Agility in the Balance: Control, Autonomy, and Ambidexterity in Agile Software Development

Short Paper

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Abstract

Agile methodologies for information systems development (ISD) are still drawing the attention of the research community. These methodologies promise to increase an ISD team's adaptiveness in such a way that ISD teams are able to respond and react to changing user requirements. Existing studies on team autonomy in agile ISD, however, imply that these projects potentially can benefit from different elements of control. Our objective is to improve the understanding of how to enact control through agile practices, and how these practices influence team autonomy and task performance in successful agile ISD projects in terms of project performance and project quality. This is achieved by developing a preliminary research model that is based on a solid theoretical foundation. As a theoretical framework, we employ ISD ambidexterity and extend it with context-specific insights from control theory. In consequence, we suggest several propositions for future testing.

Keywords: Ambidexterity, Agile Information Systems Development, Control Theory, Task Performance, Team Autonomy

Introduction

Over the past decade, agile approaches to *information systems development (ISD)* have emerged as a dominant paradigm (Baskerville et al. 2011; Highsmith et al. 2001). A core facet of agile ISD is the principle of *team autonomy* – providing individual team members and groups the freedom to self-organize and initiate action on their own. Yet extant research paints a conflicted picture of autonomy's impact on teams. On the one hand, team autonomy has been found to reduce productivity and performance in the context of project teams (Langfred 2004); on the other hand, it has been identified as an important factor in enabling teams to respond to change (Vidgen and Wang 2009). The practical impact of autonomy on performance in agile ISD teams is further complicated by the question of *control* – understood broadly to mean "any process in which a person or group of persons or organization of persons determines … what another person or group or organization will do" (Tannenbaum 1962, p. 239) As this definition suggests, the exercise of control necessarily implies certain limits on the ideal of team autonomy. Yet, substantial research suggests that control leads to better *task performance* within a team (Hackman 1987; Zellmer-Bruhn and Gibson 2006), even in agile ISD contexts (Harris et al. 2009a; Kirsch et al. 2002; Persson et al. 2011). Furthermore, the use of agile methods and the exercise of control have been shown to have a positive effect on project quality (Maruping et al. 2009a). Of course, control itself encompasses a range of different mechanisms and forms; most notably, there is a critical distinction between formal and informal modes of control (Kirsch 1997). Disentangling the nuances and effects of varied control modes in the enactment of agile practices may have substantial import for our understanding of effectiveness in agile ISD settings. Despite a range of calls for further research on the impact of control and team autonomy in ISD efforts (Chua et al. 2012; Wiener et al. 2016), the existing evidence remains ambiguous, especially in the field of evolving agile ISD methodologies (Cram and Brohman 2013). Few studies have investigated informal controls and their effects on ISD outcomes, such as software product quality, or their enactment within agile practices (Cram et al. 2016). Accordingly, we follow the call of Wiener et al. (2016) for further research on the inconclusive and partly contradictory results regarding control in ISD (Choudhury and Sabherwal 2003; Tiwana and Keil 2009), the interplay between formal and informal control mechanisms (Persson et al. 2011; Tiwana 2010), as well as their relationship to team autonomy (Gerwin and Moffat 1997) and task performance (Kirsch et al. 2002). Consequently, the central research questions guiding our study are:

(1) To what degree do modes and styles of control, as enacted through agile practices, influence team autonomy and team task performance?

(2) What are the effects of team autonomy and team task performance on ISD ambidexterity in agile development environments?

To foster a deeper understanding of the interaction of team autonomy, control, and task performance in agile ISD, we propose a model for identifying and investigating effects of agile practices on task performance and autonomy in agile ISD teams. This model draws substantially upon theories of ISD *ambidexterity* (Tiwana 2010), highlighting our focus on the degree to which autonomy and task performance are held in balance in successful agile ISD efforts. The remainder of this research-in-progress paper is structured as follows. We give a brief overview of related work on the topic of agile ISD research, focusing the aspect of control investigated on a team level view. Next, we derive the proposed model and state corresponding propositions based upon previous literature. Finally, we provide further information on the proposed research design and the planned data collection and analysis.

