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Toward an Ontology of Workarounds:
A Literature Review on Existing Concepts

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Abstract[1]

While workarounds are studied frequently in information systems research, a coherent and interrelated structure to organize the knowledge of the field is still missing. In this study, we provide a first step towards an ontology of workarounds in order to enable researchers to study the relationships among the core concepts. By identifying existing literature, we discover three gaps in workaround research: (1) lack of conceptual consensus, (2) fragmentation and (3) static perspective. To advance theory, we provide an overview of different types of workarounds that are frequently used in literature. Based on these findings we derive core concepts of workarounds that are used in literature and provide an ontology of workarounds.

1. Introduction

The utilization of information systems (IS) within organizations often results in workaround behavior [1]. Workarounds as non-trivial IS topic are prevailing across various industries and domains with different outcomes [2]. Special interest has been drawn on the use of enterprise resource planning (ERP) systems and how organizational members use them in unintended ways [3, 4]. Other perspectives interpret workarounds as a form of resistance [5] where they may lead to harmful consequences [3]. In other situations workarounds may improve the daily work and thus have a positive effect on organizations [6]. All in common, research agrees upon the assumption that workarounds have an effect on organizational performance [5] but literature still lacks a profound theory.

We discover three key gaps in workaround theory. First, our data shows that the phenomenon of workarounds lacks a conceptual consensus. Research is at odds when it comes to a consistent

interpretation. As existing literature has not offered a coherent and cumulative body of work, the theoretical and empirical investigation of workarounds can currently not be advanced. Second, we find that workarounds are currently investigated fragmented and largely independent of types and concepts. The interrelation of existing research streams offers insights into how workarounds are referred to and connected to each other. Third, workarounds are studied from a static perspective as a rigid phenomenon, which treats their emergence as a black box. Current research focuses on workarounds as an outcome rather than a process with temporality and dynamic structures. The gaps we discovered need to be considered when investigating workarounds as a behavior where organizational members utilize IS in unintended ways. Therefore, we ask the following research questions (RQ): *RQ1: What types of workarounds are discussed in literature and how can they be classified? RQ2: Which concepts are relevant when investigating workarounds and how are these concepts related?* Our research seeks to provide a first step in addressing the gap in research by answering the RQ.

2. Theoretical Background

Previous definitions have described workarounds as "misfits with the idealized representations of work" [7]. We define workarounds as anomalous use of IS where actual practices are not consistent with the designed use and official rules [8]. Research on workarounds primarily originated from the area of organizational psychology and were considered mainly as a misuse of resources with harmful consequences [9]. Disincentives and punishment were seen as effective reactions against workarounds [10]. Later, workarounds were increasingly related to the use of information technology as they became an essential part of every organization [11]. In different situations workarounds are used in order to solve problems [12], save time [13] or circumvent rules

limitations [14]. Workarounds as bottom-up ideas that are executed behind the scenes are seen as source of innovation and organizational success [6] what sheds a positive light on the phenomenon [6]. Pioneers of the neutralization model even address justification of breaking rules [15]. These studies attribute less importance to punishment as rule breaking most often grounds in conflicts [8]. The conflicts include situations where regulations are circumvented due to moral conflicts [16] or limited functionality of a system [17]. Workarounds are seen as user response to system design, e.g. shadow IT [18]. Studies about workarounds in IS are strongly connected to research regarding the introduction of new systems [19]. Research that investigates workarounds as the main focus is particularly often positioned within health care and public institutions (universities and administration) [8, 20]. This roots in the fact that physicians are able to save lives when working around IS [21] and public institutions struggle with outdated statues [22]. In unpredictable environments workarounds are an acceptable factor to address flexibility. The diversity of workflows can even be used in order to learn from emergent change [2].

