An Evolutionary Perspective on Control in IS Development Projects

Completed Research Paper

Roman Walser

Abstract

Projects in the field of Information Systems Development (ISD) are particularly prone to failure because they are complex in many respects. To increase success of ISD projects, researchers and practitioners usually recommend the implementation of control. The traditional view on control involves two parties: a controller executing control and one or more controllees being controlled. To better understand why control effectiveness has not significantly improved over the last decades, this paper gives a chronological overview of existing literature on ISD project control. We find that so far, research has been strongly focusing on controller related aspects such as the creation of control portfolios. This, however, neglects that the effectiveness of control is highly dependent on the controllees' perception and willingness to actively commit to implemented controls. We argue that a more holistic understanding of the controllee perspective on control is needed and discuss implications for theory and practice.

Keywords: IT Project Management, Control Legitimacy, Perceived Appropriateness

Introduction

After spending eight years and approximately $1.1 billion, the United States Air Force in November 2012 decided to cancel a project on the implementation of an integrated enterprise resource planning (ERP) system. Its aim was to automate and streamline logistics operations by consolidating and replacing over 200 legacy systems. Decision-makers concluded that it would cost additional $1.1B to realize only one quarter of the originally planned scope (Aronin et al. 2011). This Information Systems Development (ISD) project may be an extreme example of poor IS project management. However, apart from the scope of the project and the high stakes involved, similar scenarios where reality does not meet the management plan can often be observed in ISD projects.

The Standish Group's annual CHAOS report has analyzed more than 50,000 IS projects since 1994 and revealed that success rates are stagnating at a low level: in 2017, only 36 percent of the investigated IS development projects were completed successfully (i.e. on cost, time and target) (Johnson 2018). This is surprising because over the last decades, IS project management and project control have attracted increasing attention in the academic discourse. More and more aspects of control are being identified and a number of concept-centric literature reviews have been conducted to synthesize existing literature and to point out room for further research (e.g. Wiener et al. 2016). However, those attempts often neglect that IS development approaches and project environments have changed significantly over time. To give an example, the rise of agile development approaches such as SCRUM confronted project managers with new opportunities, but also risks, placing new demands on project control. Moreover, research focuses on only one perception of control: the one of the controller (Walser and Virag 2018).

A controller implies that there is someone to be controlled. Put simply, the prevailing one-sidedness in research ignores that ISD project control requires the controllee's active commitment to be effective. In

general, there is consensus that control can influence the controllees' behavior in a way that is beneficiary for IS project success (Kirsch 1997; Tiwana and Keil 2009). Moreover, increasing familiarity with the use of IS and a growing set of practical learnings from previous projects would not suggest stagnating but increasing success rates. However, looking at the constantly low success rates of ISD projects and if control in general is beneficiary to ISD project success, it is arguable that effectiveness of control can be improved.

In this paper, we set out to chronologically review the ongoing scientific discourse on ISD project control with an eye on the evolution of software development. This will include the transition from mostly rigid to more agile ISD approaches, the trend towards outsourcing development projects and a discussion of its implications for different types of control. We go beyond existing reviews and reflect on factors which might influence the controllees' perception and resulting behavior with regards to control. The aim of our research is to promote a more recent and holistic understanding of control in ISD projects. This is particularly important for practitioners to implement control in a more effective way and might, in turn, help to improve overall success rates of ISD projects. The resulting research question is:

"How did the understanding of control in IS development projects evolve over time and what are the implications for control effectiveness?"

The remainder of this paper looks as follows. In the following section, we define key terms to establish a common understanding of the control concept in ISD. Subsequently, we give information about the applied search and selection process and an overview of the systematically reviewed literature before presenting the results in chapter four. Finally, we discuss our findings and point to implications for future research.

Conceptualizing ISD project control

First definitions of control in the context of ISD projects go back to 1970. Back then, control was seen as a series of system documents (e.g. system description, functional descriptions, change history) (Hill 1970), whose creation's "rewards are worth the effort" (Schmitt and Kozar 1978, p. 11). Nowadays, control in ISD projects is typically defined as a means to adjust the controllees' behavior in a way that it is consistent with organizational goals. Following the popular definition of Kirsch (1997), control can be exercised via an almost infinite set of different mechanisms. Accordingly, we define ISD project control as the sum of all mechanisms implemented in ISD projects to adjust the employees' behavior with the intention of promoting project success.

The traditional view on control sees two parties involved in a so-called dyadic relationship: a controller executing control and a controllee who is being controlled. Depending on the setting, those two roles can occur in various constellations. In a company-internal ISD project, the project manager might execute control over a developer. In an outsourced ISD project, the buying company might execute control over the external seller. Moreover, dual roles can be observed in practice and thus should be taken into consideration (Soh et al. 2011). For instance, project managers themselves might be controlled by another controller such as the company's line management. To better illuminate the controllee perspective, the unit of analysis will be the individual level and organizational implications will be of lower importance.

Depending on their characteristics and underlying strategy, control mechanisms can be either formal or informal. Kirsch (1996) referred to this classification as control modes and provided a first overview. Those control modes have been taken up by various researchers and were only slightly adapted since then. Table 1 gives an overview of the different control modes and suggests exemplary control mechanisms (Kirsch 1997, 2004; Tiwana and Keil 2009; Wiener et al. 2016).

