Essays on Steering Organizational Agility in the Manufacturing Industry

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Vorwort

Mit der vorliegenden Dissertation geht ein lehrreiches und aufregendes Kapitel zu Ende, welches gleichzeitig den langersehnten Traum einer Promotion erfüllt. Die Idee zum vorliegenden Thema der organisationalen Agilität ergab sich dabei im Zuge meiner Tätigkeit in der Industrie. Die zunehmende Forderung der flexiblen Anpassungsfähigkeit bei gleichzeitiger langfristiger Beständigkeit stellt Unternehmen vor zahlreiche Herausforderungen. Der Lehrstuhl für Controlling/Performance Management, charakterisiert durch die Kombination aus Grundlagenforschung und Praxisorientierung, ermöglichte mir dabei das Thema sowohl theoretisch aufzuarbeiten als auch neue Erkenntnisse aus der Praxis zu gewinnen und zu validieren.

Die knapp dreijährige Forschungsarbeit von Oktober 2019 bis August 2022, wäre ohne die tatkräftige Unterstützung von zahlreichen Wegbegleiter/innen kaum möglich gewesen. Im folgenden Abschnitt möchte ich die Gelegenheit nutzen, um meinen tiefen Dank zum Ausdruck zu bringen.

An erster Stelle gilt ein besonderer Dank meinem Referenten Prof. Dr. Klaus Möller (ACA-HSG), der mir zum einen die Möglichkeit gab ein eher unkonventionell-innovatives Thema im Bereich Controlling/Performance Management zu bearbeiten. Zum anderen forderte und förderte er mich während meiner gesamten Zeit als wissenschaftliche Mitarbeiterin und hatte stets ein offenes Ohr und einen wertvollen Rat für mich. Diese Zusammenarbeit prägte mich sowohl aus einer fachlichen als auch persönlichen Perspektive. Des Weiteren möchte ich mich bei meinem Ko-Referenten Prof. Dr. Reinhard Jung (IWI-HSG) bedanken, welcher sich meiner Arbeit angenommen und mir wertvolles Feedback zur Verfassung meiner Arbeit gegeben hat.

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St. Gallen, im August 2022 Jasmin Schmid

Content Overview

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Executive Summary

Organizational agility is an important capability for competitive organizations in uncertain contexts. Despite its positive implications for organizational performance, e.g., increasing customer satisfaction, organizations outside the originating field of software development, particularly manufacturing organizations, are still confronted with the questions of when, how, and to what extent to apply organizational agility to maximize its benefits. The cumulative dissertation aims to illustrate how performance management systems (PMS) can steer organizational agility in manufacturing organizations.

The dissertation consists of three articles covering topics ranging from operational to strategic agility. *Article I* describes a five-phase process model for steering the effective use of agile practices and roles in agile projects. The model has been conceptualized according to prior theory and tested within multiple case studies within a manufacturing firm. The real-life application of the process model revealed that predefined agile method portfolios are insufficient. Rather, the success of any agile project, regardless of the same organizational context, relies on the situational configuration and adaptation of agile project management. *Article II* explores contextual requirements in a manufacturing organization fostering or prohibiting agile project management practice application at an operational project management level. The article summarizes five propositions, which indicate that traditional organizational structures and processes rather than people's experience or competence in agile project management negatively influence the successful application of agile practices. Moving towards and facilitating strategic agility, *Article III* reviews 41 publications, leading to the identification of 33 agile instruments which are used in agile performance management systems (APMS). APMS is thus a major enabler for gaining strategic agility by operationalizing strategies and adapting organizational patterns in a flexible, responsive, and adjustable manner. Additionally, the analysis led to five design principles that guide the design of APMS to ultimately master organizational uncertainties and promote firm's competitiveness.

In sum, this dissertation deepens our understanding of organizational agility's effective and context-specific utilization in the manufacturing industry. On the one hand, it is illustrated how PMS serves as a steering mechanism for successfully applying agile project management to maximize project performance. On the other hand, APMS is demonstrated as a major enabler for integrating strategic agility to complete operational agility and ensure organizational agility.

Zusammenfassung

Eine wichtige Fähigkeit für wettbewerbsfähige Unternehmen, in einem unsicheren Unternehmensumfeld, ist die organisatorische Agilität. Trotz zahlreicher positiver Auswirkungen auf die Unternehmensleistung, z.B. erhöhte Kundenzufriedenheit, stehen insbesondere Produktionsunternehmen vor der Herausforderung, wann, wie und mit welchem Umfang Agilität zum Einsatz kommen kann, um dessen Nutzeffekte zu maximieren. Die Dissertation zeigt, wie Performance Management Systeme (PMS) zur Steuerung der organisationalen Agilität in Produktionsunternehmen eingesetzt werden kann.

In drei Artikeln wird sowohl die operative als auch die strategische Agilität beleuchtet. *Artikel I* zeigt ein Fünf-Phasen-Prozessmodell zur Steuerung des effektiven Einsatzes von agilen Praktiken und Rollen in agilen Projekten. Das Modell wurde in Anlehnung an die bisherige Theorie konzeptualisiert und im Rahmen mehrerer Fallstudien in einem Produktionsunternehmen getestet. Die Fallstudien zeigen, dass ein vordefiniertes agiles Methodenportfolio nicht ausreichend ist. Vielmehr baut der Erfolg eines jeden agilen Projektes, unabhängig vom selben Unternehmenskontext, auf der situationsbedingten Konfiguration und Adaptation von agilen Projektmanagementansätzen auf. *Artikel II* untersucht kontextuelle Anforderungen in Produktionsunternehmen, die den Einsatz agiler Projektmanagementpraktiken fördern oder verhindern, und fasst diese in fünf Propositionen zusammen. Basierend auf der Analyse von 41 Publikationen wird in *Artikel III* ein Überblick über 33 agile Instrumente gegeben, welche in agilen Performance Management Systemen (APMS) zum Einsatz kommen. APMS stellen eine wichtige Voraussetzung für die Etablierung der strategischen Agilität dar, indem Strategien und Unternehmenstätigkeiten flexibel angepasst werden können. Darüber hinaus führt die Analyse der agilen Instrumente zur Definition von fünf Design Prinzipien. Diese dienen als Leitfaden für die Neu- oder Umgestaltung von Performance Management Systemen (PMS) hin zu mehr Agilität.

Zusammenfassend vermittelt die Dissertation ein vertieftes Verständnis über die effektive und kontextspezifische Anwendung von organisationaler Agilität in Produktionsunternehmen. Einerseits wird aufgezeigt, wie PMS als Steuerungsmechanismus für die erfolgreiche Anwendung von agilem Projektmanagement zur Maximierung der Projektperformance eingesetzt werden kann. Andererseits dienen APMS als wichtiger Faktor für die Integration strategischer Agilität und vervollständigen so die operative Agilität und gewährleisten die Etablierung organisatorischer Agilität.

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Article I

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List of Abbreviations

ADM	Automated Device Management
APMS	Agile Performance Management Systems
BIFS	Business Intelligence Forecasting System
CIMS	Centralized Information Management System
CRMS	Customer Relationship Management System
DevOps	Development & Operations
DSDM	Dynamic System Development Method
ERP	Enterprise Resource Planning
FAST	Frequent, Ambitious, Specific, Timely
FDD	Feature Driven Development
HRM	Human Resource Management
IS	Information Systems
LoC	Levers of Control
MA	Management Accounting
MbO	Management by Objectives
MCS	Management Control Systems
OKRs	Objectives and Key Results
PMS	Performance Management Systems
SMART	Specific, Measurable, Ambitious, Realistic, Time-Bound
TMGT	Too-Much-of-a-Good-Thing
TPMS	Traditional Performance Management Systems
WIP	Work in Progress
XP	Extreme Programming

1 Introduction to the Cumulative Dissertation Project

Organizational agility is an important capability for competitive organizations in uncertain contexts (Agarwal & Selen, 2009; Fitzgerald et al., 2006). It describes an organization's ability to quickly perceive changes and incorporate them into strategies, products, services, or processes by flexibly adapting organizational patterns (Dingsøyr et al., 2012; Proba & Jung, 2019). Customer satisfaction (Buresh, 2008; Cao et al., 2009) and organizational competitiveness (Conboy & Fitzgerald, 2004) are thereby the overarching goals to be achieved by organizational agility.

Despite its proven record of positive organizational performance implications, e.g., boosting customer satisfaction, improving team responsiveness, or increasing product quality (Lee & Xia, 2010; Recker et al., 2017), organizations outside the originating field of software development, particularly manufacturing organizations, are still confronted with the questions of when, how, and to which extent to apply organizational agility (Cao et al., 2009; Conforto et al., 2014; Fitzgerald et al., 2006).

These questions build on the premise that more agility does not always lead to better organizational performance (Teece et al., 2016). One explanation considers the concept "Too-Much-of-a-Good-Thing" (TMGT). It indicates that well-established management practices might have negative or minor performance implications due to a too intensive or inappropriate application (Pierce & Aguinis, 2013). The contingency theory supports this explanation. Contingency theory indicates that an organization's success depends on internal and external organizational contingencies (Wetherbe & Whitehead, 1977). Early in management research, it became clear that organizations are unique systems characterized by different visions, goals, values, beliefs, or structures. In addition, an organization coexists and is influenced by other subsystems, including competitors, governments, or suppliers (Woodward, 1958). Thus, the contingency theory of management control[1] assumes that no unified management practice can be used to organize every organization and its contingencies (Duncan, 1972). Rather, the theory states that a

[1] In this dissertation, the terms "management control" and "performance management", as well as their underlying systems, are used in an interchangeable manner. Management control occurred as an originating concept in management accounting aimed at controlling the alignment between strategic, operational, and managerial components; thereby, focusing on financial metrics (Anthony, 1965; Chenhall, 2006). As a result of increasing organizational complexity and people centricity, performance management has been established as a recent development of management control. The original rationale of management control remains the same but non-financial and informal control components are considered in performance management (Ferreira & Otley, 2009).

corporation is only successful if it uses management practices that can effectively manage contextual factors (e.g., uncertainties) in the best possible way (Chenhall, 2003; Gerdin & Greve, 2004; Howell et al., 2010; Weill & Olson, 1989).

PMS are a major mechanism for managing organizations and their underlying contingency factors. Composed of a set of management practices, these systems target the operationalization of strategies into goals by planning, directing, measuring, controlling, and adjusting organizational patterns, resources, and people behavior accordingly (Ferreira & Otley, 2009). The broad range of performance management tasks should, therefore, not be limited to a predefined set of management practices; rather, the effectiveness of PMS depends on the situational selection, configuration, and alignment of management practices (Chenhall, 2003; Gerdin & Greve, 2004; Otley, 2016) to master contextual influences.

As mentioned, organizational agility becomes vital in uncertain contexts; however, multiple contextual factors, including complex products, global value chains, or third-party dependencies, typically influence multinational manufacturing organizations (Conforto et al., 2014). Hence, organizational agility does not present the only important corporate capability but co-exists with long-term organizational stability (Chow & Cao, 2008; Lawrence & Lorsch, 1967; Weber & Tarba, 2014). Navigating between these various contextual requirements demands different designs and uses of PMS (Malmi & Brown, 2008), i.e., management practices must be flexible enough to adapt to uncertainties and stable enough to pursue long-term strategic goals (Bedford & Malmi, 2015). Two following arguments highlight the necessity to steer organizational agility on operational and strategic levels.

First, agile practices[2] and their underlying principles and values[3] have shaped the processes and ways of working since the 1990s. The so-called operational agility evolved from software development (Conboy & Fitzgerald, 2004), and it is largely applied to manage and control development projects in uncertain environments in manufacturing firms (Conforto et al., 2014; Serrador & Pinto, 2015). Despite prior findings indicating

[2] Agile methods consist of a set of different agile practices, which have different control mechanisms (Gemino et al., 2021). For example, Daily Stand-Up Meetings are used for daily communication and alignment between team members, while Sprint Planning targets short-term planning of iterative development cycles (Sprints) (Sutherland & Sutherland, 2014).

[3] The underlying values and principles of the agile practices are summarized in the "Manifesto for Agile Software Development" published in 2001 by 17 software developers (Beck et al., 2001).

greater project success when applying operational agility in manufacturing firms (Buresh, 2008; Recker et al., 2017), literature has revealed contradicting results[4] (Coram & Bohner, 2005; Hallgren & Olhager, 2009). The major reason for low project success or ongoing project failure is a lack of suitable agile practices outside software development (Cao et al., 2009; Fitzgerald et al., 2006; Gemino et al., 2021). On the one hand, agile practices coordinate different project components and thus have different performance implications. For instance, practices targeting pure software development can hardly be applied in hardware-driven or maintenance project cases. On the other hand, agile practices have been observed to conflict with traditional structures, typically found in manufacturing companies, which reduces the degree of flexible adjustments. Consequently, it is suggested to tailor agile practices (Proba & Jung, 2019) or combine different agile and traditional practices to increase their fit with the application context (Baschin et al., 2021; Gemino et al., 2021).

Second, strategic agility deals with the ongoing revision of external market trends or stakeholders (Ahammad et al., 2020; Proba & Jung, 2019) to adjust strategies, direct organizational actions, and determine future organizational directions to ensure competitiveness (Weber & Tarba, 2014). PMS serves as an essential enabler for strategy implementation. However, traditional PMS (TPMS) do not consider and master uncertainties. On the contrary, TPMS assume stable corporate conditions, facilitate rigid management practices (e.g., Forced Rankings), and are often perceived as costly. In response to the lack of flexibility and adaptability of TPMS, increasing attention has been paid to redesigning PMS towards agile PMS (APMS) (Brown et al., 2019; Cappelli & Tavis, 2016).

1.1 Three Articles on Steering Organizational Agility

The central interest of this cumulative dissertation is to show how PMS can steer organizational agility in the manufacturing industry. It aims to increase the organization's ability to utilize organizational agility situationally to maximize benefits and prohibit performance shortcomings. The thesis consists of three research articles covering operational and strategic agility perspectives. Most organizations focus primarily on operational agility because adopting agile methods promises to generate benefits quickly

[4] The results showed that wrong or inappropriate applications of agile practices in project management increase project costs (Hallgren & Olhager, 2009) or leads to scope creep (Coram & Bohner, 2005).

(Sharifi & Zhang, 1999). Therefore, the dissertation first aims to understand beneficial application purposes and contexts of agile methods, practices, and roles at an operational level before investigating general management components supporting operational and organizational agility.

Article I investigates the situational use of agile project management in manufacturing firms, i.e., how to effectively use agile methods, practices, or roles in project management. The article results in a five-phase process model guiding Project Managers and Scrum Masters to steer the context- and goal-oriented use of agile practices and roles in projects to maximize project performance. As an extension to Article I and to deepen the understanding of contextual requirements in the manufacturing industry, *Article II* explores prohibiting and fostering contingency factors that influence agile project management practice applications. Five propositions summarize the findings of the contingencies that determine agile project success and support the claim from Article I to situationally use agile project management. A multiple case study design located in a European multinational manufacturing corporation served as the empirical foundation for Articles I and II. A qualitative research method was chosen to inductively explore the present phenomenon using a real-life scenario. Completing the organizational agility picture from a strategic perspective, *Article III* reviews existing APMS to provide an overview of 33 agile instruments and illustrate five design principles for redesigning PMS toward agility. APMS are thus major facilitators of establishing strategic agility. Article III findings emerged from a systematic literature review using a keyword-based search combined with a backward and forward search.

The following table summarizes the core components of each article and illustrates the core contribution of the overall cumulative dissertation.

	Article I	Article II	Article III
Title	Context- and Goal-Oriented Steering of Agile Project Management: A Case Study in the Manufacturing Industry	Best Fit in Context: An Analysis of the Target-Specific Application of Agile Project Management Practices	Agile Performance Management Systems: An Overview of Agile Instruments in Performance Management Systems
Research Question	How to utilize agile methods, practices, and roles situationally in project management to maximize project performance in manufacturing firms?	Which contextual requirements are needed for a successful application of agile project management in the manufacturing industry?	Which agile instruments are applied in performance management systems to increase flexibility, responsiveness, and adaptability?
Methodology	Multiple case study	Multiple case study	Systematic literature review
Result	Five-phase process model for situationally steering agile project management	Five propositions indicate prohibiting or fostering contingency factors for applying agile project management practices	Overview of 33 agile instruments and five design principles for redesigning PMS toward agility
Conclusion	Regardless of a predefined and customized agile method portfolio, agile practices and roles must always be situationally selected and, if necessary, adapted to the project requirements and organizational context to maximize project performance.	Successful agile project management practice application in manufacturing firms is not so much negatively influenced by the behavior or experience of people with operational agility but causally by traditional organizational structures and processes.	Redesigning PMS towards agility enables alignment between long-term strategic goals and short-term actions and thus, enables strategic agility and fosters an organizational-wide agility integration.
Contribution	APMS steer the situational use of operational agility according to its context, while ensuring continuous alignment between short-term dynamic operations and long-term strategic goals in uncertainty through strategic agility.		

Table 1: Overview of the research projects

1.1.1 Article I: Context- and Goal-Oriented Steering of Agile Project Management: A Case Study in the Manufacturing Industry

Projects help advance and ensure organizational competitiveness. High project performance relies on managing and controlling project components – goals, resources, or time – most effectively (Turner & Müller, 2003). In uncertain project circumstances, project management uses agile methods, practices, and roles, i.e., agile project management, to ensure reactiveness and fast adaptability to unpredictable changes to fulfill customer needs (Serrador & Pinto, 2015). Scholars have observed the potential of agile project management in the manufacturing industry, including higher customer satisfaction (Buresh, 2008) and increased product quality (Coram & Bohner, 2005).

However, some studies have indicated the opposite (Magazinius & Feldt, 2011) due to a limited contextual fit of agile methods, practices, and roles outside their origin, namely software development (Fitzgerald et al., 2006; Serrador & Pinto, 2015). Therefore, according to contingency theory, prior scholars have called for situationally agile project management use (Cao et al., 2009; Liu et al., 2021). Consequently, two major trends[5] occurred: agile tailoring (Proba & Jung, 2019) and hybrid project management (Gemino et al., 2021). Apart from the contextual limitations, agile practices have been found to promote different performance implications (Alahyari et al., 2017; Mann & Maurer, 2005), e.g., Kanban fostering work in progress (WIP) optimization (Campanelli & Parreiras, 2015) vs. Reviews improving customer interaction (Sutherland & Sutherland, 2014). Consequently, agile project management should be selected and configured according to project requirements (Fitzgerald et al., 2006).

Until now, theory has lacked a steering mechanism for project management to select, adapt, and use agile methods in manufacturing firms. The paper aims to understand how agile project management can be situationally used to maximize project performance in manufacturing organizations. A five-phase process model for steering agile projects in manufacturing firms was conceptualized in response to the research question. The phases address (1) the assessment of project characteristics, (2) the evaluation of corporate context, (3) the selection of agile methods, (4) the prioritization of agile practices

[5] Agile tailoring is a technique for redesigning resp. adjusting individual agile practices or roles according to the application context and its underlying contingency factors (Proba & Jung, 2019), e.g., changing the time rhythm Stand-Up Meetings from daily to weekly. Hybrid project management in contrast describes the combination of agile methods and/or traditional project managements to a customized project management approach (Gemino et al., 2021), e.g., combining the two agile methods Scum and Kanban leading to Scrumban (digital.ai, 2021).

and roles, and (5) the agile practice and role tailoring. The model was tested and evaluated in a manufacturing firm along two agile project cases by conducting 21 semi-structured interviews. The findings were additionally compared with corporate documents for data triangulation.

From a theoretical perspective, the paper contributes to operational agility. The positive performance implications can only be achieved in agile project management if the degree of agility in projects is controlled according to project requirements (Cao et al., 2009; Conforto et al., 2014). In addition, the case study indicates the importance of aligning agile project management use based on project goals and performance indicators for generating high project performance. The paper additionally supports the call of scholars (Fitzgerald et al., 2006) who claim to reduce the amount of customized agile methods in a predefined method portfolio and focus on situational agile project management adaptations.

1.1.2 Article II: Best Fit in Context: An Analysis of the Target-Specific Application of Agile Project Management Practices

Organizational change occurs constantly (Rajshree Agarwal & Gort, 2001). Changes ensure progress within organizations but require proper control to be successful. Project control and management govern projects as change facilitators (Joslin & Müller, 2015). However, long-term project plans and detailed documentation conflict with volatile and dynamic corporate environments. Agile methods help cope with changing contingencies and provide various positive performance implications (Dyba et al., 2014).

However, three challenges remain. First, the definition of project success in agile projects is lacking. Second, although prior research showed multiple successful agile method applications (Layman et al. 2004; Lee and Xia 2010; Mann and Maurer 2005; Middleton 2001; Recker et al. 2017), application uncertainties persist. On the one hand, different agile methods can be utilized for similar problems but might lead to different project outcomes. On the other hand, (Cao et al., 2009; Conforto et al., 2014), the application context of agile methods determines the project's success. The contextual factors determining the successful application of agile methods in manufacturing firms are mostly unknown. Third, most empirical evidence for agile method applications can be assigned to software development, causing additional uncertainties for agile method applications in a manufacturing context. Considering these three remaining challenges, the

paper aims to deepen the understanding of the agile method application in project management in manufacturing organizations. Further, it aims to explore and understand contingency factors determining the suitable application of agile methods in agile projects to foster project success. Using a multiple case study design in a single manufacturing firm, 30 semi-structured interviews, group discussions, and corporate documents served as a database for analyzing five project cases, resulting in 87 contingency factors.

The results contribute to the existing research by formulating five propositions about project, organizational, and corporate environmental issues, showing contingency factors impacting the successful agile method application in project management in manufacturing firms. It is shown that mostly traditional organizational structures and processes negatively influence the application of agile methods rather than people's mindset or behavior. Considering project management methods as part of the management control system (MCS), influencing contingency factors can be situationally governed using appropriate methods to ensure project success.

1.1.3 Article III: Agile Performance Management Systems: An Overview of Agile Instruments in Performance Management Systems

Uncertainty requires the ability of an organization to be agile. Strategic agility is a core component of organizational agility (Eilers et al., 2022). APMS is an important enabler in this context by frequently developing strategies into goals and continuously planning, controlling, and adjusting corporate patterns accordingly (Dingsøyr et al., 2012). It is clear that PMS using traditional performance management instruments (e.g., Performance Appraisals) hardly support agility requirements. On the one hand, it causes conflicts between dynamic operations and stable strategic goals. The utilization and maintenance of TPMS are costly and time-consuming in dynamic environments and hardly provide support in directing corporations towards the future (Aguinis et al., 2011). On the other hand, organizational competitiveness is no longer dependent on command and control but on people's development. PMS must ensure that employees constantly learn to master changes, meet customer expectations, and generate business value (Brown et al., 2019).

Despite the evolvement of different agile instruments in PMS, including OKRs or 360-Degree Feedback, their occurrence is domain-specific, addresses one-dimensional performance management aspects, and strongly depends on their application to corporate

factors. An overview of agile instruments is required to enable a context-specific configuration of APMS in uncertainty. Due to a lack of overview, the paper reviews agile instruments in APMS. Therefore, a systematic literature review sheds light on the research interest. The systematic analysis reviewed 33 agile instruments. The overview shows that the instruments address different performance issues and thus require an individual configuration of APMS that is tailored to the organizational context. Additionally, the paper contributes to organizational agility by positioning APMS as a crucial enabler of gaining strategic agility. Five design principles serve as guidance for managers to design APMS.

1.2 Conclusion and Implications

The three articles of this cumulative dissertation deepen our understanding of how PMS can be used to steer organizational agility in the manufacturing industry. The dissertation shows that agile project management in the form of a PMS is responsible for situationally steering agile projects to maximize project performance and success. In manufacturing organizations, it becomes particularly clear that the application of agile methods in projects requires control to guarantee project success and to steer project requirements and complex organizational factors of manufacturing firms. Organizational contingencies additionally foster the need to integrate strategic agility through APMS. APMS contribute to organizational agility by harmonizing dynamic operational activities with long-term strategic goals. The dissertation provides scholars and practitioners with important insights regarding the use and design of organizational agility in manufacturing organizations.

1.2.1 Theoretical Implications

The rising interest and trend in organizational agility remain vital in times of uncertainty and change. Based on previous findings on performance effects (Lee & Xia, 2010) or methodological design and use (Proba & Jung, 2019), it becomes clear that the successful application of organizational agility depends on internal and external contingencies (Ahimbisibwe et al., 2015). Especially in manufacturing organizations, theoretical knowledge of how, when, and to which extent organizational agility can be applied and controlled is limited (Conforto et al., 2014).