3. Research Method

To provide rich insights we follow the literature review from Webster and Watson [23] extended by the guidelines from vom Brocke et al. [24] and the taxonomy of literature reviews [25]. Prior to the literature search, we defined the review scope and scanned literature for workarounds application. The goal of our literature review is to summarize types of workarounds. For organizing the review, we adopted the conceptual perspective and used a neutral representation to inform general scholars. With the review we cover central types of research. In a **first step** we included the top eight IS journals according to the AIS senior scholar list: MIS Quarterly, Information Systems Research, Information Systems Journal, European Journal of Information Systems, Journal of Management Information Systems, Journal of Strategic Information Systems, Journal of Information Technology, Journal of the Association of Information Systems. Furthermore we included Americas Conference on Information Systems, European Conference on Information Systems, Hawaii International Conference on Systems Sciences, and International Conference on Information Systems as the leading conferences in IS. We performed an explorative search by combining selected keywords related to workarounds and selected the relevant articles through a full-text

search guided by the following keywords: *workaround, customization, shadow IT/system, employee + decoupling, rule breaking, employee/workplace deviance.* The review of the IS journals and conferences led to 259 initial results. During this step, we refined the search terms to build a final search string to cover as many of the relevant articles. We added the terms *resistance, non-compliance, system misuse, fraud, computer abuse, tweaking, reinvention* and *non-conformity.* We scanned the abstracts and full articles and excluded duplicates and irrelevant papers manually. Thus, relevant papers could be determined to 58. We provide working definitions to describe the different types of workarounds. In a **second step** we conducted a backward search with relevant publications. We concentrated on the most important ones by reading their abstracts and the full papers. We were interested in their connection to the keywords. This led us to a total of 71 papers, which we integrated in our concept matrix. The **third step** was used to conduct a forward search to identify articles citing the key articles identified in the previous steps. We concentrated on the 20 most cited ones and reduced them with regard to the second step to the most important ones. The reason for this step is grounded in the fact that the plethora of papers interprets workarounds as an unexpected finding and provides them as a result. We are interested in workarounds as a starting point with deeper investigations. After this step our list resulted in 84 papers.

4. Results

In total we identified 84 papers on our search terms. Table 1 shows the types of workaround using the key terms from our literature review. We provide a clear definition to distinguish the different types. To gain insights into the relevant papers, we structured the paper with regard to the type of study (empirical or conceptual), type of workaround, level of workaround (individual, team, organization), industry, country, IS, orientation (technology or process), and intention (positive or negative) (see Appendix A).

Table 1: An Overview of Workaround Types

Types	Definition
Workaround	Anomalous IS use where actual practices are not consistent with the designed uses and official rules [8]
Shadow System/IT/work	Software applications or extensions to existing software that are neither developed nor controlled by an

	organization's central IT department [26]
Resistance	Behaviors intended to prevent the implementation or use of a system or to prevent system designers from achieving their objectives [27]
Non compliance	Security best practices and policies that are avoided [28]
Employee/ Workplace Deviance	Voluntary behavior that violates significant organizational norms and, in so doing, threatens the well-being of the organization or its members, or both [29]
System Misuse	Perform a behavior that misuse of IS resources [30]
Decoupling/ Loose Coupling	Separating formal rules from actual working practices [8]
Customization	Privately-owned IT resources, such as devices or software that are used for business purposes [31]
Rule Breaking	Violations of formal rules depending on the interests of specific actors and groups inside and outside the organization [32]
Fraud	Ill-intentioned employees use the system for prohibited aims [33]
Computer Abuse	Unauthorized, deliberate, and internally recognizable misuse of assets of the local organizational information system by individuals [10]
Tweaking	Deviation from a prescribed work processes by using a system in a slightly different way [19]
Reinvention	Practices that can be altered or tailored in order to accomplish specific tasks that were not initially planned or supported [34]
Non conformity	Striving for legitimate goals in illegitimate ways [35]

The definition of the type provides insights in how the term is used throughout research. We find that the definition may directly address the IS aspect (e.g., anomalous use of IS) or may refer to deviating process behavior (e.g., behavior that violates norms). This distinction helps in understanding whether the workaround misuses IS or if it is related to incongruence between a formal process description and actual working practice. On the other hand, the definitions indicate that the workaround may be associated to harmful behavior on purpose or the intention stems from a beneficial attitude.