Related Work and Theoretical Background

Agile Information Systems Development

Agile ISD is an umbrella term for a variety of distinct methodologies, such as Scrum or eXtreme Programming (XP) (e.g., Schwaber 1995), which collectively emphasize an iterative development model, close collaboration between stakeholders, and a lightweight approach to documentation (Cohen et al. 2004). In contrast to structured development's embedded resistance to change (at least beyond the point of requirements documentation), the lightweight practices of agile ISD are envisioned to embrace and learn from change in pursuit of increased customer value (Conboy 2009). Thus, in a business environment where available technologies, market structures, and customer preferences change rapidly, agile ISD approaches are intended to enable ISD teams to react to emergent needs in a timely manner (Lee and Xia 2010). This capability reflects what Gibson and Birkinshaw (2004) refer to as *adaptiveness* – the degree to which an individual or group is able to reconfigure its activities to correct misalignments with organizational goals, for example, due to the refinement of project requirements, technological, or environmental changes (Tiwana 2010). In order to respond effectively to change, agile ISD methodologies emphasize a variety of specific *agile practices* (e.g., Lee and Xia 2010). Examples of agile practices from XP are *pair programming* (all production code is written with two programmers at one machine) and *collective code ownership* (anyone can change any code anywhere in the system at any time). Similarly, popular Scrum practices include *daily scrum meetings* (a daily stand-up meeting in which all project participants briefly review the status of their work) and *user stories* (a method to define broad requirements while enabling creativity) (e.g., Harris et al. 2009b).

Control and Autonomy in Agile Information Systems Development

In agile ISD and its associated technical processes, key *social practices and principles* have to be considered as well (e.g., Hummel et al. 2015). These socially-oriented practices and principles include, for example, an emphasis on collaboration between business and technical stakeholders (Lee and Xia 2010), a preference for informal face-to-face communication and interactions (Hummel et al. 2015), and the promotion of self-organization and reflection within teams (Vidgen and Wang 2009). Importantly, these social facets have significant implications for the concept of managerial control (Remus et al. 2016). Research on control in ISD has produced a wealth of valuable insights. Kirsch's control theory (1996, 1997, 2004) offers a particularly valuable perspective. With respect to ISD teams, control theory distinguishes formal control types (e.g., input, behavior, and outcome controls) from informal control types (e.g., self-control and clan control) (Kirsch 1996). Table 1 summarizes key control modes, which are often exercised in concert rather than in isolation, representing a so-called control portfolio (Kirsch 1997).

Control Mode		**Characteristics**
Formal	*Input Control*	Measurable actions prior to implementation of an activity e.g., recruitment, training programs or manpower allotments
	Behavior control	Emphasizes behaviors, processes and procedures that must be followed, and offering rewards contingent on the adherence to the prescriptions.
	Outcome control	Involves outlining project goals, and offering rewards contingent on their accomplishment. Emphasizes outputs regardless of the process used.
Informal	*Clan control*	Socializes team members into sets of valued norms. Emphasizes reinforcement of acceptable behaviors through shared rituals and experiences.
	Self-control	Provides autonomy to individuals to determine what actions are required and how to execute them. Emphasizes self-regulation of goals and self-monitoring of progress.

Table 1: Summary of Control Modes following Kirsch (1996)

It is well known that traditional ISD approaches rely heavily on formal control modes (Kirsch 1997; Kirsch et al. 2002; Tiwana and Keil 2009). By contrast, informal control potentially provides developers with discretion in how tasks will be accomplished (Henderson and Lee 1992; Maruping et al. 2009a). Informal controls such as clan and self-control promise to enact autonomy, which is seen as an important antecedent for responding to changing user requirements (Gerwin and Moffat 1997; Maruping et al. 2009a). The exercise of clan control allows a development team to identify important project goals and to determine how to attain them on their own (Maruping et al. 2009a). The exercise of self-control – i.e., "the extent to which an individual exercises freedom or autonomy to determine both what actions are required and how to execute these activities" (Henderson and Lee 1992, p. 760) – similarly enables flexibility in pursuit of objectives, focusing on the role of the individual rather than that of the group. While most of the existing studies focus on controlling portfolio configuration ("what" control modes are used), few studies investigate "how" controls can be put into practice (Gregory et al. 2013a; Tiwana and Keil 2009). Consequently, we follow Wiener et al. (2016) in suggesting *control style* as a relevant concept for control-enactment. Control style can be defined as "the manner in which the interaction between the controller and the controllee is conducted" (Wiener et al. 2016). Related literature suggests two contradictory control styles – *authoritative* and *enabling* (Adler and Borys 1996; Gregory et al. 2013a). An *authoritative* control style is employed if strict behavioral compliance is desired, granting the controllee less discretion in how control is enacted (Wiener et al. 2016). An *enabling* control style, on the other hand, is used to achieve compliant behavior while granting flexibility in decision making to deal with uncertainties in daily work procedures (Adler and Borys 1996; Remus et al. 2016). The principle of control and the various ways of framing its effects have significant implications for the agile ideal of team autonomy. Following Lee and Xia (2010, p. 90), we define *team autonomy* "as the degree of discretion and independence granted to the team in scheduling the work, determining the procedures and methods to be used, selecting and deploying resources, hiring and firing team members, assigning tasks to team members, and carrying out assigned tasks" (Lee and Xia 2010, p. 90). As this definition underscores, team autonomy is intrinsically intertwined with the broader objectives of flexibility and adaptiveness in agile ISD (Larman 2003), as well as the related concepts of self-organization (Highsmith et al. 2001), self-management (Langfred 2004), and team empowerment (Larman 2003).