It is important to remark that most control mechanisms require active commitment from the controllee to function properly. From the perspective of the controllee, this implies some freedom of choice (for instance, whether one wants to attend a meeting or not).

Table 1. Control modes and examples

Control mode	**Characteristics and *exemplary control mechanism***	
Input	ensure appropriate resource allocation *team members are selected based on professional and personal skills*	Formal
Behavior	specify and monitor rules, procedures *regular meetings and feedback*	
Outcome	reward or sanction controllee output *financial bonus if controllee's work meets the initially defined criteria*	
Clan	foster shared team norms and values *promote socialization among team members (e.g. organizing regular team events)*	Informal
Self	promote intrinsic motivation *reward successful self-management (e.g. allow for autonomy and individual empowerment))*	

We will refer to those control mechanisms as *manual*. In contrast, *automated* control could strictly enforce some desired behavior of the employees (e.g. source code is automatically checked by a system and rejected/penalized in case of syntax mistakes). So far, research on IS project control did not pay close attention to the possibility of automated control. As soon as it is technically more feasible, the controller could also observe and sanction undesired behavior of the controllee automatically with system support (e.g. working times, written lines of code, number of mistakes). For the purpose of this literature review, we will focus on the currently prevailing manual control mechanisms. However, we see an increased number of automated control mechanisms in the future of IS project control.

Literature Search and Selection

To perform a comprehensible literature review, we mainly followed the leading practices suggested by Levy and Ellis (2006) and by Webster and Watson (2002). In the following, we will describe the systematic input collection and the selection process.

We decided to search within the "Senior Scholars' Basket of Journals", as suggested by the Association for Information Systems (AIS). The basket consists of eight high-quality journals publishing research in the field of information systems and is highly renown by researchers. Our analysis covered a period from March 1977 to June 2018. Due to the thematic orientation of the chosen journals, we considered all papers where the two terms 'control' and 'project' were included either in the title, abstract or in the keywords. The keyword 'project' was included due to our focus on project settings. By using only two search terms and focusing on the AIS-8 journals, we minimized the risk of missing any relevant papers while still receiving a manageable number of search hits. As we were only searching in IS-related journals, there was no need to include keywords such as 'IS', 'IT', or 'ISD'. Table 2 gives an overview of the searched journals, time coverage and number of search hits before and after reviews.

Table 2. Overview of journals and no. of hits

Journal *(time coverage)*	No. of search hits	No. after 1st review	No. after 2nd review
European Journal of IS *(1991 – mid 2018)*	20	12	6
Information Systems Journal *(1998 – mid 2018)*	7	5	3
Information Systems Research *(1990 – mid 2018)*	12	10	6
Journal of AIS *(2000 – mid 2018)*	5	3	1
Journal of Information Technology *(1986 – mid 2018)*	16	5	4
Journal of Management IS *(1984 – mid 2018)*	7	5	4

Journal of Strategic IS *(1991 – mid 2018)*	6	0	0
MIS Quarterly *(1977 – mid 2018)*	18	11	5
Sum	**91**	**51**	**29**

In a first step, we checked the 91 resulting articles for their suitability (i.e. their actual focus on ISD project control) and we removed false positives. For instance, a false positive could be a paper with the phrase "we control for" in the abstract within an IS project setting while not actually focusing on control. To extend the current understanding of ISD project control, our sample covers a broad set of contexts, such as insourced and outsourced ISD projects in various industries, agile approaches as well as different types of control and organizations. We focused on control in ISD projects, but to not exclude control in other IS-related projects (e.g. a project with the objective of implementing a new software system). Regarding research methodologies, we considered empirical investigations as well as theoretical research of qualitative and quantitative nature. However, one important selection criterium was that ISD project control is the main theme of the respective paper. Borderline cases remained in the first selection but were marked for a second review. Subsequently, the remaining 51 papers were rechecked for the final selection decision. Finally, we arrived at 29 papers, which were relevant for our literature review. The resulting papers should provide a solid foundation, but we included additional papers from other journals and conferences when appropriate. Additional papers were gathered via backward search (citations within the selected papers) and via supplementary database search using Google Scholar. Using forward search, we were able to include most recent contributions to conference proceedings which referred to our selected journal papers, arriving at 48 included papers overall.

Results

Our results indicate that the requirements imposed on IS project control have changed significantly over time. Emerging trends and patterns in software development had to be addressed by control research. For instance, recent development trends towards more lightweight and agile approaches ask for new ways of executing control over the involved project team members. The same applies to the increasing scopes of development projects, which often go hand in hand with geographic distribution and the need to control large project teams. For a better understanding of the development of control in IS projects, its changing requirements and upcoming challenges, we will orient the presentation of our results towards the evolution of IS development.

The beginnings of ISD and its control

First research on control in ISD projects can already be found at the beginning of the reviewed journals in the 1970s. This is for a reason: after first steps in software development in the 1950s have been made, rapid increase in computational power and the increasing complexity of problems led to a great difficulty of writing efficient and useful computer programs within time and budget (Auer et al. 1990). In addition, organizations were facing more and more quality issues in their software developments. Those difficulties (often referred to as the "software crisis") were in need of solutions (Bauer 1973). At that time, rigid ISD life cycles suggested that all software development projects should undergo a well-defined sequence of phases (Ahituv and Neumann 1984). Each phase was subdivided into a set of specific work steps to be followed carefully. The prevailing ISD life cycles at that time were considered as state-of-the-art by managers and thus widely applied.