Based on the identified literature and the classification framework we were able to derive an ontology that provides the concepts related to workarounds. We followed the methodology for the design of ontologies as recommended by Grüninger and Fox [36]. We used a motivation scenario that helps understanding the motivation for the proposed ontology in terms of its application [36]. Using this scenario a set of demands may be derived that are integrated in a next step using competency questions. In our case we came up with the following exemplary informal competency questions, e.g., *what are the reasons and the motivation behind workarounds? Which terms are used for workarounds in literature? What is the effect of workarounds?* Next, we specified the terminology by introducing a formal description of the vocabulary related to the tasks and activities [37]. Figure 1 presents the findings we derived from conducting the proposed steps. At this stage, the ontology has to be evaluated with formal competency questions, specification of a first-order logic and completeness theorem [36] which is not part of this research. We are rather interested in providing a first attempt for an ontology for workarounds that can be used as a basis for future research.

The emergence of workarounds is described by a process in which organizational members make their own decisions. In this process, conflicts arise where neutralization techniques are used that may lead to resistance. Resistance in turn leads to workarounds and affects the type. The dynamic relation between working environment and organizational members is based on their dependency. Relevant to the **working environment** are **rules, IS, organizational goals** and the **social climate**. Norms of **organizational members** are often determined within the social group in which they are located [8]. Often **conflicts** arise between internal norms and goals of organizational members versus the working environment. These conflicts force individuals to make a decision in line with compliance or non-compliant behavior. Thus, organizational members react to the underlying rule of the IS.

Literature suggests that the majority of these decisions are made on the basis of **neutralization** techniques [15]. Neutralizations describe the justification of rule breakers towards themselves or rationalizing an infraction in order to be regarded as reasonable or even correct [38]. Ambiguous rules often lead to neutralization by rejecting responsibility for the rule [32]. The working environment not only plays a role during the emergence of conflicts, but also during neutralization [39]. Perceived injustice leads to neutralization by discrediting the victim [40]. In literature neutralization emerges in form of workarounds that occur due to achieving a higher goal, such as maintaining higher productivity [41]. As a consequence, neutralization leads to compliant

behavior, positive or negative resistance. Those three forms of **resistance** manifest the intention of the employee [1]. The nature of the workarounds is ultimately dependent on the nature of the conflict, the nature of the resistance, the working environment and of the skills and norms of the organizational member [1]. The consequence of workarounds may either provide a **benefit** for the organization or may lead to a **risk**. Beneficial workarounds are described as innovation potential, indicator for the strengths and weaknesses of IS or a rule. The risk related aspect of workarounds includes data security, consistency and protection. Although the underlying intention of the organizational member may be positive, engaging in workaround behavior may have negative consequences for the organization [1].

