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The Nature of Adherence to Planning as Criterion for Information System Project Success

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Abstract
Derived from engineering, adherence to planning (ATP) is the central and most often used criterion for the evaluation of information system (IS) projects. Although this evaluation is questionable as ATP does not account for all of IS projects' particularities, a systematic approach for the assessment of ATP's suitability in the context of IS projects is still missing. We propose a theory to explain the suitability of using ATP as success criterion for IS projects. Thereby, we use the project life cycle's processes and their outcomes as the theory's primary constructs. We argue for the constructs' interdependencies corroborated by a systematic literature review. Our results show that ATP's suitability is not given or at least questionable in many cases. Researchers and managers should adapt the way of evaluating IS projects to avoid misleading implications.

Keywords: explaining theory, adherence to planning, information system, project success, literature review

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The Nature of Adherence to Planning as Criterion for Information System Project Success

Abstract

Derived from engineering, adherence to planning (ATP) is the central and most often used criterion for the evaluation of information system (IS) projects. Although the phenomenon of deviations between ATP and subjective success perceptions is widely known, a systematic approach for the assessment of ATP's suitability in the context of IS projects is still missing. We propose a theory to explain the suitability of using ATP as success criterion for IS projects. Thereby, we use the project life cycle's processes and their outcomes as the theory's primary constructs. We argue for the constructs' interdependencies corroborated by a systematic literature review. Our results show that ATP's suitability is not given or at least questionable in many cases. Researchers and managers should adapt the way of evaluating IS projects to avoid misleading implications.

Keywords – explaining theory, adherence to planning, information system, project success, literature review.

Research Context, Question, and Method

Scholars have been discussing adherence to planning (ATP) as success criterion for projects in general and information system (IS) projects in particular over the last two decades (Cuellar, 2010; Pinto, 2004; Atkinson, 1999; Wateridge, 1995, Wateridge, 1998). ATP (also

called iron triangle (Atkinson, 1999) or triple constraint (Pinto, 2004)) is the traditional approach to assess project success (Atkinson, 1999; Baccarini, 1999). Its definition usually inhibits three criteria. Two of them are the same in all cases: budget and schedule. The third criterion is referred to as quality (Atkinson, 1999), performance (Pinto, 2004), and specification (Wateridge, 1998) and concerns the requirements and the question whether the system under implementation fulfills these. Therefore, ATP's definition in this article denotes a project's conformance to budget, schedule, and specified requirements (functional and non-functional; cf. also (Agarwal and Rathod, 2006)).

A project is defined as a "temporary endeavor undertaken to create a unique product, service, or result" (Project Management Institute, 2008, p. 5). Such an endeavor is in most cases defined in terms of cost, schedule, and performance requirements. Although IS projects in many ways differ from projects in general (Fuller et al., 2008, pp. 12-14), ATP has been transferred to the context of IS projects (Cuellar, 2010) to measure implementation or rather project management success; probably because they are easy to measure (Pinto and Slevin, 1988). In companies, ATP is the central and most often used criterion for the evaluation of (IS) projects (Collins and Baccarini, 2004; Joosten et al., 2011; Thomas and Fernández, 2008). Although project managers argue for using additional criteria, their companies, as a matter of measurability, rely on ATP for the evaluation of their IS projects (Joosten et al., 2011).

Studies describing success rates of IS projects solely or mainly rely on these criteria as well (El Emam and Koru, 2008; Sauer & Cuthbertson, 2003; Sonnekus & Labuschagne, 2003; The Standish Group International, 2009). These studies report that only about 16-50% of all IS projects are successful (measured in terms of ATP). However, these studies may be biased (e.g., Glass, 2005). The most prominent study, the Standish Group's CHAOS Report (The

Standish Group International, 2009), has been criticized for shortcomings like incomplete description of study design, lack of reporting project selecting criteria, and the insufficient definitions of successful and failed projects (Eveleens and Verhoef, 2010; Jørgensen and Moløkken-Østvold, 2006). Nevertheless, scholars often cite this report to motivate further areas of research and to demonstrate the importance of successful project management (e.g., Balijepally et al., 2009; Chiang and Mookerjee, 2004).

Many researchers agree that information system project success (ISPS) is a multidimensional construct (e.g., Aladwani, 2002; Yetton et al., 2000). Accordingly, many scholars state that ATP is insufficient (e.g., Atkinson, 1999; Baccarini, 1999), that is, ATP is limited to project management success and does not consider all relevant dimensions of IS projects. Consequently, researchers have proposed a multitude of measurement approaches (e.g., Agarwal and Rathod, 2006; Thomas and Fernández, 2008) including criteria like customer satisfaction, user satisfaction, and benefits for the parent organization. Especially satisfaction criteria seem to be suitable to evaluate projects due to stakeholders' different perceptions of success (Freeman and Beale, 1992; Pinto, 2004).