However, soon after the ISD life cycles have gained popularity, it became apparent that they were no guarantor of project success. Researchers and practitioners started investigating cases of failed projects and found various possible explanations for project escalation: ranging from only reactive decision making to avoidable contract deficiencies and a lack of project control (Schmitt and Kozar 1978). Remarkably, at that time, control was often seen as limited to documenting information like detailed functional descriptions, program descriptions or maintaining a change history. In short, monitoring the fulfillment of predefined descriptions and considering the schedule was seen as sufficient. Already at

that time, some research noted that strict project planning and control schemes might be useless or even detrimental for project success. In a survey of IS project managers, tight control schemes were said to frustrate project leaders because "they were helpless in doing anything about improving performance beyond cutting corners" (Powers and Dickson 1973, p. 154).

First extensive research on the implementation of control mechanisms has been done already in the 1970s. For instance, Ouchi (1979) noted that there is a clear need to align employees' objectives with organizational ones. Even if Ouchi did not focus on a project setting in his conceptual framework, he had laid the foundation for later research on control in IS-related projects (may it be software development or any other kind of IS implementation projects).

Apart from Ouchi, also Eisenhardt in the 1980s made considerable contributions in the field of (general) control within organizations (Eisenhardt 1985). By combining the so-called "organizational approach" to control, adding perspectives from agency theory, Eisenhardt proposed a first comprehensive framework for implementing a control system in organizations. Her suggestions included concrete control strategies following two basic approaches: First, a focus on behavioral control would observe and reward or penalize the controllees' behavior. The second approach focused on evaluating the controllees' outcome. The control strategy decision should be mainly based on behavior observability, task programmability and the level of uncertainty (Eisenhardt 1985).

Phase of ISD projects' maturity

Starting roughly in the early 1990s, the rise of the Internet fueled the importance of ISD projects. More and more experience in managing those projects could be gained, which attracted the attention of researchers and practitioners. However, a large part of the projects was still subject to escalation (mainly regarding time, cost and/or quality) or even abandonment. Various potential reasons were determined: uncertainty regarding the requirements (e.g. through a lack of knowledge stability), scope creep, poor coordination or intangibility of software products – just to name a few. Nidumolu (1996) emphasized the need for coordination in IS projects. Although his definition of control was extremely vague ("the extent to which development process is under control" (Nidumolu 1996, p. 79), he extended the understanding of control in IS projects by adding "coordination" as an important aspect for gaining control. Nidumolu further distinguished between vertical and horizontal coordination. Vertical coordination involves at least two persons of different hierarchical positions within a company or project team. In contrast, horizontal coordination reflects the extent of mutual adjustment and communication on the same hierarchical level.

A paper of Kirsch (Kirsch 1997) can be seen as the first major and more holistic research on control in the context of ISD projects. The paper studies four cases and puts a special focus on the process of choosing and implementing different control mechanisms within an ISD setting. In other words, Kirsch wanted to identify criteria to predict why and when controllers favor specific control mechanisms over others. She finds that "the choice of particular control mechanisms depends on task characteristics, role expectations, and project-related knowledge and skills" (Kirsch 1997). To give an example, she could observe that self-control was predominating in a setting with well-defined tasks and highly skilled project team leaders. Regarding the process of creating a portfolio of control modes, Kirsch suggested a process consisting of three subsequent activities. First, controllers tend to rely on already existing mechanisms of formal control and add them to the control portfolio. To be included in the portfolio, control mechanisms have to be available, accepted and must also be perceived as appropriate by the controllers. Second (if more control mechanisms are necessary), new mechanisms of formal control are defined and included. In a third step (again, only if necessary), appropriate informal control mechanisms are determined and added. This enriched understanding given by Kirsch provided a solid foundation for future research over the following years.

Apart from the process of control choice, Kirsch concluded with two more aspects on control: The so-called control purpose and the potential need for changing control. Control purpose focuses on the control's underlying objectives. At that time, control tended to be goal-oriented and purposive, concentrating on coordination and monitoring tasks (Green and Welsh 1988). However, Kirsch pointed out that control might be implemented also for other reasons, e.g. to foster relationships or to elicit

individual contributions. Regarding the need for changing control, Kirsch stated that there is only little knowledge about how and why control changes over time. Indeed, this aspect of control change was later taken up by researchers.

To sum up, research in the field of control in IS projects gained increasing attraction not until the end of the 1990s. Mainly starting with the research of Kirsch (Kirsch 1996, 1997), general control concepts of business management were applied to an IS project setting. In addition, insights from first case studies helped to extend the fragmented understanding of control. Reviewing the literature of that time, we can observe a strong research focus on the introduction and classification of control (i.e. formal and informal control). Research continued focusing on finding out how and which types of control should be implemented under which circumstances. However, all reviewed literature focused on the decisions of the controllers and their perception of the situation. This is remarkable because the dyadic control relationship also includes one or more controllees, who are being controlled.

