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Yizhou Li
University of Mannheim, Mannheim, Germany,, yizli@uni-mannheim.de

Phillip Haake
University of Mannheim,Mannheim, Germany, haake@es.uni-mannheim.de

Benjamin Mueller
University of Groningen, Groningen, Netherlands, b.mueller@rug.nl

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Research paper

Li, Yizhou, University of Mannheim, Mannheim, Germany, yizli@uni-mannheim.de

Haake, Phillip, University of Mannheim, Mannheim, Germany, haake@es.uni-mannheim.de

Mueller, Benjamin, University of Groningen, Groningen, Netherlands, b.mueller@rug.nl

Abstract

The stage of post-adoption of an enterprise system (ES) implementation has been in the focus of recent information systems research. However, a thorough understanding of how users effectively use an enterprise system to complete their tasks is still missing. Prior research has implied that adaptive use is of great importance to facilitate effective use of a system. We investigate adaptive use solutions, which are outside the original system. This behavior is known as workaround. We conduct an interpretive case study to investigate the impact of workarounds and explain why workarounds can lead to an advance in effective use of a standard ES. We expand the theory of effective use with an explanation why workarounds can improve transparent interaction, representation fidelity and informed action via alleviating users' issues with the surface structure and the faithfulness in representations of an implemented standard ES.

Keywords: Effective Use, Adaptive Use, Workarounds, Enterprise Systems

1 Introduction

Despite an estimated worldwide spending on enterprise systems (ES) of $335 billion by the end of 2015 (Gartner, 2015), an assessment of the success of ES often reveals disappointing returns on investment (Staehr et al., 2012). Consequently, managers are eager to understand how the benefits of ES, such as increased performance, integration of business processes and cost savings can be realized. Since ES are highly-complex information systems (IS), which implement a variety of industry best practices, they are rather inflexible and often difficult to use to perform company-specific tasks (Devadoss and Pan, 2007). As a result, projects introducing ES are often found to be most troubled in the post go-live phase (Markus and Tanis, 2000; Markus, 2004). In these, the key challenge to ES success shifts away from adoption and diffusion – issues that have been shown to be problematic in the ES context (Gallivan, 2001) – and more towards the question of how users use a system for their tasks. This ties in closely with efforts to go beyond shallow concepts of usage per se (Burton-Jones and Straub, 2006; Barki et al., 2007; Elie-Dit-Cosaque and Straub, 2011) in favor of deeper engagements with how a system is used to both effectively and efficiently achieve relevant outcomes. As Burton-Jones and Grange (2013) argue, organizations can realize the benefits from their IT-related investments only if such effective and efficient use is achieved.

However, due to the standardized nature of ES and their resultant imperfect fit to any one specific business setting, users frequently need to work around perceived shortcomings of such systems in order to successfully do their work (e.g., Boudreau and Robey, 2005). These workarounds are defined as individual or group level, goal-driven adaptation behaviors for overcoming the imperfections of an ES, which are preventing users to achieve personal or organizational goals (Alter, 2014). Workarounds are commonplace in many organizations and either individual employees or user groups employ them to do their job. In some cases, employees are encouraged and supported in their use of workarounds to

overcome misfits of implemented standard software (Alter, 2014). However, few prior studies explore how and why workarounds can influence use. Instead, most prior research only offers empirical evidence of workaround development and usage without providing comprehensive theoretical explanations (Yang et al., 2012; Alter, 2014). Examining this research gap with a new perspective on the effective use of ES through workarounds, will help organizations to use ES more effectively and allow managers to sponsor those workarounds that actually alleviate problems in use.

In this paper, we present a longitudinal case study in a globally operating chemical company (CeCo). The company deploys an ES for demand planning, which is the illustrative context for this case study. This advanced supply chain management (SCM) system supports decision making processes via optimized business data management in the supply chain (Moss and Atre, 2003). The implemented SCM system is flawed in the eyes of many users, but its use is mandated by the company's global management based on the rationale that only the integrated, company-wide use of a SCM system can improve forecast accuracy. Employees at CeCo have developed several workarounds to enhance their ability to use the system effectively and efficiently. Our analysis of this case contributes to the understanding how these workarounds help employees at CeCo to deal with an otherwise cumbersome SCM system. Through our analysis and theorization, we contribute to research by expanding the concept of effective use with an improved understanding of workarounds and their effect on effective use of ES, such as SCM systems. Based on this study, we answer the following research question: *How and why do workarounds influence the effective use of an ES?*

We organize the remainder of this paper in the following way: Section two lays the theoretical foundation for our case study by introducing the concepts of effective use, adaptation and workarounds. In section three, we describe our research design. Section four presents the main findings with regards to the various workarounds used in CeCo and their effect on the effective use of SCM systems. In section five we discuss the findings and present an extension of the theory of effective use by the concept of workarounds. Finally, we conclude with a summary as well as a brief discussion of limitations and our contributions.