Despite on-going discussions, researchers have not solved the problem of a generally accepted ISPS measurement concept. Such a concept is needed to derive valid and meaningful implications concerning critical success factors in IS research and practice. Currently, many researchers use ATP as dependent variable to derive IS projects' critical success factors (e.g., Mitchell, 2006; Yetton et al., 2000). The generalizability of their results has to be scrutinized as the dependent variable ATP only covers a limited perspective of ISPS that does not necessarily match even project managers' perceptions (Furulund and Moløkken-Østvold, 2007b). This difference between subjective success perceptions and the success assessment in terms of ATP

leads to projects seen as successful failures or failed successes (Nelson, 2005). This observed phenomenon - why ATP as success criterion is suitable in some IS projects, whereas seems to be totally unsuitable in others - is still unexplained. In this article, we aim to propose a theory to explain the suitability of using ATP as success criterion for IS projects.

As can be seen, ATP is a central point in ISPS measurement in research and practice. Although many scholars have argued against the use of ATP for the measurement of ISPS as sole criterion and in general (e.g., Cuellar, 2010; Atkinson, 1999; Baccarini, 1999), others rely on ATP to assess whether projects are successful (e.g., (Mitchell, 2006; The Standish Group International, 2009; Yetton et al., 2000)). Without agreement between these two diverging views, there is lack of a common understanding whether ATP should be used for the evaluation of IS projects. Consequently, research is in need of a systematic approach for the assessment of ATP's suitability in the context of IS projects. As this approach is still missing, we aim to close this gap by answering the following research question:

How suitable is adherence to planning as success criterion for IS projects?

To answer this question, we need to understand ATP's nature and which factors influence it. Therefore, we propose a theoretical approach. When choosing a theoretical approach in IS research, there are five different types to choose from (Gregor, 2006). One of these is the explaining theory. To derive a theory, we consider ATP as the comparison of planned and actual project management data (i.e., planned and actual budget, schedule, and requirements). Thereby, data concerning project planning and tracking depends on several processes (Project

Management Institute, 2008, pp. 45-65). Consequently, an explaining theory needs to attach at this point and to refer to project life cycle's processes (Project Management Institute, 2008, pp. 45-65) and their outcomes. The processes as well as their outcomes are the influences affecting the data and thus also its comparison. We derive our explaining theory by putting the processes and their outcomes into the context of interdependent relations. For these relations, we systematically review existing research studies regarding the theory's primary constructs. Then, we use these relations to propose a chain of cause and effect from project initiation to project closing, that is, the final comparison of planned and actual data to decide whether an IS project has been successfully completed. Additionally, the primary constructs' interdependencies allow insight into whether ATP is suitable as ISPS criterion.

For researchers, we provide a theory to explain whether ATP is a suitable success criterion. Thereby, we provide new insights and direct future research to focus on the traditional approach or rather alternative criteria. Practitioners may use our results to decide whether to use ATP as criterion to evaluate their projects. Whereas additional criteria should anyway be assessed to evaluate overall success, practitioners need to decide whether to use ATP as criterion for project management success.

The remainder of this paper is the following. Next, we describe the identification of our theory's elements. Subsequently, we describe our explaining theory and argue for its structure corroborated by the literature review. Afterwards, we discuss our findings in the context of ISPS and project management in general. Finally, we provide implications for research and practice.

Identification of Theory's Elements

To answer our research question and to propose an explanation for the phenomenon of ATP's different degrees of suitability (cf. the introductory section), we aim to provide a theoretical explanation for ATP's suitability as criterion for ISPS (in the following short: ATP Theory). We intend to explain how and why different influences affect this success criterion's suitability. To develop such an explaining theory, we need to consider (1) primary constructs, (2) statements of relationship and related causal explanations, (3) means of representation, and (4) the theory's scope (Gregor, 2006).

Primary Constructs

To identify ATP Theory's primary constructs, we abstract from project life cycle's processes' single outcomes (Project Management Institute, 2008, pp. 45-65) and consider requirements, estimates and plans, changes, and progress reports as major outcomes. These outcomes are needed to assess project success by comparing planned and actual budget, schedule, and requirements. We concentrate on the processes of project management that affect the realism of project plans and therefore the suitability of ATP as indicator for success. Additionally, we use actors to consider external relations (customer delivering the requirements and project management that needs to act according to ATP's suitability).

Primary Constructs' Interdependencies

To corroborate our argumentation for ATP Theory's structure, we identified studies relating the primary constructs. Our search included articles published in leading IS and project management journals based on their titles and abstracts. We considered journals' ranking (Association for Information Systems and the senior scholars' basket of journals) and content and included the following ten journals in our search for relevant articles: European Journal of Information Systems, IEEE Software, IEEE Transactions on Software Engineering, Information Systems Journal, Information Systems Research, International Journal of Project Management, Journal of Information Technology, Journal of Management Information Systems, Journal of Systems and Software, and MIS Quarterly.