Article I contributes by expanding our understanding of steering management components within agile projects to enhance project performance. Apart from known project requirements (Coram & Bohner, 2005; Kalus & Kuhrmann, 2013), the study reveals that complex organizational structures within manufacturing firms (e.g., complex process landscapes or vendor dependencies) need to be controlled in agile projects by situationally selecting, configuring, and adjusting agile project management. On the one hand, this supports contingency theory that emphasizes aligning management practices with contingency factors (Lawrence & Lorsch, 1967). On the other hand, it supports the suggestions of prior scholars to tailor (Campanelli et al., 2018; Proba & Jung, 2019) or combine (Gemino et al., 2021) agile project management practices according to the application context. Another essential control component that has not yet been considered for selecting appropriate agile projects is project goals and its performance indicators. Suitable agile practices allow for effective management of project performance by directing project activities and people's behavior towards project goal achievement.

In addition to the known factors influencing agile project management (Howell et al., 2010) originating primarily from software development, *Article II* contributes to a better understanding of the project, corporate, and user influences on agile project management in manufacturing organizations. In contrast to prior findings that attributed misleading applications of agile project management practices to people and their missing agile experience or mindset (Renu Agarwal & Selen, 2009; Conforto et al., 2014; Coram & Bohner, 2005), Article II showed that rigid organizational processes and structures produce major negative contingencies in manufacturing firms. Performance management is thus presented to control these influences and increase project success by controlling use and design of agile project management practices.

Article III responds to previous calls from scholars to design PMS that are more reactive, quick, and flexible in uncertainties (Aguinis et al., 2011; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016). The contribution of the review is twofold. First, management accounting literature is expanded by providing an overview of agile instruments that can be used to design APMS in uncertainty. Second, APMS are presented as strategic agility facilitators to gain organizational agility. The various control areas of performance management (e.g., culture or cybernetic controls) ensure that organizational patterns are aligned, adapted, and directed towards strategic goals. The article indicates how dynamic operations executed through operational agility can be aligned with long-term

strategic goals through flexible, frequent, and people-oriented performance management processes.

To conclude, this dissertation shows how APMS steer the situational use of operational agility according to its context, while simultaneously fostering strategic agility to ensure alignment between short-term dynamic operations and long-term strategic goals in uncertainty.

1.2.2 Practical Implications

The dissertation provides guidance and recommendations for practitioners to optimize the utilization of organizational agility. *Article I* provides a five-phase process model for Project Managers and Scrum Masters on the context- and goal-oriented utilization of agile project management in manufacturing firms. Each project case requires a situational selection and adjustment of agile methods, practices, and roles according to the project requirements and the organizational context. For this purpose, the process model serves as a stepwise guidance for successfully steering agile projects. *Article II* offers additional guidance for successful agile project management practice application. Five propositions indicate prohibiting and fostering contingencies in manufacturing organizations that foster the likelihood of the suitability of agile practice in projects to increase project success. Traditional organizational characteristics generally do not allow a pure agile project application. Rather, the adverse influencing factors must be controlled by appropriate PMS. To counteract the traditional organizational characteristics, *Article III* implies that practitioners should implement strategic agility in addition to operational agility. APMS are appropriate enablers. An overview of agile instruments as well as five design principles can help practitioners transform PMS towards more agility to make performance management processes more flexible and adaptable to master uncertainties and ensure organizational competitiveness.

1.3 Appendix

1.3.1 Appendix A: Overview Article I

Title	**Context- and Goal-Oriented Steering of Agile Project Management: A Case Study in the Manufacturing Industry**
Authors	Jasmin Schmid & Klaus Möller
Contribution per Author	See declaration of co-authorships
Key Words	Agile project management, contingency theory, system theory, performance management, project controlling, case study
Abstract	In project management, agile methods have emerged as a supportive approach for projects in uncertain contexts. Multiple positive performance implications have been studied both in and outside software development. However, inappropriate context or utilization of agile methods in firms has led to divergent or conflicting effects. This builds on the contingency theory of performance management systems (PMS), assuming that a management method is only successful if it fits its context. Consequently, scholars have focused largely on tailoring agile methods. However, little is known about when and how agile methods should be situationally applied to maximize project performance. A process model for steering agile projects was conceptualized, tested, and evaluated along with two project cases within a manufacturing firm based on 21 semi-structured interviews and four group discussions. The findings were additionally triangulated with the project and corporate documents. The research showed that the use of agile methods in projects depends on controlling contextual requirements and project goals. Additionally, only a few agile methods within a predefined project portfolio can ensure agile method tailoring. Finally, the paper provides guidance for practitioners to situationally steer agile projects.
Status	• ACA Working Paper Series • Conference Contribution at the 10th Annual ERMAC • Submitted at International Journal of Productivity and Performance Management

Table 2: Overview of Article I

1.3.2 Appendix B: Overview Article II

Title	**Best Fit in Context: An Analysis of the Target-Specific Application of Agile Project Management Practices**
Authors	Jasmin Schmid, Maël Schnegg & Klaus Möller
Contribution per Author	See declaration of co-authorships
Key Words	Agile method, project management, management control, contingency theory, case study
Abstract	Agile methods are widely used for software development and are gaining popularity for project management. Despites its popularity, it is unclear why and when agile methods would be more appropriate than traditional methods for project management. Through a within-firm multiple case study design, we develop five propositions to facilitate the choice of project management method. Contingency theory of management control systems (MCS) proved appropriate to study the effectiveness of agile methods in information system context.
Status	• ACA Working Paper Series • Submitted at Project Management Journal

Table 3: Overview of Article II

1.3.3 Appendix C: Overview Article III

Title	**Agile Performance Management Systems: An Overview of Agile Instruments in Performance Management Systems**
Authors	Jasmin Schmid
Contribution per Author	See declaration of co-authorships
Key Words	Organizational agility, agile instruments, performance management systems, systematic literature review
Abstract	This study aims to identify agile instruments to redesign performance management systems (PMS) toward agility. According to the contingency theory, organizations need PMS that fits their operating context to be effective and competitive. Uncertainty, as a determining contingency factor in contemporary organizations, requires an organization to be flexible, responsive, and adaptable, i.e., agile. Although many organizations integrate operational agility using agile instruments like Scrum, most lack a strategic agility perspective. PMS is a core facilitator for aligning strategies with corporate patterns. However, traditional PMS (TPMS) are criticized for being time-consuming and costly, lacking stakeholder interaction or providing little process flexibility; therefore, TPMS conflict with operational agility and hardly address uncertainty issues. The systematic analysis of 41 publications resulted in an overview of 33 agile instruments, which address various control mechanisms (e.g., planning or cybernetic controls) in agile performance management. The paper demonstrates five design principles for redesigning PMS towards agility and demonstrates the importance of agile PMS (APMS) to manage the alignment between long-term strategic goals and agile operations and provide strategic agility.
Status	• ACA Working Paper Series

Table 4: Overview of Article III

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2 Article I

Context- and Goal-Oriented Steering of Agile Project Management: A Case Study in the Manufacturing Industry

Jasmin Schmid

Klaus Möller

Abstract

In project management, agile methods have emerged as a supportive approach for projects in uncertain contexts. Multiple positive performance implications have been studied both in and outside software development. However, inappropriate context or utilization of agile methods in firms has led to divergent or conflicting effects. This builds on the contingency theory of performance management systems (PMS), assuming that a management method is only successful if it fits its context. Consequently, scholars have focused largely on tailoring agile methods. However, little is known about when and how agile methods should be situationally applied to maximize project performance. A process model for steering agile projects was conceptualized, tested, and evaluated along with two project cases within a manufacturing firm based on 21 semi-structured interviews and four group discussions. The findings were additionally triangulated with the project and corporate documents. The research showed that the use of agile methods in projects depends on controlling contextual requirements and project goals. Additionally, only a few agile methods within a predefined project portfolio can ensure agile method tailoring. Finally, the paper provides guidance for practitioners to situationally steer agile projects.

Keywords: *agile project management, contingency theory, system theory, performance management, project controlling, case study*

2.1 Introduction

Many organizations in different industries have undertaken an agile transformation (Conforto et al., 2014). One major draw is the hype of operational agility, its methods, practices, roles, values, and principles. Agile methods are perceived as potential problem solvers in uncertain project contexts to quickly identify and adapt to unpredictable changes to satisfy customer needs (Conboy & Fitzgerald, 2004). It is proposed that more agility facilitates higher project performance (Lee & Xia, 2010; Recker et al., 2017; Serrador & Pinto, 2015) in and outside the originating field of software development.

Nevertheless, embracing agility, the concept "Too-Much-of-a-Good-Thing" (TMGT) by Pierce and Aguinis would pose a threat. According to this concept, widely accepted and beneficial management practices might have negative effects (e.g., increasing costs or employee dissatisfaction) due to their varying or intense usage (Pierce & Aguinis, 2013). Scholars from the field of operational agility have already identified deviating, conflicting, or even negative performance implications when utilizing agile methods in project management (Ajmal et al., 2020; Conforto et al., 2014; Howell et al., 2010). These undesirable implications can be attributed to incorrect or misleading agile method utilization in more traditional contexts (Papadakis & Tsironis, 2018), especially in manufacturing firms (Conforto et al., 2014). Compared to pure software development projects, manufacturing firms devise complex projects with multiple components, including hardware consisting of embedded software, and are incorporated in a complex corporate system (Conforto et al., 2014). Contingency theory, proposing that a management method needs to be aligned with its operating context to ensure situational fit and to be beneficial (Gerdin & Greve, 2004; Schonberger, 1980). From a performance management perspective, corporate goals and performance depend on methods that allow target-oriented planning, coordinating, controlling, and aligning organizational activities, resources, and employees' behaviors (Ferreira & Otley, 2009).

Prior scholars already highlighted the need to situationally optimize the use of agile methods (Cao et al., 2009; Fitzgerald et al., 2006) in different project contexts by tailoring (Campanelli & Parreiras, 2015; Kalus & Kuhrmann, 2013; Liu et al., 2021; Proba & Jung, 2019) them into new methods or hybrid project management approaches (Gemino et al., 2021; Papadakis & Tsironis, 2018). Selecting, configuring, and adjusting individual agile practices and roles, derived from an agile method, according to contextual

requirements increases the chance of performance improvement in agile projects (Fitzgerald et al., 2006). However, no guidance has been established to determine which criteria are decisive for selecting, applying, and adapting agile methods in project management in manufacturing firms. Therefore, we aim to explore *"How to utilize agile methods, practices, and roles situationally in project management to maximize project performance in manufacturing firms?"*

In the first step, we theoretically conceptualized a process model for steering agile projects. The process model provides guidance on (1) identifying the agile requirements of a project, (2) selecting and prioritizing efficient and effective agile methods, practices, and roles accordingly, and (3) tailoring agile practices and roles to increase contextual fit. In the second step, we conducted an embedded two-case study design (Yin, 2014) in an IT department of a leading multinational manufacturing firm to test and evaluate the validity of the process model along with two agile projects. To achieve our aims, we conducted 21 semi-structured interviews and triangulated the findings with the project and corporate documents.

The theoretical contribution of the research is twofold. First, we show that a performance-enhancing utilization of agility in projects depends on controlling contextual requirements, project goals, and underlying performance dimensions. More agility does not always facilitate higher performance but relies on an optimal degree and configuration of suitable agile methods and individual practices. Second, an agile method portfolio of an organization should be limited to a few core methods to support individual agile practice and role tailoring based on team experience. From a practical perspective, we provide Scrum Masters and Project Managers with a process model to situationally steer agile projects in manufacturing firms.

The paper is structured as follows. First, we review theoretical concepts of project management, operational agility, and performance management. Second, we outline the conceptualized process model for steering agile projects before testing and evaluating its validity in a real-life setup. Third, we summarize the implications and limitations of this research and offer a general conclusion.

2.2 Theoretical Background and Related Work

We built on three literature streams to analyze how agile practices and roles can be situationally utilized in project management in manufacturing firms. First, project

management identifies the need to initiate a project in organizations to foster change and coordinates its successful execution. Second, agile project management uses agile methods, practices, and roles to coordinate projects to achieve operational agility, especially in uncertain environments. Third, performance management and particularly project controlling oversees the project, focusing on context- and goal-oriented planning, control, measurement, and adjustment of projects to ensure high performance.

2.2.1 Projects as Facilitators of Change

Turner and Keegan (2001) claimed that organizations are moving from mass production to project-based work to meet the needs of demanding customers and gain a competitive position in the operating market. Therefore, organizations devise projects to drive progress or change by solving corporate problems, developing product and service innovations, or optimizing business processes without harming daily operations (Project Management Institute, 2013; Turner & Müller, 2003). Each project has a unique objective and a temporary structure with dedicated human and non-human resources, specific boundaries and scope, a limited time, and different stakeholder groups (Kolltveit et al., 2007; Turner & Müller, 2003).

In a corporate context, projects do not occur as individual phenomena but coexist or are part of a project portfolio (Engwall, 2003), a strategic initiative, or a management system (Kolltveit et al., 2007). This means that projects face internal project pressures (e.g., limited resources) along with multiple project interdependencies and corporate requirements that ultimately influence project performance (Eskerod, 1996; Kolltveit et al., 2007; Turner, 1999).

Project performance describes the efficient and effective utilization of dedicated project resources to meet stakeholder interests (e.g., product quality or ROI) (Joslin & Müller, 2015; Serra & Kunc, 2015) by implementing the overall project objective within a predefined scope and project boundaries (Atkinson, 1999; Bernroider & Ivanov, 2011; Lauras et al., 2010). Project performance is typically measured along the three dimensions of time, quality, and costs, better known and summarized in the iron triangle of project management (Lauras et al., 2010).

2.2.2 Mastering Projects in Uncertain Contexts Using Agile Project Management

Project management oversees projects to attain their intended goal by ensuring high project performance (Engwall, 2003; Turner & Müller, 2003). It adopts different methods (e.g., Waterfall), practices (e.g., Project Plan), and roles (e.g., Project Manager) and is responsible for planning, coordinating, and altering project activities, resources, and people behavior (Joslin & Müller, 2015; Turner, 1999).

In recent years, changes in numerous projects have occurred with a higher frequency and unpredictability because of global competition or demanding customers (Agarwal & Selen, 2009). Agile project management is a major draw for those uncertain contexts (Conboy & Fitzgerald, 2004; Conforto et al., 2014; Conforto & Amaral, 2016; Serrador & Pinto, 2015). Agile project management can be assigned to the literature stream of operational agility and adopts an internal corporate perspective (Proba & Jung, 2019). Operational agility refers to the organization's ability to sense and respond to unforeseen changes or upcoming opportunities by frequently adapting actions or resources (Chow & Cao, 2008; Conboy & Fitzgerald, 2004; Gemino et al., 2021; Serrador & Pinto, 2015). Agile project management builds on this logic and empowers those who take on dedicated agile roles (Sohi et al., 2016) to use agile methods and their practices to steer project parties, manage single tasks, or align project elements with project goals (Conforto et al., 2014; Dyba et al., 2014).

Agile practices and roles originated in the software development field, targeting various management and development aspects, e.g., rapid prototyping, customer interaction, or work in progress optimization (Lee & Xia, 2010; Recker et al., 2017). The 15th Annual State of Agile Report illustrated ten industry-leading agile practices and roles (digital.ai, 2021) derived from the most popular agile methods, Scrum and Kanban (Papadakis & Tsironis, 2018; see Table 5).

Agile Method	Agile Practices and Roles	Description
Scrum	Daily Stand-Up Meetings	A daily team meeting lasting for approx. 15 minutes to gain internal transparency regarding what has been done, what is planned, and was issues are currently being addressed (Sutherland & Sutherland, 2014).
	Sprint/Short Iterations	Defines an iterative and incremental development cycle lasting a pre-defined time (usually two to four weeks) (Sutherland & Sutherland, 2014).
	Retrospectives	Reflection of the development process to identify and resolve potential weaknesses and distinguish strengths within a development team after each Sprint (Sutherland & Sutherland, 2014).
	Sprint/Iteration Planning	Short-term task planning should be developed and delivered within a Sprint (Sutherland & Sutherland, 2014).
	Reviews	Assessment of customers/users regarding developed and delivered product features from a Sprint. Additional feedback might be provided regarding further improvements or changes concerning production functions and features (Sutherland & Sutherland, 2014).
	Planning Poker/Team Estimation	Collective estimation of the development team regarding developing a certain product function (Sutherland & Sutherland, 2014).
	Product Owner	Responsible for managing a product (overall outcome) and its resulting projects (operational execution), interacting with customers/users/customer representatives, and collecting project and customer/user requirements, which are captured in the Product Backlog (Sutherland & Sutherland, 2014).
Scrum and Kanban	Customer Representatives	A dedicated group of customers representing the actual customer and responsible for collecting customer needs, ideas, pain points, or changes regarding product and project requirements (Coram & Bohner, 2005; Maruping, 2020).
Kanban	Release Planning	Mid- to long-term planning refers to features/increments delivered at a certain point in time (Campanelli & Parreiras, 2015).
	Kanban	Work in progress (WIP) visualization generates work transparency and allows WIP optimization (Campanelli & Parreiras, 2015).

Table 5: Overview of selected industry-leading agile practices and roles according to digital.ai (2021)

Besides the successful use of agile methods and their practices in software development (Lee & Xia, 2010; Recker et al., 2017; Tarhan & Yilmaz, 2014), prior scholars have identified multi-dimensional performance implications, particularly in manufacturing firms (Conforto et al., 2014; Hallgren & Olhager, 2009), including improved product quality (Buresh, 2008; Coram & Bohner, 2005; Layman et al., 2004), increased customer satisfaction (Buresh, 2008; Recker et al., 2017; Tarhan & Yilmaz, 2014), faster product function deployment (Lee & Xia, 2010; Recker et al., 2017), or efficient resource consumption (Lee & Xia, 2010). On the other hand, agile practices reveal individual performance effects, e.g., Daily Stand-Up Meetings support team collaboration

and communication (Mann & Maurer, 2005), and Retrospectives ensure continuous process optimization (Alahyari et al., 2017).

In sum, agile methods and their practices have the potential to improve project performance. However, other scholars have identified conflicting or negative performance implications (Lee & Xia, 2010; Magazinius & Feldt, 2011; Tarhan & Yilmaz, 2014), e.g., extended development time (Conforto & Amaral, 2008), scope creep (Coram & Bohner, 2005), or increased costs (Hallgren & Olhager, 2009), which contribute to the limited application context or incorrect use of agile methods, practices, and roles (Serrador & Pinto, 2015; Stormi et al., 2019).

Due to goal- and context-dependency, prior scholars (Conforto et al., 2014; Conforto & Amaral, 2016; Gemino et al., 2021; Papadakis & Tsironis, 2018; Proba & Jung, 2019) have concluded that there is no one-size-fits-all agile project management configuration. Instead, they have suggested selecting or tailoring individual agile methods, practices, and roles according to the project context to ensure the benefits of agile project management applications (Campanelli et al., 2018; Cao et al., 2009; Fitzgerald et al., 2006; Proba & Jung, 2019).

This argument is based on the contingency theory of PMS, which proposes that no unified project management approach exists to increase a firm's performance (Fiedler, 1964; Gerdin & Greve, 2004). The efficiency of a project management approach depends on its alignment with its operating context (Schonberger, 1980). The number of influencing contingency factors in agile projects (Campanelli & Parreiras, 2015), including project maturity, project urgency, utilized technologies, management behavior (Cao et al., 2009), organizational structure, culture (Conforto et al., 2014), or stakeholder integration (Proba & Jung, 2019), seems infinite.

Due to influencing contingency factors, the resulting agile tailoring led to diverse new and adjusted agile methods, practices, and roles. Proba and Jung (2019) differentiated between configuration and composition. The former describes the transformation or redesign of existing agile methods, practices, or roles and results in customized agile components. The adjustments are corporate and project-specific; thus, their applicability to other corporations or industries is limited (Campanelli et al., 2018). The latter – composition – refers to selecting and combining individual agile and/or traditional practices included in a method portfolio and their incorporation into a new project management

approach (Gemino et al., 2021; Papadakis & Tsironis, 2018). Prior scholars have described this phenomenon as hybrid project management (Conforto & Amaral, 2016; Hayata & Han, 2011; Mukhtar et al., 2013). In contrast to configuration, composition enables greater use across corporate boundaries due to broader validity and applicability. Both types address contingency theory by adjusting an agile project management approach according to contextual requirements (Fitzgerald et al., 2006).

2.2.3 Project Controlling to Ensure Project Performance

Project controlling complements project management from the perspective of the performance management literature (Conforto & Amaral, 2008; Lauras et al., 2010). PMS combine different methods, practices, techniques, and processes to steer company activities to achieve its goals and foster organizational learning (Ferreira & Otley, 2009; Otley, 1999). Consequently, project controlling has three main aims: (1) ensure the achievement of project goals within a given scope and limited boundaries (Conforto & Amaral, 2008), (2) configure and apply suitable management practices to ensure high project performance (Kirsch et al., 2002), and (3) ensure systemic requirements are incorporated into the project (Bernroider & Ivanov, 2011; Lauras et al., 2010).

First, appropriate performance indicators are required to plan, measure, control, adjust, and consequently ensure the achievement of project goals. These performance indicators are derived from a project goal and are used to determine the project progress by employing actual/target analyses or project reports to counteract with suitable measures (Conforto & Amaral, 2008; Kalus & Kuhrmann, 2013). In traditional project management, the performance indicators are primarily based on input- and process-related components, summarized in the iron triangle (Agarwal & Rathod, 2006). On the other hand, agile project management focuses on multi-dimensional, progress- and people-related performance indicators (Lauras et al., 2010), which can primarily be derived from the values and principles of the Agile Manifesto, e.g., customer satisfaction, product quality, productivity, or team responsiveness (Beck et al., 2001).

Second, the project goal and its corresponding performance indicators serve as a benchmark for selecting, configuring, and applying management practices for the purposeful control of projects (Kirsch et al., 2002). Different agile methods, practices, and roles can be applied to different problems (Alahyari et al., 2017; Mann & Maurer, 2005). Reviews, for example, serve as a practice for continuous customer exchange, while Kanban

targets WIP optimization. Consequently, a project management approach should include method components that promote performance indicators and goal fulfillment.

Third, projects do not occur as a single phenomenon; rather, they are part of a management system (Kolltveit et al., 2007). A system establishes different project and company-wide requirements, including governance rules, processes, or enterprise architecture. Project controlling ensures compliance with respective requirements. Thereby, it is necessary to select project management practices and roles that achieve the required recognition and implementation to avoid potential threats to the project performance (e.g., time delays or increased costs due to external approvals). Consequently, management practices need to fit the operating context and system requirements.

Previous scholars have extensively studied and extended the design of agile methods (Campanelli et al., 2018; Cao et al., 2009; Proba & Jung, 2019), providing only few insights into when to use and tailor agile project management. In addition, the various positive, negative, and contradicting effects of agile methods have been broadly studied (Lee & Xia, 2010; Recker et al., 2017; Tarhan & Yilmaz, 2014). Nevertheless, these have rarely been considered important components for selecting, composing, and controlling agile project management approaches. Fitzgerald et al. (2006) called for guidance regarding the situational utilization of agile methods and their practices. Conforto et al. (2014) expressed the need to understand these practices in more complex environments, such as manufacturing contexts. Thus, we focused on how agile methods, practices, and roles should be applied in a goal and context-specific way to ensure project performance and thus goal achievement.

2.3 Process Model for Steering Agile Projects

Based on prior literature, we conceptualized a five-phase process model for steering agile projects to maximize project performance. Theoretical limitations of agile project management indicated the need for a model that would consider the actual project application, as most process models simply guide the implementation of agile methods in a company (Rasnacis & Berzisa, 2017). Furthermore, prior scholars have aimed to develop optimal agile method configurations in different contexts (Conforto & Amaral, 2016; Hayata & Han, 2011; Mukhtar et al., 2013). However, this approach is hardly tenable because, according to contingency theory, a management practice is only successful if it suites its operating context (Engwall, 2003; Gerdin & Greve, 2004). Finally,

most application models in project management are based on one-dimensional factors, such as context analysis (Agrawalla, 2015; Baschin et al., 2021; Campanelli et al., 2018; Cao et al., 2009; Liu et al., 2021; Proba & Jung, 2019). However, no model combines the different components, as far as we know.

We propose a process model that provides Scrum Masters and Project Managers with guidelines for goal- and context-specific agile project management applications. The process model (Figure 1) consists of five phases: (I) Assessment of project characteristics, (II) Evaluation of corporate context, (III) Selection of agile method, (IV) Prioritization of agile practices and roles, and (V) Agile practice and role tailoring. The first two phases address the evaluation of contextual requirements, determining the need for using agile methods. The third and fourth phases consider selecting and prioritizing effective agile methods, practices, and roles. Finally, the fifth phase deals with the issue of tailoring agile practices and roles to increase the fit between practices and context.