members are open to talk about workaround behavior. More than often workarounds are well known in organizations and decision makers are aware of them. Second, our ontology provides a high level of abstraction. In order to build instances of the ontology it is necessary to collect data on workarounds. As workaround behavior is rather a process than a static outcome, it would be interesting to compare different instances of the same workaround during its emergence. Third, with our ontology we are not able to render judgment about whether a workaround is positive or negative. Rather, we were interested in providing an approach on how to collect information about workarounds without a priori judgment.
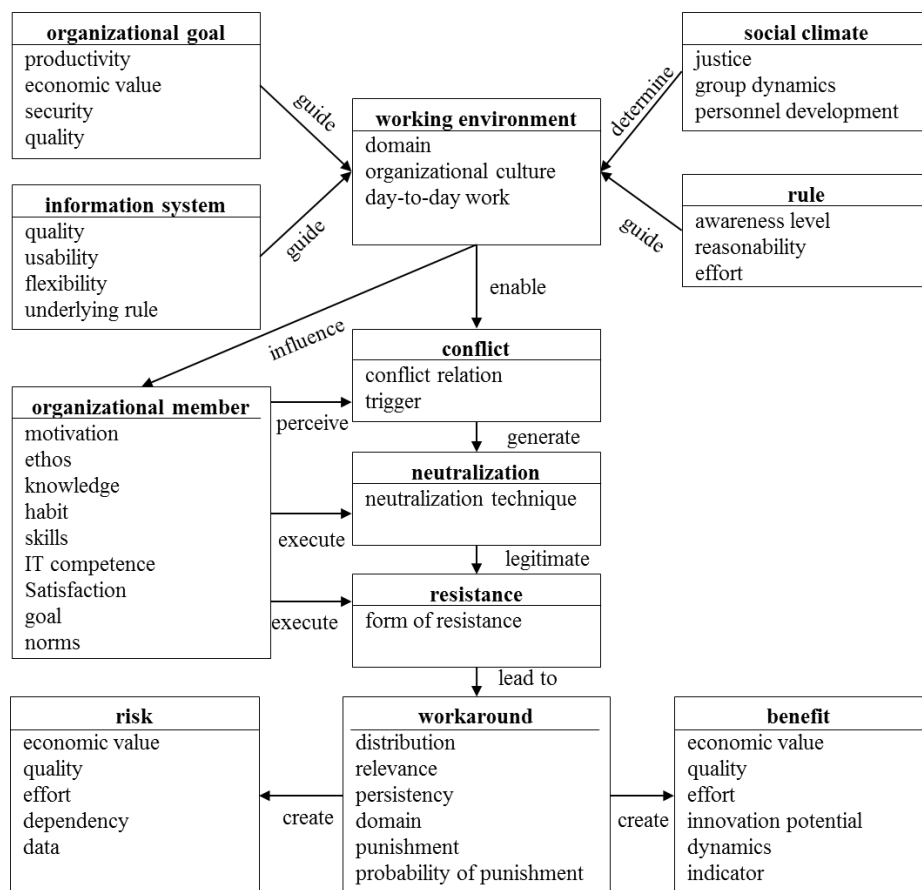
Figure 1. An Ontology of Workarounds

5. Discussion

Before discussing our findings certain limitations should be considered when interpreting the results. First, information regarding workarounds is sensitive. We found evidence in literature that organizational

Following the three gaps we identified during our review, we provide a first attempt to organize the knowledge of the field of workarounds. First, we derive an ontology of workarounds to provide a conceptual consensus. As there is no single correct ontology for any domain we only provide a first attempt towards a consistent basis to investigate

workarounds. Building on this basis we encourage researchers to evaluate and reconfigure our ontology of workarounds. We are aware that the design of an ontology is dependent on the creativeness of the designer and interpretation of viable alternatives [42]. Therefore, our suggestion may only provide a piecemeal representation from other perspectives that have yet not been considered in our analysis. Second, we address the issue of fragmentation by reviewing literature and provide a concept-related representation of our findings. We organize literature with regard to the type of study (empirical or conceptual), type of workaround, level of workaround (individual, team, organization) industry, country, IS, orientation (technology or process), intention (positive or negative) (see Appendix A). By doing so we are able to show how different types of workarounds are related to each other and how they are discussed throughout literature. Third, we provide an attempt towards reflecting the dynamic instead of static perspective on workarounds. We highlight key concepts that are related to the domain of workarounds. Reflecting the concepts stresses the dynamic nature in which workarounds are situated. Environmental factors influence behavior that determines workarounds - when conditions change, behavior may change as well. This may either be due to changing processes or changing technologies [43].