Articles relating project life cycle's processes and/or their outcomes (cf. ATP Theory's primary constructs in the previous section) to a project's conformance with budget, schedule, and specified requirements were the search's focus. The search included articles that were published since the beginning of 1995. The identification of articles also included a search backward and forward (Webster and Watson, 2002).

Initially, we identified 63 articles of potential interest. We read these articles in more depth to decide on final inclusion. If an article provided insights into the conditions, the current status, the causes or consequences of one or more of the primary constructs, it was included. Articles including such a contribution and their area of focus are presented in Table 1. 45 articles were excluded. For the remaining 18 articles, our search backward and forward led to a total of 26 articles. The literature's categorization was concept-driven (Webster and Watson, 2002).

Table 1. Concept-Matrix: Influences on ATP Theory

Citations \ Influences	ATP's Suitability: Requirements	Estimates Accuracy	Plans Realism	Project Changes	Progress Track/Report
(Abdel-Hamid, 1988)					X
(Andersen, 1996)			X		
(Austin, 2001)		X	X		X
(de Bakker et al., 2010)	X		X		
(Brooks, 1995)				X	X
(Costello, 1984)		X	X		X
(Dvir and Lechler, 2004)			X	X	
(Dvir et al., 2003)	X				
(El Emam and Koru, 2008)				X	
(Glass et al., 2008)		X	X		X
(Grimstad et al., 2006)		X			
(Han and Huang, 2007)	X				
(Hofmann and Lehner, 2001)	X				
(Iacovou et al., 2009)					X
(Jørgensen, 2006)		X			
(Jørgensen and Carelius, 2004)		X			
(Jørgensen and Grimstad, 2008)	X	X			
(Jørgensen and Sjøberg, 2004)		X			
(Keil et al., 2007)					X
(Keil et al., 2000a)					X
(Keil and Park, 2010)					X
(Keil et al., 2000b)	X				
(Kitchenham and Linkman, 1997)		X			
(Lederer et al., 1990)		X	X		
(Moløkken-Østvold et al., 2004)		X			
(Parkinson, 1955)		X	X		X

In most articles, the effects on budget and schedule and deviations between planned and actual data are the main focus. We present our theory and thereby provide the results of our systematic literature reviews in the section "Theory and Propositions".

Means of Representation

For the proposed ATP Theory, we need to define means of representation for the primary constructs and the relations.

Primary constructs are represented by white rectangles with a black border. Additionally, black arrows indicate the relationship between two different primary constructs. Thereby, the arrow is pointing towards the primary construct that is influenced by the primary construct the arrow is pointing from. Stick figures represent external actors.

Theory's Scope

A theory's scope specifies the degree to which the statements of relationships can be generalized or rather the theory's boundaries concerning generalizations (Gregor, 2006).

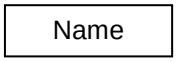
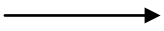
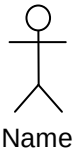
Although the presented ATP Theory uses outcomes of project life cycle's different processes as primary constructs, our systematic literature review focusses the context of software and IS projects due to the selection of journals. Thus, ATP Theory is also limited to this context. Thereby, we do not exclude any project type as the project life cycle applies to projects in general. Although for example agile projects differ from sequential developments, the theory applies to both types. Whereas sequential projects are conducted according to their plans, agile

projects determine which functionality should be realized in the next iteration. Nevertheless, in both cases, the primary constructs (requirements, estimates and plans, changes, and progress reports major outcomes) can be found.

Theory and Propositions

Table 2 provides an overview of the proposed ATP Theory and its elements (cf. the further information "Identification of Theory's Elements"). In the following, we argue for ATP Theory's structure and use our literature review to corroborate our argumentation.

Table 2. ATP Theory: Theory to Explain (according to Gregor, 2006) ATP's Suitability as Success Criterion

Theory Overview	
ATP's suitability depends on the comparison of planned and actual project data. This comparison is influenced by processes of the project life cycle (Project Management Institute, 2008).	
Theory Component	Instantiation
Means of Representation	Construct  Relationship  External Actor 
Primary Constructs	Requirements, Estimates Accuracy, Project Changes, Plans Realism, Progress Track/Report, ATP's Suitability
Statements of Relationship	See the subsections (1) – (10)
Scope	As the theory is built on the project life cycle, it is applicable to projects in general.
Causal Explanations	See the subsections (1) – (10)

The main criteria to assess whether assessments based on ATP are correct are first the realism of plans and second the correct tracking/reporting of a project's progress. To evaluate

ATP's suitability as ISPS criterion, it is necessary to assess whether the assessment in terms of a project's conformance with its planned budget, schedule, and specified requirements is conducted correctly. Based on these assessments, we explain the phenomenon why ATP as success criterion is not suitable for all projects.