The rise of lightweight ISD approaches, project outsourcing and offshoring

In 2000, a study of Keil et al. investigated reasons for software project escalation. They found that still, 30% to 40% of the analyzed ISD projects exhibited some degree of escalation (Keil et al. 2000). The authors identified issues related to agency theory (i.e. mainly information asymmetry and goal incongruence) as the main reason for project failure. The results of this study might have been a trigger for researchers to shift their view on control from mainly monitoring and coordinating to also tackling agency problems. Moreover, emerging trends in software development challenged existing control strategies.

Starting approximately at the beginning of the 21st century, tremendously growing demand for software systems also in smaller organizations required cheaper development approaches. As a consequence, an increasing number of lightweight and more flexible ISD approaches competed with the traditional and more rigid (waterfall) approaches. For instance, extreme programming (XP) cut the sequential phases of traditional waterfall models into small pieces and distributed them throughout the entire software development process (Beck 1999). Agile approaches like SCRUM see the software development process as "a loose set of activities that combines known, workable tools and techniques with the best that a development team can devise to build systems" (Schwaber 1997, p. 1). The underlying assumption is that the development process cannot be perfectly planned, estimated and successfully completed, what makes more flexible (agile) approaches necessary. All IS development approaches have their advocates and opponents. For the purpose of this paper, it is important to note that all approaches come with diverging needs on control. For instance, daily meetings in SCRUM are some essential kind of control mechanism needed in agile settings but usually not part of a traditional waterfall model. At the same time, the control portfolio of a project following traditional waterfall approaches usually contains several written documentation tasks.

With the growing spread of agile (i.e. more flexible and lightweight) development approaches, research on control was confronted with a new challenge: there was the need to bridge a gap between allowing for enough freedom and flexibility while still ensuring an appropriate level of control. Moreover, agile approaches (in comparison to traditional ones) empower the project team members to make decisions, bearing additional risks (McAvoy and Butler 2009). Maruping et al. observe that outcome control (in form of status meetings and reports) is often appropriate in an agile setting (Maruping et al. 2009). Another study on distributed agile software development concludes that both formal and informal control modes can be beneficiary when appropriately combined with mediated communication technologies (Persson et al. 2012). The growing number of studies on creating more responsive control portfolios led to criticism that research on control change should not only focus on managing ISD projects but also more generally on IS processes (Cram et al. 2016).

Another trend emerging roughly together with the rise of agile approaches was the accelerating tendency towards outsourcing of ISD projects. Usually with the aim of cost reduction and to gain access to a larger pool of professionals, many companies started outsourcing software development (Kliem 2004). The trend of outsourcing or offshoring ISD projects comes not only with potential advantages but also with risks, which include but are not limited to: misaligned interests of vendor and seller,

geographic dispersion impeding communication and increased reliance on third parties. These potential difficulties do not only apply to outsourced or offshored projects, but also to large organizations when deploying common systems globally (Kirsch 2004).

To address those new challenges arising with outsourced, offshored or distributed software development, researchers conducted studies to investigate, whether control portfolios intended for internal use would also work in external settings. For example, Choudhury and Sabherwal observed the development of control portfolios in outsourced software development projects (Choudhury and Sabherwal 2003). They find commonalities and differences compared to internal ISD projects: relying on the same control modes (behavior, outcome, self, clan), the authors observed a strong focus on outcome control at the beginning of outsourced/offshored projects. If necessary, behavior control was added at a later stage. They explain the lack of clan control with the difficulty to promote socialization across organizational boundaries (similar to Eng et al. 2012). In a similar vein, controllers might have difficulties to establish a culture, which promotes self-control of a project's controllees (Choudhury and Sabherwal 2003). Tiwana and Keil also analyze control choices within internal and external ISD projects. They find that outcome, behavior and clan control are prevailing in outsourced projects (which they refer to as controller-driven control mechanisms). In contrast, in internal projects, controllers rely more strongly on controllee-driven control mechanisms (i.e. self-control) (Tiwana and Keil 2009).

Also, some literature focused on the knowledge aspect of IS control: It could be observed that conducting boundary-spanning activities fosters knowledge-sharing between client and vendor and, in turn, positively impacts the effectiveness of formal control mechanisms (Gopal and Gosain 2010). Boundary-spanning objectives include physical prototypes, accounting ledgers, design documents, software or engineering sketches. Moreover, clan control successfully implemented across organizational boundaries foster bilateral knowledge transfer, which is beneficiary for project success (Kirsch et al. 2010; Wiener et al. 2015).