Next to team autonomy, the enactment of control is closely linked to the establishment of *task performance,* defined as the degree to which a team achieves its goals and how well its outputs match the team's mission (Hackman 1987). Although a variety of empirical studies analyze the effect of control and task performance on agile ISD project outcomes (Maruping et al. 2009a; Persson et al. 2011), results remain ambiguous (Cram and Brohman 2013). For example, in terms of product quality, Maruping et al. (2009a) suggest that agile ISD project teams can benefit from the implementation of certain control modes (especially outcome control) to create an environment in which agile practices can engender autonomy while clear performance goals and structures are maintained. On the other hand, Harris et al. (2009a) argue that formal outcome control is insufficient in agile environments and propose the novel concept of *emergent outcome control* as a way to achieve a better product-market match. Regarding informal controls, little research has investigated informal controls, such as clan and self-control, and their effects on outcomes (e.g., software product quality) (Cram et al. 2016). This reinforces some of the findings of Wiener et al. (2016), asserting that earlier studies on control in IS produced inconclusive and partly contradictory results. For example, there is no consensus if informal control has a positive (Henderson and Lee 1992; Wiener et al. 2015) or negative impact (Tiwana 2010; Tiwana and Keil 2009) on project performance and project adaptiveness. This has led to calls for examining the extent to which individual agile practices affect project outcomes, and the interplay between control modes and agile practices (Maruping et al. 2009a).

Theory Development and Propositions

Figure 1 summarizes our research model on the interrelationship between control-enacting agile practices and control styles, team autonomy, and task performance, and how they influence adaptiveness and outcomes in terms of project performance.

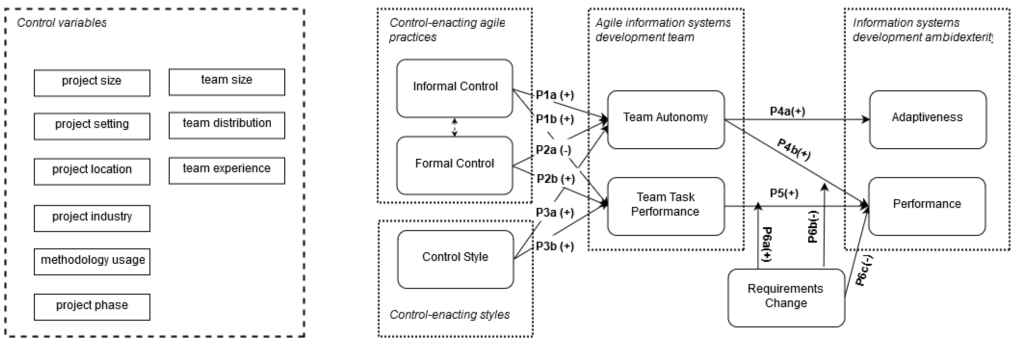

Figure 1: Proposed Research Model

The research model has three components. First, as the relevant dependent variable for agile ISD, we focus on the construct of *ISD ambidexterity* (Tiwana 2010) because it combines both adaptation to changing demands and adherence to organizational objectives. Specifically, ambidexterity is “the capacity to simultaneously exhibit alignment and adaptiveness” (Gibson and Birkinshaw 2004, p. 211), where alignment is the degree to which the work of a group fulfills the project objectivities (e.g., client requirements or quality expectations) (Tiwana 2010). Alignment is a critical consideration in determining whether a project is completed on time and within budget – thus indicating a process performance dimension (Keil et al. 2013) – as well as if it fulfills requirements in terms of quality – indicating product performance (Henderson and Lee 1992). In our analysis, we opt for the term *project performance* in place of alignment to underscore the importance of both process and product performance dimensions (Tiwana and Keil 2009; Wiener et al. 2016). As the second constituent part of ambidexterity, *adaptiveness* describes “the capacity to reconfigure activities in the business unit quickly to meet changing demands in the task environment” (Gibson and Birkinshaw 2004, p. 209). By focusing on ambidexterity in our research model, we embrace a “both/and” rather than “either/or” perspective - the two dimensions are seen as interrelated but non-substitutable (Tiwana 2010).