2 Related Work and Theoretical Foundation

2.1 From IS use to Effective IS use

In the last two decades, the understanding of IS use has been extended continuously (Burton-Jones and Grange, 2013). In particular, after lacking any widely-accepted conceptualization for a long time, the construct of IS use is more precisely conceptualized and explained (e.g., Venkatesh et al., 2008; Wu and Du, 2012). One aspect of particular emphasis in these extended conceptualizations is the role played by human agents in IS use. Following the practice lens proposed by Orlikowski (2000), Jasperson et al. (2005) argue that users make decisions about how to use a system based on the assessment of the consequences on their working environment. In addition, Jasperson et al. (2005) adopt a feature-centric view of systems. They argue that instead of treating the system as a whole, system features tend to be a more valid unit for analyzing use behavior (Griffith, 1999).

These considerations proposed by Jasperson et al. (2005) have inspired a specific stream of research on IS use conceptualizations. Most seminally, Burton-Jones and Straub (2006) offer an approach to systematically conceptualize IS use. In their paper, Burton-Jones and Straub (2006) clarify the three conceptual elements constituting the construct of IS use: users, systems, and tasks. According to them, IS use is defined as a user's deployment of an information system's features in order to perform a task; a conceptualization that has gathered considerable attention and support in the IS academic community (Piccoli and Lui, 2014). On the basis of the definition from Burton-Jones and Straub (2006), Barki et al. (2007) reemphasize the importance of human agents (the users) and indicate that IS use goes beyond the direct interaction among users, systems, and tasks. In particular, Barki et al. (2007) propose that IT use also needs to capture how users' system use shapes and re-shapes systems and tasks across time.

Beyond such a perspective on the constituents of the use conceptualization, an increasing number of papers starts to research the outcomes of use, such as the effectiveness of IS use (e.g., Liang et al., 2015; Veiga et al., 2014). Among those papers, Burton-Jones and Grange (2013) conceptualize effective use of an IS by suggesting that users apply an IS in a way that allows them to achieve the goal of their task. They ground their definition on representation theory (Wand and Weber, 1995) and propose that users see an IS as a means to represent the real world. Representations in this sense are the presentation of all information about a real world domain, such as inventory levels in a warehousing system (Burton-Jones and Grange, 2013). The system's deep structure would represent this domain, such as a specification in a product management system that a product consist of a given number of parts (Burton-Jones and Grange, 2013). Furthermore, Burton-Jones and Grange (2013) define surface structure as the structure of a system, which allows a user to interact with its representations, such as a user interface. They describe effective use as a cyclical and error-prone process, in which users use an IS to generate knowledge about the represented domain. Burton-Jones and Grange (2013) suggest a hierarchical relationship of the following three dimensions that jointly constitute effective use: (1) users can access the information presented in the system unimpeded by the system's physical and surface structures (transparent interaction (TI)), (2) users are capable of obtaining a better understanding of real world issues referring to the information presented by the system (representational fidelity (RF)), and (3) users can improve their states on the basis of their understanding of real world issues (informed action (IA)). We base our understanding of effective use on Burton-Jones' and Grange's (2013) work.

2.2 Adaptive IS use and Effective IS use

For understanding effective use, it is important to keep in mind that technology usage is an iterative process and users continuously change the way they use technology (Orlikowski, 2000). This adaptive form of enterprise system use has the potential to enhance task-technology fit (Barki et al., 2007). Moreover, adaptive use is likely to facilitate effective use of enterprise systems, because adaptation can enable effective behavior in the work place (Bruque et al., 2009). Based on these thoughts, we suggest that effective use is a goal that can never be fully reached, but that adaptive use is a testament to users' investment in discovering the imperfections and obtaining better ways of using the system along the three dimensions of effective use proposed by Burton-Jones and Grange (2013). When users adapt to gather more knowledge about an IS and deploy more features, they are more likely to understand and leverage the representation more effectively and approach a state of effective use (Liang et al., 2015). Stein et al. (2015) observe that when users are pleased with the system functions, but frustrated by other unexpected changes, users personalize the way they use the standard system. For example, users may take advantage of the functionalities provided by the system, but meanwhile complement the usage by employing workarounds. Furthermore, Stein et al. (2015) explain that in such cases, users do not have to make a trade-off between the benefit and threats brought by the standard system. Instead, users can reach a win-win situation and achieve both the organizational and their own goals. This thinking is a starting point to integrate the perspectives of research on workarounds, adaptive system use, and effective use.

