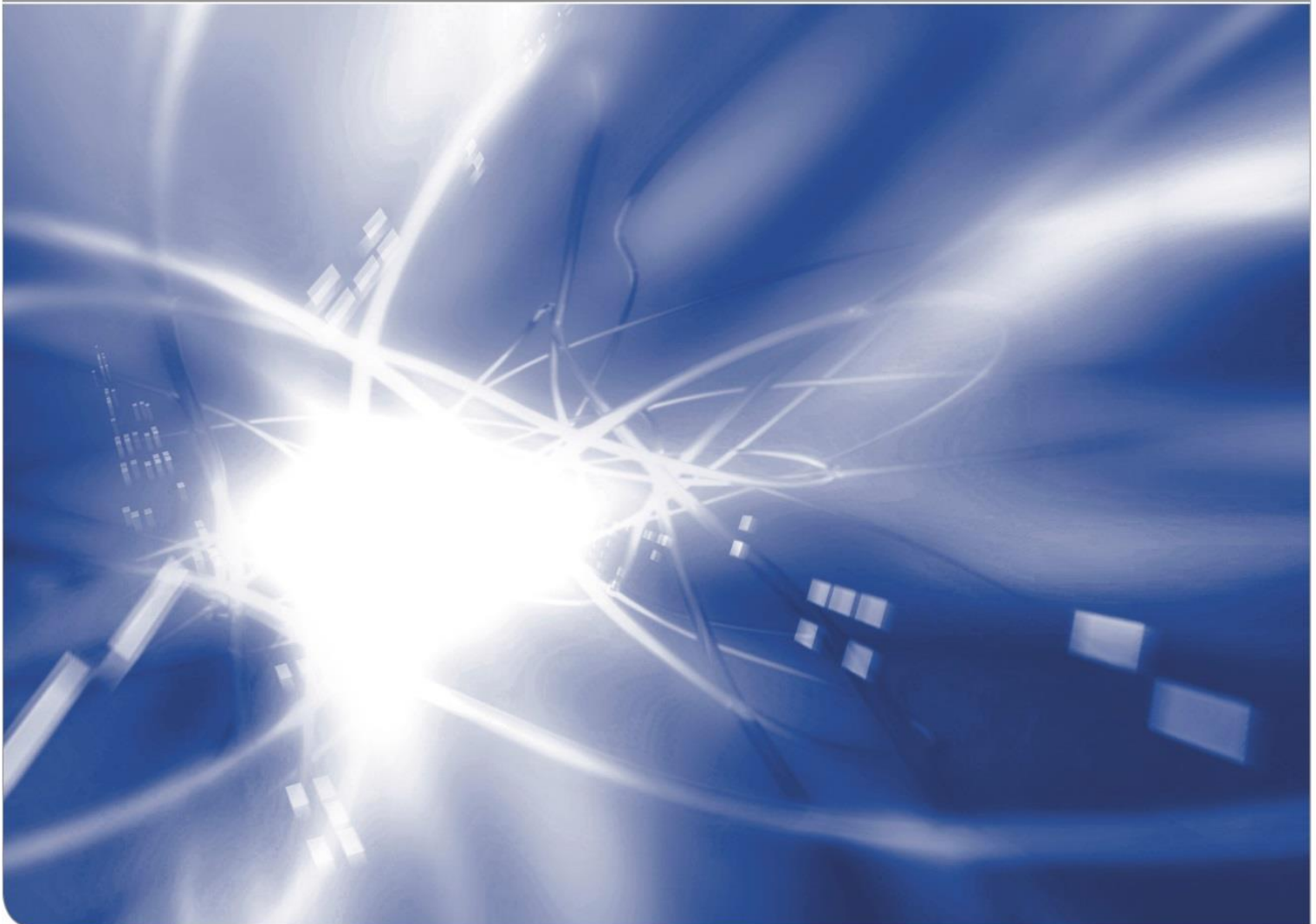


Why IT-Projects Fail

A Meta-Analysis of the Construct 'Escalating Commitment' in
Information Systems Research

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Why IT-Projects Fail: A Meta-Analysis of the Construct ‘Escalating Commitment’ in Information Systems Research

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Highlights

- Thorough collection of drivers discussed in IS and beyond IS literature
- Effect size of escalating commitment in recent IS literature

Abstract: *Escalating commitment refers to situations where decision makers tend to persist with failing courses of action by committing themselves more and more to the course of action as they invest further resources even when they face substantial negative feedback (Brockner, 1992; Newman & Sabherwal, 1996). This article examines the phenomenon of escalating commitment in the domain of information systems by i) systematically conducting a literature review where 23 triggers for escalating commitment in IS were identified. The results of the literature review yield that the main research in this field clearly focuses on studying the phenomenon in the context of it-projects but also on the upcoming research field of online services such as online-auctions. On the other hand ii) we conducted a meta-analysis with the aim of quantifying the power of the phenomenon under discussion based on the literature identified in the first part of our study. The computed overall effect size turned out to be significantly different from zero, but had to be put under reservation after testing the population for homogeneity.*

Keywords: *Escalation of commitment, sunk cost effect, escalating persistence, entrapment, deaf-effect, literature review, drivers, meta-analysis, effect size*

Introduction

Escalating commitment has received much attention in information systems research, due to its negative influence on successful implementation and adoption of an information system (Newman & Sabherwal, 1996). In particular, escalating commitment has been identified as possible explanation for situations where information systems designer/user tend to persist with failing courses of action (Brockner, 1992) by committing themselves more and more to the implementation and use of an information system as they invest further resources even when they face substantial negative feedback (Newman & Sabherwahl, 1996).

Furthermore, escalating commitment influences many aspects of IS development, implementation, acceptance and use (Newman & Sabherwal, 1996), and has recently also been investigated as a possible driver of persistence behaviour in the specific IS context of online services (Cheol, Keil et al., 2016; Schelzke, 2016). Keil et al. (2000a) report that especially the development of software projects seems to be susceptible to escalating commitment where almost 30% to 40% of all IS projects exhibit some degree of escalation. Furthermore, they reported that at least one in four planned projects finally are abandoned uncompleted after a long and costly development phase.

As a consequence, different studies investigated the influence of escalating commitment in information systems research. For instance in the context of it projects, Keil, Rai et al. (2000) showed that escalating commitment could be explained by sunk costs. And more recently, Schelzke (2016) reviewed existing research concerning the

drivers of escalating commitment in general, and suggest that escalating commitment is mainly driven by two kind of drivers, that can be separated into antecedences and post-decisional changes.

However, the topic has generated substantial research interest during the last years (see chapter 1.3, table 1), the current literature seems to be scattered and amorphous. Especially different research streams such as investigating the phenomenon in various contexts (IT-projects, online services) have far been disconnected as the same underlying circumstances in all these contexts have not yet reached a sufficient treatment under the same labelled phenomenon (Keil, Rai et al., 2000a; Khan, Khouja, Kumar, 2014; Park, Keil et al., 2016). But also the label of the phenomenon itself and which distinct and other known concepts such as sunk costs, entrapment, persistence behaviour are comprised in it at all seems to be amorphous too (Pfeiffer, 2006; Schelzke, 2012). Furthermore, most studies investigate only specific situations of IS implementation, and the generalization of the findings to other scenarios is difficult.

Consequently, it seems to be worth to pursue more precise knowledge of which mechanisms induce such IS decision-makers to become increasingly involved in the course of action. This research interest is to be taken into account in this work by systematically examining which drivers of escalating commitments can be identified in IS literature. In order to gain a comprehensive view of the multitude of commitment, and explaining why decision-maker commit to a failing course of action an overview of the respective research is required. There remains a need synthesizing the large body of commitment literature and clarifying the influence of escalating commitment in the IS literature, as measured by a general effect size. The present paper addresses this gap by investigating the influence of escalating commitment and clarifying its existence. In doing so, we identify relevant research clusters that have formed in information systems literature, which drivers are made responsible for the phenomenon and which further research gaps exist. We base our evaluation on a systematic literature review, and a quantitative meta-analysis. By meta-processing existing data on escalating commitment in IS we hope to compile previous findings of IS-authors such that a basis for a common understanding of the phenomenon in IS can be laid. It is often the case that many existing research articles deal only with single isolated aspects of a topic, but researchers typically wish to gain insight in all aspects of a topic at once. Our compilation shall satisfy this need by highlighting many aspects of escalating commitment in IS at once.

The remainder of this paper is structured in the following manner: First we give an overview of various established explanations for escalating commitment. Chapter 2 examines the phenomenon of escalating commitment in more detail by analysing recent IS literature and compiling results with respect to a) previously researched IS contexts the phenomenon has been studied in and b) drivers of escalating commitment. Chapter 3 provides a meta-analysis of available sources where the respective results are analysed and effect sizes are systematically calculated and aggregated. The resulting model provides information on whether and to what extent the phenomenon of escalating commitments occurs in IS. In Chapter 4 limitations of this study are discussed. Chapter 5 concludes with a final review, followed by an outlook for further research.

1 Theoretical Background

1.1 Escalating Commitment

Every one of us is familiar with such situations where decision-makers invest more and more resources in apparently hopeless projects, even though they are receiving more and more negative feedback to not succeed finally. For instance, while waiting for a bus that is not arriving on time one may decide whether to wait further minutes such that the time standing at the station has not been invested in vain or to just start walking to the destination that can actually be reached in moderate time (Brockner & Rubin, 1985). Also unhappy but continued partnerships and top-class sports where clubs keep up contracts with costly but low-performing players (Staw & Hoang, 1995) share the same elements of persistence behaviour. This tendency to commit oneself more and more to a project and to invest further resources even when faced with substantial negative feedback has been linked to escalating commitment (Newman & Sabherwal, 1996). In particular, psychological research describes escalating commitment by the following aspects (Brockner & Rubin, 1985; Staw, 1997; Staw & Ross, 1987; Pfeiffer, 2006):

(1) The act involves irreversible losses or costs. Decision-makers invest resources that are inextricably linked to the project, and this investment cannot be undone.

(2) The action extends over a certain period of time, with objective, negative messages about the success of the action or obstacles and difficulties appearing at a certain point in time, so that decision-makers must assess whether these are signs of start-up difficulties, temporary setbacks or even indications for a fundamental failure (Pfeiffer, 2006).

(3) The act of investing can be terminated by the decision-maker (Pfeiffer, 2006, p. 12) but this is not a safe fruitful solution because the previous investments would be lost.

(4) The belief of the decision-makers that by adhering to the action they can still achieve success and compensate for costs incurred to date. And on the other hand, there is the uncertainty as to whether this can even be brought to success.

Besides, other research linked escalating commitment to sunk costs (Arkes & Blumer, 1985), and entrapment (Brockner & Rubin, 1985). These terms stand for largely congruent phenomena and recent IS research uses them mostly synonymously (Pfeiffer 2006). However, it should be noted that sunken costs result in the state of the entrapment and consequently escalating commitment occurs. This causal chain, with the chronological sequence of these factors, may be the conceptual representation of the phenomenon labelled by escalating commitment, as it is the most abstract concept and the result of the foregone factors. From a psychological and volitional perspective, on the individual decision maker's level, escalating commitment could be defined as a stable intensity of his formed intention to reach a specific goal in the face of objective negative feedback (Schelzke, 2012, p. 48).

