pp. 20-37.
- Yigitbasioglu, O. (2017), "Drivers of management accounting adaptability: The agility lens", *Journal of Accounting & Organizational Change*, Vol. 13 No. 2.

Table 1 Case interventions

<i>KPI</i>	<i>Date</i>	<i>Theme of meeting</i>	<i>Type*</i>	<i>Attendants</i>	<i>The role of the researcher**</i>
<i>Customer net profit</i>	2015-02-10	KPI selection	I	Operation manager, Service manager, Sales manager	Active participant
	2015-02-19	Information gathering	T	Operation manager	Facilitator
	2015-02-25	Accounting data	T	Controller	Observer
	2015-03-09	Accounting data	T	Controller	Observer
	2015-03-10	Information gathering	T	Operations manager	Observer
	2015-03-11	Interview	M	Service manager + sales force	Observer
	2015-03-17	Check-up	T	General manager, Service manager, Operation manager	Active participant
	2015-03-23	Information gathering	T	Service manager	Facilitator
	2015-04-09	Information gathering	T	Service manager	Facilitator
	2015-04-17	Information gathering	T	Sales	Facilitator
	2015-04-21	Check-up	T	Controller, Service manager, General manager, Operation manager	Active participant
	2015-05-05	Check-up	M	Service Manager	Active participant
	2015-05-07	Information gathering	T	Service Manager	Facilitator
	2015-05-11	Accounting data	T	Controller	Observer
	2015-05-20	Check-up	T	General manager, Operation manager, Service manager,	Active participant
	2015-06-09	Workshop	W	Operation manager, Sales manager, Service manager, General manager	Expert and designer
	2015-08-20	Check-up	T	General manager, Operation manager, Service manager	Active participant
	<i>Customer potential</i>	2015-08-26	KPI selection	M	Service manager
2015-10-19		Check-up	T	General manager, Sales manager, Operation manager, Service manager	Active participant
2015-10-28		Accounting data	T	Controller	Observer
2015-11-09		Check-up	T	General manager, Sales manager, Service manager	Active participant
2015-12-03		Workshop	W	General manager, Service manager, Sales manager	Expert and designer
2015-12-15		Benchmark	M	Service manager, General manager, Sales manager, Product manager	Observer
2016-01-11		Check-up	T	General manager, Sales manager, Service manager, Product manager	Active participant
2016-01-20		Information gathering	T	Service manager	Facilitator
2016-03-29		Check-up	T	General manager, Product manager, Service manager	Active participant
2016-03-31		Check-up	T	General manager, Product manager, Service manager	Active participant
<i>Campaign tool</i>	2016-04-26	KPI (campaign tool) selection	W	General manager, Service manager, Sales manager, Development manager, Product manager	Expert and designer
	2016-05-16	Check-up	T	General manager, Development manager, Product manager, Service manager	Active participant
	2016-06-13	Check-up	T	Product manager, Service manager, General manager, Development manager	Active participant
		Check-up	T	Service manager, General manager, Development manager, Product manager	Active participant
	2016-09-21	Campaign development tool	T	Product manager	Expert and designer
	2016-10-10	Check-up	T	Development manager, Service manager	Active participant

	2016-12-12	Check-up	T	Development manager, Product manager, Service manager	Active participant
	2017-02-09	Check-up	T	General manager, Development manager, Product manager	Active participant
	2017-03-11	Check-up	T	Development manager, Service manager	Active participant
* I: Interview	** Observer (passive)				
M: Meeting	Active participant (balanced)				
T: Teleconference	Facilitator (active)				
W: Workshop	Expert and designer (one of use)				

Figure 1 Visual prototype: Customer potential (Potential revenues per year, €)

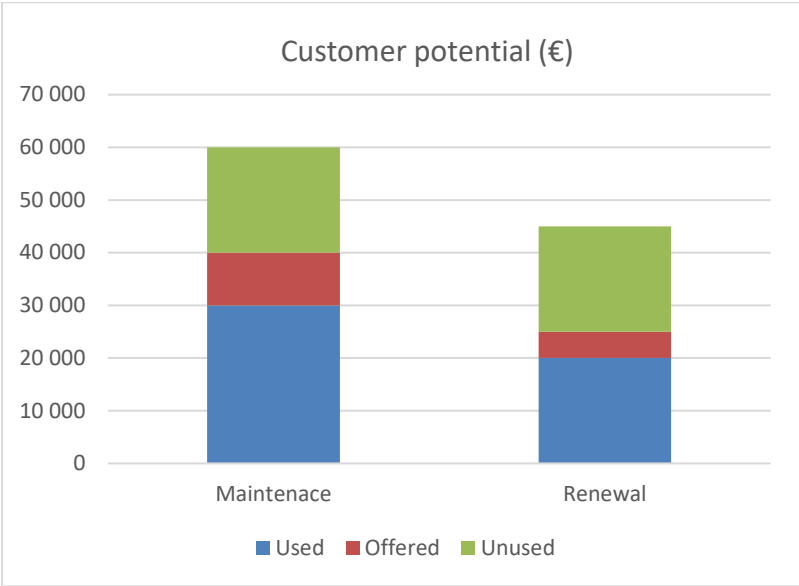


Figure 2 Campaign pipeline: Share of the selected equipment fleet with different states during the campaign