Second, from a control-enactment perspective, we include both *control modes* and *control style* as independent variables in our research model. We suggest that different types of control can be exercised through different agile practices, that is, the method-in-action and generative rules, which are adapted to fit an agile ISD team’s specific context (Highsmith et al. 2001). While some extant research has mapped agile practices to either formal or informal control modes (e.g., Harris et al. 2009b; Persson et al. 2011), conclusive designations are challenging. Based on the results of an extensive structured literature review (*anonymous for review*), we identified a total set of 29 agile practices, including an analysis of their correspondence to specific control modes. Although most agile practices defy a straightforward classification by control mode, a subset of these practices offer clear indications of formal and informal control modes in their enactment. Table 2 provides an excerpt of control modes embodied in agile practices.

Next, we see *team autonomy* as an important mediating variable in our model, which is impacted by agile practices enacting formal or informal control, as it describes the extent to which a team underlies restrictions and interdependencies through control (Piccoli et al. 2004) or is granted discretion and independence (e.g., in scheduling the work or carrying out tasks) (Lee and Xia 2010).

Practice	Description	Control Modes		References (Examples)
Backlog prioritization / estimation	Prioritize a collection of user stories. Assign IT estimation points.	Formal	BC, OC, EOC	Harris et al. (2009b); Mahadevan et al. (2015)
Burndown charts	A publicly displayed chart showing remaining work in the sprint backlog that is updated every day.	Formal	OC	Gregory et al. (2013b); Mahadevan et al. (2015)
		Informal	CC	Gregory et al. (2013b)
Code Reviews / Refactoring	After a piece of software code is developed or modified by a single software engineer, it is submitted to a code review system through which peer developers are invited to review and propose changes.	Formal	BC. OC, EOC	Harris et al. (2009a); Persson et al. (2011)
		Informal	SC, CC	Gregory et al. (2013b); Persson et al. (2011)
Collective Code Ownership	Anyone can change any code anywhere in the system at any time.	Informal	SC, CC	Maruping et al. (2009b); Persson et al. (2011)
Daily Scrum / stand-up	Daily meeting where members ex-plain briefly what they accomplished, what will be completed and indicate impediments preventing them from completing tasks.	Formal	BC, OC	Cram and Brohman (2013); Misra et al. (2009)
		Informal	SC, CC	Mahadevan et al. (2015)
Pair Programming	XP stipulates pair programming as a core practice, where two programmers, sharing the same computer, work collaboratively on all aspects of software development	Formal	BC, EOC	Harris et al. (2009b)
		Informal	SC, CC	Maruping et al. (2009a)
User stories	Documented set of requirements to be achieved by development	Formal	OC, EOC	Harris et al. (2009b); Mahadevan et al. (2015)

LEGEND: BC = Behavioral Control, CC = Clan Control, EOC = Emergent Outcome Control, OC = Outcome Control, SC = Self-Control

Table 2. Control Modes embodied in Agile Practices (Excerpt)

We also use *task performance* as a mediator, which is defined as the degree to which a team achieves its goals and how well its outputs match the team's mission (Hackman 1987; Zellmer-Bruhn and Gibson 2006). Third, we consider *requirements change* as an important moderating construct, as ISD projects often face high level of uncertainty and volatility (Lee and Xia 2010; Tiwana and Keil 2009) and therefore impact project performance (e.g., by cost overruns or poor product quality) (Maruping et al. 2009a). We now discuss propositions that link the concepts in our research model. In line with the argument of Wiener et al. (2016), we assert the need for greater consideration of the question of *control-enactment* – that is, *how* software project leaders are able to put distinct configurations of control portfolios into practice.