1.2 Escalating Commitment in IS

From the mid-1990s, scientists began to investigate the phenomenon of escalating commitment within the domain of IS (Truex et al., 2006). The reason for the increased interest was that both scientists and IS user have been noticing for many years the high failure rates of IT projects, which were regularly reported by newspapers as "runaway projects" (Keil, 1995). The intangible nature of software makes it considerably more difficult to measure project progress, which is why software projects of all kinds are particularly susceptible to escalating outcomes (Keil et al., 2000b). However, the research practice at that time considered such results to be the exception (Keil et al., 2000b), so that escalation research has not yet been considered. In particular, no approaches and solutions were found to "put escalating projects back on track", or to break them down completely in an efficient way (Truex et al., 2006).

Keil (1995) tried to make use of the findings from judgement and decision-making research to formulate a possible explanation for IT projects threatened to fail. Consequently, Keil and his colleagues started conceptual and empirical research on the phenomenon within information systems, especially in the context of IT projects (cf. Keil, 1995; Keil & Flatto, 1999; Keil & Robey, 1999; Keil et al, 2000a; Keil et al, 2000b; Keil et al, 2000c), followed by Sabherwal and colleagues (e. g. Newmann & Sabherwal, 2003). It was therefore logical not only to obtain a differentiated picture of the escalation of commitment, but also to develop research approaches and strategies for de-escalating commitment, for which Keil et al. (2000c) laid a foundation. Later, Ariely et al. (2004) investigated the phenomenon in online auctions, simultaneously with Ku and colleagues (Ku et al., 2004). Boonthanom (2003) provided a model of escalating commitment within the framework of Information Technology Outsourcing (ITO). Furthermore, we recommend the study from Truex et al. (2006) for a good overview of escalating commitment research in IS.

If we consider "escalating commitment" in the field of IS, the question of the role of IS user arises. User must be stakeholder in the development or adoption of an information technology system, i.e. a project manager who is responsible for the development of software, a bidder who is determined to bid in online auctions, or a consumer who uses popular online services such as online shopping. The element of escalating commitments would then become apparent as follows: first of all, such decision-makers would have to have already made investments, which would bind them to the course of action. More specifically, the IT manager would have to have invested a

certain amount of time, money and effort in the development of the project, such that a termination would prove to be uneconomical. For example, online shopping would result in a membership fee or search costs, which bind the online buyer to one service. Furthermore, a negative message about the success of the action would then come up, which in the first example manifests itself e.g. as a hardly identifiable bug, in the latter in an unavailability of the desired product. Escalating commitment prescribes that decision-makers would have to invest more resources as a result of the negative news, because on the one hand one does not want to see the resources already invested as lost and on the other hand there is the prospect of making the course of action perennially successful after all. In the first example, the IT manager would have to employ more qualified personnel, for example, in order to find the bug and complete the software development. In the latter example, the online buyer would have to stay with the same provider, for example, and choose a substitution of the actual target product, so that the membership fee already paid was not invested in vain.

1.3 Determinants of Escalating Commitment

Independent of theory-based discussions, escalating commitment is considered as a complex phenomenon that has been linked to a large number of possible determinants (Keil, 1995). Staw and Ross (1997) proposed a taxonomy for the classification of the various determinates by assigning four different classes, namely a project-related, a psychological, a sociological, and an organizational one (Keil, 1995). These classes were part of a multi-causal explanation model, which as such has been critically discussed in other studies (Pfeiffer, 2006).

However, when examining the phenomenon in the domain of information systems, one often refers to the taxonomy proposed by Staw & Ross (1987), for example, to check which classes offer the best explanatory power (see Sabherwahl et al., 2003), or to check which drivers of a class are capable of discriminating between IT projects that escalate against those that do not escalate. Schelske (2012) on the other hand, suggests that potential determinants should be classified according to their time of action and mode of action. Antecedents and post-decisional changes would be suitable names for two "driver classes", since this influence the formation of an intention and affect the status quo of goal pursuit, according to Schelske (2012). Schelzke's work has only recently been published (in 2012), which is why this potential taxonomy proposal to classify the reasons did not have sufficient lead time to establish itself.

The next figure below provides an overview of how the various explanatory approaches presented can be structured today (see figure 1). A classification could be found by setting out in juxtaposition explanations for the phenomenon in general and for the phenomenon with reference to a context. If explanations for the phenomenon are sought at all, these are mostly psychological explanations, whereas the explanation of the phenomenon with reference to a specific context (e.g. information systems) is mostly structured in psychological, sociological and organizational reasons, so that the taxonomy proposal of Staw & Ross (1987) is implicitly used there. Dwivedi et al. (2013) provide an other collection of drivers and taxonomy to classify.

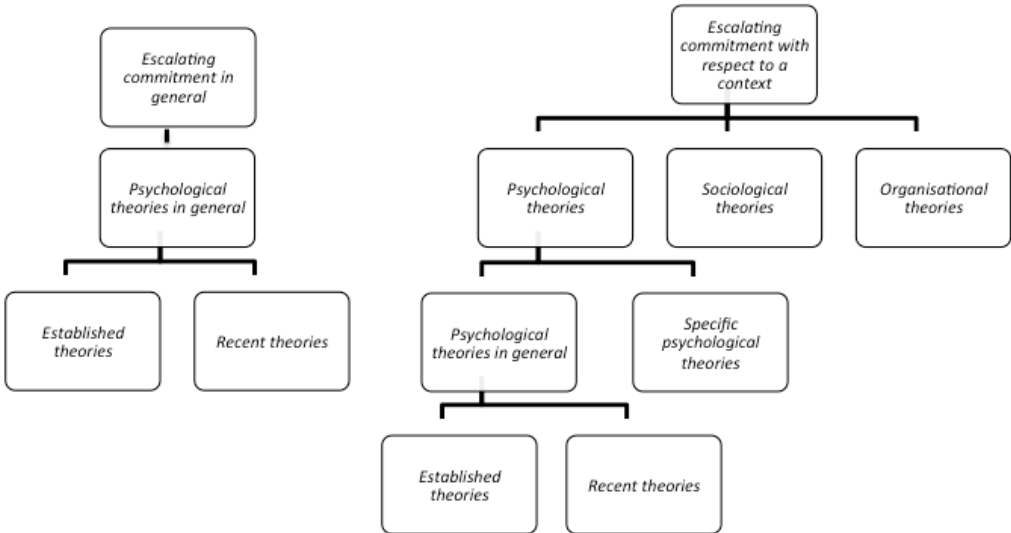


Figure1 A taxonomy of existing explanatory classifications of escalating commitment

Based on this taxonomy we can structure existing theory-based explanations of escalating commitment. In general, research suggests general psychological theories and drivers of escalating commitment. Based on these first studies, the first integrative explanatory approaches were self-justification theory (e.g. Staw, 1976) and prospect theory (Kahneman & Tversky, 1979). More recently, psychological theories of perception such as preferential-consistent information processing (e.g. Pfeiffer, 2006) or volitional psychological theories (e.g. Schelske, 2012) have been proposed. The following table presents a compilation of established and comprehensive explanatory approaches. Two established psychological theories (prospect theory, self-justification) and a recent one (preference consistent information processing) are subsequently described in detail. Theories and drivers of escalating commitment in the specific domain of information systems (escalating commitment with respect to a context) are identified and discussed in the next section (2.2.2).

<i>Comprehensive theories of escalating commitment in general</i>			<i>Linked first time by</i>
	<i>Source</i>	<i>Focus</i>	
<i>Established psychological theories</i>	<i>Prospect Theory (Kahneman & Tversky, 1979)</i>	<i>Sunk costs</i>	<i>Arkes & Blumer, 1985</i>
	<i>Selfjustification: (Staw, 1976; Fox & Staw, 1979)</i>	<i>Accountability effect; Cognitive Dissonance</i>	<i>Staw, 1976, 1980, 1981 etc.</i>
	<i>Cognitive Dissonance (Festinger, 1957)</i>		<i>Arkes & Blumer, 1985</i>
	<i>Entrapment (Brockner & Rubin, 1985)</i>		<i>Brockner & Rubin, 1985; Arkes & Blumer, 1985; Brockner, 1992; Teger, 1980</i>
	<i>Approach Avoidance Theory: Lewin, 1935, Miller, 1944, 1959)</i>		<i>Brockner & Rubin, 1975; Keil et al., 2000a</i>
<i>Recent psychological theories</i>	<i>Preference consistent information processing (Lord, Ross & Lepper, 1979)</i>		<i>Schulz-Hardt & Frey, 1999; Pfeiffer, 2006</i>
	<i>Psychological rubicon model (Heckhausen & Gollwitzer, 1987)</i>	<i>Commitment of actions and volitional psychology</i>	<i>Schelzke, 2012</i>

Table 1 Established and recent psychological theories for escalating commitment

1.3.1 Self-justification Theory

Early attempts to explain escalating commitment, drew on self-justification theory (Brockner, 1992; Rubin & Brockner 1975; Staw 1976; Tegner, 1980) - since until then (1980s) little research work has been done in this area, most studies relied on this approach (Brockner, 1992). Over time, other explanatory approaches have been added so that the theory of self-justification has lost its prominent role (Brockner, 1992), but still serves as a part of the explanation and, in particular, efforts are being made to obtain a more differentiated picture of determinants (Keil et al., 2000a).

Firstly, the self-justification theory explains escalating commitment by the fact that individuals adhere to a course of action even though negative information about the success of the action is available, because the decisions made so far are judged to be rational, correct and mistakes towards themselves or others do not want to be admitted - in other words own behaviour is justified (Staw, 1976; Brockner, 1992; Keil et al.)

According to Staw (1976), the personal responsibility of a decision-maker for the outcome of an action appears to be decisive for self-justifying behaviour (Keil et al., 2000a; Heng et al., 2003; Keil et al., 2000b). This rationale has been used ever since to operationalize self-justification.

More evidence for this argument comes from another point of view: Pfeiffer et al. suggest that escalating commitment is mediated by self-justification tendencies, which are felt by the decision-maker responsible for failure, but not by the non-responsible decision-maker Pfeiffer (2006, p. 19). The original approach of the self-justification hypothesis focussed on the self-justification directed inwardly, i.e. the self-justification in front of one's own person. Other studies, also suggest that escalating commitment is caused by an external justification, i.e. escalating commitment to other persons or organisations (e.g. Bobocel & Meyer, 1994; Caldwell & O'Reilly, 1982; Staw, 1980).

1.3.2 Prospect Theory

Other studies argue that the self-justification approach is obsolete because the prospect-theory has a greater explanatory power (Keil et al. 2000a, Whyte 1986). The core statements of Prospect Theory are the following: People do not evaluate action consequences relative to objective standards, but rather as losses or gains relative to a subjective reference point such as the status quo (framing effect). Following this rationale, these assumptions allow us to predict that people in the loss-making sector will be willing to take risks and those in the profit range will be reluctant to take risks (reflection effect).

In the context of escalating commitment, sunk costs would induce such a loss range (Keil et al., 2000a, Whyte 1986). For discursive reasons, it should be said that sunk costs of any kind are a prerequisite for escalating commitment. According to the reflection effect, individuals in such a loss range tend to be willing to take risks, so that this behaviour is reflected in an escalating commitment (Keil et al., 2000a). However, the value of prospect theory for the explanation of escalating commitments should be questioned, because the argumentation is only based on the value function (Pfeiffer, 2006). The theory, on the other hand, makes no statements about which psychological mechanisms are responsible for this increased risk friendly behaviour (Pfeiffer 2006, p. 22).