ATP's suitability directly depends on the realism in project plans and the tracking and reporting a project's progress. Customer-driven requirements build ATP Theory's foundation. As requirements are an influence on estimation accuracy and change requests, these indirectly affect ATP's suitability as well. Following, we provide the constructs' relations based on empirical findings and theoretical considerations. Thereby, the numbers correspond to those of ATP Theory's illustration in Figure 1.

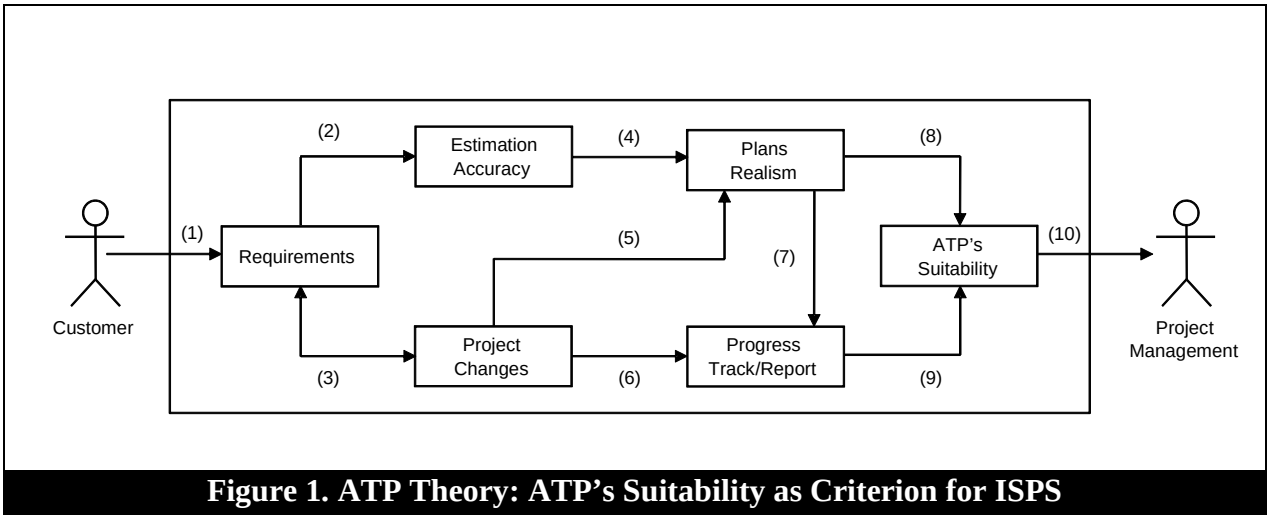


Figure 1. ATP Theory: ATP's Suitability as Criterion for ISPS

(1) Customers' Requirements

Contracted IS projects have internal or external customers defining the IS requirements. Although the contractor participates in the elicitation process, the requirements represent the

customer's needs. As result of the requirements engineering, ATP Theory's foundation are project's scope as well as functional and non-functional requirements.

To define the requirements, the involvement of customers or rather end-users is necessary and important (Dvir et al., 2003). Requirements engineering is supposed to be most crucial to IS development, mainly due to their great influence on later IS project phases (Hofmann and Lehner, 2001). Thereby, a project's scope and requirements are often (especially during early phases) unclear till the completion of a project. The level of uncertainty depends on the project's characteristics (e.g., level of innovation). This can be attributed to two distinct reasons. First, the customer is often not aware of what is really required in the desired IS (Fuller et al., 2008). Second, the process of specifying requirements is in many cases problematic (Jiang et al., 2009). The difficulties of predicting what is required can be attributed to the rapid changes that are underlying IS development (Gorschek et al., 2007). This leads to high uncertainty and thus a need for risk management. Thereby, risks are influences that may affect a project's budget and schedule (Lewis, 2005). Only if risks are controlled, a realistic assessment of a project's effort is possible. However, just the knowledge about risks is not sufficient (de Bakker et al., 2010) and it is too expensive to control all risks that may occur in IS projects (Kitchenham and Linkman, 1997). As requirements uncertainty may lead to rework, it is one of the greatest risks for developing an IS (Han and Huang, 2007). Therefore, projects with more effort in risk assessments are more likely to conform to their plans. In this context, a high degree of uncertainty related to continuance of a project leads to negative project results (Keil et al., 2000b). It is a likely risk that too little effort is spent on project planning (Boehm, 1991) and research seems to mainly focus on how risk management is supposed to work, instead of focusing on how it is really done in practice (de Bakker et al., 2010).