However, the intensified scientific discourse on control starting in the 2000s also gave rise to skeptical voices and concerns. Nidumolu and Subramani were among the first researchers who noted that control in software development "involves trade-offs between often conflicting requirements" (Nidumolu and Subramani 2003, p. 160). To be more precise, they saw conflicts between enforcing discipline and uniform development approaches (by executing control) and incorporating autonomy to nurture creativity and resourcefulness of developers. This view implies that maximizing the amount of control is not necessarily the best option to promote project success. The authors therefore investigated different control strategies to find a tradeoff between an adequate level of control while maintaining sufficient room for creativity and autonomy. For this purpose, they draw on the widely accepted view in ISD control literature (Kirsch 1997) and included various additional factors such as the firm size to investigate effects on process performance. Roughly at the same time, in 2003, Drummond and Hodgson go one step further and criticize the prevailing assumption that control is crucial for the success of IT project management. They state that control-based approaches can even harm project success by implementing more control as a first-order thinking in case of issues. By doing so, they argue that controllers rather address the symptoms instead of the underlying problems (Drummond 1996; Drummond and Hodgson 2003). Moreover, many failures are not technical ones but social and political failures and thus hardly preventable by the implementation of rigid control mechanisms (e.g. suggested by renown project management frameworks like PRINCE2). Drummond and Hodgson in their work promote rather outdated views on control (i.e. rigid and formal control mechanisms) and do not include more elaborated control concepts. However, they contributed to the scientific discourse by pointing out that control can sometimes be even counterproductive and that situations, which appear chaotic to the controller might actually be under control. Likewise, Madsen et al. argue that control is often equated with factors like a stable environment, regular patterns, or conformity (Madsen et al. 2006). They conclude that managers may have to accept that an ISD project is not entirely under control and recommend to see control rather as an emergent property of the ISD situation (Madsen et al. 2006). Other researchers remarked that control should not be isolated from user and requirement risk, as they negatively moderate the effects from formal and informal control on performance (Keil et al. 2013) or that also hidden political maneuvers on an individual or collective level could disturb rational decisions in ISD projects (Jiang et al. 2002; Sabherwal and Grover 2009).

The discovery of the controllee

Potentially as a response to the emerging criticism on control and the continuously low success rates of ISD projects, research has started attempts to extend the understanding of control over the last couple of years. Until then, various factors have been determined that should be considered when creating a control portfolio, e.g. task characteristics, role expectations, project-related knowledge and skills, development approach or the type of project (internal/external). Simply put, the choice of control mechanisms should be based on the project characteristics and its environment. This included also aspects regarding the controllees (for instance, when controllers considered personal characteristics of the controllees, such as professional experience and expertise). This seems at face value, because competent and experienced employees might need less control to finish their tasks within time, cost and at the desired quality as compared to unexperienced employees. However, also experienced employees might need control in order to tackle issues that rise from agency problems (i.e. conflicting goals of controller and controllee). Remus et al. reiterated those considerations with the concept of *control purpose* to help practitioners be more reflective on the underlying control objectives. The authors argue that control is either appropriation-oriented to address conflicting interests (agency theory) or coordination-oriented to allow coordination to be achieved most effectively (stewardship theory). Being aware of the control purpose should help practitioners to make better control choices (Remus et al. 2015).

Later, Gregory and Keil were among the first researchers who significantly expanded the still limited understanding of IS project control. They did not only examine *which* control mechanisms should be implemented, but they also analyzed *how* a chosen set of control mechanisms should be executed. In an empirical study, they investigated how IS project managers and team members deal with contrasting styles of project management (Gregory and Keil 2014). Two different management styles emerged: the bureaucratic and the collaborative style. The bureaucratic style promotes behaviors to track and evaluate activities (regarding the use of formal controls), whereas the collaborative style accounts for behavior to build shared understanding and commitment (regarding the use of informal controls) (Gregory and Keil 2014). The authors conclude that both styles should be effectively combined based on aspects such as the required skills, capabilities, and personalities of the involved persons. Research heading towards the same direction can be found by Remus et al. (2016). Similarly, Gregory, Beck and Keil in another study find that also in offshored projects, the choice of control mechanisms is only one of three aspects that should be taken into consideration (Gregory et al. 2013). Apart from the different control types (i.e. informal vs. formal ones), they identify two more aspects to be considered when executing control: first, the control degree that is based on frequency, number and intensity of control (tight vs. relaxed). Second, the control style that represents the direction of who is controlling whom (unilateral vs. bilateral). Finally, the authors argue that prior research had a strong one-dimensional focus on types of control and new ways of looking at control phenomena are needed (Gregory et al. 2013).

In 2016, Wiener, Mährich, Remus and Saunders take up the suggestions from Gregory et al. and propose an expanded theoretical framework on control configuration and enactment in IS projects (Wiener et al. 2016). The authors correspond with Gregory et al. and argue that merely researching the optimal configuration of a control portfolio neglects other important aspects to improve control effectiveness. More precisely, they introduce the term "control enactment", which reflects on *how* the controller interacts with the controllee. It consists of two aspects: control style and control congruence. First, control style can take roughly an authoritative or an enabling form (comparable to Gregory's bureaucratic and collaborative management styles). Second, control congruence reflects on the degree of similarity between the controller and controllee perceptions of enacted control. Wiener et al. further divide congruence into communicational congruence (i.e. the degree of shared understanding between controller and controllee) and evaluational congruence (i.e. the level of agreement between controller and controllee regarding appropriateness of enacted control mechanisms). Probably due to its recency, we could not find any empirical investigations of the extended framework at the time of writing this literature review. Other recent research going into a similar direction can be found from Heumann et al. (2015). The authors in their study find that task complexity, legitimacy concerns, performance considerations and performance/efficiency concerns are among the main factors influencing the controller's choice of style when enacting control (Heumann et al. 2015).

As a next step to better understand control phenomena in IS projects, Cram and Wiener (2018) put the controllees' perception of control into focus. They find that controllers should take several aspects into consideration when making decisions regarding control choice, control degree and control style. According to Cram and Wiener, it is crucial that controllees perceive enacted control mechanisms, degree and control style as legitimate. To increase control legitimacy and, in turn, improve outcomes and controllee satisfaction, controllers should take into account controllees' desire for justice, autonomy, group identification and competence development (Cram and Wiener 2018). First empirical observations of Cram and Wiener showed that, for instance, tight control is not always seen as illegitimate. To give an example, daily routines in agile development were seen as a tight control mechanism. Nevertheless, those daily routines were perceived as legitimate because they still provided the controllees with a high degree of autonomy.