1.3.3 Preference consistent information processing

Recent research criticizes self-justification theory and prospect theory as explanations for escalating commitment because they assume that individuals and decision-makers always behave not economically optimal in the sense of the rational choice criteria (Pfeiffer, 2006). Pfeiffer and Schulz-Hardt & Frey (1999) argue that in most studies the decision-maker had not enough information for a reliable decision. Hence existing settings do not show that people would behave in contradiction to the economic cost-benefit calculation and thus irrationally. In research exists various studies, illustrating that decision-maker behave rational in situations with negative feedback. In literature are many examples that show that decision-makers only apparently make irrational decisions, since they rely on the future success prospects of an action (Bateman, 1986), the causes of the negative feedback

(Bateman, 1986; Staw & Ross, 1978), the level of opportunity costs (Bateman, 1986; Northcraft & Neale, 1986) or the possibility of investing in alternative, more promising projects (Keil & Mixon, 1994; McCain, 1986; Schaubroeck & Davis, 1994).

The results of Schulz-Hardt & Frey (1999) suggest that escalating commitment is not caused by the decision-maker's responsibility for the alternative action or decision, but rather to his preference for or against an alternative (Schulz-Hardt et al. 2006, p. 26). The preference effect questions the self-justification theory, which refers to the factor of responsibility as a trigger for self-justification tendencies.

In particular, the preference effect predicts that, after negative feedback, responsible persons stick to actions or invest more resources because, in contrast to non-responsible persons, they all have an initial preference for the alternative action or decision (Pfeiffer, 2006). Preference-consistent evaluation of information should therefore have an influence on escalating commitment. In his study, Pfeiffer (2006) reports the influence of preference-consistent information processing on escalating commitment.

2 Study 1 – Systematic Literature Review

2.1 Method

The current study involved a systematic literature review as a base for the meta-analysis (see study 2) of escalating commitment in IS literature. Hence, following Webster and Watson (2002) and vom Brocke et al. (2009), the analysis procedure of this work commenced with a systematic literature search. The search procedure was undertaken in the most relevant journals in information systems (Ranking B or better). For this purpose, we use the ranking of VHB Online. A total of 934 magazines relevant to business were evaluated by VHB, of which 651 received a rating. In particular, we select journals from the partial rating of Business Informatics (status 2015), which have been awarded the A+, A and B rankings. In the next step, we then identify suitable databases (see table 4) to search for sources on the topic of “Escalation of Commitment” in IS as broadly as possible. The search had no time limit, and was conducted in February 2017.

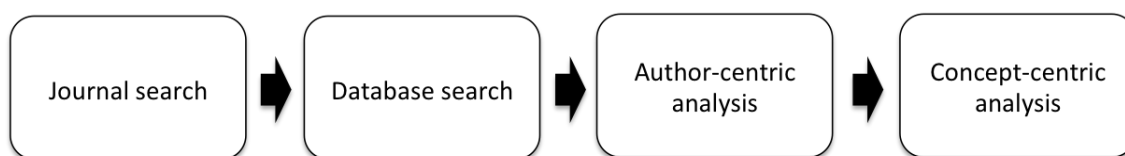


Figure 2 Analysis procedure of study 1 according to vom Brocke et al. (2009) and Webster & Watson (2002)

The literature search was conducted using a search string which consisted of A) constituents of escalating commitment and B) IS context where escalating commitment can occur. The search was based on the meta-data of the articles. The search structure was: $q = \{a1 \text{ OR } a2 \text{ OR } \dots \text{ OR } a7\} \text{ AND } \{b1 \text{ OR } b2 \text{ OR } b3\}$. Table 2 illustrates this relationship.

#	<i>A Constituents of Escalating Commitment</i>	<i>B Context</i>
1	<i>Escalat* commitment</i>	<i>Information Systems IS</i>
2	<i>Entrapment</i>	<i>(online) auctions</i>
3	<i>Sunk cost (effect)</i>	<i>(IT) projects</i>
4	<i>Auction fever</i>	
5	<i>Deaf effect</i>	

6	<i>Status quo (bias)</i>	
7	<i>Endowment (effect)</i>	

Table 2 Search structure with search strings

Based on this search structure we conducted the search process in relevant journals or with auxiliary databases if there was no search mask on the journal's website. The search structure, the number of hits and the number of articles considered as relevant can be seen in table 3. The selection of a relevant article was carried out based on a screening and depended on its title and abstract.

<i>Journal</i>	<i>Aux. Database</i>	<i>Search string</i>	<i>#</i>	<i>relevant</i>
<i>A+</i>				
<i>Information Systems Research (ISR)</i>	<i>PubsOnLine informs</i>	<i>A x B</i>	13	0
<i>Management Information Systems Quarterly (MISQ)</i>	<i>AISeL</i>	<i>Escalation commitment, sunk cost, auction fever,</i>	58	5
<i>A</i>				
<i>Journal of Management Information Systems (JMIS)</i>	-	<i>Escalation/escalating commitment, sunk cost</i>	4	3
<i>Mathematical Programming</i>	<i>SpringerLink</i>	<i>A x B</i>	0	0
<i>Journal of the Association for Information Systems (JAIS)</i>	<i>AISeL</i>	<i>Escalation commitment, sunk cost effect, auction fever</i>	25	3
<i>Journal of Information Technology</i>	<i>SpringerLink</i>	<i>Escalation commitment, sunk cost effect, auction</i>	29	1
<i>Proceedings of the International Conference Information Systems</i>	<i>AISeL</i>	<i>Escalation commitment, sunk cost effect</i>	160	4
<i>Information Systems Journal (ISJ)</i>	<i>Wiley Online Library</i>	<i>Escalation commitment, sunk cost effect</i>	50	2
<i>The Journal of Strategic Information Systems</i>	<i>ScienceDirect</i>	<i>A x B</i>	40	2
<i>European Journal of Information Systems (EJIS)</i>	<i>SpringerLink</i>	<i>A x B</i>	42	2
<i>INFORMS Journal on Computing (JOC)</i>	<i>PubsOnLine informs</i>	<i>Escalation commitment, sunk cost effect</i>	37	0
<i>SIAM Journal on Computing</i>	-	<i>Escalation commitment, sunk cost effect</i>	6	0
<i>B</i>				
<i>Journal of the ACM (JACM)</i>	-	<i>Escalation commitment, sunk cost effect</i>	20	0
<i>Decision Support Systems (DSS)</i>	<i>ScienceDirect</i>	<i>Escalation commitment, sunk cost effect</i>	93	1

<i>Decision Sciences</i>	<i>Wiley Online Library</i>	<i>Escalation commitment, sunk cost effect</i>	96	2
<i>Information & Management</i>	-	<i>Escalat* commitment, sunk cost effect</i>	33	2
				$\Sigma = 26$

Table 3 Structure of journal search

After searching for articles in ranked journals there were 24 relevant articles in total. To look for potential articles that were not captured by the journal search procedure, we then conducted a very broad search in various databases (table 4) and found 11 further articles.

Database	#
ACM DL	200
AISel	782
EBSCOhost	50
JSTOR	250
ScienceDirect	250
Scopus	13
SpringerLink	96
Web of Science	14
Summe	1053
# Selection of articles in addition to pure journal search	15

Table 4 Structure of broad data-base search

Furthermore we conducted a backward search, however further articles were not found. Thus, the conducted literature search process yielded 41 articles in total that will be further examined.

2.2 Results

The subsequent analysis of the determined literature set followed a two-stage process, and was conducted in accordance with the guidelines of Webster and Watson (2002).

2.2.1 Author-centric analysis

The first step of the literature review framework is an author-centric analysis in which studies are listed in a table (see full table in appendix 1, listed according to journal quality) and selected details from the papers are entered in columns (Hamari & Keronen, 2017). For this review the details included 1) the journal, 2) the authors and title, 3) theories and constructs used 4) definition's provenience, 5) context. This author-centric analysis yielded 41 articles in total that will be further examined and constitute the literature set for the actual literature review and the meta-analysis (study 2). 25 articles were published in A+, A, B ranked journals but further 10 articles were published in non-ranked journals, 2 conference papers among them. The articles had been published in the years between 1995 to 2016.

2.2.2. Concept-centric analysis

The second stage of the literature review framework is a concept-centric approach (Hamari & Keronen, 2017; Webster & Watson, 2002). In this step, the author-centric result was pivoted (by analysis and resynthesis to

connect related papers under a given category) into concept-centric frequency tables. In this study the first category of interest was the specific IS contexts wherein the phenomenon had been studied until today. By compiling the data from the column „context“ of the table in appendix 1 and applying descriptive statistics one could summarize the results by a chart like that in the next figure 3.

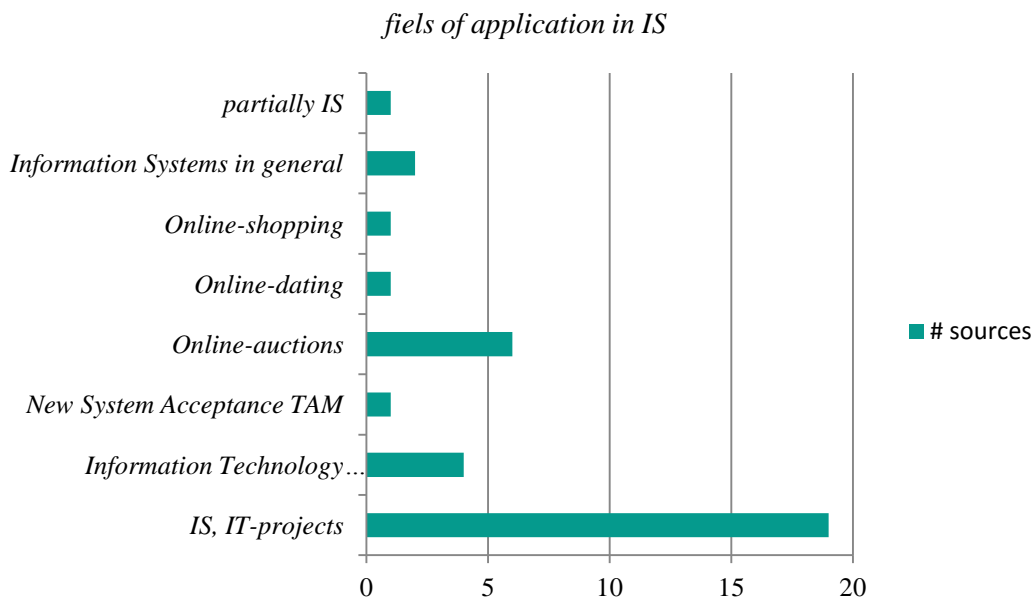


Figure 3 Research clusters in IS of escalating commitment

To summarize whether there are research clusters (fields of application), one could answer yes there are, namely 19 articles examine the phenomenon in the context of it projects, 4 articles in information technology outsourcing (ITO), 1 article in new system acceptance, 6 articles in online auctions, 1 article on online dating and 1 on online shopping. The remaining 3 articles have no reference to a specific field but study the phenomenon in a general IS context.

The second category of interest was the drivers of escalating commitment that are proposed and discussed by IS researchers to explain the phenomenon. Figure 4 summarizes the retrieved drivers and illustrates *one version* of a possible driver network. A detailed description of the drivers can be seen in the table of appendix 2. We therein formulated three classes (psychological, sociological, organisational drivers) to systemize them and assigned the articles to the class they plausibly fit in. In addition to our compilation of recent sources Sabherwahl et al. (2003), Keil et al. (2000a), Pan et al. (2003) give further compilations over the most established drivers of escalating commitment in the IS domain.