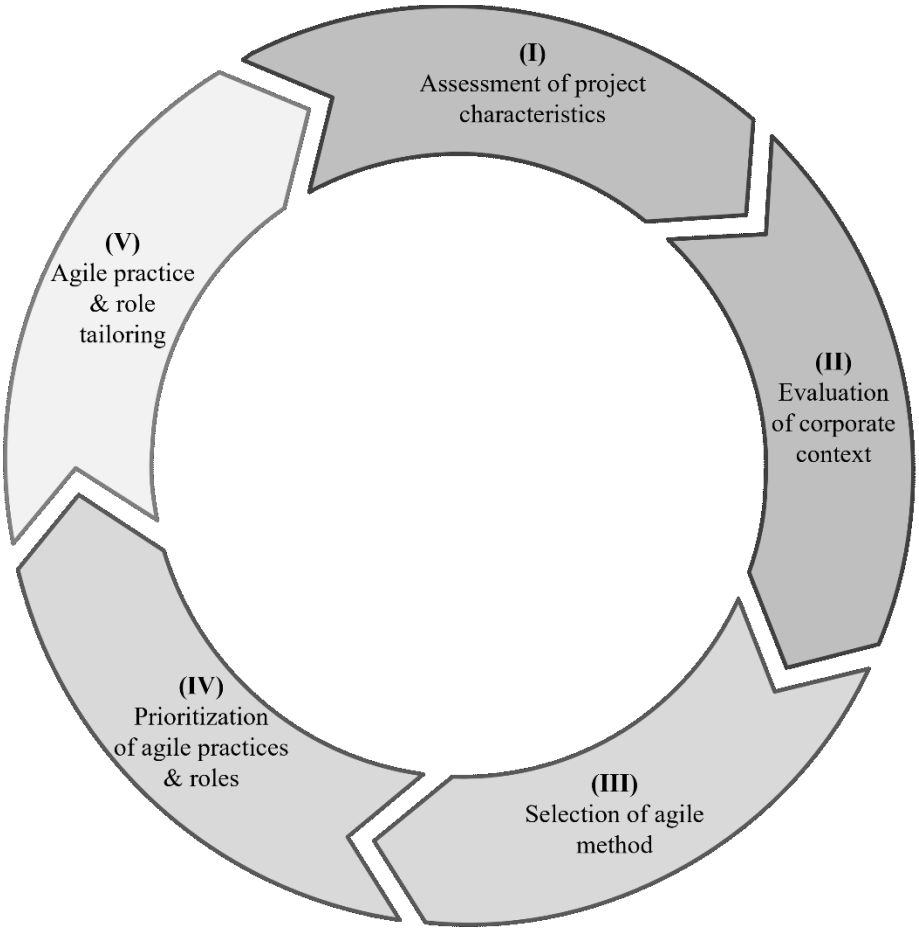

Figure 1: Process model for steering agile projects

2.3.1 Phase I: Assessment of Project Characteristics

Previous research has indicated that agile project management approaches are not suitable for every project context (Conforto et al., 2014; Schuh et al., 2017). On the contrary, scholars have advocated aligning a project management approach – traditional, hybrid, or agile – with present project characteristics (Gemino et al., 2021; Proba & Jung, 2019). Therefore, we proposed to assess the agility requirements of a project in the first step (Phase I). Turner and Müller (2003) claimed that project initiation leads to defining specific project characteristics, i.e., goal or project boundaries. The state of the project characteristics indicates the agility requirements. Prior scholars have shown that uncertain, unpredictable, unclear, or more dynamic state of these characteristics requires more flexibility and responsiveness to manage a project (Conboy & Fitzgerald, 2004; Conforto & Amaral, 2016; Lee & Xia, 2010; Schuh et al., 2017).

This logic builds on the underlying assumptions of the contingency theory. Keeping in mind that the contingency theory addresses the necessity to align a management practice with its operating context (Gerdin & Greve, 2004), it becomes particularly important within project management. Each project is initiated for a specific purpose (Turner & Müller, 2003). Therefore, previous researchers have indicated that different strategies, on a continuum between traditional and agile project management approaches, need to be used to manage projects (Ahimbisibwe et al., 2015; Howell et al., 2010). Thus, an initial analysis of project characteristics provides a direction of action rather than a specific management practice.

To assess the agility requirements of projects, we followed prior scholars' suggestions (Agrawalla, 2015; Baschin et al., 2021; Gabriel et al., 2021; Poth et al., 2019) using the "Stacey Matrix" (Figure 2). The matrix builds on two dimensions, degree of requirement clarity ("What") and degree of approach/technology certainty ("How"), and serves to classify projects into simple, complicated, complex, or chaotic (Gabriel et al., 2021). The classification thereby indicates the agility requirements (Agrawalla, 2015). Simple and complicated projects depend on traditional and hybrid project management, whereas the success of complex and chaotic projects is assumed to depend on agile project management (Baschin et al., 2021; Poth et al., 2019).

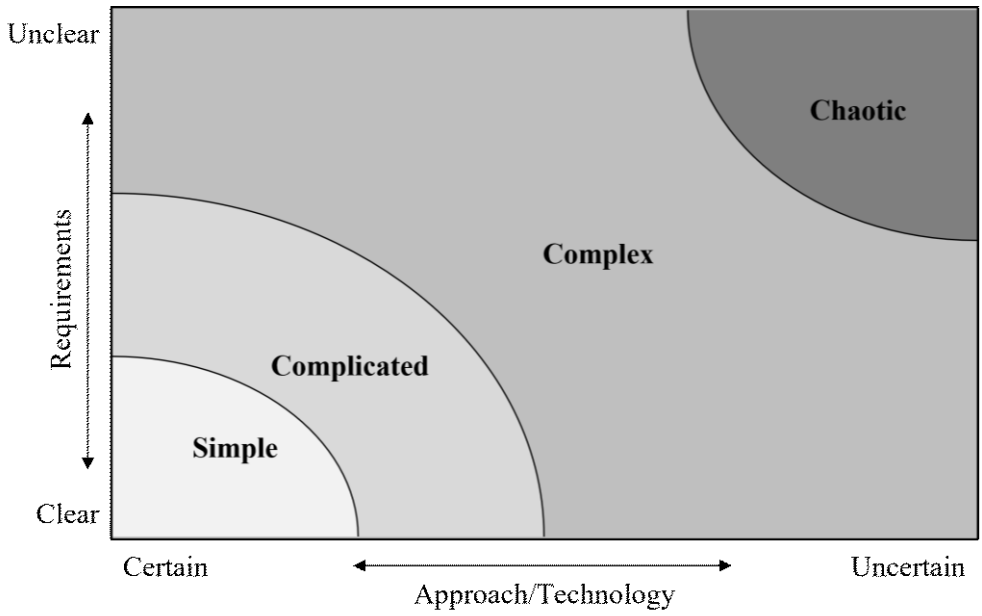

Figure 2: Stacey Matrix (own representation after Gabriel et al., 2021)

While the Stacy Matrix is a project classification tool and thus an indication for assessing agility requirements in a project, it lacks the consideration of agility requirements or restrictions outside the project context, and provides little indication of which agile methods, practices, or roles should be used. These issues are addressed in the remaining Phases II, III, and IV.

2.3.2 Phase II: Evaluation of Corporate Context

In system theory, projects are viewed as a holistic management system connected with other sub-systems (Kolltveit et al., 2007) and embedded into a dynamic and complex system (Stacey, 1995), namely the corporation. A project management system views multiple, non-linear project components (i.e., goal or structure), boundaries, and a contemporary environment (i.e., stable vs. dynamic or certain vs. uncertain) (Stacey, 1995) as interdependent components, affecting the project performance and outcome (Kolltveit et al., 2007). Therefore, multiple sub-systems (e.g., information or control systems) interplay to manage project complexity from a holistic perspective, considering system-specific and interdependent aspects instead of individual project characteristics (Kolltveit et al., 2007).

Having system theory in mind, we concluded that not only individual project characteristics but also direct or indirect related corporate system factors, including process landscape (Cao et al., 2009), customers or users, management behavior, and leadership style

(Cao et al., 2009; Proba & Jung, 2019), agile maturity level, corporate knowledge, external stakeholder groups, strategy, corporate culture, organizational structure, rapid technologies, or external corporate environment (Campanelli et al., 2018; Conforto et al., 2014; Kalus & Kuhrmann, 2013; Rasnacis & Berzisa, 2017), shape a project management approach. Therefore, we advocate evaluating corporate context factors (Phase II), since those are according to prior scholars, factors for increasing the project coordination effort and thus require traditional project planning (Conforto & Amaral, 2016; Drury-Grogan, 2014; Sohi et al., 2016). The latter is another indication of agile project management tailoring.

2.3.3 Phase III: Selection of Agile Method

After evaluating the agility requirement of a project, in another step (Phase III), we relied on contingency theory to select a suitable agile method according to the project and corporate context. Since projects have a unique structure and thus deviating contingencies, no one-size-fits-all agile method exists (Howell et al., 2010). On the contrary, scholars investigating project contingency theory have argued to provide project responsible with a broad agile method portfolio for context-dependent selection (Engwall, 2003; Liu et al., 2021). However, Fitzgerald et al. (2006) emphasized that the approach proposed in prior research does not hold in practice. On the one hand, multiple agile methods require intensive and long-term people training. This can hardly be guaranteed in dynamic and large organizations. On the other hand, in-depth method knowledge and experience evolve through intensive practice of the method instead of changing its application each time a new project is initiated (Fitzgerald et al., 2006).

Therefore, we propose two actions in this phase. First, defining a company-wide and valid agile method portfolio according to the needs of an organization (e.g., general project management vs. software development) is limited to a maximum of approximately three agile methods. This preparation action should ensure that all involved project parties – project team and stakeholder groups – build on a common understanding of the method and undergo dedicated training. Second, we recommended selecting a favorable method suiting the contextual requirements of Phases I and II. Even though some projects might follow a clear method, others might depend on a situational selection, configuration, and tailoring of individual practices.

2.3.4 Phase IV: Prioritization of Agile Practices and Roles

In another step (Phase IV), we suggested prioritizing individual agile practices and roles from the selected method in Phase III according to the project, corporate context, and project's underlying performance goals. We built this step on the contingency theory and assumptions of management control. In terms of contingency theory, scholars have shown that an optimal fit must be established between contingencies and the project management approach to achieve a high project performance (Ahimbisibwe et al., 2015; Howell et al., 2010). This relates not only to selecting an agile method but also to its underlying practices and roles (Gemino et al., 2021). Previous scholars have argued that the choice of practices and roles depends on application or context limitations (Campanelli & Parreiras, 2015; Conforto et al., 2014). Pair Programming or Unit Testing including developing or testing software solutions, can be applied exclusively in the context of software development (Recker et al., 2017). To conclude, the project and corporate context affect practice and role use.

Management control attempts to manage corporate performance and goal achievement by facilitating control practices to coordinate employee activities and behaviors (Ferreira & Otley, 2009; Malmi & Brown, 2008). Two aspects influence the prioritization of those control practices. First, practice selection depends on task characteristics. Predictable tasks depend on formal control practices, whereas dynamic tasks require informal control practices for continuous development (March & Simon, 1958). Second, the choice of practices should be aligned in terms of their effects on performance dimensions and goals (Feichter & Grabner, 2020; Henderson & Lee, 1992), e.g., Daily Stand-Up Meetings foster team collaboration (Coram & Bohner, 2005), whereas Reviews intend to strengthen customer interaction and feedback (Mann & Maurer, 2005).

Relying on contingency theory and management control, we can conclude that individual agile practice and role prioritization should be aligned with the project and corporate context, performance dimensions, and overarching project goals.

2.3.5 Phase V: Agile Practice and Role Tailoring

Finally, in the fifth phase (Phase V), we identified the need from prior research to tailor agile practices and roles due to the limited scope of application. Tailoring of agile project management describes reconfiguring, adapting, or redesigning individual agile practices and roles to meet project and corporate needs (Fitzgerald et al., 2006), as

demanded by contingency theory. The systematic literature review of Campanelli and Parreiras (2015) outlined 18 underlying project and corporate contingencies that predominantly contribute to method tailoring.

Project-Related	Corporate-Related
• Project type	• Business goals
• Complexity	• Team size
• User availability	• Team distribution
• Requirement's stability	• Domain knowledge
• Degree of innovation	• Technology knowledge
• Previous projects	• Corporate size
• Project budget	• Culture
• Communication	• Management support
	• Maturity level
	• Type of contract

Table 6: Contingency factors influencing agile method tailoring (after Campanelli & Parreiras, 2015)

Consequently, our intention in Phase V was to motivate Project Managers and Scrum Masters to adopt agile practices and roles to increase project performance and success instead of proposing or specifying a tailored agile project management approach.

2.4 Research Method and Study Design

We chose a case study approach based on Yin (2014) to test and evaluate the validity of the conceptualized process model for steering agile projects in real-life situations. A case study is particularly relevant when the object of interest cannot be examined clearly and separately from its application context (Yin, 2014). We, therefore, used an embedded two-case study design. On the one hand, different cases increase the robustness of the evaluation (Yin, 2014) and thus the extension of the theory (Eisenhardt, 1989). On the other hand, application replication is necessary to test the process model in different cases. This increases generalizability and supports additional theoretical interests (Yin, 2014), in our case, situationally steering agile project management to maximize project performance. Along with the two cases, we present and discuss the application of the process model by using an embedded case design (Yin, 2014), analyzing different units of analysis: project team members, team leaders, and executives. An embedded design aims to gather a diverse and in-depth understanding of different experts' opinions and application experiences (Eisenhardt, 1989; Yin, 2014).

2.4.1 Research Context

We selected a family-owned European corporation with approximately 30,000 employees operating in 120 countries worldwide. We chose the company due to its proven record of innovation and high-performing teams – even in times of crisis – which is reflected by its net sales of approx. 6 billion USD in 2021. The manufacturer has also received various industry design awards for innovative and impactful products. In addition, the company is popular for its entrepreneurial and team-oriented culture and a direct customer sales approach.

We validated and applied our process model within the corporate's IT department, serving as a business partner for other corporate functions (e.g., Finance, HR, or Sales & Marketing) with approximately 350 employees located in 5 countries. Like other manufacturing organizations, the IT department took the first-mover role within the company and started the agile transformation in 2018, aiming to improve the IT-business collaboration and increase the product quality. Due to the completion of the agile transformation, the corporation was able to provide us with agile test cases, while the project team members, supervisors, and executive managers assigned to the projects provided us with experience and knowledge to reflect, discuss, and evaluate individual processes and the entire process model.

2.4.2 Data Collection

In the first step, we were provided with the necessary project information to test and simulate the application of our process model across two agile projects. During this research stage, we discussed the individual phases and their procedures with various interview partners involved in the projects. In the second step, individual interview partners evaluated the findings of steering the agile projects through the process model. The third and final step involved additional interviews to gather further comments and suggestions regarding the process model and its phases for further improvements.

We conducted 21 semi-structured interviews from April 2021 to July 2021, lasting from 60 to 90 minutes. We utilized purposeful sampling (Paré, 2004), selecting 12 experts who were either directly (project team members) or indirectly (managerial functions) involved in the project cases and were capable of providing us with meaningful information on agile project management.

We designed an interview narrative consisting of open-ended and closed questions to receive and evaluate individual process phases. We began by asking general questions about the interviewees, their corporate roles and responsibilities, and their understanding and experience with agile project management. In another step, we reviewed the different phases of the process model with the interview asked. Therefore, we asked questions regarding the sequence and content of the phases. Finally, we provided the interview participants to voice their critical thoughts and articulate additional aspects and key drivers for steering agile projects. The content of the interview narrative was slightly adjusted regarding the different interview partners.

We transcribed the interviews for data analysis and performed four group discussions with an average duration of 90 minutes. The discussions were used to evaluate the overall process model. Finally, we received project and corporate documents for data triangulation. The former was used to simulate the application of the process model. The latter provided additional insights into the best practices or company rules when performing agile projects.

2.4.3 Data Analysis

Building theory from multiple cases requires a within-case and cross-case analysis (Eisenhardt, 1989). We started by examining the applicability and validity of the process model in each case. Therefore, we used the interview transcripts and subjected them to a three-stage coding approach (Corbin & Strauss, 2008). In the first stage, we explored the interviewees' different opinions, experiences, and insights regarding the content, applicability, and potential outcomes of applying the process model (e.g., agile mindset and team dedication being the most relevant organizational factors or Stacey Matrix for project classification). In the second stage, we identified commonalities and differences between the codes (e.g., agile maturity) to specify higher-level categories in a third step (e.g., organizational contingency). The categories are related to the process model's application or further development. Afterward, we compared the findings of both cases to identify similarities and differences and increase generalizability. Finally, we triangulated the findings from the interviews by comparing them with insights from our group discussions and corporate documents.

2.5 Case Illustration and Model Evaluation

This chapter introduces two agile projects that we used to apply, test, and evaluate the five-phase process model for steering agile projects. Subsequently, we summarize our findings and observations of the real-life application. We employed theoretical sampling (Eisenhardt, 1989) to select the project cases. First, the projects were to be performed by agile roles (e.g., Scrum Master and Product Owner) and agile practices (e.g., Sprint Planning and Retrospectives). Second, project members had agile project management experience due to an agile training or a participation in another agile project. Table 7 summarizes the projects. Project A, *Automated Forecasting* was an exploitation project aimed at automizing and unifying sales forecasting. Project B, *Customer Engagement* targeted the development of a modern customer relationship management (CRM) system for improved customer relations, interaction, and satisfaction.

	Project A Automated Forecasting	**Project B** Customer Engagement
Project Type	Exploitation	Exploration
Purpose	Automizing and unifying sales forecasting through AI applications and a Power BI visualization	Improving customer engagement by finding new customer interaction, exchange, or support opportunities through a modern CRM system
Project Size	Small	Large
Requirements	Unknown, evolving, and changing user requirements	Unknown, evolving, and changing user requirements
Approach/ Technology	Known technology and processes but the new data model	Unknown processes and new software
User Dependency	Partial	Yes
Duration	1 year	2+ years
Team Structure	The cross-functional, dedicated project team (approx. 10 team members)	The cross-functional, dedicated project team (approx. 150 team members)
Team Responsibilities	Performing multiple projects in parallel and running maintenance/support tasks	Performing project B and running maintenance/support tasks
Release Plan	No	Yes
Regulation Dependency	No	Yes

Involved Parties	Two functions (Sales and Logistics)	Multiple internal functions and external parties (Marketing & Sales, Customer Service, Finance function, external consultants, and software provider)
Common Agile Work Approach	Yes	Yes
Common Agile Understanding	Yes	Partial (lacking agile understanding from users)
Management Support	Partial (requesting project plan and limited control release)	Yes
Agile Project Management Approach	Agile (Scrum)	Hybrid (Scrum/Waterfall)
Agile Tailoring	Method configuration within Scrum	Method composition and configuration within Scrum

Table 7: Overview of project cases

When utilizing the five-phase process model for steering agile projects, the first step (Phase I) was to assess the agile requirements of a project using the Stacey Matrix. Even though both projects had a clear goal, user requirements (What) were initially unknown and evolved during project execution. From a technological perspective (How), *Automated Forecasting* might be classified as a "complicated" project since technological and process aspects are known. However, the quality and thus the applicability of the sales forecast are contingent on a new data model that could not be conceptualized yet. Therefore, continuous development, testing, and readjustments were expected. *Customer Engagement*, in contrast, consisted of multiple uncertainties regarding processes and new software with limited customization in a stable IT infrastructure.

Consequently, project teams of *Customer Engagement* depended on fast development, frequent user feedback, and rapid response. The Stacey Matrix indicated that both projects should be classified as complex due to existing uncertainties and potential changes. Therefore, we might conclude that agile project management seems to be the control mechanism for ensuring a high project performance. However, apart from the two dimensions of the Stacey Matrix, we identified additional project-related complexity

drivers, especially in *Customer Engagement*: the size of the project and its team, team structure, project interdependencies, the number of project parties involved, diversity of team tasks, and project duration. Those drivers, however, depend more on planning certainty and less on flexibility. Therefore, *Customer Engagement* is complex yet highly complicated, indicating a customized agile project management approach.

Moving to the second phase (Phase II), both projects were embedded into a single corporate context; however, the process model indicated differences in the corporate factors affecting the project cases. Corporate factors hardly influence *Automated Forecasting* because of the exploitative nature of the project, meaning the project operates in an existing corporate process and architecture landscape that requires little corporate-specific clarification or approval. In contrast, as an exploration project, *Customer Engagement* targets new ways of customer engagement. The newly defined processes and software cause ongoing changes in the corporate landscape, requiring multiple alignments, and approvals (e.g., enterprise architecture or corporate governance). Foreseeable and mandatory corporate-internal exchanges lead to upfront planning. Long-term and rigid planning conflicts with agile operations, indicating the limited usability of agile textbook methods.

Until now, i.e., before the analysis of the contingency factors, the process model led to the conclusion that *Automated Forecasting* consists of some project uncertainties and is largely independent of company-specific requirements. Even if the team is responsible for multiple projects simultaneously, it can still use the capacities in a dedicated way. The team can therefore choose a pure agile project management approach. In comparison, *Customer Engagement* is linked to project uncertainties. At the same time, the complicated project structure and the abundance of corporate requirements suggest choosing an adapted agile project management approach.

During the third phase (Phase III), the case company served its project teams with an agile project management portfolio consisting of the two agile methods, Scrum and Kanban, and two hybrid methods, including Scrumban and Waterfall/Scrum. *Automated Forecasting* targets a unified and automated sales forecast. Hence, including customer needs and quickly delivering product features are two relevant aspects. Therefore, Scrum was applied to steer the project activities and people's behavior to achieve given goals and high project performance. The method fulfills both requirements. First, it

regularly involves users and gathers their feedback on new product features. Second, it facilitates the development of product features through iterative and incremental development cycles. *Customer Engagement*, on the contrary, must balance the goal of innovation and comply with corporate standards. This calls for a hybrid project management approach consisting of planning and control security and creative and customer-oriented development based on Waterfall/Scrum.

After selecting a general project management approach, additional practices, i.e., agile practices and roles, should be prioritized according to individual project cases (Phase IV). On the one hand, this would lead to effective and efficient project management and thus project goal achievement. On the other hand, it allows flexibility in dealing with influential contextual factors to increase project performance. *Automated Forecasting* does not show any specific requirements that need additional method calibration. On the other hand, *Customer Engagement* uses a hybrid approach that prioritizes individual agile practices and roles. We followed the prioritization according to the overarching project goal of customer satisfaction.

Increasing product quality or product satisfaction can affect customer satisfaction. Due to a limited people capacity and lack of direct customer interaction, the team should focus on improving the product quality. First, the project team should focus on the correctness of the product functions. We propose using the practice Product Vision to demonstrate the overall customers' vision and the product they need. According to the vision, requirements can be specified and transparently outlined in the Product Backlog. The Backlog is thus the single source, for both the involved stakeholders and the project team, specifying what should be delivered. Second, the team should increase product requirement transparency. During the project progress, requirements need to be adapted in the Product Backlog to guarantee correct product functions. Two key roles are responsible for aligning the customer requirements with the project goal. First, Customer Representatives, especially when direct customer interaction is lacking, collect the customer requirements and communicate them to the second important role, namely the Product Owner. The agile role needs to ensure that the Product Backlog is updated, reliable, and transparently available for the customer and project team. The project team receives the tasks for developing the product functions from the Product Backlog.

The steering model's fifth and final phase (Phase V) concerns tailoring agile practices and roles to increase the contextual fit. The additional tasks of the project team, i.e., additional projects, maintenance, and support tasks, have the biggest effect on *Automated Forecasting*. The abundance of tasks prevents Sprints from performing multiple tasks in parallel. To provide team members with focus, projects are divided into themes and assigned to a tailored version of Sprints, namely Focus Sprints, i.e., up to three projects are considered for a Sprint, which are repeated after a certain time. Both practices and roles were tailored in the *Customer Engagement* project. From a practice perspective, Daily Stand-Up Meetings were replaced by Weekly-Stand-Up Meetings. The daily 15 minutes were too limited to provide insights into the progress due to the large amount of team members. From a role perspective, the major adjustment was role sharing of Product Owners, who are typically limited in their experience and knowledge of IT solutions. At the same time, Product Owners from the IT department lacked business experience. To gain synergy effects and consider both IT and business interests, two Product Owners, one from IT and one from business, joined to ensure project success. It was additionally found that only experienced project teams have the experience to shape individual practices and roles according to contextual needs.

2.6 Implications and Limitations

Agile methods and their components have a proven record of providing positive implications for project performance (Hallgren & Olhager, 2009; Lee & Xia, 2010; Recker et al., 2017). However, they do not suit every context (Cao et al., 2009) and consequently lead to lower performance or project failure (Magazinius & Feldt, 2011; Recker et al., 2017; Tarhan & Yilmaz, 2014). Therefore, agile project management should not be applied just because of its hype. Instead, through the conceptualization of a process model for steering agile projects, we showed that the performance-enhancing utilization of agility in project management depends on two major control factors: contextual requirements and project goals.