6. Conclusion

This study was motivated by providing a holistic understanding of workarounds and their related concepts. We began this study by reviewing literature on workaround behavior and clustered their types. The analysis resulted in a concept centric evaluation where the 15 most frequent workaround types have been presented. We provide an ontology of workarounds which allows the comparability of workaround behavior in IS. This enables organizations to share a common understanding of the structure of workarounds among organizational members.

Our study makes several contributions to IS research. First, we propose that workarounds need to be differentiated with regard to their type. For example highlighting the intention behind the workaround (positive or negative) can provide rich insights on how organizations can control this behavior. Second, technical as well as process workarounds need to be differentiated with regard to their outcome. When organizations seek to prevent workaround behavior, controls for technical workarounds differentiate from those that affect the organizational processes. Third, providing an

ontology makes workarounds comparable and may - in a next step - provide patterns on how to react to them. Organizations may tolerate, hinder or use the workarounds that are uncovered with our ontology.

From our findings it follows that there are several avenues for future research. First, the ontology needs to be evaluated with empirical data in order to ensure generalizability. By using interviews and archival data, workarounds may be collected to provide insights about different types. The visualization of incongruence in business processes promises to offer a consistent basis for comparing and analyzing workarounds [44]. Second, as workarounds describe dynamic behaviors future investigations need to consider and integrate temporality in the analysis. To unpack the black box of workarounds, research may provide insights into how the ontology can integrate the dynamic aspect and help in understanding the evolution. As the development of an ontology is an iterative process the evaluation may include a discussion with experts [42]. Third, the risks and benefits associated with workarounds have yet not fully been investigated. Still, there is a lack of evaluating incongruence between formal process descriptions and informal working practices. Using our ontology may enhance the understanding of factors that influence this ratio. Risks and benefits are related to workarounds and affect individual decisions of organizational members [45]. In different situations the same workaround may result in a positive or negative outcome [1]. A final area for future study would be how to control different forms of workarounds from an organizational or managerial perspective. With our findings, we are able to show different types of workarounds and how they are studied in research. In a following step, researchers may built upon these findings and suggest how organizations may gain control on the negative consequences of workarounds while at the same time be open for improving business processes by absorbing the positive side effects.

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Appendix A: An Overview of Workaround Research