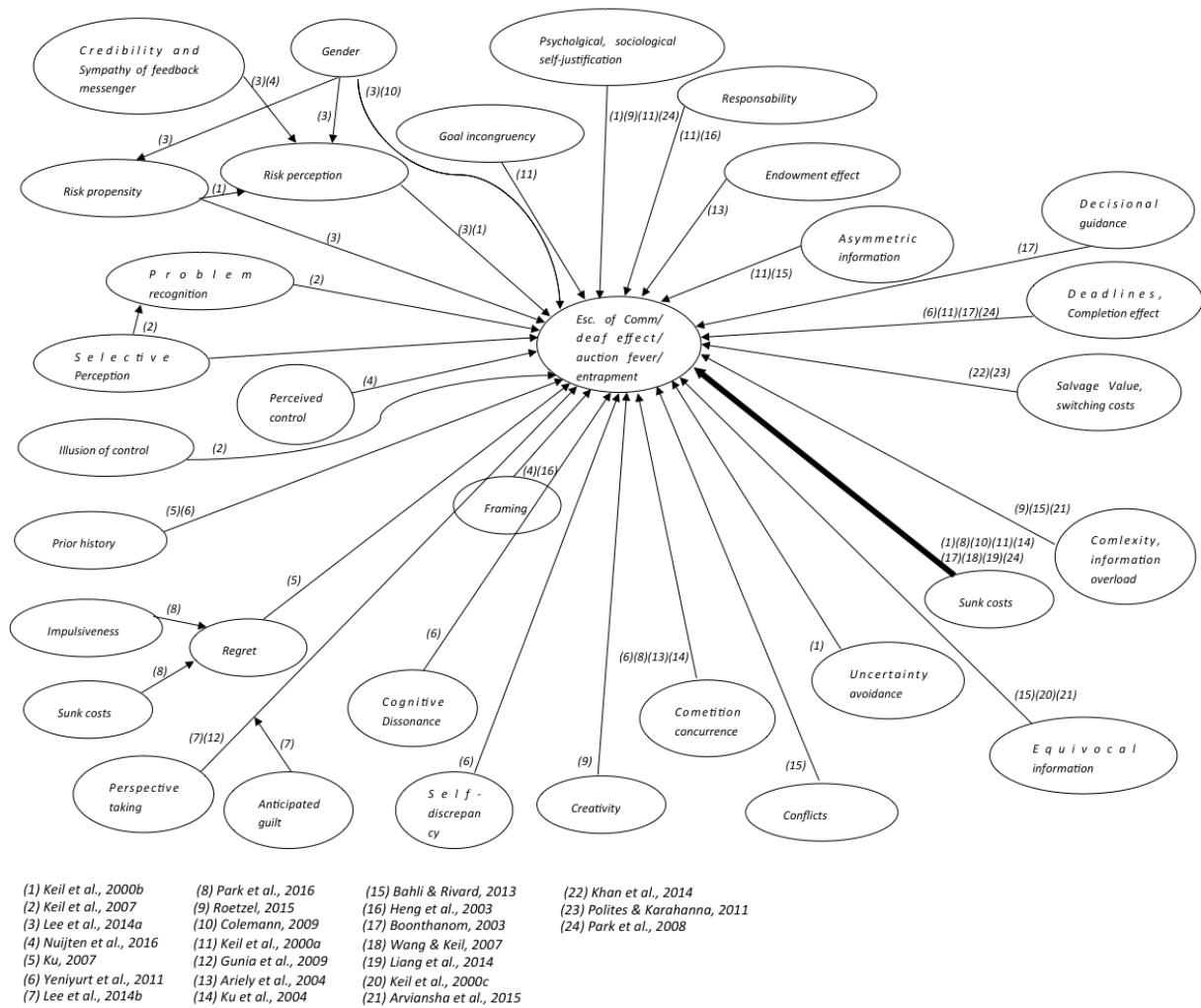


Figure 4 Drivers and determinants of escalating commitment in IS

In addition to the mere table in appendix 2 of the identified drivers, figure 4 instead is a graphical version of the results and provides an overview to easily grasp the 32 drivers and their relations to escalating commitment, sunk cost effect, auction fever and deaf-effect. Exemplarily sources of the relationships are added to each arrow. Furthermore, the bold arrow of sunk costs to the set in the middle indicates that most studies referred to sunk costs as driver for the constructs in the middle set.

3 Study 2 – Meta-Analysis

3.1 Meta-Analytic approach

Meta-analysis is an established tool for secondary-analysis used in disciplines like medicine, pedagogy and psychology (Keil & Wang, 2006; Hwang, 1996). Meta-analysis uses mathematical and quantitative approaches where the effect size of the reviewed studies are combined using calculations (Jamari & Keronen, 2017) to get an overview about current research in a field (Bortz & Döring, 2005). The narrative review follows the same aim but has been found to be susceptible to subjective moments that influence the selection and assigned weight of the studies. On the other hand meta-analysis have more objective character as the aggregation of studies is not done on the linguistic but on the statistical level (Bortz & Döring, 2005). Moreover, large amounts of studies that increase the complexity cannot be handled by the narrative approach (Hamari & Keronen, 2017), whereas meta-analysis can by reducing the processed data to statistical results only.

Bearing in mind the aim of this study to get a reference for the power of the escalating commitment effect in recent IS literature we shall systematically build up a model that is capable to inform about the effect of interest. To determine an effect size of the construct escalating commitment, it has to be clarified what exact part of the phenomenon can be measured at all. For this purpose we circumscribed escalating commitment to a single constituent of it by using the level of sunk cost as proxy. We used this reduction strategy as it seems that, after screening the 41 articles again, sunk costs are the most frequent characteristics of escalating commitment that is jointly stated by the IS authors. Thus, research question 3 has to be modified such that the new aim of this meta-analysis is to determine the effect size of sunk costs in recent IS literature.

Bortz & Döring (2005) and Stamm & Schwarb (1995) propose several steps to reach that goal by subdividing the process in a) data selection, b) calculation of all single effect sizes from primary studies, c) aggregation to an overall effect size, d) test for heterogeneity and e) moderator analysis.

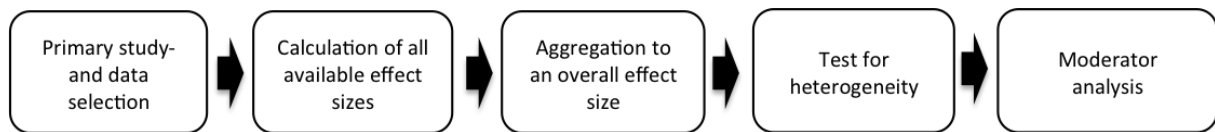


Figure 4 Analysis procedure of study 2

3.2 Primary study- and data selection

The previously identified literature set (see appendix 1) was screened with respect to which of the 41 articles quantitatively studied the effect of sunk costs or if their study design yielded possibilities to ex-post calculate effect sizes of sunk costs. The following table 5 illustrates the screening result with 13 out of originally 41 identified studies¹ that are admissible to form the population for the calculation of the overall effect size. These 13 articles again contained in total 25 independent sub studies, gaining their independence by a varied level of sunk costs or other participant groups etc.

With this section the population for the subsequent calculation of the overall effect size was identified.

Publication	Context	Level of sunk costs		Experimental group			Control group			Reference source effect size	Effect sizes according to Cohen	Corrected effect size according to Hedge's
		experimental group	control group	Groupsize	Mean dependent variable	Standard deviation dependent variable	Groupsize	Mean dependent variable	Standard deviation dependent variable			
Heng, Wan, & Wie (2003)	It-projects	75% of capital	25% of capital	180	80.52	14.32	180	57.1	14.32	Mean, SD	1.64	1.63
V., An, & Saarinne (2000b)	It-projects	90% of capital	15% of capital	47	62.08	22.78	46	44.04	26.76	Mean, SD	0.723	0.71
		90% of capital	15% of capital	30	73.94	22.78	30	37.19	21.14	Mean, SD	1.402	1.38
		90% of capital	15% of capital	58	80.88	14.30	58	57.59	20.55	Mean, SD	1.07	1.06
Boonthanom (2003)	It-projects	75% of capital	25% of capital	119	60.82	24.10	116	53.9	24.1	Mean, SD	0.54	0.53
Polites, Karahanna, & Park (2011)	New System Acceptance			334						Effect size directly	0.19	0.189
Bock, Kim, & Bock (2016)	Online-auctions			155	4.93	1.16	146	3.73	1.15	Mean, SD	1.039	1.036
Whytten, Wakefield, & Bahl (2013)	Information-technology outsourcing			160						Coefficient of determination of 0.15	0.176	0.175
Liang, Lee, & Tung (2014)	Online-shopping	400 Dollar	20 Dollar	5	14.3%		30	85.7%		Proportion	-2.04	-1.993
		400 Dollar	20 Dollar	24	64.9%		13	35.1%		Proportion	0.624	0.61
		400 Dollar	80 Dollar	7	17.5%		33	82.5%		Proportion	-1.71	-1.676
		400 Dollar	80 Dollar	13	30.2%		30	69.8%		Proportion	-0.86	-0.842
		80 Dollar	20 Dollar	7	15.9%		37	84.1%		Proportion	-1.628	-1.599
		80 Dollar	20 Dollar	10	22.7%		34	77.3%		Proportion	-1.3	-1.277
		80 Dollar	80 Dollar	12	29.3%		29	70.7%		Proportion	-0.91	-0.891
		80 Dollar	80 Dollar	27	69.5%		14	34.1%		Proportion	0.761	0.746
Ku, Murnighan, & Park (2004)	Online-auctions			8	1.8	2.8	7	0.7	1.8	Mean, SD	0.46	0.432
Park, Kim, & Bock (2008)	Online-auctions			223	path coefficient: 0.38, t-value: 5.56	SD: 0.048	246	path coefficient: 0.17, t-value: 2.16	SD: 0.048	Correlations	0.228	0.228
Yeniyurt, Watson, Carter, C., & Stevens (2011)	Online-auctions	1992 bids	557 bids	9474	1.029	0.002	2408	1086	0.018	Mean, SD	6.87	6.87
Gunia, Sivanathan, & Galinsky (2009)	Investment decisions	more	less	27	5.29	2.79	27	3.87	2.13	Mean, SD	0.572	0.563
	Decisions personnel selection	more	less	27	0.23	0.87	27	-0.23	0.72	Mean, SD	0.576	0.567
Colemann (2009)	Online-dating	50% of capital	0% of capital	59	48.89	16.92	59	28	23.48	Mean, SD	1.021	1.014
		50% of capital	0% of capital	85	28	18.89	85	12.63	18.51	Mean, SD	0.822	0.82

Table 5 Database and population for meta-analysis

Since the source Gunia et al. (2009) has been classified as IS literature and provides also two other independent results for the effect of sunk costs, these two individual results were included in the overall calculation as well. Even if they were not collected directly in the IS environment, this favourable opportunity may increase the number of samples by two.

3.3 Single Effect size calculation

To compare the primary studies and their sub studies (table 5) the respective study results have to be transformed into a uniform effect size (Stamm & Schwarb, 1995). Under a uniform effect size we understand an effect size that has been evolved from a single author. In this study we use the effect sizes and calculations proposed by Cohen (1988) since they are well-established and widely used (Lakens, 2013; Keil & Wang, 2007; Meca et al, 2003). Furthermore, we took the first five effect sizes of table 5 from Keil & Wang (2007) who used Cohens effect sizes too.