Regarding the effects of formal and informal controls, several studies find that informal control usage provides high levels of autonomy in managing assigned work tasks – for example, by enabling the team to determine objectives, tasks, and monitoring activities to achieve project goals (Kirsch et al. 2002; Remus et al. 2016). Moreover, informal controls have been found useful in promoting effectiveness, and recent studies emphasize their performance-enhancing effect in the context of specific ISD projects (Chua et al. 2012; Tiwana and Keil 2009). In particular, the use of self-control provides developers with discretion with regard to how tasks are accomplished (Henderson and Lee 1992; Kirsch et al. 2002). For example, self-controlling team members are able to align their resources and choose methods for goal achievement without asking the project leader (Henderson and Lee 1992; Maruping et al. 2009a). Clan control can be promoted by establishing a collaborative culture within the team, allowing the controller to create an environment where the controllee has freedom to make use of her own skills and knowledge in order to accomplish certain tasks, leading to better task performance (Chua et al. 2012; Gopal and Gosain 2010). Consequently, we propose:

P1: *Greater use of informal controls positively impacts (a) team autonomy and (b) task performance.*

In contrast, other studies find that formal controls "limit the team's autonomy" (Piccoli et al. 2004, p. 366) by overemphasizing work formalization (Barker 1993; Remus et al. 2016). For example, routine team progress reports and strict adherence to schedules and task assignments may hinder a team's effectiveness, as teams frequently turn to managers instead of solving problems on their own (Piccoli et al. 2004; Robey et al. 2000). Emphasizing functional specialization puts a manager in the position of controlling most decision making, leading to decreasing team autonomy (Gerwin and Moffat 1997). On the other hand, formal controls provide some degree of guidance and structure, which supports the execution of tasks (Remus et al. 2016). Such controls may provide clear directions and predefined workflows on how to perform certain tasks (Kirsch et al. 2002) or recommend proven techniques or practices (e.g., user stories), which in turn positively affect task performance (Remus et al. 2016). Thus, our second proposition is:

P2: *Greater use of formal control negatively impacts (a) team autonomy, while it positively affects (b) task performance.*

As authoritative and enabling control styles can be seen "as end points on a continuum" (Wiener et al. 2016, p. 755) we follow Remus et al. (2016) and focus on an enabling style in our model. An enabling control style has two main characteristics, "repair" and "transparency" (Adler and Borys 1996). Together, both features establish an environment for the controllee, that is characterized by feedback, involvement in the control configuration, and some degree of freedom to "deviate from controller prescriptions [...] in order to respond to real-work contingencies" (Remus et al. 2016, p. 7). Additional exchange of knowledge, regular feedback, and close collaboration between controller and controllee leads to increasing task performance (Adler and Borys 1996; Remus et al. 2016). Conversely, a lack of information exchange and feedback mechanisms associated with an authoritative style leads to decreased task performance (Choudhury and Sabherwal 2003). We also suggest that an enabling control style increases team autonomy. An enabling style is likely to promote informal controls (such as clan control) which in turn positively affects team autonomy (see P1) (Wiener et al. (2016). This may be due to the repair and transparency characteristics, which allow for better knowledge exchange and continuous feedback loops (Adler and Borys 1996; Wiener et al. 2016). Hence, we propose:

P3: *Greater degrees of an enabling control style positively affect (a) team autonomy and (b) task performance.*

However, agile ISD teams need to respond to changing user requirements (Conboy 2009). Much of the extant literature highlights the idea that "doing agile" is closely linked with the principle of autonomy. Indeed, a*gile ISD views team autonomy as an important antecedent of adaptiveness (Lee and Xia 2010). In addition to its effect* on adaptiveness, team autonomy "brings decision making authority to the hands of the people who face and handle problems every day" (Lee and Xia 2010, p. 90), suggesting an increased effectiveness in problem solving (Larman 2003). *Thus, our fourth proposition is:*

P4: *Greater degrees of team autonomy positively affect (a) adaptiveness and (b) project performance.*

Furthermore, task performance directly impacts project performance. Task performance of individuals "ultimately affects performance on the project level" (Remus et al. 2016, p. 2). For example, if formal control is enacted through agile practices, formal rules and procedures are established, assisting team members in efficient and effective task execution, which in turn positively impacts performance on a project level (Gopal and Gosain 2010; Remus et al. 2016). Therefore, we propose:

P5: *Task performance positively impacts project performance.*

Agile ISD teams tend to consider many alternative problem-solving approaches, creating the risk that they could possibly "lose sight of project objectives" (Maruping et al. 2009a, p. 383). To counteract this dilemma, high degrees of task performance can be achieved by establishing formal controls, emphasizing task outcomes and task behavior and mitigating the team's risk of failing to achieve predetermined project goals (Kirsch 1997; Maruping et al. 2009a). Without "guidance," teams may miss important objectives (Maruping et al. 2009a, pp. 383-384). However, there is also a downside regarding high degrees of autonomy when requirements continuously change over time (Maruping et al. 2009a). In environments with high requirements volatility, clan control is difficult to establish and self-control is minimally effective (Keil et al. 2013). Under these conditions where developers need to effectively coordinate their tasks, different approaches (e.g., coding processes) may be highly incongruent, adversely affecting performance and software quality (Maruping et al. 2009a). Finally, we assert that user requirements changes tend to inhibit agile ISD performance directly, because they may create a shifting standard for performance and the potential for conflicting outcomes. Indeed, requirements changes have consistently been identified as one of the top risks in ISD (e.g., Boehm 1991). Dynamic markets and changing user needs may also result in technical and managerial issues that can adversely affect performance measures (e.g., on-time completion or completion within budget; (Wiener et al. 2015). Consequently, our last proposition is:

P6: *When requirement changes are high rather than low, (a) the positive relationship of task performance on (agile ISD) performance is strengthened, (b) the positive relationship of team autonomy on (agile ISD) performance is mitigated and (c) project performance is negatively affected.*

Our research design includes several control variables relating to a) agile ISD teams, i.e., team size, team distribution, team experience, and b) the project domain and specific project characteristics, i.e. size, setting (in terms of collocated, distributed or outsourced development), location (domestic vs. international), industry, methodology usage, project phase.

Proposed Research Design

We have chosen a research design that corresponds to our objective of explaining and predicting the phenomenon of interest (Recker 2012) – that is, exploring and explaining the effects of applying agile practices on team autonomy and task performance in agile ISD teams and predicting patterns concerning process and product performance as well as the effect on adaptiveness. To increase generalizability by considering divergent views (Creswell 2009) and to provide stronger evidence of our conclusions (Esteves and Pastor 2004), we will investigate our conceptualized model and the associated propositions using a *mixed method approach*, incorporating both qualitative and quantitative research methods. This has been shown to be a fruitful approach in investigating agile ISD (e.g., Lee and Xia 2010). We follow the guidelines of Creswell (2009) by using a sequential exploratory strategy (i.e., within a first phase we collect and analyze qualitative data to adjust our research model and propositions, followed by a second phase of quantitative data collection and analysis that builds on the results of the first phase). Specifically, we will start by conducting in-depth case studies (Yin 2003). We will test the feasibility of our preliminary research model in a manageable environment to elaborate our propositions and constructs of the model, before testing the model within a wider field (Hunter 2004). The qualitative data will be coded, starting with pre-defined concepts derived from our model and coupled with open coding to identify novel concepts. Following this qualitative analysis phase, we will conduct a quantitative analysis using structural equation modeling (SEM). The primary data collection instrument will be a questionnaire-based survey administered to practicing software development professionals. To the extent possible, objective data sources (e.g., logs from project management and tracking tools) will also be used, particularly for the measurement of project outcomes. We will design this study as a panel, and with data collection at multiple points in time (start, middle, and end of projects). Multivariate analysis will be used for analyzing the survey's results. To ensure generalizability beyond the data collection setting, we will apply the pre-tested research model on a larger scale by extending it to a larger sample of national and international agile ISD projects.

Contribution

The proposed research model describes how control can be enacted through agile practices while considering control styles, how these controls impact the autonomy and task performance within an agile ISD team, and the resulting effects on an agile ISD team's performance and adaptiveness. Based on the intended results, we are able to provide answers to our research questions and to enhance our knowledge on control in agile ISD projects from both a theoretical as well as practical point of view. We contribute to theory by fostering our knowledge of the interaction of control, team autonomy, and task performance in agile ISD as well as the overall influence on ISD ambidexterity. We provide practitioners guidance on how to enact control through agile practices, taking into account different control styles and how to achieve the degree to which autonomy and task performance are held in balance in successful agile ISD efforts.

Acknowledgements

The German Research Foundation (DFG) funded part of this study under record no. RO 3650/8-1.

References

Adler, P. S., and Borys, B. 1996. "Two Types of Bureaucracy: Enabling and Coercive," *Administrative Science Quarterly* (41:1), p. 61.