#	Source[1]	Year	Type of Study[2]	Type of WA[3]	Level of WA[4]	Industry	Country	Information System	Orientation[5]	Intention	Focus[6]
1	Alter [2]	2014	conc	C, D, E, F, NC, R, RI, S, W	all	general	US	general	proc	/	t
2	Alter [17]	2012	conc	W	all	general	-	ERP	proc	+	s
3	Alvarez [46]	2008	conc	C, R, S, W	I	higher education	US	ES	proc	/	s
4	Ansari [16]	2010	conc	D, NC, R	all	general	-	general	proc	+	t
5	Azad [21]	2008	conc	R, S, T, W	I	health care	-	HIS	proc	/	t
6	Azad [8]	2012	emp	D, N, RB, S, W	G	tax collection, health care	-	tax arrears collection	proc	+	t
7	Bagayogo [33]	2013	conc	C, F, NC, SM, R, W	all	general	-	general	proc	/	t
8	Baker [47]	2005	emp	NC, T, W	all	general	-	general	proc	+	s
9	Bala [48]	2013	conc	C, R, S, W	all	manufacturing	US	ERP	proc	+	s
10	Behrens [4]	2009	conc	S, W	I, G	higher education	AU	platform	proc	/	s
11	Behrens [49]	2004	conc	S, W	all	higher education	AU	ERP	proc	+	s
12	Beimborn [50]	2013	conc	C, S	all	general	US	general	tech	+	s
13	Bennett [29]	2000	emp	E	I	general	US	general	proc	/	t
14	Berente [51]	2012	conc	D, R, RI, S, W	I, G	aeronautics administration	US	ES	proc	+	t
15	Bhattacherjee [52]	2007	emp	R, W	I	health care	US	HIS	proc	-	t
16	Boss [53]	2009	emp	N, R	I	health care	US	general	proc	-	s
17	Boudreau [19]	2005	conc	RI, S, SM, T, W	I	government	US	ERP	proc	+	s
18	Bulgurcu [41]	2010	emp	N	I	general	US	general	proc	/	t
19	Campbell [54]	2012	conc	W	I	investment	US	general	proc	+	t
20	Campbell [55]	2007	conc	CA, E, D, SM, RB	I	general	-	general	tech	-	t
21	Chua [56]	2014	conc	S, W	I	IT service provision	US	general	proc	/	s
22	Courtright [57]	1988	emp	W	all	general	-	general	proc	/	t
23	Craig [58]	1999	emp	C, S	G	general	CAN	ES	tech	+	s
24	D'Arcy [59]	2014	emp	CA, E, D, RI, SM	I	general	-	general	proc	/	s
25	D'Arcy [30]	2009	emp	CA, SM	I	general	US	general	tech	/	t
26	da Cunha [60]	2009	emp	D	G	telecommunication	EU	CRM	tech	/	t
27	Davern [61]	2008	conc	W	I	accommodation	AU	booking system	tech	/	s
28	Davison [14]	2013	conc	S, W	I	hospitality industry	CN	networks	proc	+	t
29	Ferneley [1]	2006	conc	D, E, N, R, SM, W	I	service industry, public sector	UK	incident reporting	tech	+	t
30	Fürstenau [26]	2014	emp	T, W	I	recycling	-	all systems	proc	/	s
31	Gasparas [62]	2009	emp	R, T, W	I	engineering	EU	all systems	proc	+	s
32	Gasser [63]	1986	emp	W	I	manufacturing	US	all systems	proc	/	s
33	Gerson [7]	1986	conc	NC, W	I	insurance	US	insurance	proc	+	s