Cohen's effect size depends on the data of the primary studies (Keil & Wang, 2007; Lakens, 2013). For example if mean and standard deviation are given, Cohen's d is calculated by:

$$Cohensd = \frac{\bar{X}_E - \bar{X}_K}{\sqrt{\frac{(n_E - 1)SD_E^2 + (n_K - 1)SD_K^2}{n_E + n_K - 2}}} \quad (1)$$

In the numerator there is the difference between the mean of the dependent variable of the experimental group and the one of the control group, whereas in the denominator the joint standard deviation is corrected by sample sizes.

If primary study results contain percentual data, Cohen's d can be calculated as follows (Meca et al., 2003; Johnson, 1989):

$$Cohensd = \frac{p_E - p_K}{\sqrt{\frac{(n_E - 1)p_E(1 - p_E) + (n_K - 1)p_K(1 - p_K)}{n_E + n_K - 2}}} \quad (2)$$

If study results yield only R^2 Cohens f^2 is calculated:

$$Cohens f^2 = \frac{R^2}{1 - R^2} \quad (3)$$

If there are only correlations available in primary studies Cohen (1988) proposes an effect size q which interprets the difference between two correlations which also have to be Fisher-Z-transformed (Lenhard & Lenhard, 2017):

$$Cohens q = Z_a - Z_b \quad (4)$$

Applying these formulas to the data given in the primary studies we obtain either Cohens d, f or q and collected them in column 11 in table 5 above. The calculation was made according to Lenhard & Lenhard (2017).

As Cohen's d is based on differences in means which produce biased estimators in particular for $n < 20$ (Lakens, 2013; Keil & Wang, 2007). That is why Cohen's d is called the uncorrected effect size whereas Hedge's g is called the unbiased effect size (Lakens, 2013). The transformation of Cohen's d into Hedge's g (1985) is done by the following formula:

$$Hedge's g = cohensd * \left(1 - \frac{3}{4(n_E + n_K) - 9}\right) \quad (5)$$

The list of Hedge's gs can be seen in table 5 column 13. A reference point for the distribution of the 25 corrected effect sizes can be seen in the following figure 6. Based on this descriptive result with negative as well as positive calculated effect sizes neither the overall effect size can be estimated nor can the justification for an aggregation of all effect sizes be evaluated at all.

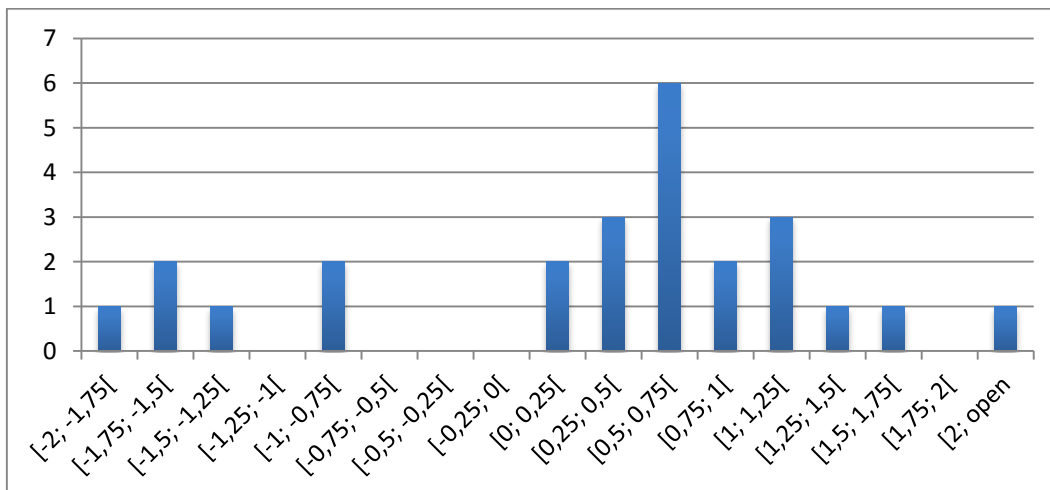


Figure 6 Distribution of the 25 single effect sizes

We also separated effect sizes from figure 6 into two groups (it projects vs online services) to evaluate if there are differences in the effect of escalating commitment with respect to a specific context.

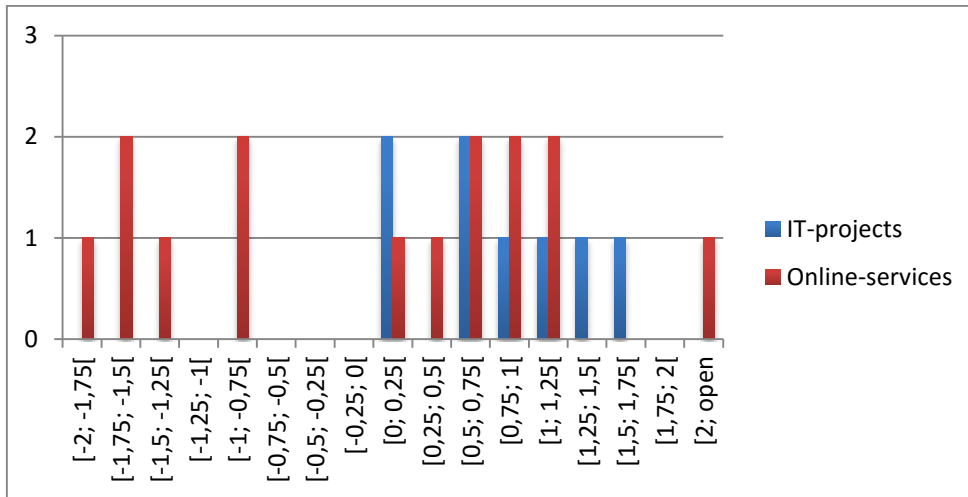


Figure 7 Distribution of effect sizes of sunk costs in it-projects and online-services

Looking at the chart it can be noticed that the effect sizes of IT projects are all positive, whereas the ones of online services are also negative. But only via aggregation of the data it can be checked if they differ significantly. Both for single effect sizes and the overall effect size it can be questioned how they should be interpreted since for example Cohen's d is not normed between 0 and 1. Subsequent table illustrates a collection of how effect sizes can be interpreted.

Cohens d	Interpretation after Cohen (1988)	Cohens f^2	Interpretation after Cohen (1988)	Cohens q	Interpretation after Cohen (1988)
< 0	Negative Effect	< 0	Negative Effect	< 0	Negative Effect
0	No effect	0,02	Small effect	< 0,1	No effect
0,1		0,15			
0,2	Small effect	0,35	Medium effect	0,2	Small effect
0,3				0,3	
0,4				0,4	
0,5	Medium effect			0,5	Medium effect
0,6				> 0,5	
0,7					
0,8					
0,9	High effect		High effect		High effect
>= 1					

Table 6 Interpretation of effect sizes after Cohen, 1988 (according to Lenhard & Lenhard, 2017)

To summarize this section one could plausibly say that first we calculated 25 comparable non corrected effect sizes after Cohen (1988) and secondly corrected effect sizes after Hedges (1985).

3.4 Aggregation

In the following section we will now check whether the aggregation of the 25 effect quantities is justified. After screening the respective 25 articles and applying a reasonable level of abstraction, we found that the studies were designed in a comparable way with experimental- and control groups and student participants and the various dependent variables of sunk costs were indicators of a common construct. Thus, in this stage we accepted all variations of operationalizations of sunk costs as dependent variable. These factors ensure reasonable homogeneity and possibly justify an aggregation of the studies which subsequently shall be examined in detail. On the other hand a wide variety of independent variables is sought after as it plausibly serves the objective of a meta-analysis to give a broad overview (Bortz & Döring, 2005).

Hedges & Olkin (2007) report that an aggregation of a series of single effect sizes to one overall effect size can only be done if the format of all primary studies' data is reasonably equal and the subsequent transformation into effect sizes was carried out by a single formula. We chose the difference of mean and standard deviation for the standardized format and Cohen's *d* as standardized formula. We obtain 14 effect sizes that immediately fulfil these requirements. As the calculation of effect sizes based on percentages is actually a difference in means as well we integrated further 8 studies into the new set. Hence, we focus more on the second requirement of a standardized formula and neglect the first requirement of standardized data. We excluded the studies of Whytten & Wakefield (2006), Bahli & Rivard (2013) and Park et al. (2008). The new set of studies comprises 22 sub studies that are ready for aggregation if it is assumed that these studies are a replication of each other (Hedges & Oltkin, 1985). That means in particular that they measure the same construct and only differ in their sample size and response scales. This assumption is called a fixed effects model where a single value of the true effect is assumed (Hedges & Olkin, 1985; Bortz & Döring, 2005). As the purpose of this meta-analytic study was to give a first and recent overview about the overall effect of escalating commitment in IS we chose an fixed effects model for this study. If complexity issues are optionally taken into account to model the overall effect in more detail, a so called random effects model should be assumed. It seems clear that in practice identical study conditions never exist such that the assumption of an identical replication of each other implausibly holds. Consequently, a random effects model would be the more appropriate though more complex model (Hamari & Keronen, 2017).

The easiest and therefore most applied way to calculate an overall effect size is the calculation of the mean of all effect sizes. If the studies have different sample sizes a weighting can be integrated in the calculation since the variance of the estimator depends on the sample size (Hedges & Oltkin, 1985). The weighted mean then corresponds to a kind of expected value with weights that sum to one.

The estimator for the overall effect size then can be obtained by (Bortz & Döring, 2005; Hedges & Oltkin, 1985; Eisend, 2004; Stamm & Schwarb, 1995):

$$\hat{g}_w = \frac{\sum_{i=1}^{22} w_i * g_i}{\sum_{i=1}^{22} w_i} \quad (6)$$

For the sake of convenience we use weights that are based on the sample size which then can be calculated by (Bortz & Döring, 2005):

$$w_i = \frac{1}{v_i} \text{ with } v_i = \frac{1}{N_i - 3} \text{ and } N_i = n_i^E + n_i^K \quad i = 1, 2, \dots, 21$$

The study Yenyiyurt et al. (2011) had to be excluded as the high sample size would have drawn too much weight on this study as result all other studies would have received a weight marginally different from zero.

Applying formula (6) an overall effect size of

$$\hat{g}_w = 0,6405$$

can be calculated.

With

$$s_{standard} = \sqrt{\frac{1}{\sum_{i=1}^{21} w_i}}$$

a confidence interval

$$\left[\hat{g}_w - z_{(1-\frac{\alpha}{2})} * \sqrt{\frac{1}{\sum_{i=1}^{21} w_i}}; \hat{g}_w + z_{(1-\frac{\alpha}{2})} * \sqrt{\frac{1}{\sum_{i=1}^{21} w_i}} \right] \quad (8)$$

can be calculated that can serve as further reference (Bortz & Döring, 2006).

With $s_{standard} = 0,0212$ und $n = 21$ and to a level of significance of $\alpha = 0,05$ ($z_{(1-\frac{\alpha}{2})} = 1,96$) a confidence intervall for \hat{g}_w can be obtained by

$$[0,5989; 0,6820].$$

If the population of effect sizes is reasonably homogeneous, \hat{g}_w is a good estimator for the true effect size delta (Bortz & Döring, 2005). To check whether \hat{g}_w differs significantly from zero the following test can be applied (Bortz & Döring, 2005, Hadish & Shadock, 1994):

$$y = \hat{g}_w * \sqrt{\sum_{i=1}^{21} w_i} \quad (9)$$

The effect size is significant on the 5% level, if the standardized normal distributed test statistic $y \geq 1,65$ (Bortz & Döring, 2005). With the parameters from above $y = 30,18$ can be calculated such that the overall effect size \hat{g}_w is significantly different from zero.