Barker, J. R. 1993. "Tightening the Iron Cage: Concertive Control in Self-Managing Teams," *Administrative Science Quarterly* (38:3), pp. 408-437.

Baskerville, R., Pries-Heje, J., and Madsen, S. 2011. "Post-Agility: What Follows a Decade of Agility?," *Information and Software Technology* (53:5).

Boehm, B. W. 1991. "Software Risk Management: Principles and Practices," *IEEE Software* (8:1).

Choudhury, V., and Sabherwal, R. 2003. "Portfolios of Control in Outsourced Software Development Projects," *Information Systems Research* (14:3).

Chua, C. E. H., Lim, W.-K., Soh, C., and Sia, S. K. 2012. "Enacting Clan Control in Complex Projects: A Social Capital Perspective," *MIS Quarterly* (36:2), pp. 577-601.

Cohen, D., Lindvall, M., and Costa, P. 2004. "An Introduction to Agile Methods," *Advances in computers* (62:03), pp. 1-66.

Conboy, K. 2009. "Agility from First Principles: Reconstructing the Concept of Agility in Information Systems Development," *Information Systems Research* (20:3), pp. 329-355.

Cram, W. A., Brohman, K., and Gallupe, R. B. 2016. "Information Systems Control: A Review and Framework for Emerging Information Systems Processes," *Journal of the Association for Information Systems* (17:4), p. 216.

Cram, W. A., and Brohman, M. K. 2013. "Controlling Information Systems Development: A New Typology for an Evolving Field," *Information Systems Journal* (23:2).

Creswell, J. W. 2009. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications, Incorporated.

Esteves, J., and Pastor, J. 2004. "Using a Multimethod Approach to Research Enterprise Systems Implementations," *Electronic Journal of Business Research Methods* (2:2), pp. 69-82.

Gerwin, D., and Moffat, L. 1997. "Withdrawal of Team Autonomy During Concurrent Engineering," *Management Science* (43:9), pp. 1275-1287.

Gibson, C. B., and Birkinshaw, J. 2004. "The Antecedents, Consequences, and Mediating Role of Organizational Ambidexterity," *Academy of Management Journal* (47:2), pp. 209-227.

Gopal, A., and Gosain, S. 2010. "The Role of Organizational Controls and Boundary Spanning in Software Development Outsourcing: Implications for Project Performance," *Information Systems Research* (21:4), pp. 960-983.

Gregory, R. W., Beck, R., and Keil, M. 2013a. "Control Balancing in Information Systems Development Offshoring Projects," *MIS Quarterly* (37:4), pp. 1211-1237.

Gregory, T., Mathiassen, L., and Sambhara, C. 2013b. "Chains of Control in Agile Software Development," in: *AMCIS 2013 Proceedings*.

Hackman, J. R. 1987. "The Design of Work Teams," in *Handbook of Organizational Behavior,* J.W. Lorsch (ed.). Englewood Cliffs, NJ: Prentice Hall, pp. 315-342.

Harris, M. L., Collins, R. W., and Hevner, A. R. 2009a. "Control of Flexible Software Development under Uncertainty," *Information Systems Research* (20:3), pp. 400-420.

Harris, M. L., Hevner, A. R., and Collins, R. W. 2009b. "Controls in Flexible Software Development," *Communications of the Association for Information Systems* (24:1).

Henderson, J. C., and Lee, S. 1992. "Managing I/S Design Teams: A Control Theories Perspective," *Management Science* (38:6), pp. 757-777.

Highsmith, J., Cockburn, A., and Boehm, B. 2001. "Agile Software Development: The Business of Innovation," *Computer* (34:9), pp. 120-123.

Hummel, M., Rosenkranz, C., and Holten, R. 2015. "The Role of Social Agile Practices for Direct and Indirect Communication in Information Systems Development Teams," *Communications of the Association for Information Systems* (36).

Hunter, M. G. 2004. Qualitative Research in Information Systems: An Exploration of Methods in the Handbook of Information Systems Research. Hershey et al. : Idea Group.

Keil, M., Rai, A., and Liu, S. 2013. "How User Risk and Requirements Risk Moderate the Effects of Formal and Informal Control on the Process Performance of It Projects," *European Journal of Information Systems* (22:6), pp. 650-672.