34	Guo [5]	2011	emp	CA, E, D, RB, SM, W	I	general	-	general	proc	+	t
35	Györy [64]	2012	emp	N, S	I	general	CH, DE	general	tech	+	t
36	Haag [65]	2014	conc	C, D, E, N, S, SM, W	O	general	-	general	proc	/	t
37	Handel [66]	2011	emp	S, W	I, G	software development	US	Excel	proc	+	t
38	Harrington [67]	1996	emp	CA, F, SM	O	general	US	general	tech	/	s
39	Heumann [68]	2014	emp	E	I	manufacturing	DE	product lifecycle	proc	/	s
40	Huuskonen [69]	2013	emp	S, W	I, G	social work	FI	client IS	proc	+	t
41	Ignatiadis [3]	2009	conc	CA, R, W	I	transport	UK	ERP	proc	-	t
42	Ilie [70]	2013	conc	N, R, SM, W	I	health care	US	EMR	proc	/	t
43	Jones [71]	2004	conc	D, S, W	O	higher education	AU	ERP	proc	+	s
44	Kirsch [72]	2007	emp	E, N	I	medical area	US	general	tech	/	s
45	Koch [73]	2014	emp	C, S	I	general	-	general	proc	+	t
46	Köffer [74]	2014	emp	C, S	I	general	DE, RO, US	general	tech	+	s
47	Koopman [75]	2003	conc	W	I	general	-	general	tech	+	t
48	Koppel [20]	2008	conc	W	I	health care	US	BCMA	proc	+	t
49	Lapointe [27]	2005	emp	E, N, R, SM, W	I, G	hospital	-	medical report	tech	+	s
50	Laumer [76]	2010	emp	R, W	I	automotive supplier	DE	administration	proc	+	s
51	Laumer [77]	2010	emp	R, W	I	general	-	general	tech	+	s
52	Li [78]	2010	emp	E, SM	I	general	CN	general	proc	+	s
53	Madhavan [79]	2005	emp	D	O	brewery	NZ	ES	proc	+	s
54	Mainemelis [35]	2010	conc	E, NC, RB	I	-	-	general	proc	+	s
55	Martin [32]	2013	conc	D, E, R, RB	all	general	-	-	proc	/	t
56	Maulaurent [34]	2011	emp	C, E, W	I, G	-	CN	ERP	/	+	s
57	McGann [13]	2008	emp	C, W	all	manufacturing	US	supply chain collaboration	proc	+	s
58	Orlikowski [80]	1992	conc	D, E, N, W	G	manufacturing	-	automated manufacturing	tech	+	s
59	Ortbach [81]	2013	emp	C, S, W	I	general	DE	general	tech	+	s
60	Ortbach [82]	2013	conc	C, S, W	I	general	DE	general	tech	+	s
61	Petrides [83]	2004	emp	W	I	higher education	US	general	proc	/	t
62	Recker [84]	2014	conc	R, W	I	general	-	general	/	+	s
63	Rentrop [85]	2012	conc	S	G	general	-	general	proc	+	t
64	Robey [86]	2002	conc	D, R, RI, W	I	manufacturing	US	ERP	proc	/	s
65	Robinson [9]	1995	emp	E, F, RB	all	various	US	general	proc	/	s
66	Röder [45]	2014	emp	F, N, R, RB, S, W	I	health care, accounting, automotive	-	HIS	proc	+	t
67	Röder [87]	2014	emp	D, N, S, W	I	health care	-	general	tech	+	t
68	Safadi [88]	2010	emp	N, R, W	I	health care	CAN	EMR	/	/	t
69	Saleem [89]	2011	emp	W	I	health care	US	HIS	proc	+	t
70	Sallaz [90]	2002	emp	CA, D, N	I	gambling, casino	US	-	proc	+	s
71	Silic [91]	2014	emp	N, S, W	all	general	-	general	tech	+	s
72	Siponen [15]	2010	emp	CA, N, RB, SM	I	various	-	general	proc	-	t
73	Sobreperez [92]	2005	emp	D, E, N, W	I	garment manufacturing	-	workflow systems	proc	/	t
74	Srivardhana [93]	2007	conc	D, T, W	all	general	-	ERP	tech	/	S
75	Straub [10]	1990	conc	CA, F, SM	I	various	US	general	tech	-	S
76	Straub [94]	1998	emp	CA, D, F, R	I	information services companies	US	general	tech	-	s
77	Strong [95]	2010	emp	W	all	industrial equipment	US	ES	/	/	s
78	Subramaniam [96]	2013	emp	W	I	telecommunication	FI, DE, UK	ES	proc	+	s
79	Suwannakoot [97]	2011	emp	T, W	I	university	AU	administration	proc	+	t
80	Thoresen [98]	1997	emp	E, W	G	material administration	NO	group work systems	proc	+	s
81	Willison [99]	2013	conc	CA, E, F, N, RB	I	general	-	general	proc	-	t
82	Winkler [100]	2013	emp	S	O	manufacturing	DE	SAAS	proc	+	s
83	Zamani [101]	2013	emp	RI, R, S, W	I	general	-	general	tech	+	s
84	Zimmermann [102]	2014	emp	N, S	O	general	FR, DE, CH	general	proc	+	t

[1]Due to page restrictions we only provide the first authors name; [2]con = conceptual, emp = empirical; [3]W = Workaround, S = Shadow System/IT/work, R = Resistance, N = Non-compliance, E = Employee/Workplace Deviance, SM = System Misuse, D = Decoupling/Loose Coupling, C = Customization, RB = Rule Breaking, F = Fraud, CA = Computer Abuse, T = Tweaking, RI = Reinvention, NC = Non-conformity; [4]I = Individual, G = Group, O = Organization; [5]pro c= process-oriented, tech = technology-oriented; [6]t = workaround as topic, s = workaround as side effect