2.3 Workarounds, Adaptive IS use, and Effective use

Gasser (1986) was the first to define working around inadequate computing systems as an alternative adaptive strategy with the purpose of overcoming IS misfit. However, in the past 30 years, the term *workaround* has been defined in various ways in different papers (Alter, 2014). Alter (2014) grounds the concept of workaround on agency theory and work system theory, and indicates that using a workaround is a collective action with the purpose to adapt insufficient functionality. Alter (2014) implies that the given definition of workarounds covers many situations, but lacks specificity (Gasser, 1986; Koopman and Hoffman, 2003; Schwarz et al., 2014). Furthermore, Alter (2014) indicates that these definitions lack a clearly defined boundary for distinguishing workarounds from other concepts. For example, Sun describes *adaptive action* as a behavior through which users revise the spirit of IS features and define new ways of using IS features (Sun, 2012). However, this action is very similar to the definition given by Alter (2014).

Prior empirical evidence has shown hints that workarounds can lead either to positive or negative impacts on individuals' ability to use a system – whether effectively or at all. From the perspective of negative impacts, a workaround can show the lack of understanding of an ES (Staehr et al., 2012). Along these lines, Burton-Jones and Grange (2013) argue that workarounds generally reflect uneducated adaptations. Moreover, solutions based on workarounds often lack support from IT professionals and cannot be efficiently reused (Zolper et al., 2014). Additionally, workarounds lead to an illusion that problems have been solved, but in the long term this illusion will erode the standard ES and cause uncertainties (Morrison, 2015).

In contrast to this, other papers imply that using a workaround can be a proper adaptation strategy for enhancing effective use. These studies (e.g. Strong and Volkoff, 2010; Azad and King, 2012; Staehr et al., 2012) argue that workarounds can actually represent a group of users' consolidated knowledge of the standard system. Monteiro and Rolland (2012) regard using workarounds as a reflection of the technology's malleability. Orlikowski (2000) indicates that users start to appropriate ES in use when they are more knowledgeable about the ES. Sun (2012) also makes a similar argument by showing that users adapt their usage of a particular system by drawing on combinations of features from other systems. Moreover, researchers have identified that workarounds are sometimes monitored or even promoted by central IT. For instance, Malaurent and Avison (2016) observe a case in which a workaround was built on request of a project team from the headquarter and thereby endorsed by central IT. Other similar examples are from Kitto and Higgins (2010), Novak et al. (2012), and Cabitza and Simone (2013), in which the developing process of the workaround is mediated by parties with deep knowledge of the standard system.

Additionally, workarounds can considerably facilitate the integration of a formal system into routine tasks. Such routine tasks often face an unpredictable range of contingencies that make it unlikely that task performance will be identical in all circumstances (Weick, 1995). Similarly, a complete match of standardized, prescribed technology use and work procedures is unlikely (Ferneley and Sobreperez, 2006). Consequently, users have to employ available resources to deal with low-level problems in order to make sure that they can execute routine tasks. While those problems will not influence the work situation dramatically, they still have a strong impact on the actual execution of routine tasks (Gasser, 1986). In such situations, a workaround that requires limited resources can be a functional ad hoc strategy to facilitate task execution. This phenomenon, first captured by Gasser (1986), is also reemphasized in more recent papers. Goh et al. (2011) indicate that workarounds are usually designed to support routine tasks rather than altering the business process. Similarly, Novak et al. (2012) explain that workarounds enable better implementation of IS in the routine tasks by providing flexibility. Additionally, workarounds can help to identify root problems, which impede the alignment of an ES with organizational goals and provide signals for further system optimization (Vassilakopoulou et al., 2012). Several papers have also suggested that users proactively develop workarounds to bypass the imperfection of the standard system and to enhance their job performance. For instance, McGann and Lyytinen (2008) suggest that users are likely to improvise ES use because of not only the system's shortcomings, but also the new opportunities to enhance performance. Also, Vassilakopoulou et al. (2012) indicate that motivations, such as saving time and saving effort, can lead to the adoption of workarounds regardless of system imperfections. Finally, workarounds can also be a more feasible resource for adapting the system or the way work is done with the system (Gattiker and Goodhue, 2005). Sia and Soh (2007) indicate that organizations usually have to make a trade-off between system customization, which requires technological resources, and organizational change management, which requires organizational resources, for solving a misfit of a packaged enterprise system. Here, workarounds offer a solution that requires limited change in both the business process and/or the system (Sia and Soh, 2007).

For implementing workarounds, users require knowledge of the technology and the context to work around the misalignments of system and task effectively (Sia and Soh, 2007). Users can obtain the system knowledge necessary for educated adaptations during trainings, self-learning (e.g., learning-by-doing and experimentation), and learning from peers (Gnewuch et al., 2016). Generally, users acquire the relevant knowledge for developing successful workarounds by experimenting with and exploring

the IS during use and by trying new ways of using it (Sun, 2012; Alter, 2014). Thus, end users improve their knowledge of system features and also build new areas of knowledge on IS features during use (Jasperson et al., 2005; Yamauchi and Swanson, 2010). This aspect of learning and adaptation also applies to workarounds that management explains and promotes. Guidelines and training are required for this type of workaround in order to inform end users.