First, contextual requirements refer to the sum of the project- and corporate-specific influences as indicators of the degree of agility needed in a project, which can be determined using the Stacey Matrix (Gabriel et al., 2021; Liu et al., 2021; Poth et al., 2019). The matrix, however, considers preliminary project-related aspects (i.e., requirements and approach/technology) and disregards planned coordination efforts triggered by

company-specific factors (e.g., governance rules or enterprise architecture). The project *Customer Engagement* exemplifies the effect of multiple contextual requirements, resulting in the need to combine traditional and agile management practices. On the other hand, project controlling sees contextual influences as the potential risk during project execution that can lead to low performance (Conforto & Amaral, 2008). Therefore, context-oriented selection and utilization of appropriate agile methods, practices, and roles foster contextual risk mitigation and performance control.

Second, project realization depends on the alignment of project goals with the configuration of a project management approach. The methods, practices, and roles relevant to this approach are selected based on their effect on goal and performance dimension (i.e., Kanban to increase WIP efficiency). This serves the purposeful planning, control, measurement, and adjustment of project activities, resource consumption, and employee behaviors (Ferreira & Otley, 2009) to achieve project goals (Lauras et al., 2010). Therefore, project control is relevant for measuring project progress, steering project performance, and ensuring goal achievement (Conforto & Amaral, 2008; Kirsch et al., 2002; Lauras et al., 2010).

The application of the process model highlighted the need to select and tailor agile methods, practices, and roles, not only across industries, as proposed by prior researchers (Cao et al., 2009; Fitzgerald et al., 2006; Proba & Jung, 2019), but also within a single corporate context. The selection emerged as a critical element in configuring a project management approach, while tailoring played a minor role. Tailoring in a real-life context involves making small changes in individual practices or roles instead of addressing the entire method. Furthermore, tailoring depends strongly on the team's experience in agile project management. This limitation supports Fitzgerald et al.'s (2006) claim that it is not so important to have a broad and diversified agile method portfolio but rather to use some methods to gain in-depth experience to enable situational selection and tailoring.

Apart from its contributions, our research consists of some limitations. First, we evaluated the validity of the process model within a single case company. We realized that the successful application of the process model depends on two corporate pre-conditions. On the one hand, the corporation requires a certain agile maturity level, including an agile mindset, cross-functional and dedicated teams with agile experience in project

management, a common agile method portfolio, and management support. On the other hand, the implications of agile methods, practices, and roles within the corporate context must be known so they can be selected according to the project goal and its performance dimensions. Second, we focused on two projects in the IT department. Even though the business counterparts of the IT department initiated the projects, our sample of interview partners consisted only of experts from the IT department due to limited access to business counterparts. Therefore, to increase the validity of our findings, we encourage future research to test the process model across other functions, corporations, and industries.

2.7 Conclusion

This research paper aimed to increase our understanding of how agile project management can be situationally used to control and maximize project performance in manufacturing firms. Previous literature has outlined the positive performance implications in and outside software development (Lee & Xia, 2010; Recker et al., 2017; Serrador & Pinto, 2015). However, scholars have identified low or negative performance effects of agile methods in project management in traditional corporate contexts (Ajmal et al., 2020; Howell et al., 2010) due to misleading application contexts or wrong use (Gemino et al., 2021; Papadakis & Tsironis, 2018). This circumstance motivated further studies on operational agility dealing with agile method tailoring (Cao et al., 2009; Fitzgerald et al., 2006; Proba & Jung, 2019). Nevertheless, no project control instrument exists to guide how agile methods, practices, or roles can be situationally utilized and controlled to ensure performance gains in projects in manufacturing firms. Therefore, in the first step, we conceptualized a process model for situationally steering agile projects. In a second step, we evaluated and tested the process model in two agile projects within a manufacturing firm. From a theoretical perspective, we contribute to the literature by showing that a performance-enhancing utilization of agility in projects in manufacturing firms depends on controlling contextual requirements and project goals across industries and within a single company. Second, we outlined the importance of limiting the number of agile methods in a firm's project management portfolio. A limited number of agile methods enables a common understanding and fosters application experience, which is ultimately needed to situationally utilize agile project management. From a practical

perspective, we provide Project Managers and Scrum Masters with a process model, serving as a guidance for context- and goal-oriented steering of agile projects.

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3 Article II

Best Fit in Context:
An Analysis of the Target-Specific Application of Agile Project Management Practices

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Abstract

Agile methods are widely used for software development and are gaining popularity for project management. Despites its popularity, it is unclear why and when agile methods would be more appropriate than traditional methods for project management. Through a within-firm multiple case study design, we develop five propositions to facilitate the choice of project management method. Contingency theory of management control systems (MCS) proved appropriate to study the effectiveness of agile methods in information system context.

Keywords: a*gile method, project management, management control, contingency theory, case study*

3.1 Introduction

In a competitive landscape, companies evolve and change at various paces (Agarwal & Gort, 2001) to capture and defend a competitive advantage or gain efficiency (Ireland & Hitt, 1999; McGrath, 2013; Porter, 1996). Companies reorganize part of their activities through projects. During a project, the part that needs to be changed or enhanced is identified, and the new process is developed and implemented to replace the existing system (Unger et al., 2012).

These change processes, limited in time by their nature, need to be carefully organized and controlled to be successful (Anthony, 1965; Giglioni & Bedeian, 1974; Machin, 1983). Project management methodologies have been designed to ensure the project's efficient and effective development (Joslin & Müller, 2015; Papadakis & Tsironis, 2018). As such, these methodologies act as control systems designed and applied (Ferreira & Otley, 2009) to successfully implement the objective of a project.

In recent years, project management literature advanced significantly (Ahimbisibwe et al., 2015), with a large variety of methodologies proposed (Anwer et al., 2017; Papadakis & Tsironis, 2018), focusing especially on managing projects in fast, interchangeable, and flexible manners (Conboy & Fitzgerald, 2004; Dyba et al., 2014). In parallel, software developments saw profound changes in the last 30 years, forcing developers to set up innovative and lightweight development methodologies to write and quickly adjust software codes, ensuring fast and correct software delivery in favor of their users (Anwer et al., 2017; Dingsøyr et al., 2012; Highsmith & Cockburn, 2001). Agile methods, due to their rising popularity, soon became more influential in project management in the field of information systems (Anwer et al., 2017; Lee & Xia, 2010; Recker et al., 2017), and they were later used as a project management method (Conforto et al., 2014; Gemino et al., 2021; Shenhar, 2008).

As the popularity of agile methods is rising and their application has proven to generate positive outcomes, three major challenges remain unclear. First, the success of agile projects has not been well defined yet. Second, there are dozens of practical examples of successful applications of agile methods (Layman et al., 2004; Lee & Xia, 2010; Mann & Maurer, 2005; Middleton, 2001; Recker et al., 2017). However, applying various agile methods to solve the same problem led to application uncertainties. At the same time, it seems that agile methods may not be appropriate for every project or

corporate context and can even be detrimental to its success (Cao et al., 2009; Conforto et al., 2014). Little is known about the project and corporate components that define whether an agile method application would be successful. Third, a lack of empirical applications apart from software development provides another explanation for uncertainties concerning agile method application and its underlying practices in project management. Thus, this paper aims better define agile methods in project management in the manufacturing industry and investigate whether certain contingency factors lead to the successful application of agile practices.

To do so, various project management cases were investigated in one European manufacturing firm, leading to rich insights on why a management team would decide to deploy a project following a traditional, hybrid, or agile method. The findings led to five propositions regarding contingency factors influencing the application of a method. The first proposition suggests that no corporate-specific entry barrier related to (internal) people preventing the use of agile project management practices. Second, high project interdependencies, which are foreseeable/unforeseeable, will match with a traditional/agile method, respectively. Third, some regulation dependencies exclude the application of agile project management practices. The fourth proposition outlines that some agile design components in a traditional project are possible, but not the opposite. Fifth, the more a project scope is characterized by uncertainties, the more likely it is to benefit from an agile project management practice application. The paper also calls for a more intensive reliance on the contingency theory of MCS (Otley, 2016) to investigate the design, use, and performance of agile methods in a specific context. The paper is structured as follows. The next section reviews the literature on successful MCS implementation, project management methods, and contingency theory, followed by a section on the research methodology used for this multiple case-study research. The evidence and observations collected during the cases are outlined in the fourth section. The discussion of contribution addresses the five main propositions of the paper before illustrating the limitations, outlook, and conclusion.

3.2 Theoretical Background

The research drew on three major streams of literature to analyze the successful application of agile methods for project management. The first stream covered the literature on MCS, specifically, the project management and operationalization of project success.

The second one concerns operational agility with which firms manage their projects. The third one concerns the link between contingency factors and the application of agile methods to successfully drive projects.

3.2.1 Management Control of Projects and Project Success

Management identifies, designs, and implements strategies to successfully occupy a competitive position in the business environment by creating a competitive advantage (Ansoff, 1965; Porter, 1979). These advantages are difficult to defend, and they will not last long before being copied or enhanced by competitors (McGrath, 2013). Consequently, firms will have to take advantage of positioning while looking for future ones (March 1991; Markides, 2013; Raisch et al., 2009).

Management control aims to operationalize corporate strategies and ensure that corporate activities and people's behaviors are directed towards goal achievement (Anthony, 1965; Feichter & Grabner, 2020; Malmi & Brown, 2008; Otley, 1999). Companies mobilize formal and informal control practices into two main types of tasks to help them with exploitation and exploration activities (March, 1991). The first type involves planning, steering, and maintaining organizational and personnel aspects (Feichter & Grabner, 2020; Ferreira & Otley, 2009). The second type involves gathering information to control and incorporate changes to increase organizational success (Ferreira & Otley, 2009; Simons, 1987).

Malmi and Brown (2008) classify control practices into five core types. First, planning control practices targets short- to long-term goal setting by simultaneously directing effort and people's behavior. Second, cybernetic control practices aim to detect deviations in results and goal achievement to initiate modification measures in actions and behavior. Third, rewards and compensations foster people's performance and motivation through incentives. Fourth, administrative control practices steer people by organizing individuals through an artificial construct and making them accountable for their actions and behaviors. Fifth, cultural control practices aim to establish common values, beliefs, and norms, directing the way of working and thinking.

Controlling the successful running and ending of projects requires multiple control practices. In the context of project management, management control occurs in the form of project control and aims to maximize project success (Kirsch et al., 2002; Rozenes et al., 2006). Control practices represent different project management practices (e.g.,

Roadmap, Sprint Backlog, or Documentation), which are applied, among others, to manage the project and its scope (Bernroider & Ivanov, 2011), monitor and track its evolution (Munns & Bjeirmi, 1996), and ensure its success (Müller & Jugdev, 2012; Munns & Bjeirmi, 1996). A project scope evolves through project initiation and pre-project planning. It describes the boundaries of a project regarding its goal, deliverables, stakeholders, resources, schedule, and project risk (Ajmal et al., 2020). In summary, project management practices coordinate the various project activities and people's behaviors within predefined boundaries to ensure project success (Conforto et al., 2014; Rozenes et al., 2006).

Project success describes the degree of project goal achievement and is categorized into project success and project management success (Joslin & Müller, 2015). The former relates to the outcome of a project and indicates its effectiveness. From a customer and corporate perspective, it is evaluated whether the planned business impact has been generated and whether stakeholder or customer expectations have been fulfilled (Joslin & Müller, 2015; Serra & Kunc, 2015; Wateridge, 1998). Project management success, in contrast, refers to the operational efficiency of managing and performing projects. As such, the iron triangle (time, cost, quality) presents a major tool for evaluating project management success (Atkinson, 1999; Bernroider & Ivanov, 2011; Joslin & Müller, 2015). Due to increasing operational uncertainties and customer engagement during project execution, scholars have proposed to extend the list of performance indicators, including responsiveness time, team satisfaction, customer impact, or strategic potential (Agarwal & Rathod, 2006; Bernroider & Ivanov, 2011; Müller & Jugdev, 2012; Shenhar et al., 2001; Wateridge, 1998).

3.2.2 Operational Agility and Agile Project Management

In an increasingly unpredictable and changing organizational environment, the need to identify new sources of growth is becoming more salient (Rajshree & Gort, 2001; Markides, 2013; Markides et al., 2017). New opportunities are often integrated through project implementation (Turner, 1999). Project success builds on the project teams' ability to continuously identify and rapidly incorporate upcoming changes or opportunities (Dyba et al., 2014; Highsmith & Cockburn, 2001; Sharifi & Zhang, 1999; Shenhar, 2008).

For these reasons, agile project management has become more prominent and promising (Conforto et al., 2014). It provides managers and project teams with agile methods (e.g., Scrum), practices (e.g., Retrospectives), values (e.g., customer collaboration), and principles (e.g., welcome changes) to ensure a flexible, lean, and fast adjustment of tasks, resources, or processes to adapt evolving changes into the project progress and outcome (Conboy & Fitzgerald, 2004; Dyba et al., 2014; Fitzgerald et al., 2006; Lee & Xia, 2010). The overarching objective is to ensure customer satisfaction and corporate competitiveness (Boehm & Turner, 2004; Serrador & Pinto, 2015).

Agile project management belongs to the operational agility literature stream (Agarwal & Selen, 2009; Proba & Jung, 2019). Operational agility evolved in the 1990s from two major streams: agile manufacturing (Hallgren & Olhager, 2009; Sharifi & Zhang, 1999) and agile software development (Dingsøyr et al., 2012). The latter gained higher attention due to the existence of agile textbook methods[6]. The methods are built on a selection of values and principles specified in the Agile Manifesto[7] in 2001 and facilitate processes, models, practices, artifacts, and roles (Chow & Cao, 2008; Fitzgerald et al., 2006; Recker et al., 2017; Serrador & Pinto, 2015). Agile methods are a key component of gaining operational agility (Proba & Jung, 2019) and are thus a crucial element in agile project management.

Prior scholars have addressed the issue of the lack of suitability of agile methods in project contexts apart from software development (Cao et al., 2009; Teece et al., 2016). The major reasons are grounded in deviating contingency factors in manufacturing organizations (Conforto et al., 2014). These include complex and multifaceted project components, multiple stakeholder dependencies, or overall project complexity (Boehm & Turner, 2004; Gemino et al., 2021; Papadakis & Tsironis, 2018). Consequently, agile project management in manufacturing firms hardly applies pure forms of agile methods. In contrast, individual agile practices from different agile methods are chosen, tailored, and configured (Cao et al., 2009; Fitzgerald et al., 2006; Gandomani et al., 2013; Proba

[6] We use agile methods as a synonym for agile software development methods. Popular agile methods are Scrum, Kanban, Extreme Programming, Test Driven Development, Feature Driven Development, Lean Software Development, or Dynamic System Development (Anwer et al., 2017; Chow & Cao, 2008; Papadakis & Tsironis, 2018).
[7] The Agile Manifesto consists of four values and twelve principles (Beck et al., 2001); individual agile methods, however, approach different values and principles, causing different application affects.

& Jung, 2019) into a customized agile project management approach to ensure project success (Conforto et al., 2014).

An upcoming agile literature stream categorizes this phenomenon into agile, hybrid, and traditional project management (Gemino et al., 2021; Mukhtar et al., 2013; Papadakis & Tsironis, 2018). The first one refers to the original textbook application of an agile method, for example, Scrum or Extreme Programming (Dingsøyr et al., 2012; Serrador & Pinto, 2015). The last describes utilizing traditional project management methods, including Stage-Gate or Waterfall (Shenhar, 2008). Hybrid or customized project management compounds the boundaries between agile and traditional. It allows the project team to select individual agile and traditional practices to configure and apply context-specific approaches (e.g., Scrumban or Waterfall/Scrum) (Conforto et al., 2014; Gemino et al., 2021; Papadakis & Tsironis, 2018). This categorization can also serve as a framework to evaluate projects' agility.

The choice and application of the respective approach depend on the influencing contingency factors (Conforto et al., 2014; Gemino et al., 2021) described in the next subsection.

3.2.3 Contingency Theory

Contingency theory emerged very early in the understanding of organizations when it became clear that there was not one best way to organize firms and that the choice of adequate structure, practices, or management was contingent on various factors (Woodward, 1958). Thus, business strategy is not a deliberate choice but depends on internal organizational factors and external market and technological conditions (Hofer, 1990).

Similarly, the design and implementation of management controls and practices are contingent on specific factors (Waterhouse & Tiessen, 1978; Wetherbe & Whitehead, 1977). If practices fail or result in low organizational performance, it can be attributed to a low fit between organizational conditions and the utilized controlling practices (Gerdin & Greve, 2004; Wetherbe & Whitehead, 1977). A firm's survival and success should, therefore, not be limited to a predefined and rigid set of methods but rather built on the identification of influencing contingency factors to control and adjust methods according to their operating context (Chenhall, 2003; Gerdin & Greve, 2004; Otley, 2016).

Projects are characterized by specific factors (Ahimbisibwe et al., 2015; Howell et al., 2010). They have a unique and temporary structure – purpose, resources, time horizon, or stakeholder groups – and face different technological or environmental uncertainties and changes (Turner & Müller, 2003). In line with the general contingency theory of MCS (Otley, 2016), the deviating project conditions limit a one-size-fits-all configuration of project management practices (Besner & Hobbs, 2013; Cao et al., 2009; Gemino et al., 2021; Howell et al., 2010; Papadakis & Tsironis, 2018; Turner & Müller, 2003). Thus, project management contingency theory indicates that project success depends to a large extent on how project conditions can fit project management practices (Ahimbisibwe et al., 2015; Howell et al., 2010).

Researchers have distinguished various types of contingencies, starting with the difference between environmental (external) and organizational (internal) factors (Schonberger, 1980). This split stays apparent even when being less specific in the distinction. For example, Chenhall (2003) identifies the external environment, national culture, technology, and organizational structure, size, and strategy. From a meta-level, organizational strategy, structure, business environment, individuals, technology, and tasks are major contingency factors (Weill & Olson, 1989). The list of contingencies on a micro-level perceives to be infinite and can include industry, firm size, organizational structure, culture, vendor relationship (Premkumar & King, 1994), system design and quality (Premkumar & King, 1994; Schonberger, 1980), task complexity (Andres & Zmud, 2001; Howell et al., 2010), time-horizon (Premkumar & King, 1994), innovativeness, stakeholder relationship (Howell et al., 2010; Teo & King, 1997), or individual characteristics (Hambrick & Mason, 1984).

To allow for comparative analysis, the following study focuses on corporate internal contingencies, including (1) project characteristics, (2) corporate environment, and (3) user presence.

First, project initiation leads to the definition of project-specific characteristics and boundaries (project scope), including objective, size, resources, stakeholder groups, urgency, requirements, project team structure, or complexity (Ahimbisibwe et al., 2015; Conforto et al., 2014; Wysocki, 2011; Turner & Müller, 2003). Project characteristics can be changed during project execution (e.g., upcoming customer requirements or budget cuts), especially during explorative projects (Howell et al., 2010). The

requirements and project deliverables are defined (or at least redefined) during the progress of the project; therefore, project characteristics are a decisive factor in selecting project management practices (Ahimbisibwe et al., 2015) to perform project activities, control changes, or establish a suitable work environment (Hussein, 2019).

Second, corporate environment contingencies cover the wide spectrum of social and physical aspects affecting individual decision-making behavior. The internal environment refers to employees, managers, and cultural components, whereas external factors refer to outside stakeholders and technology (Duncan, 1972). Therefore, environmental contingencies are closely linked to a project's degree of complexity and uncertainty, requiring a specific practice use (Boehm & Turner, 2004; Teece et al., 2016). Empirical findings of the existing agile literature are limited to the software industry (Lee & Xia, 2010; Mafakheri et al., 2008; Recker et al., 2017). Prior scholars have called for additional investigations in the manufacturing industry since those projects show a higher degree of complexity due to multiple project components, long project duration, cost-intensive prototyping, globally facilitated corporate structures, or complex and globally distributed supply chains (Cao et al., 2009; Conforto et al., 2014).

Third, a core component of a successful agile project is the customer[8] (Beck et al., 2001). Customer needs and changes are gathered through customer interaction to prohibit project failure (Maruping, 2020). From a contingency perspective, customers can be differentiated into internal and external customers. Internal customers[9] usually refer to corporate internal users or employees performing business processes, whereas external customers are product or service consumers (Lukas & Maignan, 1996). Collaborating with customers represents a clear advantage to align the process with the needs, although it has several risks associated with changing needs, limited reachability (Cao et al., 2009; Maruping, 2020), insufficient knowledge, or engagement willingness (Fitzgerald et al., 2006; Maruping, 2020). Thus far, researchers have outlined how customers affect the configuration of agile project management; however, empirical understanding of how users affect the project management configuration is lacking.

[8] The values and principles of the Agile Manifesto outline the importance of the customer: *"customer collaboration over contract negotiation"* or *"[…] highest priority is to satisfy the customer […]"* (Beck et al., 2001). We use the term "customer" as a synonym for user and/or customer.

[9] In the following sections, we use the term "user" as a synonym for the internal customer. In contemporary organizations, supporting corporate functions, i.e., IT, Finance, or HR, are seen as business partner. This means that those functions do not provide a service to an internal customer but rather solve problems or build solutions in a collaborative manner (Järvenpää, 2007; Wright, 2008).

3.3 Research Methodology

The goal of this study is to identify links between contingency factors and agile project management practice application that leads to project success. To better understand the internal contingency factors, we applied a within-firm embedded multiple case study design to build theory inductively (Eisenhardt, 1989). A case study is especially useful when an in-depth understanding of a research phenomenon is required due to its complexity, occurrence in a real-life scenario, and the limited separation from its occurring context (Paré, 2004; Yin, 2014). The investigation of multiple cases helps explore the phenomenon and ensures a high degree of robustness and generalizability of the research findings (Eisenhardt & Graebner, 2007).

The research focused on a multinational European manufacturing firm operating as a leading product and solution supplier for the professional construction industry. In its 80-year history, the company has steadily grown, operating in 120 countries worldwide, gaining net sales of approximately 6 billion USD, and employing roughly 30'000 employees in 2021. The investigation focused on agile projects in the IT department of the company. From an agile transformation and operation perspective, the IT department takes a leading role within the corporation. In 2018, the IT management team identified the need to run projects in an agile manner for three major reasons. First, the IT department takes the role of a business partner, being responsible for developing digital solutions with the business counterparts. Its second role is to efficiently operate and maintain the IT infrastructure. Finally, the role of IT management is to ensure fast delivery of user-centered and high-quality product functions through user interaction. The company did a complete agile transformation and is actively executing agile projects. The direct access to the projects allowed us to examine the project executors and users.

3.3.1 Cases

Theoretical sampling was used to identify cases expected to provide meaningful knowledge to build and extend the theory (Eisenhardt, 1989; Glaser & Strauss, 1967). Therefore, the focus was on completed[10] projects where agile practices and roles were consciously applied. In addition, project team members must have a certain agile

[10] The term successfully completed refers to both the project management success (on-budget, on-time, quality, and team responsiveness) and project outcome success. We illustrated definitions of both success factors in Chapter 2.1 "Management Control on Project and Project Success."

experience by participating in a two-day agile training or actively participating in at least one agile project. Pettigrew (1990) suggested selecting cases with extreme variances to make observations and findings even more understandable. The five selected cases summarized in Table 8 – representing agile and hybrid projects from the IT department – show extreme differences in project purpose and context.

Characteristics	CIMS (centralized information management system)	BIFS (business intelligence forecasting system)	ADM (automated device management)	CRMS (customer-relationship management system)	APMS (agile performance management system)
Project Goal	Centralizing information access and preventing information asymmetries	Deriving instant, reliable, and unified forecasting numbers across business functions	Automation of the provisioning process of hardware devices for corporate users	Identifying and creating new ways of customer collaboration, interaction, and engagement	Digitizing the performance management (PM) system for internal and external employees
Project Solution	IM System	BI Forecasting System	Device Management	CRM System	Agile PM System
Business Impact	Very high	High	Low	Very high	High
Project Type	Exploration		Exploitation	Exploration	
Project Size	Large	Small	Medium	Large	Medium
IT Domain	Information Management & Governance		IT Infrastructure	IT Marketing & Sales	IT HR
Involved Business Functions	Finance, Marketing & Sales, Logistics, Fleet Management, IT	Finance & Logistics	On-side IT	Customer Service, Marketing & Sales, Accounting	HR
Internal Target User	Finance, Marketing & Sales, Logistics, Fleet Management, IT	Finance & Logistics	Corporate hardware user	Customer Service, Marketing & Sales, Accounting	Corporate internal & external employees
Project Driver	Internal user		Management		
Project Management Approach	Hybrid (Scrum and Waterfall)	Agile (Scrum)	Agile (Kanban)	Hybrid (Scrum and Waterfall)	

Drivers for Project Management Approach	Unknown system and user requirements, cross-functional collaboration, incremental and fast deliver of product functions, multiple stakeholder involvement, strategic initiative, release plan	Dedicated project team, incremental and fast deliver of product functions, and unknown user requirements	Flexibility in work prioritization and ensuring progress structure	Unknown system and user requirements, cross-functional collaboration, incremental and fast deliver of product functions, multiple stakeholder involvement, release plan	Unknown user requirements, multiple technologies from various vendors

Table 8: Overview of investigated project cases

3.3.2 Data Collection

Semi-structured interviews were the primary data collection method to gather in depth-knowledge from experts (Eisenhardt, 1989). Purposeful sampling (Paré, 2004) helped us select interview participants involved in the mentioned project cases based on their knowledge and experience in agile project management. In total, 17 stakeholders, including project executors, steering-board members, and users, participated in 30 interviews. Interviewees originated from different hierarchy levels, representing team leaders, middle managers, and top managers. Interviews details are listed in Table 9.