With these two results it can be summarized that the overall effect size of sunk costs in recent IS literature is 0,64 with possible deviations of $\pm 0,04$. The tight confidence interval possibly indicates that an aggregation is reasonable, but if it is justified at all, has to be checked in the subsequent section.

3.5 Test for Heterogeneity

Consequently, it shall be examined whether the 21 sub studies constitute a sufficiently homogeneous population such that a calculation of an overall effect size is justified. Thus, tests of heterogeneity measure if the model accounts for the natural variation within the single effect sizes (Hedges & Oltkin, 1985).

Those authors propose a test of heterogeneity based on a q-statistics which is calculated as follows (Bortz & Döring, 2005; Shadish & Hadock, 1994):

$$Q = \sum_{i=1}^{21} \frac{(g_i - \hat{g}_w)^2}{v_i} \quad (10)$$

Which is equivalent to

$$Q = \sum_{i=1}^{21} w_i * g_i^2 - \frac{(\sum_{i=1}^{21} w_i * g_i)^2}{\sum_{i=1}^{21} w_i} \quad (11)$$

The g_i denote the effect sizes of table 5, $g_w = 0,6405$ the overall effect size ist and w_i the individual weights. If the nullhypotheses holds Q is appoximativly χ^2 -distributed with k-1 degrees of freedom, where k denotes the total number of integrated studies (Bortz & Döring, 2005; Hedges & Oltkin, 1985; Keil & Wang, 2007). With the parameters above a Q of 1494,84 can be calculated which is highly significant (5%, $\chi_{crit}^2 = 31,14$) such that the nullhypotheses of homogeneity has to be denied.

To double check this result we followed the proposition of Hunter & Schmidt (1990) and applied the so called 75% rule which states that at least 75% of the total variance should be explained by the sample variance (Eisend, 2004, S. 13; Stamm & Schwarb, 1995; Hunter & Schmidt, 1990). The formula for the sample variance can be calculated by (Stamm & Schwarb 1995, S. 15)

$$\sigma_{sample}^2 = \frac{K(1-g_w^2)^2}{\sum_{i=1}^K N_i} \quad (12)$$

and the total variance by

$$\sigma_{total}^2 = \frac{\sum_{i=1}^{21} [(g_i - g_w)^2 * N_i]}{\sum_{i=1}^{21} N_i} \quad (13)$$

where N_i is the sample size of study i. With $K = 21$ and $\sum_{i=1}^{21} N_i = 2283$ a $\sigma_{sample}^2 = 0,001188$ and a $\sigma_{total}^2 = 0,6914$ can be calculated. For the quotient of both one obtains 0,0017 which means that only 0,2% of the total variance is explained by the sample variance. The result of this test and the result above indicate that the set of studies constitute a heterogeneous one such that an calculation of an overall effect size only counts under reservation or is not justified at all.

3.6 Moderator Analysis

To possibly purge the set of studies by removing single studies such that the remaining ones form a reasonable homogeneous partition, Hedges & Oltkin (1985) propose a descriptive analysis for outliers. Hence we calculated confidence intervalls for all 21 effect sizes with the proposed variance of

$$\phi_i^2 = \frac{n^E + n^K}{n^E * n^K} + \frac{g_i^2}{2(n^E + n^K)} \quad (14)$$

and collected them in the subsequent chart.

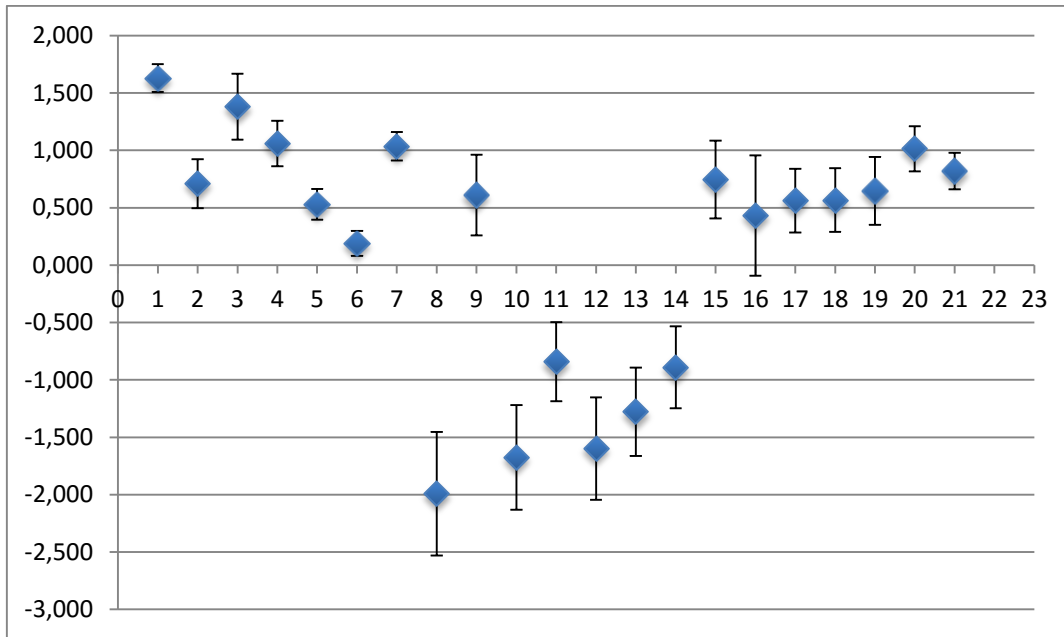


Figure 8 and 21 Effectsizes with confidence intervalls

Analysing the chart, it can be noted that effect sizes 8, 10, 11, 12, 13 & 14 are negative and have a relatively high variance. Not farfetched seems to be that a more homogeneous population could be reached if those studies were excluded. But this example of calculation shall not be executed for statistical purposes only without considering semantic reasons. Taking semantic reasons into account an actual moderator analysis shall be executed. The technical purpose of a moderator analysis is to check whether a population of studies can be partitioned by a moderator variable that produces homogeneous subgroups. The purpose with regards to contents is to examine differences in meta-analysis results that possibly evolve by joint contexts of the integrated studies.

We were interested if the context of the studies may be responsible for the substantial heterogeneity of the whole population. Hence, we tried separating articles that study sunk cost in the context of IT-projects from the ones that study sunk costs in online-services. This dichotomous variable is employed firstly since Keil & Wang (2007) used a very similar one and secondly since it is assumable that two classes of studies account for the joint systematic difference within them. A joint characteristic of studies for example with the context online-services might be the shorter course of action, less complex and expensive courses of action as well as less switching costs to an alternative course of action. Consequently, we test with the Q-test from above whether this moderator variable produces two subgroups of effect sizes that are heterogeneous inter-group and homogenous intra-group.

Subgroup it-projects			Subgroup online-services		
Study	w_i	Corrected effect size according to Hedges g	Study	w_i	Corrected effect size according to Hedge's g
1	357	1,630	1	298	1,036
2	90	0,710	2	32	-1,993
3	57	1,380	3	34	0,610
4	113	1,060	4	37	-1,676
5	232	0,530	5	40	-0,842
6	331	0,189	6	41	-1,599
			7	41	-1,277
			8	38	-0,891
			9	38	0,746
			10	12	0,432

			11	72	6,870
			12	45	0,647
			13	115	1,014
			14	167	0,820
$\sum w_i = w_j:$	1180			1010	

Table 7 Database to calculate effectsizes of the two subgroups

As already mentioned above in the course of calculating the total effect strength, the weight of the effect strength of Study 11 Yenyurt et al. (2011) could not be calculated in a prescribed manner due to the excessive sample size. Instead, an average weight of 72 was chosen.

With the data above and formula (1) an average effect size of $\hat{g}_{IT} = 0,8727$ for the it-projects and $\hat{g}_{online} = 0,8209$ for the online-services can be calculated.

To check whether the small difference of both overall effect sizes is not an artefact (test for heterogeneity inter-group) we employ a variant of the Q-test proposed by Bortz & Döring (2005) with $p = 2$:

$$Q_{inter} = \sum_{j=IT}^{online} (\hat{g}_j - \hat{g}_w)^2 * w_j \quad (15)$$

If there are no inter-group differences (null hypotheses) Q_{zw} is approximately χ^2 - distributed (Bortz & Döring, 2005). With the parameters from above a Q_{inter} of 94,49 can be calculated which is highly significant (5%, $\chi^2_{crit} = 3,84$) consequently the nullhypotheses has be be denied.

To check for intra-group homogeneity Bortz & Döring (2005) propose a modified Q of:

$$Q_{intra} = \sum_{j=IT}^{online} Q_{in,j} \quad (16)$$

mit

$$Q_{intra,j} = \sum_{k=1}^q (\hat{g}_{kj} - \hat{g}_j)^2 * w_{kj} \quad (17)$$

$j = IT, Online; q = 6, 14.$

If the null hypotheses of no differences in effect sizes within the group holds Q_{in} is approximatively χ^2 -distributed with $[6+14=20] - p$ degrees of freedom. The test for homogeneity in group j can be tested by $Q_{intra,j}$ which is χ^2 -distributed with $[6-1$ oder $14-1]$ degrees of freedom (Bortz & Döring, 2005).

For $Q_{intra,IT}$ a value of 407,73 and for $Q_{intra,online}$ a value of 3784 can be calculated, which both are highly significant. Q_{intra} is calculated by summing both $Q_{intra,j}$ -values that sum up to 4191 which again is highly significant.

In accordance with Bortz & Döring (2005) a moderator variable divides k studies in p homogenous subgroups if and only if Q_{inter} is significant and Q_{intra} is not. In our case indeed Q_{inter} is significant but Q_{intra} as well such that the applied moderator variable really accounts for some variance of the general model (Keil & Wang, 2006), but still leaves behind to heterogeneous subgroups. Consequently, the calculated effect sizes \hat{g}_{IT} and \hat{g}_{online} are a reference point in the solution space only.

3.7 Discussion

The first step was to identify suitable effect sizes that account for different natured data. Cohens d , f^2 , q were considered suitable and were calculated for all 25 substudies. Subsequently these 25 uncorrected effect sizes

were transformed into corrected Hedge's g s. The ensuing aggregation only allows same effect sizes thus Cohen's f^2 and q were excluded such that 21 studies remained ready for aggregation. For the overall effect size a significant estimator of $\hat{g}_w = 0,6405 \pm 0,04$ was calculated following the proposed formula of Bortz & Döring (2005). Since a calculation of an overall effect size can only be computed if it is based on a homogeneous population, the test of heterogeneity proposed by Shadish & Haddock (1994) was applied which yielded heterogeneity of the studies. The 75% rule proposed by Hunter & Schmidt (1994) yielded a result that is redundant to the latter one. Both information criteria indicate that the calculation of the overall effect size was not justified or is only valid under reservation and serves as a reference point. Consequently a moderator analysis was applied by partitioning the population into two parts by the dichotomous variable it-projects vs online-services. The test on inter-group differences indeed yielded heterogeneity but the test on intra-group differences yielded heterogeneity too, such that the two overall effect sizes are only valid under reservation.