Discussion and suggestions for future research

Our literature review yields three main findings. The first finding relates to the unit of analysis. Until recently, control phenomena in ISD projects were mainly illuminating the perspective of the controller. First research in the 1960s proposed very rigid guidelines for implementing a limited set of control mechanisms in also very rigid ISD life cycles. Those control mechanisms were mainly concerned with monitoring and coordination activities. It soon turned out that those over-simplified "one-fits-all" solutions worked neither for all available software development approaches nor for the increasingly diversified ISD contexts (e.g. outsourcing or offshoring settings). Perhaps in response to low success rates of ISD projects, researchers started extending the selection criteria for project managers when creating a control portfolio. In other words, they recommended to consider more aspects related to the project environment and the project team members' characteristics (e.g. task characteristics, expertise of controllees, size and type of the ISD project). Aim of this extension was to implement a set of control mechanisms that better fits specific situations. However, studies such as the Standish Group's CHAOS report teach us that success rates of ISD projects remained at a low and unsatisfactory level (Hastie and Wojewoda 2015; Johnson 2018), indicating that control in its existing form was not able to adequately promote project success. Only over the last couple of years, research has started seeing also the controllee as an important unit of analysis. This was overdue as the traditional view on control includes both a controller (executing control) and a controllee (being controlled). As most control mechanisms enacted today are of manual nature, they are depending on the controllees' willingness to actively commit. Consequently, the perception of the controllees and their resulting behavior can considerably promote or impede the effectiveness of ISD project control. This is because some controllee behavior might only be observable to a limited extent, giving the controllees considerable scope of action. One consequence which was already observed by researchers is that controllees tend to keep unfavorable information secret (mum effect) (Park et al. 2008). Even worse, controllees perceiving control as too tight might not only withhold information but even behave detrimentally. For example, if controllees feel harassed by the instruction to document every single work step, they might tend to start tracking their progress carelessly or start glossing over information to satisfy their controller with the desired but wrong information. In the end, this would seriously jeopardize control effectiveness or even make control mechanisms counterproductive. Also, other forms of resistance to control mechanisms perceived as inappropriate could be observed (e.g. ignorance or neglect of required work steps related to a control mechanism). A study recently published by Cram and Wiener (2018) comes with important contributions on the way to a better understanding of the controllee perspective. Even if previous research has extended the knowledge on how to make more suitable control choices, Cram and Wiener were (at the best of our knowledge) the first to clearly put the controllee perspective into focus. They state that "without explicitly considering controllee attitudes and preferences, managers may inadvertently select and implement controls that contribute to subordinate dissatisfaction and stress, potentially leading to negative side-effects on ISD performance (e.g. efficiency, quality, speed)" (Cram and Wiener 2018, p. 712). We want to go even one step further and suggest that enacting control, which is perceived as inappropriate by controllees could even lead to (intentionally) detrimental behavior. Consequently, additional knowledge about the controllees' perspective and their resulting behavior should be gained. Future research in this direction could pose questions such as: *How does the employees' perception of control mechanisms impact their compliance intentions?*

Our second finding relates to the project contexts, which have been investigated so far. Following the evolution of IS development and its different approaches, also the understanding of control developed and was extended over time. Researchers identified a huge set of relevant aspects (e.g. controllee characteristics, role expectations) in various settings (e.g. waterfall and agile approaches, internal and outsourced projects), resulting in a huge set of factors to be considered when choosing and enacting control within an ISD project. So far, most researchers put a focus on a specific but isolated setting. This could be a comparison of control in internal versus outsourced ISD projects or an investigation of different control modes within a specific setting. However, increasingly complex environments of today's IS development projects would ask for some more integrated research. For instance, a project manager might be confronted with both internal and outsourced projects involving different controllees and ISD approaches, for which an optimal control portfolio and control enactment is needed. We are aware that integrating and further extending previous research will be a highly challenging task and interdependencies might bias results. Nevertheless, existing studies are often too isolated to help practitioners improving their choice and enactment decisions when implementing control in very complex real-world situations. Possible research questions include: *How do project contextual factors (such as project complexity, development approach, team size) impact the employees' perceived appropriateness of implemented project control mechanisms?*

Third, we see the necessity to quantify the impact of different control characteristics, which have been identified over the last years. Researchers have proposed more and more aspects, which should be considered for an optimal control choice and effective control enactment, including initial findings from Cram and Wiener, who found control mode, degree and style to significantly influence legitimacy perceptions. This legitimacy perception might also impact the controllees' resulting behavior when it comes to compliance with implemented controls. The extended understanding of control activities is good, because a large set of factors and control characteristics is needed to cover the wide range of possible contexts when developing IS in practice. However, there is an increasing risk of arriving at an unmanageable high number of factors. As managers typically have to make compromises due to limited resources and conflicting interests, we can expect some aspects to be more beneficiary as compared to others. Consequently, we want to encourage researchers to shift their focus towards prioritization. Existing research is mainly built on case studies, which are analyzed mainly qualitatively at a smaller scale. Especially when shifting the focus towards the controllee perspective, applying semi-quantitative approaches like factorial surveys could help to get not only a list of potential factors, but also a first idea of how strongly different factors are shaping the controllee's perception and resulting behavior. A better understanding of the weightings could support decision makers (i.e. project managers) when trying to find the best trade-off for implementing a set of control mechanisms, which is perceived as appropriate and thus supported by the affected controllees. To give an example, it might be valuable for project managers to know whether the control degree has a higher impact on legitimacy perceptions as compared to control style. One potential question for further research might look as follows: *To what extent do control mode, degree and style influence employees' perceived control appropriateness in IS projects?*