If a project is not directly contracted to an internal IS development department, the customer may announce the contract for bidding. The design of the bidding process can influence a project's granted budget (Jørgensen, 2006; Jørgensen and Carelius, 2004). The number of bidders should be kept low and it should be asked for bids as late as possible to secure that requirements are as certain as possible.

Requirements are ATP Theory's basic determinant (cf. Figure 1). If the requirements are completely and correctly elicited, the foundation for the suitability is given. Otherwise, the realism in project plans and progress tracking may by be flawed.

(2) Requirements and their Influence on Estimation Accuracy

Estimates are delivered for the effort to implement projects' specified requirements. Depending on the resources available, the time needed to implement such requirements can be derived. Consequently, estimation accuracy at least partly depends on project requirements.

With a high certainty, estimates are inaccurate (Kitchenham and Linkman, 1997). Apart from IS professionals seeing unclear requirements as cause for estimation inaccuracy (e.g., Furulund and Moløkken-Østvold, 2007a; Jørgensen, 2004; Jørgensen and Moløkken-Østvold, 2004), experiments have shown slightly different wordings in requirement specifications (irrelevant and misleading information) leading to significantly different estimates (Jørgensen and Grimstad, 2008). In this context, customer expectations also need to be mentioned. Customer expectations can be seen as additional requirements. It has been shown that such requirements significantly influence effort estimates when known by the estimation team (Jørgensen and Sjøberg, 2004; Jørgensen and Grimstad, 2008).

Furthermore, budgets are influenced during project initiation by haggling and political actions (Lederer et al., 1990). If for example user representatives believe that the project will not be accepted due to too high cost, the estimated effort is reduced without adapting the project's scope.

Requirements' influence on estimation accuracy (cf. Figure 1) in combination with the potential problems surrounding requirements engineering (cf. section (1) Customers' Requirements) show that ATP' suitability highly depends on these primary constructs.

(3) Changes of Project Requirements

The positive effect of planning quality is overridden to a large extent by goal and plan changes (Dvir and Lechler, 2004) that often occur in IS projects (Javed et al., 2004). Thereby, the relation between requirements and project changes is bi-directional.

First, projects' requirements are often unclear, ambiguous, and incomplete in the beginning (cf. section (1) Customers' Requirements). Apart from requirements uncertainty, change requests occur due to the demand of new features. Both causes have to be regarded to secure estimation accuracy and realism in project plans. Second, problems due to initially specified requirements change the project's scope. Thus, new, extended, or removed features have an impact on the requirements that are meant to be implemented during the project.

If a project's scope changes, it is important to precisely assess the consequences. As professionals name change requests as one of the most important reasons for inaccuracy (Jørgensen and Moløkken-Østvold, 2004; Lederer and Prasad, 1995), it seems that related consequences are not sufficiently assessed. Not changing plans and consequently exceeding

budgets may be one reason for project failure as changes in requirements and scope have been identified as one of the main reason for project cancelation (El Emam and Koru, 2008). Consequently, project changes need to be accurately considered as they influence project plans and their tracking and thus indirectly affect the suitability in the suggested ATP Theory (cf. Figure 1).

(4) Estimation Accuracy and Plans Realism

Even without any empirical evidence, it seems obvious that inaccurate estimates cause unrealistic plans. If estimates are inaccurate, plans that are built on these estimates will in most cases be unrealistic. For example, if activities on a project's critical path exceed their planned duration as a consequence of underestimated effort, the plans are not realistic. As a consequence, estimation accuracy is one of ATP Theory's major determinants and thus the suitability is affected as well (cf. Figure 1).

In this context, activity planning can be a problem for the performance of projects if applied in early phases of projects (Andersen, 1996). If only insufficient information is available, project planning should start with milestones and a detailed planning for every milestone should occur right before work starts on that milestone.

(5) Project Changes and Plans Realism

Change requests are seen as cause for deviations between planned and actual effort (Jørgensen and Moløkken-Østvold, 2004; Lederer and Prasad, 1995); indicating that project changes are often neither considered in the underlying requirements nor in re-estimations.

Project's initial plans are only a starting point. The adaption of plans due to changes seems to be more essential (Dvir and Lechler, 2004). If project plans are not adapted due to requirements changes, it is not realistic that the project will be completed in accordance with its plan. As can be seen, changes and according plan adaptions have a considerable impact on ATP's suitability according to the proposed ATP Theory (cf. also Figure 1).

(6) Tracking and Reporting of Project Changes

Subsection (5) is also important for tracking and reporting a project's current status (cf. Figure 1). If project changes are not considered in the requirements and estimates, this bias influences tracking project progress. Changes that are not considered in project plans adulterate the comparison of planned and actually realized effort. As a consequence, progress reports do not reflect the project's actual state.