Interview Participants	Position	No. of Interviews	Duration	Tenure in Current Position	Tenure in the Company	Domain Project Case	Agile Experience
Top Management							
H	Head of IT Infrastructure	1	82 min.	2 years	15 years	IT ADM	In house training
I	Head of Supply Chain Management IT	1	55 min.	7 years	24 years	IT BIFS	In house training
J	Head of Information Management and IT Governance	1	85 min.	5 years	23 years	IT CIMS & BIFS	In house training

K	Head of IT Controlling and Business Development	11	90 min.	3 years	3 years	IT APMS	In house training
Middle Management/Operational Execution							
A	Head of SAP Business Analytic Solutions & Business Warehouse	1	90 min.	2 years	5 years	IT CIMS	3 years
B	Global Head of Data Science and Data Architecture	1	80 min.	3 years	8 years	IT BIFS	6 years
C	Product Owner for Workplace Collaboration	1	95 min.	7 years	23 years	IT ADM	In house training
D	Head of Digital Workplace Platforms & Connectivity	1	65 min.	2 years	2 years	IT ADM	4 years
E	Head of Manufacturing and Industry 4.0 IT	1	120 min.	2 1/2 years	12 years	IT CIMS, BIFS, ADM, CRMS, APMS	5 years
F	Chief Product Owner for Customer Service and SalesForce	2	135 min.	2 years	16 years	IT CRMS	5 years
G	Head of Global HR Systems	2	120 min.	6 months	5 years	IT APMS	8 years
L	Global Head of Marketing Automation	2	60 min.	2 years	16 years	Business BIFS & CRMS	6 years
M	Head of Customer Experience and Ecommerce	1	60 min.	6 months	7 years	Business CRMS	1 year
N	Head of Market Reach Processes & CRM	1	60 min.	6 months	17 years	Business CRMS	4 months
O	Head of Direct Sales Force and CRM	1	60 min.	2 years	18 years	Business CRMS	1 year
P	Scrum Master and Agile Coach	1	60 min.	9 months	9 months	Business CIMS, BIFS, ADM,	10 years

Q	Agile and Lean Coach	1	60 min.	2 months	2 months	CRMS, APMS Business CIMS, BIFS, ADM, CRMS, APMS	9 years

Table 9: Overview of interview participants

The interviews included open-ended questions to collect experiences, opinions, reflections, or unexpected insights from the interview participants (Eisenhardt, 1989; Eisenhardt & Graebner, 2010; Paré, 2004). The structure of the interview narrative was as follows. First, an opening sequence aimed to gain background information about the expert. Second, the main part included questions assessing the general understanding of agile project management in the manufacturing context to gain insights into the project and corresponding agile practices and roles, influencing contingency factors, and the role and engagement of internal users. In the third sequence, interview participants were allowed to express their final thoughts, risks, or doubts. The content of the interview narrative was adapted slightly according to the role of the interview participant. Interviews were conducted from February to October 2021. Due to Covid restrictions, interviews were held and recorded via MS Teams and had an average duration of 90 minutes. Two interviews were held in German and subsequently translated into English. Interviews were transcribed to enable a transparent data analysis.

The following three measures were set up to address potential biases inherent in the research methodology. First, interviewing participants in IT or business departments in varying hierarchical positions ensured diversity of perspectives (Koriat et al., 2000). Second, interviews followed a multiple investigator strategy (Eisenhardt, 1989). Initially, two researchers conducted the interviews. One researcher directly engaged with the interview participant by asking questions, while the second researcher observed the interaction and took notes. The researchers' different perceptions led to a broader understanding of the key informants and increased the strength of the findings to build a more robust theory. Additionally, interview data were analyzed and discussed by a third researcher to enhance the objectivity and reliability of the findings. Third, interview results were triangulated by discussing observations in groups and using secondary data,

namely corporate documents (Eisenhardt, 1989; Paré, 2004; Yin, 2014), to provide further information about project contingencies and general application rules of agile practices in the manufacturing company and replicate the findings from the interview data (Paré, 2004) and ground theory on multiple sources (Eisenhardt, 1989).

3.3.3 Data Evaluation

According to Eisenhardt (1989), building theory from a multiple case study design requires a within-case and cross-case analysis. In the first step, each case in this study was investigated individually. Thereby, each case's interview transcripts and corporate documents were analyzed before comparing the results across the cases. In the second step, similarities across the individual cases were specified to verify and replicate the results. This approach increases the robustness and generalizability of the findings (Eisenhardt, 1989; Yin, 2014).

The interviews were evaluated following a three-stage coding approach (Bhattacherjee, 2012; Corbin & Strauss, 2008). First, open-coding aimed to analyze interview data line-by-line to identify general concepts (specifically, influencing contingency factors such as enterprise architecture dependencies or degree of project clarity). Eighty-seven contingency factors that potentially foster or prohibit the utilization of agile project management practices emerged from the analysis (e.g., acceptance of agile working or degree of dependencies). Second, axial coding helped determine commonalities or differences across the concepts, resulting in 13 sub-categories (e.g., project type or agile maturity). Third, the observed sub-categories were selectively coded according to the predefined categories from the theoretical background (i.e., project characteristics, corporate environment, and user presence).

3.4 Influencing Contingencies for Agile Project Management Application

This section summarizes (1) the project characteristics, (2) the corporate environment, and (3) user presence and its underlying sub-categories (see details in Table 10) that foster or hinder the application of agile project management practices. Observations indicate that the contingency factors influence the choice, configuration, and utilization of agile practices. Moreover, the project's success depends strongly on how the most suitable project management practices fit the contingency factors.

(1) Project Characteristics	(2) Corporate Environment	(3) User Presence
1. Project type 2. Project tasks and process sequence 3. Project components 4. Project team structure	5. Agile maturity 6. Organizational structure 7. Corporate governance regulations and rules 8. Management support 9. Technological dependencies 10. Role of IT	11. Type of user group/interaction 12. User reachability 13. Impact on user

Table 10: Contingencies categories and sub-categories

3.4.1 Project Characteristic

The five projects varied substantially from each other. The nature of the project, being explorative or exploitative, substantially influenced the project management method. Explorative projects are characterized by the novelty of the projects leading to requirement uncertainties. Typically, technological and user perspectives give rise to project uncertainties. Interviewees from these projects indicated that the former relates to two aspects: developers either identify new requirements while experimenting with the technology or realize that requirements could not be implemented due to technical limitations. Consequently, at least parts of agility practices were required in these projects.

From a user perspective, users with a limited system understanding express requirement uncertainties. They are not fully aware of or have various expectations from diverse solutions. Interview Participant H mentioned the advantage of agile practices in such a scenario: "*We informed users better about technological shortcomings. So, they were aware that things will not work and did not perceive them as a bug but rather as an announced but not yet delivered feature.*" Second, up-front defined requirements were deleted, re-specified, or extended due to users experiencing system features through continuous testing. Interviewee F explained: *"[…] agile practices have the value of close collaboration with the user […] to get direct feedback on what is good, what is not needed or not so good. […] So, looking for customer needs and sense and understand opportunities helps us to gather requirements."* Third, requirements from different user groups must be combined, coordinated, and re-prioritized, resulting in changes.

In contrast, the exploitative project consisted of automatizing the existing process. The user and technological requirements were mostly known, leading to Participant D's conclusion: *"I know the Scrum principles and rituals, but we cannot fully introduce them into our products and projects because it is too much overhead for us."*

According to all interviewees, process and task characteristics are important determinants of the need for agile practice application. In *CRMS* and *APMS*, work and task packages were derived from pre-specified or evolving requirements. The requirements typically represented different system functions, features, or design elements independent of each other. Therefore, the tasks in both projects were not bound to a specific process sequence but were performed in parallel at different time points by various team members. In addition, the work packages consisted of unique and complex development problems, suggesting that task resolution did not follow a known routine but required creative and iterative solution paths.

In comparison, the work package characteristics (e.g., data models) of projects *CIMS*, *BIFS*, and *ADM* were a major obstacle to utilizing agile practices (e.g., Sprints or Daily Stand-Up Meetings). Some work packages are too extensive or sequential and cannot or should not be developed through an iterative development cycle. Executive manager (Interview Partner J) mirrors:

> *If you want to build or need to build that up (referring to the data model) in the reporting environment, it takes months, and we are actually still working on it after a year now. I mean there you can say agile is most probably not the most suited one because you have a very long sprint.*

Interview Partner H expressed a general opinion regarding highly sequential projects:

> *There are situations in projects that are very sequential in their execution – particularly in infrastructure. Things start with a first evaluation; afterward, you identify your core requirements, then you get the requirements, integrate the operating system, deploy the application, and start working with the application. There is little to be run in parallel; you have a very clear sequence that you can run in a traditional way.*

Some specific, predictable operational routine tasks (e.g., support or maintenance) are unfit for agile project management because they require neither a creative nor an

iterative approach. Observations showed that a traditional Stage-Gate process is most efficient, as mentioned by a team leader from the *CRMS* project (Interview Participant N):

> *We have within our teams also certain areas where we say agile is not the right thing. You have to finish in a sequence, and you have to do the work in a certain way or methodology where agile would be more disruptive than helpful. Those areas are where you have a clearly defined set of tasks and deliveries codependent one over the other.*

Further in-depth analysis revealed that project components, especially in *CRMS* and *APMS* projects, played an important role in selecting agile methods. Both projects were built on a single software obtained directly by the software vendor based on two benefits. First, technical issues were allocated to a single software without aligning changes with other dependent software. Second, a direct vendor relationship ensured direct vendor support and fast resolution of technical issues.

The other projects comprised interfering components. Projects C*IMS* and *BIFS* were built on multiple and interdependent software. Project *ADM* relied on hardware and embedded software components. Due to lead times, the interdependencies caused upfront planning efforts, i.e., through project plans. Consequently, flexible and rapid project component changes were limited. Interview Participant E explained, *"[...] if I have a project that includes hardware, it's another area of dependency added that I cannot control. The more dependencies you have, the more you need [...] to plan properly and look ahead."*

Articulating software and hardware requires specifically organized teams. Nevertheless, observations did not reveal an optimal project team structure for agile projects. Therefore, agile practice utilization does not appear to be strictly bounded to a specific team structure. However, individual project team member dependency typically leads to project management adaptations. Three major project structures were identified. First, projects *BIFS* and *APMS* showed a beneficial team structure, where individual team members were dedicated to a single project team by performing multiple projects simultaneously. This team setup minimized dependencies on external team members, promoted consistent, agile practice utilization, and considered a stable team capacity to allocate project priorities.

Second, Interview Participant O described the team structure of the *CRMS* project: *"We decided to build a virtual organization within the company between marketing and IT, consisting of 150 employees. They are dedicated purely to the project, have the same direction, work towards this direction, and have joint responsibility."* This team configuration allowed using individual capacities to interact with customers, recognize opportunities, change incorporation quickly, or expedite incremental development. Nevertheless, the large number of project members caused the restructuring into smaller subproject teams where *"[…] we still have the challenge of alignment across the teams, "* as expressed by Interview Participant F.

Third, projects C*IMS* and *ADM* showed limiting the effectiveness of agile textbook practices. Individual team members were assigned to multiple projects and project teams simultaneously, increasing people's dependence. Hence, team members could not fully focus on a single project but needed to share it with various project teams. Interview Partner A illustrated the problem:

> *We had situations where one team member was part of six or seven different teams, and you have to imagine if you to do six or seven dailies a day, crazy, right? […] every minute you spend in a meeting keeps you away from work.*

Moreover, the project teams were not fully cross-functional, meaning that they were dependent on external experts and their skills, resulting in increased planning and alignment efforts.

3.4.2 Corporate Environment

Besides project-specific factors, the corporate environment also influenced the project management method. One major factor influencing agile project management practices was the agile maturity of an organization consisting of four major aspects: agile mindset, agile work approach, willingness to operate in an agile mode, and agile understanding. All projects showed a high degree of agile maturity from the team, user, and management perspectives. On the one hand, the teams consisted of young and motivated developers who proactively demanded or were curious about working in an agile mode. On the other hand, users and managers quickly realized the benefits of operating in an agile mode. Interview Partner N explained:

> *Let's say it is a learning curve not only for us in the development team but also for the markets because the perception, at least in the beginning, is you*

> *(as a developer) brought me (as a user) something that is half complete. […] […] It took some time, and it is taking time on the receiving side to understand that what we bring to you is not the end product. It is the first iteration of what we will continuously improve.*

The experts concluded that agile project management requires learning by doing rather than rigorous training. The agile understanding, mindset, and knowledge typically develop through hands-on experience and communication between project parties. Therefore, the perceived entry barrier relates more to the people's willingness to apply agile practices rather than in-depth knowledge.

Another influencing contingency factor is the organizational structure of the investigated case company. The individual or multiple small and cross-functional teams consisting of IT and business people (e.g., Product Owner IT and Business) were embedded in a complex and hierarchical corporate structure. A limited IT knowledge from business employees and limited experience in business processes from an IT perspective required an agile role adaptation. Even though the supporting Agile Coach (Interview Participant Q) claimed that *"Agile teams should be composed by everybody, so by IT and business […],"* he further called for *"[…] separating the powers between IT and business."*

This duality of roles generated hidden reporting lines. Project team members (e.g., Product Owners) are typically part of a project team and a corporate function. Hence, team members bear different responsibilities and are confronted with divergent goals and interests of their functions and corresponding supervisors. One team leader (Interview Partner F) expressed his thoughts:

> *[…] having an organization in place with organizational charts, boxes, and hierarchies that's always tricky […] even myself, I still want to be asked, and I still have an opinion, and I still want to decide on one or another thing even if the product owner is there. And there is a little bit of conflict by nature.*

Individuals' dependency on and affiliation (e.g., rules or culture) with their functional reporting line can thus lead to the unforeseen conflicting project or functional goals (e.g., prioritization according to functional instead of user interests). Interview Partner O explained the phenomenon:

> *Even if you are staffed into an agile team, you still have another team leader or top manager. Now, if you are located in a different place, for instance, the IT or business department, and you run across him two or three times a day, and he expects you to incorporate other aspects, then you quickly end up in disalignment. That's a real challenge.*

To add to the complexity, observations showed that no specific roles are required to lead or operate in a shared agile project environment. Interviewee Q critically outlined:

> *I also think that there are too many roles. It is still a mix of the old and the new world. It is very hard to be the head of whatever, and you are supposed to give it up and be part of this bullshit flat hierarchy.*

Close encountered with the organizational structure are corporate governance regulations and rules. Every interviewee considered it the most critical corporate factor prohibiting agile practice application. The company builds on a stable and standardized process landscape. Whenever new products, services, or processes trigger changes, business process experts, enterprise architects, risk managers, lawyers, or other corporate functions must screen and approve the changes. Interviewee G mentioned:

> *Protocols or internal protocols are the biggest pain point. As I said, depending on your team, you have different rules. And this restricts you a lot and takes away your flexibility. Because in the end, you have some boundaries which are not necessarily really helping you in your approach, but you need to stick to those. So, to me, protocols are the number one thing that is a killer in agile project management.*

Even though protocols and rules challenge all projects, some managers stick to them to keep control, as mirrored by Interview Participant B:

> *It is super convenient for a manager to ask for a roadmap for work packages – so if something happens – it can be blamed on the project manager if it is not done.*

Governing rules are challenging. They are implemented by managers who also integrate agile practices into project management. Project C*IMS* was the only project showing poor management support, adopting a hybrid management approach. On the one hand, the management team continuously asked for a detailed upfront project plan to set

expectations regarding milestones and deliverables. On the other hand, the management team used a rather command-and-control leadership approach, meaning that the project team was frequently asked for status updates, reports, or project changes triggered by the management.

Interview Partner A claimed:

> *Management buy-in is the most important of any agile transformation. When I say management buy-in, it needs to be a full management buy-in. Not just a cool concept, but let's try it out in one area. Afterward, if you spread it into other areas but still have the top-down management alignment, do a status update in an agile fashion. Just to give you another example. When we started with our project, we were always challenged to give a detailed project plan. Everyone was then wondering what project plan are you asking for? We are doing agile right? We have a good feeling about our requirements; this is our projection, and this is how an agile plan looks. That's what helped us be a new organization and do agile practices.*

Interview Participant E further explained:

> *We have the clear wish from our management teams to have clear deadlines, clear go life dates, and things like that, which is, I would say, not impossible with Scrum or with agile methodologies but a challenge.*

A successful agile project execution builds on the management's willingness (also depending on potential fear of new methodologies) to utilize agile practices and change management's behavior, as embodied by Interview Participant B: *"Agile also means that management is losing control a bit. So, this is also super important for agile projects […] And it kind of hurts to give this away."*

Often, project outcomes depend on software and hardware components. These two can be significant factors arising from two perspectives. First, projects are integrated into a complex and rigid IT landscape. On the one hand, potential dependencies or restrictions must be identified in advance. Interviewee F explained:

> *[…] we are very much working in SAP. In this S4 HANA world, we have multiple dependencies. We have some release dependencies and technology*

> *dependencies; we have some potential side effects, and all this consideration ends in a kind of planning that is against the concept of agility.*

On the other hand, enterprise architects must review and validate contextual IT changes in advance. Interviewee G explained:

> *If you have a project and want to go live, give the architecture team your requirements before Wednesday because they need 5 days a month to evaluate you. They say they don't care if your house is burning. Five days, that's it.*

As a result, Interviewee P demonstrated the limited applicability of agile practices by illustrating:

> *[...] if an agile team is coming now and wants to continuously perform some technical changes or get fast approvals – that's simply not possible because you always have to request these guys weeks or months before.*

Second, technological dependencies also arise from software or service providers. Project staff must implement user requirements within a technological framework specified by providers. However, providers are also concerned with the continuous improvement of their solutions. As a result, project teams need to identify and adapt to unforeseen technological requirements. Interview Partner C expressed his concerns:

> *I have worked with large software companies, and they are using the agile or user-centric approach as well [...]; overnight, you get new software features that are supposed to make everything better, but in the end, you have to adjust this stuff to your landscape because you depend on it.*

Unlike software development companies, manufacturing firms typically utilize technology to renew or invent products, services, or processes and rarely create and directly deliver software to their customers. The potentially more limited dependencies in the software industry also facilitate more frequent service renewal (monthly software updates), whereas for a manufacturing firm, the cycles to renew product would generally be longer (measured in years).

3.4.3 User Presence

The (future) users of the project deliverables are closely linked to the corporate environment. This study's results can help users complete daily operations effectively, better

interact with end customers, and solve their issues to ensure the corporation's long-term success. All interviewees agreed that direct and/or indirect user interaction through agile practices was fundamental for developing user-centric products, particularly for exploration projects. It encouraged teams to gather frequently relevant user requirements, building a user understanding, ensuring user feedback, and recognizing potential changes. Nevertheless, two potential obstacles, user report dependency and unknown user behavior, can affect successful agile project management practice applications.

C*IMS*, *BIFS*, *CRMS*, and *APMS* project teams obtained information from direct and indirect users. Interviewee G explained indirect user information derived from regional, business processes, or domain experts:

> *[…] you can easily fall into bias when you work with HR people [domain experts] who see the world in an HR [domain] color. I strongly believe that if you´re doing a system for users, you should not just focus on this community […]. So, we have a so-called group of "PM explorers." These are our actual users […] from all over the world, and they are not HR. They are people from very different backgrounds.*

Interviewee Partner B agreed with this statement and further elaborated:

> *When users see these guys are actually listening and acting, they are highly motivated to provide input and be engaged. And actual users mean direct information on their pain points or problems, allowing us to find and develop sustainable solutions.*

Like other IT infrastructure projects, Project *ADM* built its success on indirect, upfront-known user information, which does not necessarily require agile practice application. Interview Participants C, D, and H concluded that IT infrastructure projects provide users with a reliable and innovative IT infrastructure. Users are either not interested in how the technology is implemented, or they lack domain knowledge, as illustrated by Interview Partner H:

> *Ideally, we have a single point of interaction and very rarely can or should the direct user go down to a detailed level. […] I mean, we had situations where a user told us, please execute this command on the machine. When we*

asked where you found this command, they said, "Oh, we googled it. Okay, then it is not about expertise but individual fact-based knowledge […].”

The behavior and interests of users, especially indirect users, are potentially threatened to be unknown or different from those of actual users. Interview Partner F explained:

We started now having indeed sessions where the developer is talking to the user. This gives a huge insight for the developer itself to enlarge what is used with my code and this helps. […] The region has the understanding that they are “owning” the user, and no one is getting into touch with their users. They want to be involved because I am the region, I filter, and I say no or yes. That’s something we need to break up. We definitely need the region to multiply and steer the change – for sure – but also, we have the opportunity to get without the region information without a filter.

Consequently, agile practices – forcing continuous exchange and feedback with users – become necessary when resolving information and require uncertainties regarding various user groups.

Reaching users, especially direct ones, was a big challenge. This plays an essential role in quickly clarifying uncertainties regarding requirements, comprehension questions, or product features. Interview Participant G explained this:

“On a monthly basis we send them (users) newsletters just to give them hints on what we´re doing, and this is like an exclusive treatment. In exchange, we have ongoing user research activities with them. […] we have interviews with my team, and I ask them to give us feedback on our processes and to allow us to witness how they would do these processes. While doing this shadowing and user research, we also get to validate our assumptions and allow the product teams to see the direct result of their work.

3.5 Contribution

Operational agility is a relatively new practice, providing a new way to control project implementation. Operational agility assumes flexible and fast adjusting of tasks (Conboy & Fitzgerald, 2004; Fitzgerald et al., 2006). An uncertain and changing environment was thus highly likely to affect the implementation of agile practices.

An unstable environment and changing conditions can affect employees. They are forced to develop a part or all of their tasks without a clear vision of the product features and output and potentially change or rework a part of tasks that have been already realized. Consequently, one might assume a change in culture (Conboy & Fitzgerald, 2004; Sharifi & Zhang, 1999) that needs to be implemented and controlled to be successful. Such changes will not occur easily by implementing new methods and processes or buying competencies. Observations showed a quite fast organizational adaptation. In some cases, an information system can help change management and facilitate the transition towards operational agility. The information system, however, was not a condition for success.

Adapting to a new project management method will require people to go through a learning process (Gandomani et al., 2013; Teece et al., 2016). To help with a cultural change and support new processes and controls, the organizational structure might require some adaptations (Gandomani et al., 2013) to comply with the agile methods. Indeed, people claimed they acquired some sort of experience after performing an agile project. The learning process was well illustrated in project *CRMS*, where participants only had limited experience and knowledge of an agile method. They still manage to leverage the flexibility of the method rapidly. The reason for this adaption concerned the learning method. People had to adapt to some new structures through practice. The learning process helped individuals acquire and maintain habits over time through trial and error instead of learning hard competencies.

Observations did not identify organizational or structural factors preventing the application of agile project management methods to gain productivity. The observations indicated that fear or lack of willingness sometimes served as a barrier to trying a new project management method. For these reasons, the following proposition was formulated.

Proposition 1: There is no corporate-specific entry barrier related to (corporate-internal) people preventing the application of agile project management practices.

If agility fitted every situation, its application would replace traditional methods. Even in a company prone to that change, we still observed that traditional methods were favored and more successful in some conditions.

Aligning various stakeholders and resources promptly is a challenging aspect of project management. Because each step must be adapted to upstream changes in the project supply chain, various factors can intervene, such as availability of materials, knowledge, suppliers, consultants, and partners. Each additional interlink within the project generates a new potential source of the disturbance. Stakeholders originate from a different place in the organization (or even outside) and typically have their agenda, constraints, and dependencies. Indirect or distant participants might not consider a project as important since a potential failure will not affect their evaluation or goal achievement. Aligning goals is necessary, which is done through control systems (Ferreira & Otley, 2009) and in particular by selecting the best-fitting project management method. The more interdependencies between stakeholders and constraints, the more complicated it becomes to align them. Thus, an appropriate way to deal with the challenge is important.