As with any research, also this literature review comes with limitations. By searching the AIS Senior Scholars' Basket, we aimed at covering papers published by the eight most renown journals in the field of IS research, supplemented with additional papers from the references and a Google Scholar database search. However, we cannot guarantee that there might be some additional relevant papers available that are not included in our work. Given our focus on high-quality journals and their typically long revision cycles of up to three years, there is also the possibility that we could not include some of the most recent findings, which will be published in the near future (although we are covering papers that were published until mid-2018).

Conclusion

In this paper, we reviewed literature in the field of ISD project control. By establishing a connection to the evolution of software development, we wanted to allow for a better understanding of the formation and development of the concept of 'control' both in research and practice. Overall, we found that research has made considerable progress in the past few years. More and more relevant aspects have

been included and the focus has shifted from merely considering the choice of control mechanisms towards also considering the enactment of control (i.e. how the chosen control mechanisms should be executed by controllers). However, previous research has almost exclusively taken the controller as unit of analysis while ISD project success rates keep stagnating at a low level. Consequently, it is time to further expand the knowledge about control by shifting the focus towards the second part of the dyadic control relationship: the controllees. Moreover, previous findings from diverse but also dispersed project settings should be better integrated to address today's complex project environments. Finally, literature is already covering many important aspects regarding the project and employee context. Those aspects should be quantified in a next step (e.g. to allow project managers for prioritization). In summary, we argue that a more holistic understanding of the ISD project context and the controllees' perception of control is needed to improve control effectiveness and, in turn, overall ISD project success rates.

References

Ahituv, N., and Neumann, S. 1984. "A Flexible Approach to Information System Development," *MIS Quarterly* (June), pp. 69–79.

Aronin, B. S., Bailey, J. W., Byun, J. S., Davis, G. A., Wolfe, C. L., Frazier, T. P., and Bronson, P. F. 2011. "Expeditionary Combat Support System : Root Cause Analysis," *Institute for Defense Analyses (Working Paper)*.

Auer, A., Levanto, M., Okkonen, A., and Okkonen, J. 1990. "Solution in Software Crisis," *Microprocessing and Microprogramming* (30:1–5), pp. 273–280.

Bauer, F. L. 1973. "Software and Software Engineering," *Society for Industrial and Applied Mathematics (SIAM) Review* (15:2), pp. 469–481.

Beck, K. 1999. "Embracing Change with Extreme Programming," *Computer (IEEE Computer Society)* (32:10), pp. 70–77.

Choudhury, V., and Sabherwal, R. 2003. "Portfolios of Control in Outsourced Software Development Projects," *Information Systems Research* (14:3), pp. 291–314.

Cram, W. A., Brohman, M. K., and Gallupe, R. B. 2016. "Hitting a Moving Target: A Process Model of Information Systems Control Change," *Information Systems Journal* (26:3), pp. 195–226.

Cram, W. A., and Wiener, M. 2018. "Perceptions of Control Legitimacy in Information Systems Development," *Information Technology & People* (31:3), pp. 712–740.

Drummond, H. 1996. "The Politics of Risk: Trials and Tribulations of the Taurus Project," *Journal of Information Technology* (11:4), Nature Publishing Group, pp. 347–357.

Drummond, H., and Hodgson, J. 2003. "The Chimpanzees' Tea Party: A New Metaphor for Project Managers," *Journal of Information Technology* (18:3), pp. 151–158.

Eisenhardt, K. M. 1985. "Control: Organizational and Economic Approaches," *Management Science* (31:2), pp. 134–149.

Eng, C., Lim, W.-K., Soh, C., and Kien, S. 2012. "Enacting Clan Control in Complex It Projects: A Social Capital Perspective," *MIS Quarterly* (36:2), pp. 577–600.

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. 960–982.

Green, S. G., and Welsh, M. A. 1988. "Cybernetics and Dependence: Reframing the Control Concept," *The Academy of Management Review* (13:2), p. 287.

Gregory, R. W., Beck, R., and Keil, M. 2013. "Control Balancing in Information Systems Development Offshoring Projects," *MIS Quarterly* (37:4), pp. 1211–1232.

Gregory, R. W., and Keil, M. 2014. "Blending Bureaucratic and Collaborative Management Styles to Achieve Control Ambidexterity in IS Projects," *European Journal of Information Systems* (23:3), Nature Publishing Group, pp. 343–356.

Hastie, S., and Wojewoda, S. 2015. "Standish Group 2015 Chaos Report - Q&A with Jennifer Lynch," *InfoQ*. (https://www.infoq.com/articles/standish-chaos-2015, accessed May 16, 2018).