4 Limitations

In part I of this study articles of different quality were processed, in particular the identified drivers were not weighted by their journal relevance. Furthermore, *one* version of the driver network has found its way into this study. It seems clear that the analysis and pivoting process is subject to subjective moments that influence the particular version. It is worth to note that in case of full objectivity and rigorosity in finding all relevant relationships, the completeness not only contributed to confusion but also extended the scope of the most papers. Combining different studies it is necessary to apply a reasonable level of abstraction to unify the differently operationalized constructs and their relationships of each study in one overview. Thus in the table of appendix 2 we speak for example of decision makers and courses of action in a general manner to integrate all the findings of the examined studies under these labels although this abstraction of the relationships from a specific context (e.g. online auctions) to a general domain (IS) is not justified.

In part II the processed data and the methodological framework are subject to limitations. The 21 single effect sizes were calculated based on statistical results of primary studies which did not share the same journal quality. Thus, there might be slight biases in the overall effect size of escalating commitment in IS caused by mediocre primary study results. Indeed another issue was the small population of 25 sub studies in the beginning which was even reduced to 21 sub studies, however the overall effect size turned out to be significant. Even though the processed data would be immaculate, the methodological model would be critically subject to limitations. Since we employed a fixed effects model although a random effects model would have been the more appropriate one to model and incorporate the specific nuances of each study. Furthermore we employed approximated weights according to Bortz & Döring (2005) which only yield a biased estimator for the overall effect size.

5 Conclusion

The present study's contribution is a better understanding of the phenomenon of escalating commitment in IS which was achieved by systematically compiling theories and empirical studies. The study not only tried to get to the bottom of the phenomenon by collecting and analysing possible drivers of it but also tried to thoroughly quantize the phenomenon to draw conclusions about its importance in IS. Moreover the study offers results that are based on rigorous documented approaches both in the literature review and meta-analysis part such that they can be replicated and the used approaches can serve as methodological guidelines for further research.

Literature reviews not only serve as a summary of research that is undertaken recently but indicate also where progress in research is still needed (vom Brocke et al., 2009).

To further develop the research of the phenomenon within the information systems it will be crucial to find a final ranking of the explanatory power of the numerous drivers and theories. A ranking would systemize the current list of drivers that only as a whole may be adequate to explain escalating commitment today.

Better than a systemized list of many drivers would be a parsimonious set of only a few or a single driver with less assumptions and higher explanatory power.

The identification of only one but an apposite driver could be of importance which triggers escalating commitment first or at all. For a standalone theory, aspects of psychology of perception seem to be particularly predestined such as preference-consistent information processing, since information on facts must first have "passed through" the decision maker, i. e. be perceived by them before attitudes, opinions, intentions and decisions become actions. The more precise knowledge of these mechanisms exist the more could escalating commitment be explained on a general level, from a perceptual psychological perspective, without using a context-specific, high-dimensional set of explanations. On the other hand, it is also conceivable that all previous explanatory approaches could be traced back to a theory of volitional psychology. This could be the case because the perennial element of escalating commitment seems to be attributed to volition (cf. Schelzke, 2012) and persistence is the strategy par excellence, in order to bring any course of action to success, which is the goal of all initiated courses of action. The latter theories assume that the reasons for escalating commitment first of all crucially depend on decision makers and accordingly are to some degree rooted within them, only in later instances the context will be important to consider.

With detailed knowledge of the final causes of escalating commitments, precise recommendations for de-escalation could also be given, which up to now have only been formulated context-specifically.

It is also very likely that there is no overall theory due to the defined very general character of the phenomenon and that several theories which take contexts into account must be used. For constituents of the phenomenon such as sunk costs the reasons seem obvious but as soon as more concepts or constructs come into play and are comprised under a common fictive label (phenomenon) it will be difficult to find precise answers. If we for example refer to abstract labels such as "success" or "failure" of an IT project it is not clear at all what is meant by them or what they are really referring to out in reality. The underdetermination of these labels hence makes it hard to find reasons. The long way from reality to reasoned labels, that are only retrieved by/of reality and that only grasp aspects of it, is subject to interpretation. "Escalating commitment" behaves in a very similar manner which is probably why no final drivers can be identified as it is utterly not clear what is really meant.

For escalating commitment, for example in the specific context of IT projects, it could also be conceivable that limited rationality (Simon, 1959) causes decision-makers to define a project framework in the first place or rather to prematurely define a project with too narrow systemic boundaries (cf. planning fallacy: Kahneman & Tversky, 1979). Due to the narrow boundaries, possible uncertainties beyond the project scope, whether near or far, are "cleverly" hidden. If the limits of the project were widened in advance, negative news about the success of the project would probably not arrive at all or not in unforeseen and fateful ways. The simplifying strategy of the narrow project framework could be "for the time being/for now" satisfactory or satisfying (Simon, 1955) and in particular owing to the human, limited cognitive information processing capacity (Pfeiffer, 2006, p. 99).

It does not seem to be farfetched either that there may not be any objectively comprehensible explanatory approaches at all, since it is difficult to see why "goals are sometimes so centrally and inseparably linked to the self that neither massive setbacks, nor serious experiences or enlightening indications lead to the reconsideration of the abortion of action" (Schelze, 2012, p. 166), so that the persistent pursuit of goals is subjectively simply without alternatives, although objectively speaking, obviously escalating persistence would exist.

The provision of a unified definition of escalating commitments could be conducive to the effort to find a theory. As e.g. Pfeiffer (2006) observes, the term is used inconsistently.

A consistent definition could, for example, help in the investigation of the phenomenon in primary studies to ensure that at least all authors deal with the same phenomenon and that the study designs become comparable. Comparability simplifies potential meta-analysis in a way that less unexplained heterogeneity is recorded in the study results. Complete homogeneity in the population cannot be achieved by nature, but an approximate homogeneity can be achieved, provided that all studies refer to a consistent definition.

Regarding the fields of application of escalating commitment in IS, future research may study the phenomenon in the established fields or conceive about evolving fields due to the general trend for digitization of commercial operations. For example the broad field of sharing economy may be interesting to study as sunk costs play an important role there when individuals need to search for information (search costs) or pay for a membership etc.

In conclusion, our two studies in general suggest that escalating commitment in IS has not yet reached a sufficient treatment under a consistent label. Instead it is treated under different labels in various IS contexts where in fact similar situations and their common underlying escalating features have been recognized which however have not been matched to a consistent label. After more than 30 years of research on escalating commitment where analysis had been the main process it may now be of relevance to integrate and synthesize again all the findings from previous years not only to retrieve common terminal underlying features of the phenomenon itself but also of the analysed drivers.

7 Literature

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Appendix

Ranking	Journal	Publication	Title	Escalation of Commitment			
				Theories	Constructs	Definition	Context
A+	Information Systems Research (ISR)	None					
	Management Information Systems Quarterly (MISQ)	Keil M., Rai A., Mann D. (2000a)	Why Software Projects Escalate: An Empirical Analysis and Test of Four Theoretical Models	Self-justification theory, prospect theory, agency theory, approach avoidance theory	Psychological self-justification, social self-justification, sunk cost effect, goal incongruity, information asymmetry, completion effect	Brockner (1992)	IT-Projects
		Keil M., Tuunainen V., Tan B., Saarinen T. (2000b)	A Cross-Cultural Study on Escalation of Commitment Behaviour in Software Projects		Risk propensity, level of sunk cost, risk perception, willingness to continue project	Brockner (1992), Garland (1990)	IT-Projects
		Montealegre R., Keil M. (2000c)	De-Escalating Information Technology Projects: Lessons from the Denver International Airport		Publicly stated limits, availability of alternative investments, setting minimum target levels, regular evaluation of project etc.		IT-Projects
		Keil M. (1995)	Pulling the Plug: Software Project Management and the Problem of Project Escalation		Project factors, psychological factors, social factors, organizational factors	Brockner (1992)	IT-Projects
		Polites G., Karahanna E. (2011)	Shackled to Status Quo: The Inhibiting Effects of Incumbent System Habit, Switching Costs and Inertia on New System Acceptance	Habit, loss aversion, psychological commitment, maintain social position	Incumbent system habit, inertia, switching costs, attitudinal beliefs, normative beliefs, intention to use new system	Samuelson & Zeckhauser (1988)	New IT-System Acceptance
	Journal of Management Information Systems	Keil M., Mixon R., Saarinen T., Tuunainen V. (1995)	Understanding Runaway Information Technology Projects: Results from an International Research Program Based on Escalation Theory	Self-justification theory, prospect theory, agency theory, approach avoidance theory		Brockner (1992), Garland (1990)	IT-Projects
		Seok K., Keil M., Vijayak. (2014)	The Effect of Initial Budget and Schedule Goals on Software Project Escalation				IT-Projects
		Keil M., Robey D. (1999)	Turning Around Troubled Software Projects: An Exploratory Study of the Escalation of Commitment and Failing Courses of Action		Publicly stated limits, availability of alternative investments, setting minimum target levels, regular evaluation of project etc.	Brockner (1992), Garland (1990)	IT-Projects
		Mähring M., Keil M., Mathiassen L., Heje S. (2008)	Making IT Project De-Escalation Happen: An Exploration into Key Roles				IT-Projects
Journal of the Association for Information Systems (JAIS)	Heng S., Tan B., Wie L. (2003a)	Willingness to Continue with Software Projects: Effects of Feedback Direction and Optimism under High and Low Accountability Conditions		feedback optimism, accountability, feedback direction	Staw (1997)	IT-Projects	
	Truex D., Holmström J., Keil M. (2006)	Theorizing in Information Systems research: A reflexive analysis of the adaptation of theory in information systems research				General IS	
Journal of Information Technology	Drummond H. (2005)	What We Never Have, We Never Miss? Decision Error and the Risks of Premature Termination				IT-Projects	
Proceedings of the International Conference on Information Systems (ICIS)	Boonthanom R. (2003)	Information Technology Project Escalation: Effects of Decision Unit and Guidance		project factors, decisional guidance, escalation behavior, project completion	Staw (1976)	Information Technology Outsourcing	
	Khan S., Khouja M., Kumar R. (2014)	Explaining Escalation of Commitment in Information Technology Investments	time inconsistent preferences	salvage value	Keil (2000)	Information Technology Outsourcing	
	Arviansha, Spill, Hillegersberg (2015)	To Continue or Discontinue the Project, That is the Question	equivocal information	Content, Context, Process, Equivocal Situation, Complexity in process, Lack of Standards etc		IT-Projects	
	Lee J., Lee H., Keil M. (2014b)	Using Perspective Taking to De-Escalate Commitment to Software Product Launch Decisions	perspective taking	Personal cost, Anticipated guilt, Perspective taking, Willingness to launch product as scheduled	Brockner (1992)	IT-Projects	
	Park S., Keil M., Bock G., Kim J. (2016)	Winner's Regret in Online 2C Auctions: An Automatic Thinking Perspective	automatic thinking	trait impulsiveness, sunk cost, competition intensity, winners regret;		Online auctions	
The Journal of Strategic Information Systems	Pan G., Pan S., Flynn D. (2004)	De-escalation of Commitment to Information Systems Projects: A Process Perspective		behaviour disconfirmation, continuous commitment, provision of psychological safety, development, and the alignment and integration of new attitudes and behaviours	Staw & Ross (1987)	IT-Projects	
European Journal of Information Systems (EJIS)	Whytten D., Wakefield R. (2006)	Measuring Switching Costs in IT Outsourcing Services	transaction cost theory, social exchange theory	switching cost, uncertainty costs, post-switching hiring and retraining, system upgrade costs, lost benefits, search and evaluation		Information Technology Outsourcing	
	Cheol S., Keil M., Back K. (2016)	Understanding Verbal Bidding Behavior in 2C Auctions: An Escalation Theory Perspective				Online auctions	
	Nuijten, A., Keil, M., Commandeur, H. (2016)	Collaborative Partner or Opponent? How the Messenger Influences the Deaf Effect in IT Projects	deaf effect	a.o. framing, perceived control		IT-Projects	