Observations showed that dependencies on multiple stakeholders could lead to choosing both traditional and agile methods. On the one hand, the success of project *CRMS* depended on a vast variety of stakeholders. Since their agendas were clear (people had deadlines from other internal projects, and external partners also had clear milestones), a traditional and well-scheduled project management methodology fitted better. On the other hand, when uncertainties regarding the dependencies for the project were high (the project requirements were not set in stone, partners' schedule was unreliable, deliverables characteristics still needed to be developed, etc.), an agile method was chosen.

Some researchers argued that either one or the other method is more appropriate for dealing with uncertainties (Conboy & Fitzgerald, 2004; Conforto et al., 2014; Gemino et al., 2021; Lee & Xia, 2010; Proba & Jung, 2019). Observations confirmed that traditional methods work better when interdependencies can be predicted or foreseen (lead time or deadline by a supplier, clear expectations from the customer, etc.). The reason is that a robust process can support planning various steps precisely and organizing them in a compelling order. In practice, aligning various inputs and process requires robust controls that can be costly considering that projects are inherently time limited. For example, robust and tailored planning and cybernetic controls, such as the integration of an ERP system, require a lot of time to be implemented and would require a lot of resources to be changed (Cao et al., 2009; Gemino et al., 2021). Since using such an ERP is supposed to last many years, the long-term efficiency gains realized will overturn the

initial cost. However, the efficiency gains of robust controls in short-term projects might not be able to return their implementation cost.

The cost of the structure also advocates for an agile method. Indeed, that was also observed in the cases studied. When these numerous interdependencies are difficult to foresee, for example, when the final product or service is not specified, agile methods perform better. Investing time in developing and controlling a precise course of action proved impossible in practice, and in these cases, the agile method was applied.

When output measures are controlled, as is often the case with cybernetic controls, the variance of one metric can cascade over the other aspect of the process and delay it in the case of project management. Each point of dependency of a project creates a weak point on the project, as their change can alter its further implementation. On the other hand, agile methods are designed to be constantly adapted and changed (Dyba et al., 2014; Highsmith & Cockburn, 2001; Shenhar, 2008).

Contrary to the expectations, the increasing number of interdependencies is not handled more easily with one or the other method. Interdependencies make a clearly defined method more salient. However, the foreseeability of the interdependencies determines the selection of one method or the other. Consequently, the following proposition was developed:

Proposition 2: When project interdependencies are high, their foreseeability/unforeseeability will match the traditional/agile method.

As previously seen, traditional methods can be appropriate in high dependencies context. Some are more constraining than others (Ahimbisibwe et al., 2015; Proba & Jung, 2019), and some might provide more flexibility. For example, on the one hand, a pure legal interdiction gives limited room for adaptation (i.e., there is only one solution path). On the other hand, the need to develop a new piece of software to interact with a specific interface can be realized in various ways and with a lot of flexibility.

An agile method can easily reshape and reschedule projects, which would be the case in the second example. However, it cannot cope with major barriers: security, governance, or legal constraints. In addition, policies and procedures that could arise from internal or external and legal sources that could be voluntary or mandatory can heavily constrain how some activities are organized, deployed, and controlled.

The present observation also indicated that a manager in charge of running a project could prevent the application of an agile method for preferential or unexplained reasons. The observations suggest that this is partly related to planning controls that give managers a clear, potentially incorrect picture of milestones or overall project planning. However, the supposed certainty of planning contradicts agile methods and the idea of lightweight planning. Those restricting contingency factors led to the third proposition:

Proposition 3: Some regulation (security, architecture, or governance regulations) dependencies exclude the application of agile project management practices.

Considering these propositions, some contingency factors affect the choice of a traditional or an agile method to manage a project. A management team might have to rely on multiple methodologies. The question thus is, "How easy is it to switch from a traditional method to an agile one and vice-versa? It was observed that stakeholders perceived a gap between the agile and traditional methods and showed reluctance to move from one to the other. For example, as one of the interviewees explained, the choice of one manager can greatly limit the choice of method. However, observations showed that a radical change might not be necessary to migrate from one method to another.

Operational agility acts non-linearly and fuzzy, whereas traditional one needs a chronological chain (Ahimbisibwe et al., 2015). From there, it is understandable that one traditional chronological chain can be performed in a fuzzy and agile way. It is more complicated to identify a sub-unit of agile project management and execute it traditionally. In *CIMS* and *CRMS* projects, people had some basics of an agile method (Scrum) and could partially apply it in projects when it was perceived that the application of an agile method would lead to quicker and more efficient results.

From a project control perspective, the same would be expected. Indeed, in the course of action of a project, process, or business task, the control can be loosened to develop a novel, innovative, or irregular activity (Bernroider & Ivanov, 2011). In the case of cybernetic controls on output measure, it is inherent to its design that the execution is freed until the result is measured (Malmi & Brown, 2008). On the contrary, designing and using a control system within a process governed by flexibility is a very tedious and probably unproductive task, as the delay between the need for the control and its application would be shorter than the time usually devoted to its implementation (Ferreira & Otley, 2009).

Proposition 4: Agile design components in a traditional project are possible, but not the opposite.

Proposition 4 might partially explain proposition 3. As soon as a part must be done in a certain order and chronology, it is impossible to isolate it from the rest of the project. Consequently, traditional design elements need to be integrated into an agile method, leading to hybrid project management, as suggested by prior scholars (Gemino et al., 2021; Papadakis & Tsironis, 2018).

Agile methods were designed to cope more easily with changes that can take place in the setup and structure of projects, in the environment of project teams, or in an organization (Conboy & Fitzgerald, 2004). Mechanisms that help drive a project for which the output or the process is not yet defined are the essence of agile method design (Dyba et al., 2014; Fitzgerald et al., 2006). Consequently, agility works better under uncertainty (Cao et al., 2009; Hussein, 2019; Mafakheri et al., 2008).

From a control perspective, elaborated cybernetic controls might have to be frequently adapted to fit the changing environment; otherwise, they lose efficacy. The cost to adapt them will also alter their efficiency.

Proposition 5: The more a project scope is characterized by uncertainties, the more likely it is to benefit from an agile project management practice application.

The contingency theory of MCS (Otley, 2016; Waterhouse & Tiessen, 1978) proved to be an appropriate medium to investigate factors favoring or preventing the application of one or the other method. This research showed that management control literature outcomes could be applied to deal with project management challenges. The various management control categories provide guidance in addressing project management challenges by applying specific project control practices. The management control research field was developed extensively based on the need to categorize (Simons, 1994, 1995) and evaluate (Langfield-Smith, 1997; Wiersma, 2009) the efficacy of certain controls. These results also call for better integration of existing analysis grids provided by MCS literature in the field of information systems.

3.6 Conclusion, Limitations and Future Research

Operational agility has been an important topic for many years. Evolved in software development, agile methods were considered promising; therefore, they were applied to

manage projects besides software development. Despite the trending method, knowledge of when and why agile methods are applied in project management is still limited.

Five project management cases in one European manufacturing firm were investigated to study the question of what requirements are needed for applying agile project management practices in projects to foster agile project success. Relying on the contingency theory of MCS (Otley, 2016), the objective was to identify specific factors that would be fitted with agile or more traditional practices or methods.

The case was realized in only one company. Moreover, only successful projects were selected. These selection criteria were done on purpose. By investigating only one company, some difficult to identify and consider intra-factors did not interfere with the observations. In this particular case, the corporate culture of trust and collaboration was strong and might as well be a catalyst factor when running novel projects. The objective was to evaluate the project's end-to-end components, necessitating the selection of a successfully finalized project. Yet, this selection limits the generalizability of the outcomes and calls for further investigations in different setups and with potentially failed outcomes.

In the specific case selected, the top management put a lot of effort into increasing project management's productivity and efficiency. Operational agility is an important part of it. The willingness to innovate in the way projects were managed was felt throughout the organization. This important factor could also have biased the results and limited their generalizability.

The findings are generally limited to the case firm. Nevertheless, the generalizability to similar project environments and organizations seems feasible through the multiple measures taken to limit biases. It would be beneficial to further investigate and test bigger and more diverse samples to increase generalizability.

Observations showed that an agile method would not fit any project, particularly outside of a software development context, and it would be impossible to identify one critical factor in deciding on the appropriate method in the manufacturing context. Rather, multiple factors would play a role, as some aspects of a project, for example, the flexibility and rapidity of the agile method, would generate more positive results. In other cases,

the possibility of standardizing and planning well in advance hindered the potential positive effect of an agile method.

The study leveraged contingency theory and management control methods to show they are well-suited for analyzing project management methods. Looking at project management methods as control systems framed the research and facilitated the investigations by relying on widely available frameworks. The study results also call for better integration of management control into information systems literature.

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4 Article III

Agile Performance Management Systems:
An Overview of Agile Instruments in Performance Management Systems

Jasmin Schmid

Abstract

This study aims to identify agile instruments to redesign performance management systems (PMS) toward agility. According to the contingency theory, organizations need PMS that fits their operating context to be effective and competitive. Uncertainty, as a determining contingency factor in contemporary organizations, requires an organization to be flexible, responsive, and adaptable, i.e., agile. Although many organizations integrate operational agility using agile instruments like Scrum, most lack a strategic agility perspective. PMS is a core facilitator for aligning strategies with corporate patterns. However, traditional PMS (TPMS) are criticized for being time-consuming and costly, lacking stakeholder interaction or providing little process flexibility; therefore, TPMS conflict with operational agility and hardly address uncertainty issues. The systematic analysis of 41 publications resulted in an overview of 33 agile instruments, which address various control mechanisms (e.g., planning or cybernetic controls) in agile performance management. The paper demonstrates five design principles for redesigning PMS towards agility and demonstrates the importance of agile PMS (APMS) to manage the alignment between long-term strategic goals and agile operations and provide strategic agility.

Keywords: *organizational agility, agile instruments, performance management systems, systematic literature review*

4.1 Introduction

Organizational agility presents a major corporate ability to resist uncertainties (Conboy & Fitzgerald, 2004). Its various instruments, values, and principles enable self-organized teams to regularly identify changes by interacting with relevant stakeholders (Dingsøyr et al., 2012; Serrador & Pinto, 2015). Those changes can be quickly incorporated through flexible work processes into strategies, products, or services to guarantee competitive advantage and customer satisfaction (Lee & Xia, 2010; Recker et al., 2017). Although most companies have successfully integrated operational agility by facilitating agile instruments[11], such as Scrum (Darino et al., 2019), many of them lack a strategic perspective (Eilers et al., 2022; Rigby et al., 2018; Weber & Tarba, 2014).

A PMS operationalizes strategies into tangible goals and coordinates the sum of organizational activities and behavior accordingly (Ferreira & Otley, 2009; Otley, 1999). Therefore, PMS is a potential facilitator for strategic agility integration. Most PMS, though, still assume stable contexts and build on traditional instruments, including Management by Objectives (MbO) or Performance Appraisals (Aguinis, 2009; Brown et al., 2019; Buckingham & Goodall, 2015). However, in uncertain corporate environments, TPMS are found to be costly and time-consuming (Aguinis et al., 2011; Rivera et al., 2021; Van Dooren, 2011) and lack the flexibility to quickly incorporate changes into goals (Ramesh et al., 2012), lack stakeholder interaction (Srinivas, 2009), follow overly centralized leadership approaches (Lohan et al., 2010), or build the future on past performance indicators (Aguinis, 2009; Budworth et al., 2015; Cappelli & Tavis, 2016).

Prior scholars call for redesigning PMS into more flexible, reactive, adjustable, and people-centered systems (Brown et al., 2019; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016). Therefore, scholars (Brown et al., 2019; Cappelli & Tavis, 2016; Darino et al., 2019; Jolayemi, 2008; Mittal et al., 2019) from different fields (e.g., management accounting [MA], human resource management [HRM], or Information Systems [IS]) have dedicated themselves to the conceptualization of individual agile instruments, their implementation, or effects. The application of successful PMS is linked to various contingency factors, e.g., uncertainty (Chenhall, 2003). Therefore, keeping contingency theory in mind, PMS should be designed to fit environmental and corporate requirements

[11] "Agile instruments" serve as an umbrella term for the various forms of agile approaches, methods, practices, or techniques. For more information on the different instrument classifications and their characteristics, see Gemino et al. (2021).

for the organization to be effective (Chenhall, 2003, 2006; Ferreira & Otley, 2009; Lawrence & Lorsch, 1967). To select and configure APMS properly, an overview of agile instruments and their characteristics is required. Nevertheless, there is hardly any indication for existence of such an interdisciplinary overview. Therefore, this study addressed the following research question: *Which agile instruments are applied in performance management systems to increase flexibility, responsiveness, and adaptability?*

To answer the research question, this paper built on a systematic literature review to identify 33 agile instruments facilitated in APMS. Furthermore, the analysis of the characteristics of the agile instruments led to the definition of five design principles, addressing frequency, the leadership style, application scope, multidimensional performance measurement, and agile mindset. The research contribution is twofold. First, APMS are an important driver for adopting strategic agility in organizations (Appelbaum et al., 2017b, 2017a; Rigby et al., 2018). On the one hand, APMS have the central task of coordinating and controlling corporate operations and people behavior in alignment with strategic goals. On the other hand, interactive controls in APMS ensure that goals and actions are regularly evaluated and adjusted according to stakeholder interests and environmental uncertainties. Second, the research paper supports and complements the call of previous scholars (Brown et al., 2019; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016) for more flexibility, responsiveness, and adaptability in PMS, providing an overview of agile instruments and design principles, which serves as a guide for PMS redesign.

The paper is structured as follows. First, contingency theory was used to build the theoretical foundation for this paper. It illustrates the need to adjust management practices according to the operating context of a company. In an uncertain context, organizational agility becomes a major management practice, which is demonstrated as another theoretical basis before illustrating the need for PMS in companies. Second, the research method is illustrated before presenting the results in the third step. Fourth, the five design principles are described. The final section provides the conclusions and directions for future research.

4.2 Theoretical Background

The following section provides an overview of the theoretical foundations for analyzing APMS. It first introduces the contingency theory, which justifies that corporations

should use different management practices to control environmental requirements effectively. Uncertainty is a critical contingency factor in contemporary organizations, driving the need for the second theoretical fundament: organizational agility. Third, it describes how PMS serves organizations with control mechanisms for strategy implementation and operational control.

4.2.1 Contingency Theory

Organizations are complex social systems consisting of various subsystems, including business units, functions, teams, and individuals, and they are part of a large subsystem, the organizational environment (Lawrence & Lorsch, 1967; Premkumar & King, 1994; Weill & Olson, 1989). The social part of organizations – individuals – are responsible for strategy implementation and task performance (Lawrence & Lorsch, 1967) and are coordinated through management systems (Weill & Olson, 1989).

However, corporate contingency factors influence performance execution (Duncan, 1972; Lawrence & Lorsch, 1967; Ramesh et al., 2012). Internal and external factors must be differentiated (Duncan, 1972). The former characterizes an organizational system through its strategy, structure, processes, and culture. Therefore, corporate members can actively control and change factors by utilizing effective management systems (Lawrence & Lorsch, 1967; Lukas & Maignan, 1996; Ramesh et al., 2012; Schonberger, 1980). The latter presents customers, suppliers, global competitors, and national or international governments who influence corporations but have limited controllability from a company's perspective (Premkumar & King, 1994; Ramesh et al., 2012). In addition, contingency factors can be dynamic or stable, increasing the requirement for suitable management systems (Duncan, 1972; Lawrence & Lorsch, 1967).

However, many corporations fail or perform inefficiently due to applying supposedly best management systems that do not fit their operating context (Wetherbe & Whitehead, 1977). According to contingency theory, there is no best way to manage every corporate condition (Premkumar & King, 1994; Weill & Olson, 1989; Wetherbe & Whitehead, 1977). Rather, the effectiveness of a management system depends on practices that can best control corporate and environmental contingencies and constraints (Wetherbe & Whitehead, 1977) and thus ensure high performance and corporate success (Premkumar & King, 1994; Weill & Olson, 1989).

According to Lukas and Maignan (1996) and Wetherbe and Carlton (1977), management system configurations should prioritize core influencing contingencies to effectively control strategic, managerial, or operational aspects (Schonberger, 1980). Therefore, practices can have closed and stable characteristics as well as open and adaptive characteristics. The adaptability of systems becomes increasingly important in uncertainty (Duncan, 1972).

4.2.2 Uncertainty and Organizational Agility

Uncertainties are one of the most critical contingency factors impacting corporate management (Garner, 1962; Lawrence & Lorsch, 1967). Uncertainties are changes in social and/or physical organizational factors that occur frequently, are ambiguous, or are unpredictable (Duncan, 1972). Prior scholars (Garner, 1962; Premkumar & King, 1994; Ramesh et al., 2012) have investigated various uncertainties: multiple probabilities, lack of information clarity, or unclear causal relationships. Most of them are triggered by digitalization, globalization, or changing customer demands. Duncan concluded, *"[...] organizations must adapt to their environment if they are to remain viable. One of the central issues in this process is coping with uncertainty"* (1972, p. 313).

Approximately three decades ago, organizational agility evolved as a major management approach to mastering uncertainties (Conboy & Fitzgerald, 2004; Sharifi & Zhang, 1999). It describes the ability of corporations to remain competitive and satisfy customers in uncertain situations by rapidly identifying changes and adjusting them into strategies, products, services, or processes (Appelbaum et al., 2017a, 2017b; Teece et al., 2016). Additionally, the term can be categorized to different concepts and application.

From a conceptual perspective, previous scholars (Agarwal & Selen, 2009; Proba & Jung, 2019; Weber & Tarba, 2014) have distinguished largely between operational and strategic agility. The former addresses internal operations (Proba & Jung, 2019), including project, innovation, or software development (Conforto et al., 2014; Dyba et al., 2014; Lee & Xia, 2010). Thus, agile instruments (e.g., Scrum or Kanban) equip teams to quickly sense and respond to unpredictable changes by flexibly adjusting operations to create customer value (Anwer et al., 2017; Conboy & Fitzgerald, 2004; Serrador & Pinto, 2015). The latter describes the ability of a firm to constantly identify market trends, risks, or changes from customers or external parties (Ahammad et al., 2020; Proba & Jung, 2019) to continuously adjust strategies (Eilers et al., 2022) and the course

of action to stay competitive (Ahammad et al., 2020; Weber & Tarba, 2014). Integral components of strategic agility embrace developing dynamic capabilities, fostering learning and development, initiating strategic business renewal, or balancing exploitation and exploration (Eilers et al., 2022; Weber & Tarba, 2014).

From an application perspective, organizational agility can be classified as doing and being agile. Doing agile describes individuals' application of agile instruments to perform tasks (Eilers et al., 2020; Rahman et al., 2018). Thus, agile instruments can present agile approaches (e.g., SAFe), methods (e.g., Scrum), or practices (e.g., Daily Stand-Up Meetings) (Gemino et al., 2021; Papadakis & Tsironis, 2018), which shape work processes and leadership styles in different ways (Eilers et al., 2020). On the other hand, being agile describes the work environment facilitated by trust, collaboration, or communication at an organizational level (Denning, 2016; van Manen & van Vliet, 2014). At individual and team levels, it determines the beliefs of teams, lived values and principles derived from the Agile Manifesto (Eilers et al., 2022), and the use of dynamic capabilities (e.g., flexibility or responsiveness) to operate in an agile setup (Weber & Tarba, 2014).

Although many companies claim to be agile (digital.ai, 2021), most have limited strategic agility components and/or their employees lack being agile (Agarwal & Selen, 2009; Weber & Tarba, 2014). Initially, corporations focused on operational agility[12] due to a greater need for flexibility and responsiveness in development activities (Coram & Bohner, 2005; Dyba et al., 2014). On the other hand, an organization does not need to be fully agile due to some stable and predictable corporate areas (Cao et al., 2009; Conforto et al., 2014; Fitzgerald et al., 2006). The increasing presence of operational agility and related business conflicts (e.g., budget processes or hierarchies) and the increasing uncertainty in other business areas require a full agile transformation (Denning, 2016; Rigby et al., 2018). Eilers et al. (2020) and Weber and Tarba (2014) criticized the inadequate and vague definition and the lack of implementation instruments for gaining strategic agility and being agile.

[12] Operational agility occurred from the two streams, software development and agile manufacturing in the 1990's. To differentiate from competitors, mass production was no longer a guarantor for corporate success but product customization. In addition, digitalization enabled customers to increase their power over organizations and demand special needs. Therefore, agile methods as well as values and principles summarized in the Agile Manifesto provided flexibility in development processes to recognize and adjust customer needs (Conboy & Fitzgerald, 2004; Serrador & Pinto, 2015; Sharifi & Zhang, 1999).

4.2.3 Performance Management Systems for Strategy Implementation and Task Coordination

PMS[13] are various control instruments[14] that direct and alter corporate patterns (Simons, 1995) and behavior towards goal achievement (Ferreira & Otley, 2009; Merchant & Otley, 2006; Otley, 1999) to enable strategy implementation. The alignment between strategy, operations, and the underlying management can be organized through different PMS designs (Feichter & Grabner, 2020) to ensure goal achievement (Chenhall, 2003), corporate development, and organizational learning (Ferreira & Otley, 2009).

Previous scholars have addressed the issue of PMS design and its use in different ways. Apart from Simons' (1995) levers of control (LoC) and Ferreira and Otley's (2009) framework for PMS design, Malmi and Brown (2008) illustrated a typology for conceptualizing management control systems (MCS) (see Figure 3) as a package considering five control pillars. First, cultural controls guide individuals on how to behave and interact within an organization. Second, planning addresses goal setting and thus determines task execution and reference for performance measurement. Third, cybernetic controls aim for the actual performance evaluation by considering both financial and non-financial measures. Fourth, reward and compensation control practices incentivize individuals' accomplished performance. Fifth, administrative controls consist of general work procedures and processes that support individuals in accomplishing tasks while demonstrating their level of responsibility (Malmi & Brown, 2008).

<table>
<tr><td colspan="7">Cultural Controls</td></tr>
<tr><td colspan="2">Clans</td><td colspan="2">Values</td><td colspan="3">Symbols</td></tr>
<tr><td colspan="2">Planning</td><td colspan="4">Cybernetic Controls</td><td rowspan="2">Reward & Compensation</td></tr>
<tr><td>Long Range Planning</td><td>Action Planning</td><td>Budget</td><td>Financial Measurement Systems</td><td>Non-Financial Measurement Systems</td><td>Hybrid Measurement Systems</td></tr>
<tr><td colspan="7">Administrative Controls</td></tr>
<tr><td colspan="2">Governance Structure</td><td colspan="2">Organization Structure</td><td colspan="3">Policies and Procedures</td></tr>
</table>

Figure 3: MCS typology according to Malmi and Brown (2008)

[13] In this context, PMS and management control systems (MCS) are used synonymously. The original components of MCS – alignment between strategy, operations, and management – are also found in PMS. Over time, the tasks and characteristics of MCS evolved, e.g., personnel, customer-specific or non-financial metrics became more relevant. These extensions of MCS are nowadays better known as PMS (Brown et al., 2019; Ferreira & Otley, 2009).

[14] In this paper, control instruments refer to formal and informal methods, processes, techniques, practices, mechanisms, or networks.

The typology is particularly relevant for modern PMS (Malmi & Brown, 2008). Based on the assumption of contingency theory that no single system exists to control every situation (Chenhall, 2006; Lawrence & Lorsch, 1967; Otley, 1980), Malmi and Brown (2008) instead called for individually configurated control packages according to the influencing contingency factors. Other authors agree that the combination of control practices allows managers to consider various corporate interests and stakeholder expectations (Brown et al., 2019; Chenhall, 2003; Malmi & Brown, 2008).

However, traditional control practices and TPMS cannot respond to uncertain organizational environments. Instead of process optimization, APMS focuses on employees and their ability to proactively identify and integrate changes (Aguinis, 2009; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Weber & Tarba, 2014). Traditional control practices, however, hardly consider customer, employee, or other external interests (Brown et al., 2019; Lukas & Maignan, 1996). Formal and diagnostic practices aim for documentation, annual planning, and plan/actual analysis (Buckingham & Goodall, 2015). In addition, TPMS, relative to their business impact and value creation within a company, are too costly and time-consuming (Aguinis, 2009; Coller et al., 2018; Van Dooren, 2011). Previous researchers from different fields (e.g., HRM or MC) have already investigated this problem and called for redesigning PMS toward agility (Aguinis, 2009; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016). Until now, most scholars have developed or investigated individual control practices, e.g., OKRs, 360-degree feedback, or Beyond Budgeting. However, an overview of the different agile instruments and their underlying control mechanism to redesign APMS is missing.

4.3 Research Method

A systematic literature review was conducted to answer the research question: *Which agile instruments are applied in performance management systems to increase flexibility, responsiveness, and adaptability?* A literature search generally investigates, collects, and processes prior findings in the field of interest (Cooper, 1988; Vom Brocke et al., 2009). It aims to provide an overview of the current state of the research in a particular field and potential trends. Additionally, it helps identify future research directions (Cooper, 1988; Vom Brocke et al., 2009; Webster & Watson, 2002). Besides that, systematic literature reviews present an overall picture of a phenomenon from multiple publication sources (Tranfield et al., 2003) – in this case, organizational agility in the

context of PMS – instead of investigating individual aspects (e.g., empirical study on a single agile instrument).