Heumann, J., Wiener, M., Remus, U., and Mähring, M. 2015. "To Coerce or to Enable? Exercising Formal Control in a Large Information Systems Project," *Journal of Information Technology*

(30:4), pp. 337–351.
Hill, P. B. 1970. "The Control of Large-Scale Software Projects," *IAG Journal* (3:4), pp. 1–12.
Jiang, J. J., Klein, G., and Discenza, R. 2002. "Pre-Project Partnering Impact on an Information System Project, Project Team and Project Manager," *European Journal of Information Systems* (11:2), pp. 86–97.
Johnson, J. 2018. "Decision Latency Theory: It Is All About the Interval (CHAOS Report Series)."
Keil, M., Mann, J., and Rai, A. 2000. "Why Software Projects Escalate: An Empirical Analysis and Test of Four Theoretical Models," *MIS Quarterly* (24:4), pp. 631–664.
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), Nature Publishing Group, 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. 215–239.
Kirsch, L. J. 2004. "Deploying Common Systems Globally: The Dynamics of Control," *Information Systems Research* (15:4), pp. 374–395.
Kirsch, L. J., Ko, D.-G., and Haney, M. H. 2010. "Investigating the Antecedents of Team-Based Clan Control: Adding Social Capital as a Predictor," *Organization Science* (21:2), pp. 469–489.
Kliem, R. 2004. "Managing the Risks of Offshore IT Development Projects," *Information Systems Management* (21:3), pp. 22–27.
Levy, Y., and J. Ellis, T. 2006. "A Systems Approach to Conduct an Effective Literature Review in Support of Information Systems Research," *Informing Science: The International Journal of an Emerging Transdiscipline* (9), pp. 181–212.
Madsen, S., Kautz, K., and Vidgen, R. 2006. "A Framework for Understanding How a Unique and Local IS Development Method Emerges in Practice," *European Journal of Information Systems* (15:2), pp. 225–238.
Maruping, L. M., Venkatesh, V., and Agarwal, R. 2009. "A Control Theory Perspective on Agile Methodology Use and Changing User Requirements," *Information Systems Research* (20:3), pp. 377–399.
McAvoy, J., and Butler, T. 2009. "The Role of Project Management in Ineffective Decision Making within Agile Software Development Projects," *European Journal of Information Systems* (18:4), pp. 372–383.
Nidumolu, S. R. 1996. "A Comparison of the Structural Contingency and Risk-Based Perspectives on Coordination in Software-Development Projects," *Journal of Management Information Systems* (13:2), pp. 77–113.
Nidumolu, S. R., and Subramani, M. R. 2003. "The Matrix of Control: Combining Process and Structure Approaches to Managing Software Development," *Journal of Management Information Systems* (20:3), pp. 159–196.
Ouchi, W. G. 1979. "A Conceptual Framework for the Design of Organizational Control Mechanisms," *Management Science* (25:9), pp. 833–848.
Park, C., Im, G., and Keil, M. 2008. "Overcoming the Mum Effect in IT Project Reporting: Impacts of Fault Responsibility and Time Urgency," *Journal of the Association for Information Systems* (9:7), pp. 409–431.
Persson, J. S., Mathiassen, L., and Aaen, I. 2012. "Agile Distributed Software Development: Enacting Control through Media and Context," *Information Systems Journal* (22:6), pp. 411–433.
Powers, R. F., and Dickson, G. W. 1973. "MisProject Management: Myths, Opinions, and Reality," *California Management Review* (15:3), pp. 147–156.
Remus, U., Saunders, C., Wiener, M., Mähring, M., and Kofler, M. 2016. "Control Modes Versus Control Styles : Investigating ISD Project Control Effects at the Individual Level," *Thirty Seventh International Conference on Information Systems*, pp. 1–21.
Remus, U., Wiener, M., Mähring, M., Saunders, C., and Cram, W. A. 2015. "Why Do You Control? The Concept of Control Purpose and Its Implications for Is Project Control Research," *36th International Conference on Information Systems. Fort Worth*, pp. 1–19.
Sabherwal, R., and Grover, V. 2009. "A Taxonomy of Political Processes in Systems Development,"

Information Systems Journal (20:5), pp. 419–447.
Schmitt, J., and Kozar, K. 1978. "Management's Role in Information System Development Failures: A Case Study," *MIS Quarterly* (2:2), pp. 7–17.
Schwaber, K. 1997. "SCRUM Development Process," *Business Object Design and Implementation* (April 1987), pp. 117–134.
Soh, C., Chua, C. E. H., and Singh, H. 2011. "Managing Diverse Stakeholders in Enterprise Systems Projects: A Control Portfolio Approach," *Journal of Information Technology* (26:1), Palgrave Macmillan, pp. 16–31.
Tiwana, A., and Keil, M. 2009. "Control in Internal and Outsourced Software Projects," *Journal of Management Information Systems* (26:3), pp. 9–44.
Walser, R., and Virag, P. 2018. "Being Controlled : Exploring Controllees' View on Control in IS Projects," *IADIS 11th Conference on Information Systems*, pp. 185–192.
Webster, J., and Watson, R. T. 2002. "Analyzing the Past to Prepare for the Future : Writing a Literature Review," *MIS Quarterly* (26:2), Xiii–Xxiii.
Wiener, M., Mähnrich, 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. 741–774.
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.