Kirsch, L. J. 1996. "The Management of Complex Tasks in Organizations: Controlling the Systems Development Process," *Organization Science* (7:1), pp. 1-21.

Kirsch, L. J. 1997. "Portfolios of Control Modes and Is Project Management," *Information Systems Research* (8:3), pp. 215-240.

Kirsch, L. J., Sambamurthy, V., Dong-Gil, K., and Purvis, R. L. 2002. "Controlling Information Systems Development Projects: The View from the Client," *Management Science* (48:4), pp. 484-499.

Langfred, C. W. 2004. "Too Much of a Good Thing? Negative Effects of High Trust and Individual Autonomy in Self-Managing Teams," *Academy of management journal* (47:3), pp. 385-399.

Larman, C. 2003. *Agile and Iterative Development: A Manager's Guide*. Pearson Education.

Lee, G., and Xia, W. 2010. "Toward Agile: An Integrated Analysis of Qualitative and Quantitative Field Data on Software Development Agility," *MIS Quarterly* (34:1), pp. 87-115.

Mahadevan, L., Kettinger, W. J., and Meservy, T. O. 2015. "Running on Hybrid: Control Changes When Introducing an Agile Methodology in a Traditional "Waterfall" System Development Environment," *Communications of the Association for Information Systems* (36:1).

Maruping, L. M., Venkatesh, V., and Agarwal, R. 2009a. "A Control Theory Perspective on Agile Methodology Use and Changing User Requirements," *Information Systems Research* (20:3), pp. 377-400.

Maruping, L. M., Zhang, X., and Venkatesh, V. 2009b. "Role of Collective Ownership and Coding Standards in Coordinating Expertise in Software Project Teams," *European Journal of Information Systems* (18:4), pp. 355-371.

Misra, S. C., Kumar, V., and Kumar, U. 2009. "Identifying Some Important Success Factors in Adopting Agile Software Development Practices," *The Journal of Systems and Software* (82:11).

Persson, J. S., Mathiassen, L., and Aaen, I. 2011. "Agile Distributed Software Development: Enacting Control through Media and Context," *Information Systems Journal* (22:6), pp. 411-434.

Piccoli, G., Powell, A., and Ives, B. 2004. "Virtual Teams: Team Control Structure, Work Processes, and Team Effectiveness," *Information Technology & People* (17:4).

Recker, J. 2012. *Scientific Research in Information Systems: A Beginner's Guide*. Springer Publishing Company, Incorporated.

Remus, U., Wiener, M., Saunders, C., Mähring, M., and Kofler, M. 2016. "Control Modes Versus Control Styles: Investigating Isd Project Control Effects at the Individual Level," in: *ICIS 2016 Proceedings*.

Robey, D., Khoo, H. M., and Powers, C. 2000. "Situated Learning in Cross-Functional Virtual Teams," *Technical Communication* (47:1), pp. 51-66.

Schwaber, K. 1995. "Scrum Development Process," *Conference on Object-Oriented Programming Systems, Languages, and Applications*, pp. 117-134.

Tannenbaum, A. S. 1962. "Control in Organizations: Individual Adjustment and Organizational Performance," *Administrative Science Quarterly* (7:2), pp. 236-257.

Tiwana, A. 2010. "Systems Development Ambidexterity: Explaining the Complementary and Substitutive Roles of Formal and Informal Controls," *Journal of Management Information Systems* (27:2), pp. 87-127.

Tiwana, A., and Keil, M. 2009. "Control in Internal and Outsourced Software Projects," *Journal of Management Information Systems* (26:3), pp. 9-44.

Vidgen, R., and Wang, X. 2009. "Coevolving Systems and the Organization of Agile Software Development," *Information Systems Research* (20:3), pp. 355-377.

Wiener, M., Mähring, M., Remus, U., and Saunders, C. 2016. "Control Configuration and Control Enactment in Information Systems Projects: Review and Expanded Theoretical Framework," *MIS Quarterly* (40:3), pp. 741-789.

Wiener, M., Remus, U., Heumann, J., and Mähring, M. 2015. "The Effective Promotion of Informal Control in Information Systems Offshoring Projects," *European Journal of Information Systems* (24:6), pp. 569-587.

Yin, R. K. 2003. *Case Study Research: Design and Methods*. SAGE Publications.

Zellmer-Bruhn, M., and Gibson, C. 2006. "Multinational Organization Context: Implications for Team Learning and Performance," *Academy of Management Journal* (49:3), pp. 501-519.