4.3.1 Data Collection

A core element of a high-quality literature review is a rigorous search process, which should be reliable and valid (Vom Brocke et al., 2009). The former refers to the replicability of the search process. This is particularly relevant for systematic literature reviews to justify identifying and selecting the reviewed sources (Tranfield et al., 2003). The latter describes the accuracy, relevance, and quality of the selected literature, that is, the selection of search terms, the type of database, or the choice of exclusion criteria (Cooper, 1988). The present research followed Vom Brocke et al.'s (2009) approach to ensure a rigorous research process and transparent data collection. The process followed five phases:

1. Definition of review scope
2. Conceptualization of the topic
3. Literature search
4. Literature analysis and synthesis
5. Research agenda

The first step involves defining the review scope. For this purpose, Vom Brocke et al. (2009) recommend using Cooper's taxonomy of literature reviews (1988, p. 109), represented in Table 11.

Characteristics	**Categories**			
(1) Focus	Research Outcomes	Research Method	Theories	Applications
(2) Goal	Integration	Criticism	Central Issues	
(3) Organization	Historical	Conceptual	Methodological	
(4) Perspective	Neutral Representation	Espousal of Position		
(5) Audience	Specialized Scholars	General Scholars	Practitioners	General Public
(6) Coverage	Exhaustive	Exhaustive & Selective	Representative	Central

Table 11: Cooper's (1988, p.109) taxonomy of literature reviews

The review focuses on identifying agile instruments utilized in APMS. Consequently, the goal of the literature review is to summarize these agile instruments since the ability of a company to quickly recognize and adjust to environmental uncertainties through flexible steering mechanisms becomes vital in performance management. It also helps management accounting scholars generate new research directions (e.g., influence or configurations of APMS). On the other hand, the review provides practitioners with general design guidelines to reshape future PMS. Although many academic and practitioner studies have offered an exhaustive overview, they tend to be limited to certain areas of inquiry (e.g., MA, IS, HRM).

In the second step, Vom Brocke et al. (2009) suggested conceptualizing the topic for two reasons. The first reason is to gain a general overview of relevant definitions, foundations, or concepts, in this case, the necessity, meaning, and applicability of agility in the context of PMS. Second, it is important to define the topic to identify relevant search terms in phase 3. The general concepts and definitions are presented in Chapter 2, "Theoretical Background."

The third phase involves the actual process of literature search (Vom Brocke et al., 2009) illustrated in Figure 4.

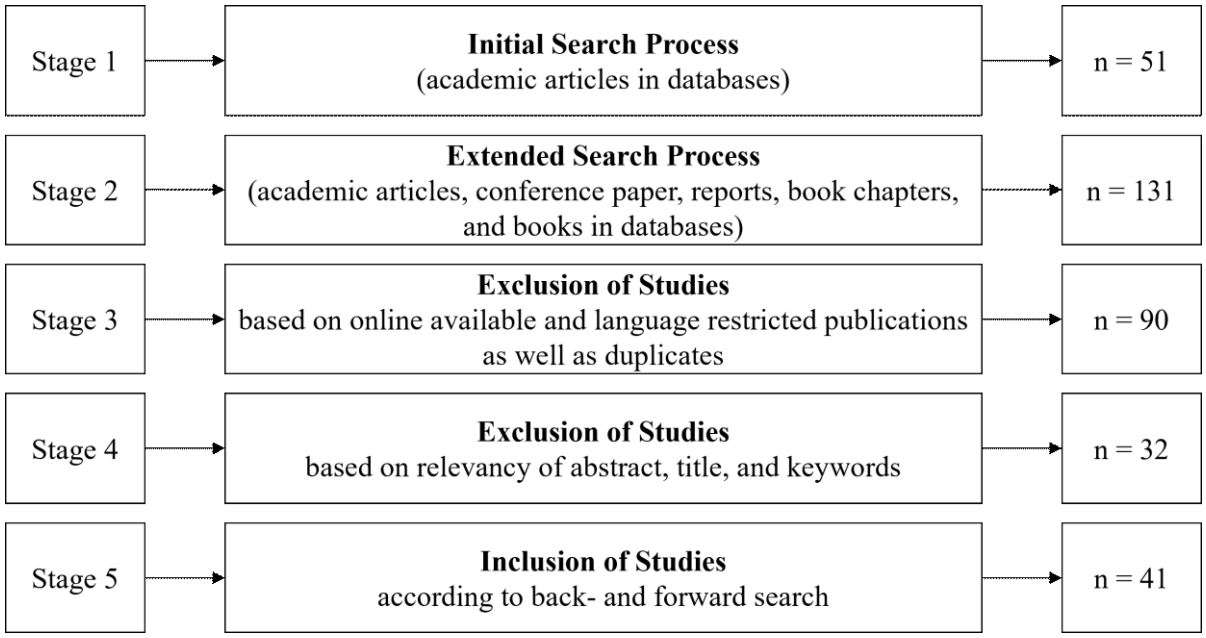

Figure 4: Search process of literature

The search process builds on a keyword search. On the one hand, keywords were specified along with the research interests, i.e., agile approaches, methods, or practices

utilized to design APMS. On the other hand, the keywords from the articles that served as the theoretical foundation served as orientation. In academia, some scholars refer to management control, whereas others use the term performance management. In the end, the following keywords were identified for the literature search:

Search terms	Where
("agil* method*" **OR** "agil* practice*" **OR** "agil* approach*") **AND** ("performance management*" **OR** "management control*") **AND** (system*)	Title, abstract, keywords

Table 12: Overview of keyword search

Scopus, ProQuest, and Emerald were used as databases to search for academic publications. These databases offer comprehensive and multidisciplinary bibliographies and full texts of peer-reviewed articles. Additionally, articles published from 2001 to 2022 were considered. The reason for the time restriction is the evolution of the Agile Manifesto for Software Development in 2001. As one of the core foundations of organizational agility, it guides the trend in other research areas outside software development. Therefore, it is not expected to identify critical publications of APMS before 2001, because they would not reflect the agile trend. The initial search considered only academic journal articles ranked in VHB-JOURQUAL 3 higher than C; however, the resulting small sample size of 51 articles led to the decision to extend the search scope by including articles, conference papers, reports, book chapters, and books. The broad query thus intends to identify and summarize the various trends from the different disciplines, both in academia and practice. The second search stage yielded 131 publications.

Only full-text English publications available online were considered. Furthermore, duplicates were removed, resulting in 90 articles being evaluated according to their relevance to the research. For this purpose, the title and abstract of each source were screened for the predefined keywords (e.g., agile practice and performance management). Subsequently, 32 studies remained.

Webster and Watson (2002) and Vom Brocke et al. (2009) additionally recommended using a backward and forward search to extend the list of relevant studies which have not been identified with the search algorithm. The backward search involves identifying relevant older literature sources cited in articles identified through keyword search. The forward search, in contrast, refers to sources that cite the articles found through the

search. Both search processes led to nine additional sources, resulting in a final sample of 41 publication sources.

4.3.2 Data Analysis

After identifying a set of data sources, the fourth step entailed analyzing the collected literature (Vom Brocke et al., 2009) according to the topic of interest (i.e., the use of agile instruments in PMS) (Tranfield et al., 2003) before synthesizing the findings (i.e., design principles of APMS). Qualitative content analysis systematically codes and classifies large sets of text data to specify patterns. Thus, qualitative data analysis follows an inductive and deductive approach. The former uses a conventional approach that targets coding from the original text data. The latter uses the identified codes to validate and/or extend prior research findings (Hsieh & Shannon, 2005).

The analysis in this study followed Braun and Clarke's (2006) suggestions. First, the content of each study was read to develop individual codes in the second step. Third, the codes were combined into superordinate categories. Atlas.ti was used as a supporting text analysis software for evaluation. In the fourth step, the categories were compared with the primary studies to ensure the validity of the interpretation. Fifth, the categories were combined into higher-level patterns to synthesize the literature review.

Besides demonstrating research findings from the data analysis, Vom Brocke et al. (2009) mentioned that the fifth and final literature review phase outlines a research agenda. Chapter 6, “Conclusion and Future Research," concludes the study and suggests directions for future research.”

4.4 Results

The following section presents the results of the systematic review of the literature. The first part of the results presents the descriptive analysis of the publications. The second part reviews the agile instruments in PMS, followed by a description of the three most important[15] agile instruments.

4.4.1 Descriptive Analysis

The descriptive analysis revealed that three major research fields investigated and addressed the redesign of PMS towards more agility: Management Accounting, Human

[15] Importance refers to the number of sources that contain and explain the respective agile instrument.

Resource Management, and Information Systems. These research fields produced 35 publications (see Figure 5). The first two fields attempted to respond to increasing uncertainty by adjusting the PMS. As an originating field of operational agility, the third research field addressed the topic in a rather traditional corporate setup due to the challenges of operational agility.

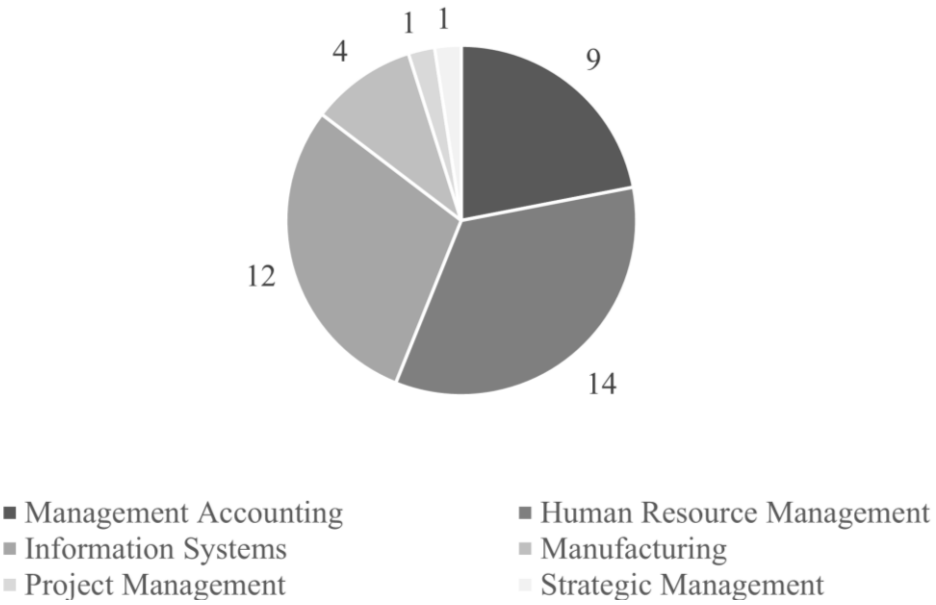

Figure 5: Emerging research fields

When analyzing the temporal perspective, APMS appeared three years after the emergence of the Agile Manifesto in 2001 (see Figure 6), possibly due to the increased interest of scholars in operational agility, i.e., the implementation, application, transformational aspects, or implications of agile methods in software development or project management. Furthermore, the articles were published in waves between 2007 to 2013 and from 2015 to 2022. The first wave consisted of 14 publications strongly influenced by the research fields of Information Systems, Project Management, or Manufacturing, describing predominantly operational performance aspects when utilizing agile instruments. The second wave was characterized by increased interest in APMS in other disciplines, such as Management Accounting or Human Resource Management, and the number of publications (n = 25). However, in the second wave, the trend shifted toward combining strategic with operational agility to enable organizational agility. In summary, the descriptive analysis of the systematic review of the literature indicated an increasing trend toward using agile instruments in PMS.

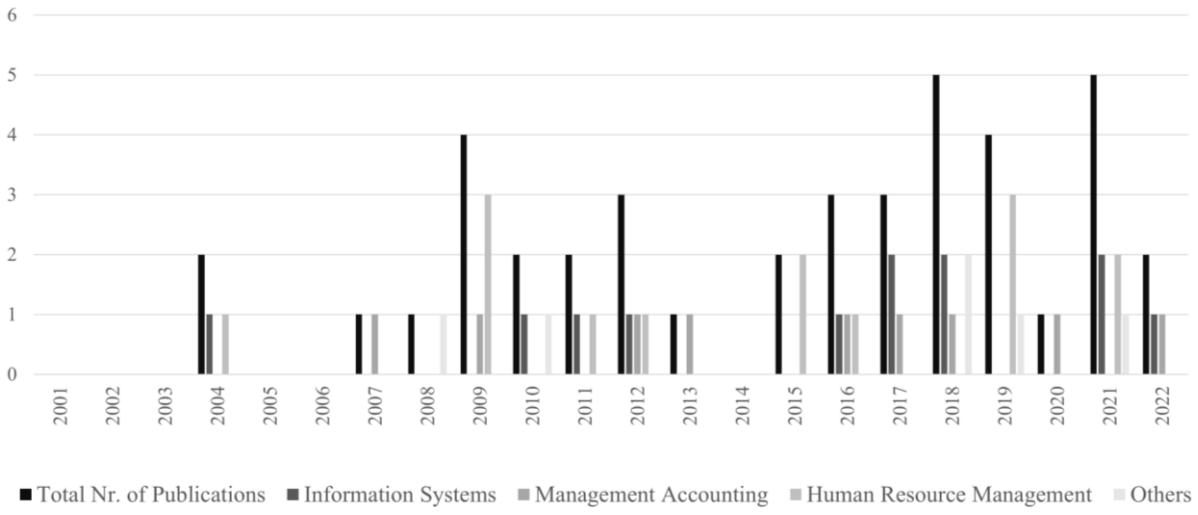

Figure 6: Number of APM-related publications from 2001-2022 (n=41) across research fields

4.4.2 Overview of Agile Instruments Utilized in APMS

In response to the research question, the systematic analysis of the data sources resulted in 33 identified agile instruments (see Table 13). Although the instruments address different individual or multiple aspects of PMS (e.g., planning or feedback), their overarching purpose is to increase flexibility, adaptability, and responsiveness in performance management. The agile instruments are presented along with the five control areas of the Malmi and Brown (2008) typology framework. It becomes clear that most agile instruments for agile performance management can be assigned to planning (15 instruments mentioned in 18 publications) and cybernetic control (9 instruments mentioned in 20 publications). In the area of cultural controls (four publications) and administrative controls (one publication), only one agile instrument was mentioned in each case. Interestingly, no explicit agile instrument for reward and compensation was identified. Finally, seven instruments (11 publications) could not be assigned to individual control areas. Each of these instruments contains a sum of different control mechanisms, which is why they are presented separately in the table as multidimensional controls.

Agile Instruments	Description	#Ref.	References
Cultural Controls			
Agile Manifesto	The Agile Manifesto consists of four values and twelve principles that define and shape individuals' general behaviors, beliefs, and mindsets in an agile environment.	4	(Cappelli & Tavis, 2016; Coller et al., 2018; Khanagha et al., 2022; Traini, 2022)
Planning			
Long-Range Planning			
Skill Mapping	Skill mapping is a long-term planning practice for an organization's current and future skill requirements to ensure progress and goal achievement. Skill mapping provides a reference point for future development paths of existing employees and a strategic element for employee recruitment.	3	(Aguinis, 2009; Gandomani et al., 2021; Mittal et al., 2019)
Hoshin Kanri	Hoshin Kanri is an agile approach that combines long-term visions and strategic goals with annual goals, short-term action plans, and success factors, which are visualized in the X-Matrix. The method focuses on aligning individual and team interests with corporate goals. Therefore, close interaction between managers and employees should be ensured.	2	(Jolayemi, 2008; Staedele et al., 2019)
North-Star Goals	A North-Star Goal is an individual goal-setting practice representing a company's overarching long-term goal. The goal not only serves as the most important guidance for corporate actions and corporate development but represents a metric by which a company is measured. Thus, North Star goals provide a stable but aspirational goal for the company, which is used as an orientation for individuals and their future development.	1	(Darino et al., 2019)
Action Planning			
Team Goals	Team goals practice is a typical goal-setting practice for agile teams. Goals are derived jointly in the team from annual goals. Therefore, employees can contribute to the actions of a team and, at the same time, a high level of commitment is achieved through the joint definition of the goals. Therefore, team goals serve as a single source of truth when specifying individual goals, coordinating work, or making decisions in the team.	4	(Brown et al., 2019; Darino et al., 2019; DeShon et al., 2004; Khanagha et al., 2022)

Performance Goals	Performance goals are also used as a goal-setting practice in an APMS. Supervisors set goals and expectations for an individual, and it is up to the employee to implement them. By formulating precise objectives, employees can efficiently manage the use and scope of their skills and demonstrate their abilities.	4	(Brown et al., 2019; Lohan et al., 2010; Rigby et al., 2018; Torneo & Mojica, 2020)
Sprint Planning	Sprint Planning belongs to the Scrum method and targets short-term action planning for an upcoming iteration cycle (lasts between one and four weeks) within a development team. According to the goals and priorities of the product backlog and the length of the iteration cycle, team members jointly specify tasks, estimate their effort, assign it to individuals according to their capacity and skills, and set delivery expectations to assess them in the feedback sessions Reviews and Retrospectives.	3	(Cappelli & Tavis, 2016; Darino et al., 2019; Traini, 2022)
Cascading Goals	Cascading goals process involves breaking down long-term goals into smaller and more tangible short-term goals for business units, functions, teams, and individuals. Cascading goals in a corporation is a joint effort between supervisors and employees to ensure the consistency of the goals.	2	(Aguinis et al., 2011; Torneo & Mojica, 2020)
Individual Goals	Individual goals practice requires setting personal goals based on individual interests and aligning them periodically with strategic goals. Employees should consider how they can contribute to the corporate strategy and what skills are required for goal achievement to encourage meaningful work and personal development.	2	(Cappelli & Tavis, 2016; DeShon et al., 2004)
Stretch Goals	High-risk and high effort characterizes Stretch Goals. Different stakeholders set ambitious goals to drive change within the company. Even if the goals seem impossible to implement, they aim to motivate employees to learn new things to master the goals and drive change.	2	(Lohan et al., 2010; Rigby et al., 2018)
Kanban	Kanban is a method built on lean principles and targets the optimization of work in progress (WIP). Therefore, a Kanban Board lists the sum of team tasks and their priorities. Along with the pull principle, team members select tasks with the highest priority only after completing an open task.	3	(Appelbaum et al., 2017a, 2017b; Lohan et al., 2010)
SMART Goals	SMART – specific, measurable, ambitious, realistic, and time-bound – is a method where managers and employees jointly formulate goals based on the five aspects of the	2	(Sull & Sull, 2018; Torneo & Mojica, 2020)

	goals. Both interests and requirements from a corporation and an employee are incorporated.		
FAST Goals	It is a method to formulate goals that can be applied at any company level. The abbreviation stands for frequent, ambitious, specific, and timely. Goal setting is discussing the present and future goals between involved parties at regular intervals. The goals must have a high level of ambition, be specific and measurable, and have a time indication for completion.	1	(Sull & Sull, 2018)
Product Backlog	A core goal-setting practice within the Scrum method is a Product Backlog. The Product Owner (a specialized role within Scrum) is responsible for interacting with and collecting user or customer requirements captured and prioritized within the Product Backlog. Thus, the Product Backlog demonstrates an overarching goal (user/customer requirements) serving teams as an action plan.	1	(Traini, 2022)
Mastery/ Learning Goals	A Mastery or Learning Goal is a goal-setting practice that focuses less on the actual goal and more on an employee's learning and development during the goal achievement process. Goals consist of a high degree of difficulty that triggers employees to learn new knowledge and skills allowing them to ultimately achieve the goal. Therefore, strategic skill development is ensured within a company.	2	(Brown et al., 2019; DeShon et al., 2004)
Cybernetic Controls			
Budgets			
Beyond Budgeting	The 12 principles of Beyond Budgeting (e.g., using resources only when necessary rather than allocating them in advance) serve as guidance for budget-free planning. Decentralized and self-organized teams determine how and why resources are linked to corporate goals. Negotiating across the teams is an informal but regulatory mechanism to dispose of resources sustainably and in the company's interest.	2	(Lohan et al., 2010; Otley, 2006)
Rolling Forecast	Rolling forecasting is a period-oriented method of cost planning that is especially used in product and project management. Characteristics of the method include regular cost updates, specifications, and adjustments in a predefined time interval (e.g., quarterly). The level of cost details becomes more precise as the activity approaches. Therefore, changes in cost planning can be continuously considered and integrated.	1	(Otley, 2006)

Financial Measurement Systems			
Performance Feedback	Performance feedback is a practice that reflects an individual's performance in short iteration cycles, typically in projects. It compares which tasks with what kind of resources and capacities were planned and delivered by the individual. In case of deviations, the feedback aims to improve measures defined by the supervisor and the team members.	3	(Buckingham & Goodall, 2015; DeShon et al., 2004; Tippins & Coverdale, 2009)
Non-Financial Measurement Systems			
Check-Ins	Check-Ins are designed to replace annual goal setting and assessment of individuals. Rather, it is a two-way conversation between the manager and the employee, taking place weekly or monthly, to discuss current tasks, priorities, behaviors, development potential, or goals. The manager takes the role of a coach and provides valuable tips so the employee can continuously improve.	6	(Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Jolayemi, 2008; Rivera et al., 2021; Srinivas, 2009)
Retrospectives	Retrospectives are another practice of the Scrum method. The focus of the practice is the regular evaluation (approximately every one to four weeks) within a team regarding the execution of tasks and processes. Critical and especially positive aspects are discussed during the evaluation to optimize processes and promote long-term team learning.	5	(Aguinis et al., 2011; Brown et al., 2019; Cappelli & Tavis, 2016; Jolayemi, 2008; Traini, 2022)
Strength-Oriented Feedback	The feedback is linked to the discussion between the manager and employee about their strengths and using them more effectively in situations that have already been experienced similarly. Both parties can request feedback at any time. Additionally, managers can initiate simulation situations to further promote the employee's talent. Therefore, feedback has the purpose of employee development and motivation.	3	(Aguinis et al., 2011; Brown et al., 2019; Van Dooren, 2011)
(Daily/Weekly) Stand-Up Meetings	Daily Stand-Up Meetings belong to the Scrum method and are daily status updates (about 15 minutes) between team members who inform each other about the work progress, upcoming tasks, and potential problems. Information exchange promotes transparency within the team and encourages cooperation. Due to the simplicity of the meetings, they are often applied outside Scrum. However, if team members are not dedicated to a cross-functional team, these meetings are typically held weekly to save people's capacity.	2	(Brown et al., 2019; Traini, 2022)

Informal Feedback	Informal feedback is not an evaluation practice; it is about the continuous exchange between people, e.g., work colleagues, managers, or external parties. Usually, informal feedback is not planned but requested by a party to discuss personal and company-specific matters. The purpose is to foster communication and cohesion, as well as the collection of new ideas or opportunities.	1	(Cappelli & Tavis, 2016)
Hybrid Measurement Systems			
360-Degree/ Peer Feedback	360-Degree or Peer Feedback is a holistic feedback practice that allows multiple raters to evaluate the witnessed performance of a person. These can include supervisors, team members, or external partners. Feedback provides information about the person's behavior, strengths, or results. Due to the scope of the feedback, only biannual or annual analyses are performed.	11	(Aguinis et al., 2011; Appelbaum et al., 2017a, 2017b; Brown et al., 2019; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; DeShon et al., 2004; Lohan et al., 2010; Meawad, 2021; Rivera et al., 2021; Tippins & Coverdale, 2009; Torneo & Mojica, 2020)
Reviews	Originally derived from the Scrum methodology, Reviews are frequent feedback loops (at intervals of one to four weeks) between development teams and stakeholders aiming to update progress, assess the quality of a deliverable, align priorities, and clarify future actions to achieve goals. The resulting information helps teams frequently identify and adjust changes or opportunities and add value to stakeholders.	4	(Aguinis et al., 2011; Bellisario & Pavlov, 2018; Brown et al., 2019; Jolayemi, 2008)
Reward & Compensation			
Administrative Controls			
Organizational Structure			
Holacracy	Holacracy is an organizational structuring approach in an agile organization. The approach aims to reduce the controlled hierarchies and dependencies between teams to enable decentralized and cross-functional work. Furthermore, conflicts of goals and resources are prevented by integrating independent holacratic units (Circle) acting for themselves but in alignment with strategic goals.	1	(Bernstein et al., 2016)

Multidimensional Controls			
Instant/Real-Time Feedback	Instant or Real-Time Feedback aims to provide fast feedback to the employee upon completing a task, i.e., keeping the period between performance and feedback as short as possible. In doing so, supervisors or team members can communicate recognition and potential for improvement. Typically, software solutions support electronic monitoring, short communication paths, and continuous learning. The instrument targets employee development, motivation, and recognition.	8	(Aguinis, 2009; Aguinis et al., 2011; Bellisario & Pavlov, 2018; Cappelli & Tavis, 2016; Fan & Bai, 2004; Ramesh et al., 2012; Rivera et al., 2021; Traini, 2022)
Objectives and Key Results (OKRs)	OKRs are a goal-setting method that addresses the specification of few but ambitious goals and defines results accordingly. OKRs are evaluated quarterly to continuously identify and integrate changes or opportunities. Management typically sets the goals to provide a direction of action, whereas the teams determine the results and implementation.	4	(Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Sull & Sull, 2018)
Scrum	Scrum is one of the most popular agile methods used in development projects. The goal is to develop a customer-centric product characterized by high uncertainty and complexity. Thus, products are developed through incremental and iterative development cycles, with lightweight planning but in close and informal alignment with the customer/stakeholder.	4	(Lohan et al., 2010; Ramesh et al., 2012; Rigby et al., 2018; Torneo & Mojica, 2020)
Extreme Programming (XP)	XP is an agile software development method that supports small teams developing software projects. The method is used when software requirements are unknown or if ongoing changes are expected. The goal is to develop working software in a short time. Therefore, small software packages are developed in short intervals, tested regularly, and integrated quickly.	1	(Lohan et al., 2010)
DSDM	DSDM is another agile method used for software development. Resources are determined in advance, which the team can flexibly coordinate to develop various software features.	1	(Lohan et al., 2010)
FDD	FDD is a customer-oriented and iterative software development method. The method focuses on features that determine the flow and development of a project. Additionally, regular status reports are used to measure and control progress.	1	(Lohan et al., 2010)

DevOps	The agile method consists of Development and Operation teams, aiming for a close collaboration between those parties to optimize IT-supported processes. Although the method targets continuous integration and close collaboration between teams, it still uses traditional monitoring but measures qualitative and quantitative performance indicators.	1	(Mazkatli & Koziolek, 2018)

Table 13: Overview of agile instruments used in APMS (n = 33)

The agile instruments 360-Degree/Peer Feedback, Instant/Real-Time Feedback, and Check-Ins are the most important instruments according to the number of citations per publication source. The following sections describe each instrument in detail.