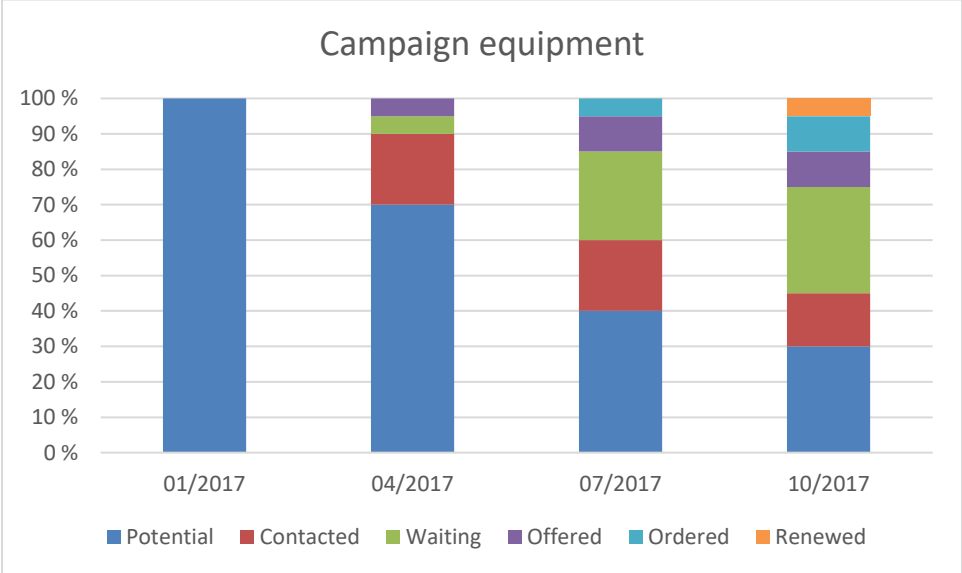


Table 2 Equipment states

<i>State</i>	<i>Name</i>	<i>Description</i>
1	Potential	Customer is not contacted
2	Contacted	Customer contacted
3	Waiting	The customer does not yet want renewal. Contact later.
4	Offered	Offer sent
5	Ordered	Renewal order received
6	Renewed	Piece of equipment renewed

Table 3 An example of a Product Backlog

<i>KPI</i>	<i>User story</i>	<i>Reason to abandon</i>
<i>Customer net profit</i>	<p>As general manager I want to see all customers, their net profit (€ and %) in order to:</p> <ul style="list-style-type: none"> • Segment customers based on their profit • Increase prices for less valuable customers • Abandon less profitable customers 	<ul style="list-style-type: none"> • Changes in data collection processes. • Heavy IT investments • Relevance compared to contribution margin controversial
<i>Customer potential</i>	<p>As an account manager I want to see customer's installed base and service potential according to the customer's installed base in order to:</p> <ul style="list-style-type: none"> • Proactive sales <p>As general manager I want to monitor customer and company level unused potential during the year. In order to:</p> <ul style="list-style-type: none"> • Develop service offering • Make sales more effective • Improve potential calculation 	Implementation postponed due to the limited installed base database
<i>Campaign progress/Sales person</i>	<p>As account manager I want to monitor how well sales persons perform during the campaign in order to:</p> <ul style="list-style-type: none"> • Increase the number of equipment reached • to give feedback and encouragement to sales persons 	
<i>Overall campaign progress</i>	<p>As general manager I want to monitor the overall progress of the campaign in order to:</p> <ul style="list-style-type: none"> • Give feedback to sales 	
<i>Campaign pipeline</i>	<p>As a general manager I want to monitor the progress of the campaign in order to</p> <ul style="list-style-type: none"> • Evaluate the number of equipment in different states 	

Table 4 An example of a Sprint Backlog

<i>KPI</i>	<i>Task</i>
<i>Customer net profit</i>	Identify information needs Gather accounting information Interview account managers Interview service manager
<i>Customer potential</i>	Implement a functional prototype (Excel tool) Implement a visual prototype Create installed base database
<i>Campaign tool</i>	Import installed base information from an internal databases Implement a visual prototype Evaluate the prototype with the manager Evaluate the prototype with users Implement the tool Train users Update the tool Release the campaign