Reliable reporting is supposed to be a critical success factor in IS development (Iacovou et al., 2009). For reliably monitoring and controlling progress, project management depends on updated data constantly at its disposal. Otherwise, it is not possible to detect deviations and take corrective actions accordingly.

To guarantee updated data, changes need to be communicated. Professionals lying on software projects (Glass et al., 2008) indicate that realistic values concerning the current state of a project are not always available. Additionally, project managers often do not even know about lying. In such cases, it is almost impossible to assess a project's current state. Team members may just not know the percentage of work completed and how much longer it will take them to finish their tasks. According to the 90%-syndrome (Abdel-Hamid, 1988), a project's progress is

constantly reported up to 90% and IS projects seem to be almost completed for most of their duration. In this context, it is critical to decide whether projects should be continued if the prospects for success are not obvious (Keil et al., 2000b).

The impact of project changes as well as their tracking and communication on project work shows the importance of the interdependency of these primary constructs on ATP's suitability (cf. Figure 1).

(7) Reporting Progress regarding Project Plans

To report project progress according to ATP, the planned and actual state (requirements, budget, and schedule) are compared. Apart from the influence of change requests, reporting a project's progress can only be correct if the plans are realistic (cf. points (4) and (5)). Otherwise, implications for project management based on progress reports may be misleading.

Reporting project progress can be related to negative outcomes. In general, the reluctance to report bad news may lead to project failure. Reporting bad news on projects is a common topic in IS research (e.g., Keil et al., 2007; Keil and Park, 2010). Team members do not want to lose face and thus the project's course may be in danger. Tracking project progress also has positive consequences. Team members' motivation is presumably higher if it is obvious that the project is actually proceeding to its goals. In general, higher motivated teams may produce better results.

Compared to the previous section, the effect of this interdependency on ATP'S suitability is equal as the realism in project plans affects project work and thus its tracking. According to ATP Theory, correct progress reports are an essential condition for ATP's suitability.

(8) Realism in Plans

ATP can only be suitable as ISPS criterion if project plans are realistic. If those plans are unrealistic due to inaccurate estimates or changes that are not considered, the comparison between planned and actual project data is misleading.

Furthermore, unrealistic plans can have harmful consequences. If too few resources are available for project implementation, time pressure may lead to shortcuts (Austin, 2001), e.g., neglecting quality assurance. Deadlines are supposed to be the "greatest enemy of software engineering" (Costello, 1984), p. 15). It is argued that deadline pressure limits software engineers' time to guarantee a system's effectiveness. This shows that it is essential to carefully control the availability of resources during IS projects to guarantee ATP's suitability (cf. Figure 1). Otherwise, ATP's suitability will not be given according to ATP Theory.

(9) Correctly Tracking and Reporting Project Progress

Throughout carrying out projects, it is necessary to monitor and control project work (Project Management Institute, 2008, pp. 59-64). Tracking and reporting the project's status has a direct impact on ATP's suitability (cf. Figure 1). Detection of budget and schedule deviations is important for correct status reports. Without controlling changes and tracking/reporting the status, the suitability of decisions made on the basis of the project's status is questionable.

Although budget and schedule depend on a project's scope, it is comparatively easy to control these values. Deviations between actual and planned schedule may lead to project management adding more staff. According to Brooks Law (Brooks, 1995), this often makes the

project even later due to the increased training and communication overhead and a higher need for communication in general.

According to Parkinson's Law, project plans tend to fulfill themselves (Parkinson, 1955). All available time will be used, so that tasks are never completed before schedule. In that way, team members try to avoid that a fewer amount of time is assigned for future tasks. This law can also be applied for IS projects. Time that is left for implementing tasks will not be used for other tasks, but to optimize the according part of the system.

The coherence described in (8) also applies for the relation between project progress and ATP's suitability as ISPS criterion. As the comparison of planned and actual data requires reports of the project's actual status, ATP's suitability is not given in cases in which reports are flawed. This effect is strengthened due to the progress report's dependence on plans realism. Thus, plans realism has a direct and an indirect effect on ATP's suitability.

(10) Effects on Project Management

The suitability of ATP depends on the aspects described above. In this context, ATP's suitability as success criterion for IS projects affects project management. If the necessary conditions are not fulfilled (e.g., change requests are not regarded in re-estimations), the use of ATP as success criterion has negative consequences for project management. For example, projects might unnecessarily be cancelled if progress reports are wrong. Misleading project management decisions may also strengthen the effects of the commitment to failure behavior (Keil et al., 2000b).

Project escalation is a common phenomenon in IS projects (Keil et al., 2000a). Escalation of commitment to a failing course of action leads to so called runaway systems. More resources are invested even if a cancelation would be appropriate. There are several theories that explain such behavior. One of these is described in the following. In case of self-justification theory (Keil et al., 2000a), commitment is kept high as justification for previous actions on that project. Therefore, success decisions based on ATP have to be considered carefully as it is even worse if a project is continued under such conditions. Even if project data is accurate and realistic, this information might not be available to those who decide on a project's continuance.