The 360-Degree Feedback (Aguinis et al., 2011; Brown et al., 2019; Cappelli & Tavis, 2016; Rivera et al., 2021; Tippins & Coverdale, 2009; Torneo & Mojica, 2020), also known as Peer Feedback (Aguinis et al., 2011; Brown et al., 2019; Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Darino et al., 2019; Lill & Wald, 2021; Lohan et al., 2010; Meawad, 2021; Traini, 2022), is a cybernetic control mechanism for providing holistic feedback to individuals to enhance their personal development (Aguinis et al., 2011; Brown et al., 2019; Rivera et al., 2021; Torneo & Mojica, 2020). The feedback builds on a multi-rater anonymous evaluation of supervisors, team members, mentors, or external consultants in direct contact with the raters in their day-to-day work (Brown et al., 2019; Darino et al., 2019; Tippins & Coverdale, 2009). Feedback provides insights into behaviors (Lohan et al., 2010; Rivera et al., 2021; Tippins & Coverdale, 2009), strengths (Buckingham & Goodall, 2015; Budworth et al., 2015), work relationships (Rivera et al., 2021), or successes of an individual (Brown et al., 2019; DeShon et al., 2004). Thus, the multifaceted assessment prevents personal bias of raters regularly identified in traditional performance appraisals (Aguinis, 2009; Aguinis et al., 2013; Buckingham & Goodall, 2015; Budworth et al., 2015; Hussein, 2019; Torneo & Mojica, 2020). On the other hand, the strengths and interests of the ratee can be promoted through target-oriented development by simultaneously ensuring alignment with long-term corporate requirements (Brown et al., 2019; Tippins & Coverdale, 2009). Due to the extensive evaluation and involvement of different peers, 360-Degree/Peer Feedback is conducted biannually or annually (Rivera et al., 2021).

Instant or Real-Time Feedback (Aguinis et al., 2011, 2013; Bellisario & Pavlov, 2018; Cappelli & Tavis, 2016; Fan & Bai, 2004; Ramesh et al., 2012; Rivera et al., 2021; Traini, 2022) fosters continuous communication with individuals or teams (Aguinis et al., 2011, 2013; Ramesh et al., 2012). Therefore, it has two control mechanisms. First, a timely evaluation and feedback of performance deliveries allow for early initiation of corrective measures to achieve a goal (Coller et al., 2018; Fan & Bai, 2004; Van Dooren, 2011), accomplish a task (Coller et al., 2018; Hossain & Prybutok, 2016; Otley, 2006), or improve employee behavior (cybernetic control) (Fan & Bai, 2004; Lill & Wald, 2021). Second, the instrument serves as a reward mechanism expressing recognition to individual team members or entire teams to continuously promote employee motivation (reward and compensation) (Lill & Wald, 2021; Otley, 2006). Instant/Real-Time Feedback is not time-specific but can be provided at any point in time (e.g., upon achieving the desired outcome or as recognition in between) by different employees (e.g., supervisor or team member) who observed performance of other individuals or teams (Aguinis et al., 2013; Cappelli & Tavis, 2016; Rivera et al., 2021). Typically, digital solutions (e.g., an app) support this form of feedback to minimize the time between performance delivery and feedback (Aguinis, 2009; Brown et al., 2019).

Check-Ins (Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Jolayemi, 2008; Khanagha et al., 2022; Rivera et al., 2021; Srinivas, 2009; Traini, 2022) present a cybernetic control mechanism that fosters regular alignment between employees and supervisors (Cappelli & Tavis, 2016; Khanagha et al., 2022). During informal meetings, individuals can reflect on goal achievement and its contribution to the corporate context (i.e., meaningful work) (Salah et al., 2010), clarify expectations and priorities (S. Lee et al., 2017), and enhance personal development through goal-oriented coaching (Buckingham & Goodall, 2015). From a temporal perspective, Check-Ins are recommended weekly or monthly (Buckingham & Goodall, 2015; Jolayemi, 2008; Khanagha et al., 2022). However, initiating a conversation is an employee's responsibility (Buckingham & Goodall, 2015). The agile instrument promotes employee/supervisor interaction, creates confidence in employees to solve tasks in a self-determined and self-organizing manner, and ensures the continued development of employees (Salas et al., 2009).

4.5 Design Principles for Agile Performance Management Systems

The overview of agile instruments and the elaborated examples show that the agile instruments for performance management differ in their control mechanisms. In addition, the instruments consist of various design characteristics, for example, application scope, application frequency, or purpose, which affect the context-dependent configuration of an APMS. The following section shows how five design principles help redesign PMS towards agility based on the degree of uncertainty.

1. Design Principle – Frequency: Corporate activities and people's behavior need to be reviewed more frequently in uncertain business contexts to achieve strategic goals.

The agile instruments (e.g., Daily Stand-Up Meetings, OKRs, or Instant Feedback) have, in general, a high utilization frequency (Buckingham & Goodall, 2015; Cappelli & Tavis, 2016; Coller et al., 2018; Darino et al., 2019; Lee et al., 2017; Lohan et al., 2010; Ramesh et al., 2012; Staedele et al., 2019) compared to traditional (e.g., Performance Appraisals or Forced Rankings) (Aguinis et al., 2011; Cappelli & Tavis, 2016; Sull & Sull, 2018). Typically, the frequency of utilization could be hourly (Meawad, 2021), daily (Buckingham & Goodall, 2015; Coller et al., 2018; Jolayemi, 2008; Khanagha et al., 2022; Salah et al., 2010; Staedele et al., 2019; Traini, 2022), weekly (Lohan et al., 2010; Rigby et al., 2018; Tippins & Coverdale, 2009), monthly (Buckingham & Goodall, 2015; Jolayemi, 2008; Rigby et al., 2018; Rivera et al., 2021; Staedele et al., 2019), or quarterly (Buckingham & Goodall, 2015; Jolayemi, 2008; Meawad, 2021; Rivera et al., 2021; Van Dooren, 2011). In summary, APMS targets short-term movements instead of rigid long-term planning (Brown et al., 2019; Jolayemi, 2008). Informal reflections ensure a constant information flow about work status, result progress, resource consumption, team and employee behavior, or target achievement (Aguinis et al., 2011; Buckingham & Goodall, 2015). On the one hand, this information helps teams detect potential problems or unpredictable changes at an early stage, which can be quickly adjusted, if necessary (Aguinis et al., 2011; Appelbaum et al., 2017b, 2017a; Budworth et al., 2015; S. Lee et al., 2017; Oduntan & Park, 2012). Additionally, high frequency serves as a team-internal control mechanism, ensuring ongoing result delivery (Aguinis et al., 2011; DeShon et al., 2004; Tippins & Coverdale, 2009). On the other hand, information serves as an informal control mechanism for managers, assuring that self-organized agile teams deliver results regularly and

contribute to strategic goal achievement (Coller et al., 2018; Lill & Wald, 2021; Lohan et al., 2010). In addition, timely reflections ensure that lessons learned, coaching, and development initiatives are tied to recent performance (Aguinis et al., 2011; Brown et al., 2019).

Simons already indicated the necessity for a higher frequency in PMS in 1995. He claimed that information changes occur rapidly; therefore, yearly diagnostic control instruments (e.g., Performance Appraisals) can hardly fulfill the needs of contemporary situations but require frequent information flow at an operational level to detect potential strategic threats early on (Simons, 1995). Ferreira and Otley (2009) supported this claim by arguing that most TPMS lack instruments that provide timely and frequent information for quick actions in uncertainty.

However, agile instruments address not only short-term related operational performance management aspects but also ensure the implementation of long-term strategies (Jolayemi, 2008; Lohan et al., 2010; Meawad, 2021; Ramesh et al., 2012; Van Dooren, 2011). Agile instruments approaching this target consist of a biannual or annual (e.g., 360-Degree Feedback, Team Goals, or Product Backlog) (Aguinis et al., 2011; Buckingham & Goodall, 2015; Rivera et al., 2021) rhythm and are closely connected to instruments consisting of a multiple year rhythm (e.g., Skill Mapping or North-Stare Goals) (Jolayemi, 2008). Compared to highly frequent evaluations, these do not assess individual performance aspects but aim to derive a holistic picture of individual performance. Therefore, the range and effort of the evaluation are decisive for the relatively low application frequency (Rivera et al., 2021). From an organizational agility perspective, this design principle supports the call of previous authors to continue aligning stable strategic aspects with dynamic operations (Striteska, 2012; Torneo & Mojica, 2020; Weber & Tarba, 2014). Aligning stable strategies and dynamic operations through different agile instruments supports prior research findings from management control, where a successful PMS needs to be configured from various controls to fit environmental and corporate contingencies (Gerdin & Greve, 2004; Malmi & Brown, 2008).

2. Design Principle – Leadership Style: Do not control individuals and teams but control strategic goal alignment and judge outcome quality.

The values and principles of the Agile Manifesto, i.e., self-organization, empowerment, and responsibility, shape agile teams' culture and working environment (Beck et al.,

2001; Eilers et al., 2022). Independent work is built on agile instruments that promote active communication and coordination between management (top-down) and teams (bottom-up). This supports the claim of van der Meer-Kooistra and Scapens (2008) that new forms of performance management must involve communication, collaboration, and coordination instead of command-and-control.

Agile instruments have a two-way interaction. Top-down management should provide clear guidelines in the form of goals and their priorities (e.g., Stretch Goals, Hoshin Kanri, or Product Backlog). This increases employees' understanding of a company's aspirations and their contributions to the company. Therefore, prior scholars (Aguinis, 2009; Chenhall, 2003) suggest a change in leadership, i.e., moving from keeping people accountable for past actions to coaching people to accomplish future tasks. Furthermore, specifying and controlling outcomes are the task of managers in an agile setup. Bottom-up, empowered teams derive goals from overall strategic goals (e.g., Team Goals, OKRs, or Sprint Planning) and specify tasks and their distribution accordingly (e.g., Daily Stand-Up Meetings, Retrospectives, or XP). Before task execution, short-term plans are informally coordinated between the team and management to obtain alignment (Cappelli & Tavis, 2016). The final control concerns the top-down assessment of the delivered outcome and its quality. Therefore, informal agile control instruments (e.g., Reviews or Instant Feedback) are utilized. The evaluation concerns the level of goal achievement (as aligned in advance) and the reflection of outcome quality. These instruments fulfill the purpose of informal controls fostering bottom-up and top-down alignment, as requested by management control scholars (Otley, 1999; Simons, 1995).

3. Design Principle – Application Scope: Corporations affected more by uncertainties, should facilitate agile instruments in more control areas in PMS.

Considering contingency theory, contextual factors, particularly factor uncertainty, and their magnitude put pressure on companies. Uncertainties arise in various forms (Duncan, 1972) and influence corporate functions and activities (Garner, 1962; Lawrence & Lorsch, 1967). Concerning PMS redesign towards more agility, the question should be how and to what extent uncertainty affects the organization, i.e., do uncertainties affect a single project team or the entire organization? This follows Malmi and Brown (2008), who express the dependency of PMS configuration based on the existing uncertainties. Thus, Buckingham and Goodall (2015) and Cappelli and Tavis

(2016) conclude that modern PMS requires flexibility, adaptability, and reactiveness to cope with uncertainties and simultaneously be reliable and strategically and contextually congruent (Aguinis et al., 2011) and to some degree stable (Reilly & Aronson, 2009).

The agile instruments support this theoretical claim by being composed of different design characteristics. Instruments can take the form of a single practice, method, or approach (Gemino et al., 2021), i.e., extensive instruments including methods and approaches (e.g., Scrum or Beyond Budgeting) consists of control packages and cope with multiple uncertainties simultaneously, whereas practices (e.g., Learning Goals or SMART Goals) control individual corporate uncertainties (Gemino et al., 2021; Papadakis & Tsironis, 2018). The composition indicates the application scope at the corporate level: the more limited the control range of instruments, the more limited the implementation reach, and the more likely the applicability at an individual or team level. On the contrary, the more comprehensive the control package of instruments, the more extensive the implementation reach, and the more likely it is to be applied at a business unit or corporate level.

In conclusion, the scope of the application of agile instruments depends on the degree of uncertainty and implementation. This is also reflected in organizational agility research (Cao et al., 2009; Conforto et al., 2014; Fitzgerald et al., 2006; Gemino et al., 2021). Initially, uncertainty was primarily related to development projects addressed by operational agility instruments (e.g., Scrum or Kanban) (Bouguerra et al., 2021; Conforto et al., 2014; Dingsøyr et al., 2012). Increasing external uncertainties and conflicts triggered by operational agility require further implementation measures, i.e., organizational-wide agile transformation using Holacracy, for example (Bernstein et al., 2016).

4. Design Principle – Multidimensional Performance Measurement: The performance measurement of APMS must build on multiple performance dimensions and sources.

Performance measurement through agile instruments comprises two unique characteristics: (1) multidimensional performance indicators and (2) various data sources. First, agile organizations follow the values and principles of the Agile Manifesto, including customer collaboration, working products or individuals, and interactions over processes (Beck et al., 2001). Financial performance indicators, however, reflect only a

one-sided performance indicator and are process-oriented (Appelbaum et al., 2017a; Budworth et al., 2015; Fan & Bai, 2004; Keathley & Van Aken, 2013). However, scholars (Aguinis et al., 2013; Brown et al., 2019; Meawad, 2021; Ramesh et al., 2012; Sivarethinamohan et al., 2021; Srinivas, 2009) call for a shift from the process- toward a people-oriented performance measurement and management. Therefore, performance measurement should mirror qualitative/non-financial and quantitative/financial performance indicators (Brown et al., 2019; Coller et al., 2018; Traini, 2022; Van Dooren, 2011). To do so, respective agile instruments must be integrated for performance measurement in agile setups, including 360-Degree Feedback, Review, or Strengthen-Oriented Feedback.

Second, performance measurement should no longer be tied to a single supervisor. Agile working is based on active communication and collaboration between team members, supervisors, business counterparts, or customers. Each stakeholder group experiences an employee in different situations with different responsibilities (Cappelli & Tavis, 2016). Therefore, agile instruments for performance measurement (e.g., 360-Degree Feedback, Instant Feedback, or Strengthen-Oriented Feedback) rely on a holistic and "hands-on" assessment, i.e., stakeholders who have experienced an employee performing a task can become a rater in the performance measurement process (Brown et al., 2019; Cappelli & Tavis, 2016). Multi-rater instruments provide additional support for avoiding the criticism of traditional performance appraisals: biased, unfair, non-value-adding, and cost-intensive (Aguinis et al., 2011; Brown et al., 2019; Coller et al., 2018). The potential biases of a single supervisor can be reduced through multiple raters, leading to a fair evaluation (Aguinis, 2009; Aguinis et al., 2013). Additionally, the various opinions and evaluations provide a diverse picture of an employee’s strengths and weaknesses (Tippins & Coverdale, 2009). These are important for the target-oriented development of employees and reflect the long-term skills and capabilities needed in a company (Brown et al., 2019).

5. Design principle – Agile Mindset: Successful APMS not only build on the selection and integration of agile instrument (doing agile) but also require an agile mindset from people (being agile).

An agile mindset of employees and managers is the second essential foundation, along with appropriate agile instruments, to gain organizational agility (Eilers et al., 2022;

Rigby et al., 2018) and thus successfully design and use APMS. An agile mindset constitutes the daily integration of agile values and principles from the Agile Manifesto (Eilers et al., 2022) and requires dynamic capabilities to actively incorporate them and apply the agile instruments (Appelbaum et al., 2017b, 2017a). Previous scholars (Agarwal & Selen, 2009; Teece et al., 2016) in the field of organizational agility have identified various relevant dynamic capabilities, such as responsiveness, leanness, and adaptability.

Five dynamic capabilities have been identified as particularly relevant for operating APMS. First, learning refers to creating and transforming information into business value to ensure corporate growth. Since most agile instruments are based on ongoing reflection, people must be able to process the information and use it in a meaningful way in their daily life. Simultaneously, managers must be trained to provide appropriate information to ensure learning. Second, collaboration and communication capabilities address frequent exchanges between various stakeholder groups. Multiple informal exchanges facilitate ongoing goal alignment and alter corporate patterns in agile performance management. Therefore, the organization's employees need to be trained in interaction skills. Sensing as the third dynamic capability ensures that people are open-minded and search for new challenges or opportunities. Those need to be addressed by flexibly readjusting activities and processes, representing the fourth dynamic capability, to fifthly and ultimately adapt changes in products, services, or processes to meet strategic goals. In sum, dynamic capabilities are a prerequisite for utilizing agile instruments in performance management.

4.6 Conclusion and Future Research

The purpose of this study was to show (1) how PMS can be redesigned towards agility in uncertain corporate contexts and to demonstrate (2) how APMS complement organizational agility from a strategic perspective.

First, the contingency theory of management control shows that corporate uncertainties are a major threat to organizations requiring suitable PMS to stay competitive (Lawrence & Lorsch, 1967; Otley, 1980). TPMS lack process frequency and flexibility, are too time and cost-consuming, disregard stakeholder interaction, and build on formal and diagnostic controls. Therefore, prior scholars have called for redesigning PMS to increase flexibility, responsiveness, and adaptability (Aguinis, 2009; Brown et al., 2019;

Buckingham & Goodall, 2015; Cappelli & Tavis, 2016). This work contributes by systematically analyzing agile instruments utilized in PMS. It was not limited to MA research; rather, it was one of the first studies to collect and demonstrate agile instruments from multiple research domains (i.e., MA, HRM, and IS). In sum, 33 agile instruments were identified, building on people-centricity, favoring frequent interactions over documentation, targeting ongoing stakeholder interaction, and fostering future corporate development instead. The instruments have been additionally assigned to an individual or multiple management control areas of the Malmi and Brown (2008) typology. Finally, and according to the characteristics of the agile instruments, five design principles regarding frequency, the leadership style, application scope, multidimensional performance measurement, and agile mindset were specified, serving as a guideline for redesigning PMS towards agility.

Second, organizational agility is not a new phenomenon. On the contrary, three decades ago, corporations identified the need to become agile to cope with uncertainties by quickly sensing and responding to changes (Conboy & Fitzgerald, 2004; Sharifi & Zhang, 1999). Although many organizations successfully utilize operational agility in the project, innovation, or software development, they often miss a strategic agility perspective (Appelbaum et al., 2017b, 2017a; Teece et al., 2016), which APMS can facilitate (Aguinis, 2009; Buckingham & Goodall, 2015; Rigby et al., 2018). PMS combines instruments to operationalize strategies and set goals, coordinate work, or manage people's behavior (Ferreira & Otley, 2009). Therefore, agile instruments in PMS increase flexibility in planning and allocating resources (e.g., Rolling Forecast), reduce the length of goals (e.g., OKRs), target continuous learning to ensure dynamic capabilities and an agile mindset (e.g., Strengthen-Oriented Feedback), enable evaluation based on multiple performance indicators and data sources (e.g., 360-Degree-Feedback), and ensure ongoing task and goal alignment (e.g., Check-Ins). The presented agile instruments bridge the gap between long-term and stable strategic goals with agile operations.

The paper also has some limitations. On the one hand, the search algorithm might potentially overlook publication sources. For instance, hardly any publication sources or instruments were identified in the reward and compensation management control area. This issue could be addressed by including performance compensation or reward systems as predefined keywords in the search process. Nevertheless, reward and

compensation are a part of PMS (Ferreira & Otley, 2009; Malmi & Brown, 2008); therefore, keywords should have addressed this issue. On the other hand, the specified design principles might be recognized as subjective since they are derived from a qualitative content analysis. One could argue for different or additional design principles.

This study provides the foundation for future research in management control and organizational agility. Management control scholars should use the overview of agile instruments as an incentive to develop and test future PMS configurations in uncertain contexts to investigate the implications of new control instruments on a company's financial performance or alignment between shareholder and stakeholder interests. Furthermore, and due to the lack of agile instruments, reward and compensation research should investigate and, if necessary, identify new instruments to support organizational agility. In the organizational agility field, it is advisable to look at how the various instruments can be applied in case companies and whether they improve the mismatch between stable strategies and dynamic operations.

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02/2018 – 08/2018	**Autoneum Switzerland AG**, Sevelen, Switzerland Change Management & Master Production Scheduling

Publications

2022	**Möller, K. & Schmid, J.** (2022) Controlling & Agilität: Konvergenz oder Koexistenz? Gestaltungsempfehlungen für mehr Agilität im Controlling. *CFOaktuell*, 16(5). 168-172.
2022	**Möller, K. & Schmid, J.** (2022) Agile Steuerung in der Finanzfunktion: Wie findet man die richtige Balance zwischen Flexibilität und Stabilität? *Expert Focus*, 96. 383-388.
2022	**Möller, K., Schmid, J. & Schatzmann, J.** (2022) CO2-Preise als Steuerungsinstrument für das Controlling: Treiber, Instrumente und Umsetzung einer umweltbezogenen

Nachhaltigkeitsorientierung. *Controlling: Zeitschrift für erfolgsorientierte Unternehmenssteuerung*, 34(5). 43-50.

2022 **Möller, K. & Schmid, J.** (2022) Agile Steuerung in der Finanzfunktion – Wie findet man die richtige Balance zwischen Flexibilität und Stabilität? *Expert Focus*, 383-388

2022 **Möller, K., Schatzmann, J., & Schmid, J.** (2022) Internal Carbon Pricing – How to Operationalize, Measure and Control Carbon Emissions. University of St. Gallen, White Paper

2022 **International Group of Controlling (IGC) / Klaus Möller (eds.).** (2022). Controlling & Agility. https://www.igc-controlling.org/downloads/standards

2021 **Möller, K. & Schmid, J.** (2021) Agile Praktiken im Performance Management - Auswahl und Nutzung moderner Steuerungswerkzeuge. *Controlling: Zeitschrift für erfolgsorientierte Unternehmenssteuerung*, 33(4). 48-55.

2017 **Kraus, S., Schmid, J., & Gast, J.** (2017). Innovation through coopetition: An analysis of small-and medium-sized trust companies operating in the Liechtenstein financial centre. International Journal of Business Science & Applied Management (IJBSAM), 12(1), 44-60.

Conference

2021 **Schmid, J.** (2021). Effects of agile project management on customer outcome and financial performance: A case study in the manufacturing industry. *10th ERMAC Conference*, Vienna.

Extracurricular Activities

04/2017 – today	**Rotaract Club Liechtenstein**, Vaduz, Liechtenstein Founding Member and Member of the Board
02/2022 – 05/2022	**St. Gallen Symposium (SGS)**, St. Gallen, Switzerland Member of the Academic Jury
11/2020 – 12/2021	**Mentoring Program University of Liechtenstein**, Vaduz, Liechtenstein Member of the Mentor Team
04/2019	**Rotary Youth Leadership Award (RYLA)** Rotary Scholarship