Appendix

B	Decision Support Systems	Bahl B., Rivard S. (2013)	Cost escalation in information technology outsourcing: moderated mediation study		Asymmetrical relationship-specific investments; Bargaining power; Measurement difficulty; Hold-up problem; Disputes; Multi-sourcing		Information Technology Outsourcing
	Decision Sciences	Keil M., Depledge G., Rai A. (2007)	Escalation: The Role of Problem Recognition and Cognitive Bias	biased belief updating; cognitive bias	Selective perception of software quality; marketing illusion of control; software quality problem recognition; proclivity to launch planned	Brockner (1992)	IT-Projects
		Mähring M., Keil M. (2008)	Information Technology Project Escalation: A Process Model				
	Information Management	Sabherwal R., Sein M., Marakas S. (2003)	Escalating Commitment in information system projects: findings from two simulated experiments	psychological, social, project and structural factors	various	Garland (1990)	IT-Projects
		Heng S., Tan B., Wie K. (2003b)	De-Escalation of Commitment: What Matters? What Matters?	self-justification	sunk costs; shoulder blame; provide assurance	Staw (1976)	IT-Projects
		Information Resources Management Journal	Wang J., Keil M. (2007)	A Meta-Analysis Comparing the sunk cost effect for on- and off-line projects	sunk costs		Arkes & Blumer (1985)
	Electronic Commerce Research and Applications	Liang T., Lee C., Tung W. (2014)	The role of sunk costs in online consumer decision-making	sunk costs		Arkes & Blumer (1985)	Online-shopping
	Journal of Interactive Marketing	Ariely D., Heyman S., Orhun Y. (2004)	Auction fever: The effect of opponents and quasi-endowment on product valuations	quasi-endowment; opponent effect/competition effect			Online auctions
	Organizational Behavior and Human Decision Processes	Ku G., Malhotra D., Murnighan J. (2004)	Towards a competitive arousal model of decision-making: a study of auction fever in live and Internet auctions	competitive arousal			Online auctions
	European and Mediterranean Conference on Information Systems 2008	Ku G. (2007)	Learning to de-escalate: the effects of regret on escalation and commitment	regret; escalation of commitment	post-escalation regret		General
Journal of Supply Chain Management	Park S., Kim M., Bock L. (2008)	Understanding the bidder's escalation to commitment in online C2C auctions	sunk costs; completion effect; self-justification	Continued commitment to purchase; sunk costs; completion effect; self-justification; willingness to continue project	Staw & Ross (1987)	Online auctions	
Journal of experimental social psychology	Yeniurt S., Watson S., Carter C., Stevens C. (2011)	To bid or not to bid: Drivers of bidding behavior in electronic reverse auctions	escalation of commitment	prior wins and losses; self-discrepancy; bidders need for cognition; auction competition; time pressure and deadlines; bid visibility		Online auctions	
Current Psychology	Gunia B., Sivanathan N., Galinsky A. (2009)	Vicarious entrapment: Your sunk costs, my escalation of commitment	Escalation of commitment; psychological connectedness	perspective taking;	Brockner (1986)	General	
European Conference on Information Systems	Coleman M. (2009)	Sunk costs and commitment to dates arranged online	sunk costs		Arkes & Blumer (1985)	Online dating	
European Conference on Information Systems	Roetzel P. (2015)	The impact of creativity and information load on escalation of commitment	self-justification theory	creativity; information load	Keil (1995), Staw (1976)	IT-Projects	
DATABASE for Advances in Information Systems	Lee J., Cuellar M., Keil M., Johnson R. (2014a)	The role of bad news reporter in information technology project escalation: a deaf effect perspective	deaf effect	Credibility; Gender; Role Prescription; Message Relevance; Risk Perception; Risk Propensity		IT-Projects	
IFIP Advances in Information and Communication Technology	Dwivedi R., Ravichandran K., Williams M., Miller S., Lal B., Antony G., Kartik M. (2013)	IS/IT project failures: A review of the extant literature for deriving a taxonomy of failure factors				IT/IS-Projects	
AMCIS 2016 Proceedings	Liang T., Yen N., Li Y., Hsu S. (2016)	Escalation of Commitment in Software Projects: A Neural Science Perspective				IT-Projects	
AMCIS 2017 proceedings	Mallampalli V., Karahanna E. (2017)	Why don't systems die? An escalation of commitment perspective				IS-Systems	
Other	International Journal of Information Technology Project Management	Mobekk H., Fagerstrom A., Hantula D. (2018)	The influence of probability discounting on escalation in information technology projects				IT-Projects

Appendix

		Drivers			
Class	Denotation	Description	Sources		
Psychological drivers	Self-justification; Accountability; Endowment effect; Positive self-perception; Goal incongruity	Responsible decision maker commits to current course of action and commitment, builds up relationship and endowment with associated objects and invests further resources to justify the decision for persistence with the proceeding. Self-justification shall have positive self-image. Personal interests are pursued instead of acting in the economic sense for the company and without considering the situative context.	Keil et al. (2000a); Park S., Keil M., Bock G. (2008); Heng S., Tan B., Wie K. (2003); Roetzl (2015); Keil M., Mixon R., Saarinen T., Tuunainen S. (1995); Ariely D., Heyman J., Orhun Y. (2004)		
	Risk behaviour: Risk perception and assessment; Selective perception; Problem recognition; Risk propensity	Different decision makers perceive and assess differently. Within groups, risk perception, -assessment of members can differ significantly. The higher the risk propensity the lower risk perception. High risk propensity supports escalating commitment, high risk perception supports de-escalation of commitment.	Keil et al. (2000b); Keil M., Depledge G., Rao A. (2007); Lee J., Cuellar M., Keil M., Johnson R. (2014)		
	Control behaviour: Perceived control; Illusion of control	Perceived control over success of course of action is unreasonably higher assessed than objective true control really is. Accordingly, personal probability of success is unreasonably higher assessed than objective probability of success promises.	Keil M., Depledge G., Rao A. (2007); Nuijten et al. (2016)		
	Reflection of the past: Sorrow, regret, prior history/experience with similar proceedings; Consideration of future; Personal costs; Anticipated guilt	Decision maker's predominant good experiences with similar escalating situations support escalating commitment in subsequent situations. If for a miserable outcome he anticipate a down guilt is assessed as high, escalating commitment will be supported.	Ku G. (2007); Yenyurt S., Watson S., Carter C., Stevens C. (2011); Lee J., Lee H., Keil M. (2014); Park S., Keil M., Bock G., Kim J. (2016)		
	Self-discrepancy; Cognitive-dissonance	Perceived discrepancy between current and intended status of proceeding promotes dissatisfaction of decision makers such that efforts will be executed to reduce these unpleasantnesses.	Yenyurt S., Watson S., Carter C., Stevens C. (2011)		
	Creativity	If there is substantial negative feedback for the success of course of action, creative decision makers tend to invest more resources to save the proceeding	Roetzl P. (2015)		
	Impulsivity	Impulsivity as a character disposition promotes unreflected acting, without caring about consequences and weighing up the pros and cons and costs and benefits respectively	Park S., Keil M., Bock G., Kim J. (2016)		
	Sex and deaf-effect	Sex of decision makers influences the deaf-effect, which is gain effects escalating commitment	Lee J. et al. (2014); Colemann (2009)		
	Sociological, intra-group, inter-group drivers	External, social self-justification	Responsibility of the decision maker for the course of action and incoming negative feedback self-justification as a consequence to save face in front of group members	Keil et al. (2000a)	
		Perspective taking; capability for empathy; Psychological connectedness	In spite of negative information regarding the success of course of action, sociological and psychological similarities of group members can support herding behaviour and information cascades	Lee J., Lee H., Keil M. (2014b); Gunia B., Sivanathan N., Galinsky A. (2009)	
Competition pressure		High competition pressure promotes escalating commitment	Park S., Keil M., Bock G., Kim J. (2016); Yenyurt S., Watson S., Carter C., Stevens C. (2011); Ariely D., Heyman J., Orhun Y. (2004); Ku G., Malhotra D., Murnighan J. (2004)		
Conflicts		Conflicts between negotiating parties promotes escalating commitment	Bahl B., Rivard S. (2013)		
Framing		If the messenger of feedback regarding the success of course of action emphasizes losses instead of profits, deaf effect as a consequence which gain promotes escalating commitment	Nuijten et al. (2016); Heng S., Tan B., Wie K. (2003)		
Cultural dimension: Uncertainty avoidance		Decision makers from cultures with high values in Hofstede's cultural dimension uncertainty avoidance tend more likely to escalating commitment	Keil et al. (2000b)		
Credibility & sympathy of feedback messenger		Decision maker describes more meaning of negative feedback regarding negative outcome of the proceeding if messenger has status and high rank. Feedback will be more considered if messenger is rated as top partner.	Lee J. et al. (2014a); Nuijten et al. (2016)		
Organisational drivers		Sunk costs	The higher the sunk costs the higher the tendency to escalation of commitment	Keil et al. (2000a); Keil et al. (2000b); Park S., Keil M., Bock G., Kim J. (2016); Park S., Kim J., Bock G. (2008); Boonathanom R. (2003); Wang J., Keil M. (2007); Liang J., Lee C., Tung W. (2014); Colemann M. (2009); Ku G., Malhotra D., Murnighan J. (2004)	
	Equivocal information	A lack of evaluation of course of action, hence no data, hence no methods and standards can be developed to adequately evaluate the current status of proceeding which leads to escalating commitment	Keil et al. (2000c); Arviansha, Spil T., Hillegersberg J. (2015); Bahl B., Rivard S. (2013)		
	Complexity	Complexity within projects scope, equivocal information regarding the success of course of action and information overload are further determinants of escalating commitment	Arviansha, Spil T., Hillegersberg J. (2015); Bahl B., Rivard S. (2013)		
	Salvage value; Switching costs	If there is substantial negative feedback regarding the success of course of action, escalating commitment then depends on the amount of the salvage value and the transition-, switching costs to an alternative proceeding	Khan S., Khouja M., Kumar R. (2014); Polites G., Karahanna E. (2011)		
	Deadlines; Completion effect	Deadlines and the associated time pressure promote escalating commitment; Completion effect promotes escalating commitment	Yenyurt S., Watson S., Carter C., Stevens C. (2011); Park S., Kim J., Bock G. (2008); Keil M., Rao A., Mann J. (2000a); Boonathanom R. (2003)		
	Decisional guidance	Less alternatives and the absence of decisional guidance promote escalating commitment	Boonathanom R. (2003)		
	Information asymmetry	Information asymmetry regarding the project's status between decision maker (agent) and project manager (principal) can lead to an increased investment although there is substantial negative feedback. Accordingly, agent only reports positive aspects and bezzles negative ones	Keil et al. (2000a); Bahl B., Rivard S. (2013)		

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