Closing a project depends on the project's current status and therefore also is an important aspect. As a project's evaluation and decision on its continuance can have harmful effects, it is important that these decisions are made according to the actual status of the project. Thus, accurate progress reports are critical in this context. Measuring success in terms of ATP after a project's completion is easier than during the course of the project. After project completion, it is not necessary to calculate the additionally needed effort. Then, a comparison of planned and actual data is decisive for success or failure. Thereby, it is necessary to agree upon overruns that are acceptable. The definition of ATP does not account for the degree of deviation a project is considered to be a failure. Depending on the project duration, an overrun may be acceptable (except for special circumstances like legal bounds). The same applies for the criteria of budget and requirements. Success studies like the CHAOS Report (The Standish Group International, 2009) classify projects with potentially insignificant overruns as already being unsuccessful.

As described above, using ATP in cases with low suitability can have harmful effects for project management and the success of projects. Thus, project management needs to regard ATP's suitability (cf. Figure 1) to ensure an adequate management of projects.

Discussion

This article's focus is on the analysis of ATP's suitability as ISPS criterion (cf. our research question "How suitable is adherence to planning as success criterion for IS projects?") to propose an explanation for the phenomenon that ATP as success criterion does not apply to the context of IS projects in general. We proposed an ATP Theory with regard to project life cycle's processes and their outcomes (cf. section "Identification of Theory's Elements, Figure1, and Table 2) and argued for its structure corroborated by a systematic literature review (cf. section "Theory and Propositions" and Table 1). Thereby, the review's results provide insights into the suitability according to our theory.

The proposed ATP Theory considers requirements, estimates and plans, changes, and progress reports as primary constructs and explains their interrelations with regard to ATP's suitability as ISPS criterion (cf. Figure 1). The differences between IS projects and the uniqueness of single projects seem to be the predominant reasons for the resulting problems when deviations from the planned course of action occur. In our literature review, we identified 26 articles (cf. Table 1) showing that the maturity of the project life cycle's processes is often not given in practice and that the resulting outcomes only seldom allow using ATP as ISPS criterion. With regard to Figure 1, underlying requirements are often unclear, making plans that are drawn upon these requirements unrealistic. As stated before, the "use of estimated budget and schedule

for success evaluation assumes the efficiency of estimation models, which is a debatable issue for years to come" (Agarwal and Rathod, 2006, p. 360). Despite the improvements in estimation techniques' accuracy, there is still room for improvements. Especially experience data concerning similar already completed projects may help (Furulund and Moløkken-Østvold, 2007a).

Additionally, correctly reporting a project's current status is biased (e.g., 90%-syndrome) and influenced by political actions (e.g., lying). Although change requests are quite common in IS projects, there seem to be only few studies that focus on coping with those in project plans (cf. Table 2). Despite the importance of changing plans, change requests are in many studies named as reason for deviations between the planned and actual progress. This clearly indicates that IS professionals do not adapt project plans; maybe to avoid losing face.

Not losing face also seems to be a phenomenon leading to deviations between plans and a project's actual course of action. As a consequence, reducing the effort for quality assurance can be attributed to the fact that project managers are evaluated on their ability to bring a project to an end that conforms to its budget, schedule, and specified requirements (Shenhar et al., 2001). Thus, reputation is an important influence on how projects are carried out.

Although we cannot provide empirical findings for all relations between the different constructs, we provide an argumentation for our theory's structure in the section on "Theory and Propositions". Existing research majorly focuses on the processes of eliciting requirements and estimating the related effort. Especially, adapting plans as a consequence of change requests is important. There seem to be only few studies that actually address the handling of deviations from a project's planned course of action.

Not having experience data from similar projects is a high risk of not planning realistically. Famous examples from other disciplines, like the Sydney Opera House, corroborate this finding (Pinto, 2004). Such projects will probably be seen as success by most people. Simply comparing planning data and subjective perceptions shows that using ATP is not necessarily an adequate indicator for success. Furthermore, projects developed on-time and in-budget does not necessarily represent realistic planning (Grimstad et al., 2006). It is shown that only a reduction of effort and the freedom from defects may lead to development according to project plans.

Previous research has shown that it is doubtful that all of ATP Theory's influences (cf. Figure 1 and Table 1) are controlled in practice. Nevertheless, studies show that ATP is still a central criterion in assessing ISPS (Thomas and Fernández, 2008; Joosten et al., 2011). Despite a variety of other criteria that have been discussed and researched in literature, the predominance of ATP is still prevailing. An interesting point is the use of ATP (conformance with its budget, schedule, and specified requirements) to measure the efficiency of the development process (ratio of resources used and outcome achieved) in many studies (Aladwani, 2002; Crawford and Bryce, 2003; Shenhar et al., 2001; Thomas and Fernández, 2008). As efficiency is in general a valid index to measure process success, the focus on ATP seems reasonable if these concepts are seen as equal. However, this equalization is only valid in cases where project plans are realistic. The difference can be shown in terms of the following example. If project plans are unrealistically optimistic, it is no surprise if the corresponding projects exceed their budget and schedule to fulfill the specified requirements. Nevertheless, the use of resources can be efficient.

Although studies have shown that project planning itself contributes to project success (e.g., Dvir et al., 2003), it seems that predominantly negative consequences are analyzed. This may be due to the high rate of projects that experience budget and schedule overruns. Then,

research aims to explain why these overruns occur by finding risk factors. It is assumed that avoiding these factors will lead to projects that are completed on-time and in-budget.

We conducted this study to solve the problem of diverging views concerning ATP's suitability and its usage in IS contexts (cf. the introductory section). Although we provided a systematic approach for the assessment of ATP's suitability, a general statement on the suitability of ATP as criterion for IS projects cannot be derived. Rather ATP's suitability depends on a project's context and thus needs to be assessed accordingly.

If project plans are realistic, that is, the requirements are the ones that are really needed and the time and budget constraints are realistically planned, ATP can be used as success criterion. These conditions are only seldom fulfilled in todays IS practice. As the definition of success and failure depends on the degree of deviation between actual and planned data and this definition is not distinct, using ATP as success criterion during project closing seems unreasonable. Thereby, we need to differentiate between different contexts of IS projects. One specific group of projects may be characterized to be highly time critical. If for example an insurance company is legally bound to change its systems, the project cannot be seen as a success in case of schedule overruns. In such cases, the adherence to schedule criterion is at least a necessary condition for the project to be successful. The example shows that there is the definite need to partly fulfill ATP to make a project successful. Nevertheless, the time criticality of many of today's projects (further examples are marketing announcements, first mover advantages, or contracted deadlines) shows that this dimension of ATP should not be neglected and in some contexts may be the most decisive criterion. However, we emphasize that it is actually not a matter of how much time has been spend to realize the IS under implementation, but that the final release date is the decisive aspect. Thus, success is rather a matter of on-time

availability than development time. In this context, releasing an IS does not necessarily comprise all demanded requirements but a workable system that can be released on time.

The suitability of ATP as ISPS criterion depends on the context it is used in. Thus, companies that use highly mature processes are more likely to use ATP as their development process might inhibit more accurate assessments of the outcomes of the processes of the project life cycle. Additionally, the suitability of ATP's suitability might even change during a single project. If requirements are more certain till the end of a project, the according plans might contain a higher realism as well. Thereby, the plans need to be adapted according to the requirements. As the IS development's current state shows a different picture, reasons for professionals anyway using ATP all throughout the development process need to be analyzed. In this context, the finding that measuring ISPS is mainly a matter of measurability (Joosten et al., 2011) is a first step towards the solution of this problem.

Conclusions

The answer to the question whether to use ATP as success criterion for IS projects depends on the context the criterion is used in. With our explaining theory, we provide an approach to systematically analyze the often questioned suitability of ATP as criterion for IS projects and to explain the phenomenon that ISPS cannot be adequately measured in terms of ATP in projects in general. Thereby, a project's context determines the suitability. Accordingly, we provide an explanation for the diverging views in previous research on this topic. Depending on the situation, using ATP is suitable.

According to ATP Theory, using ATP as success criterion is only suitable under the following conditions: (1) Requirements have to be defined and changes have to be controlled carefully. This will contribute to secure (2) the realism in project plans. (3) Tracking and reporting a project's progress has to be conducted correctly. As we have shown, processes that are necessary to fulfill these conditions are often neglected.

Although it is rather easy to control the performance indices that are related to ATP, it is rather difficult and costly to make sure that the conditions for controlling these indices are kept. This leads to the following implications: (1) Projects should not be evaluated primarily on the basis of ATP. (2) Success studies should use additional or rather other criteria to show the actual current state of IS projects. (3) Studies focusing on critical success factors have to apply different success criteria. Nevertheless, practitioners should not relinquish planning projects as plans and especially the initial estimates are needed.

We recommend using our study for future research. It might be helpful to consider our explaining theory as further analyses of the constructs' interrelations may lead to new insights. Especially, status reports (e.g., detection between planned and actual data) and the handling of change requests have been only marginally researched in the past. To use ATP as success criterion for IS projects, different conditions need to be fulfilled. Therefore, it is necessary to research different approaches in which these conditions can be fulfilled. For example, one of the most important topics should be to consider how to completely and precisely elicit a project's requirements.

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