Despite these apparent virtues of workarounds, very few papers comprehensively explain how and why workarounds can improve the performance in a work system (see Yang et al., 2012 for a notable exception). Following this thought, we propose that workarounds can facilitate the effective use of an implemented ES and thereby enhance a work system's overall performance. On this basis, our view differs from Burton-Jones and Grange (2013) original argument that workarounds generally reflect uneducated adaptations. Quite contrarily, we argue that workarounds indicate educated adaptions of capable individuals in order to increase their effective use of an ES. For instance, for a company's SCM software this goal can be accurate information and subsequent forecasting and planning. The workarounds of interest to our research are part of employees' collective action to work around the shortcomings of a SCM system for their particular business domain and their required routines. In particular, we analyze workarounds that are incorporated and managed by a central IT department.

We want to clarify that we are particularly going to investigate workarounds that are built in separate IS, such as Microsoft (MS) Excel, MS Access, or R Studio. Furthermore, the workarounds that we focus on are either endorsed or at least condoned by management, not least because employees would not be able to perform their job successfully without them. Accordingly, we define effective use of an IS in a work system as the use of an IS in a way that allows users to achieve the goal of their task in the work system. In line with Burton-Jones and Grange (2013), our understanding of effective use also encompasses the efficient attainment of goals.

3   Research Methodology

We follow a case study approach and conduct an interpretive case study on the basis of the seven principles for interpretive field research developed by Klein and Myers (1999) as the key research method for refining the effective use theory. Interpretive case studies can not only generate insights on the phenomenon, but also the comprehension of the complex context (Keutel et al., 2014). We chose an interpretive research approach to develop an extension of effective use theory because we are examining how individuals in organizations make sense of an ES and their use context and then find a collaborative approach to deal with the impediments to effective use. In turn, they are able to have an impact on their context through effective use of the ES. Interpretive case studies require a close interaction between researchers and the research entities (Klein and Myers, 1999; Bygstad and Munkvold, 2011). Hence, one of the researchers worked in the case company for nine months to generate a better understanding about the complex environments, the employed workarounds, and effective use of the standardized SCM system.

3.1   Case Description

CeCo (alias) is one division of a large chemical company in Central Europe. For CeCo, basic chemical products are a huge part the product portfolio. Market competition is rather intense for basic chemical products and accurate planning is especially vital for CeCo because it allows more precise inventory control and more efficient production. It is very demanding to generate accurate demand forecasts for basic chemical products because the product portfolio covers a wide range of different products and a volatile market. Moreover, CeCo has to align the demand for the markets in three continents.

As a consequence, CeCo invested into its Supply Chain Management (SCM) system, which is a large-scale ES for managing the planning process. In terms of demand planning, major functionalities offered by SCM are used through a planning process that can be summarized in two stages. In the first stage, the data is transferred in a top-down manner. The global key users maintain master data and the system generates corresponding forecasts on a monthly basis. In order to improve the data for forecasting, global key users are responsible for updating the master data on the product and customer portfo-

lio in the system, segmenting products, ruling out the outlier data, selecting forecast strategies, etc. Forecasts are subsequently distributed to local sales representatives. Sales representatives directly contact customers to discuss the forecast and subsequently upload the expected sales volume for the next three to six months. In the second stage, forecast data is transferred bottom-up. After local sales representatives upload their forecasts, regional planners gather forecast data and present it in a sales and operation planning meeting. In the final step, agreed forecast numbers are allocated to each factory for detailed production planning.

Although this process is supposedly smooth and SCM is supposed to align with the whole planning process, problems occurred during use of the system. For instance, it is not feasible for key users to effectively group customers and products because of the huge data volume and complicated market context. Consequently, SCM cannot facilitate users to generate more accurate demand forecasts as it was expected. Therefore, the users at CeCo cannot use SCM to attain the goals of their work systems. Originally, it had been the organizational goal of SCM use to increase the demand forecast accuracy. In response to increasing competition, CeCo is searching for solutions to optimize demand planning and the company is dedicated to enhance the effective use of SCM for the goal of more accurate company-wide planning. After a pre-study, it was evident that the customization of SCM requires a great amount of change management and would take at least one year. Hence, it was decided that the company attempts to adapt existing workarounds and create new ones to improve the overall effective use of its standardized SCM system. The condoned workarounds do not substitute but compliment functionalities of SCM. As aforementioned, one author worked as an embedded researcher in CeCo's central IT support during this phase. He worked collaboratively with the employees there to identify current workarounds and to facilitate the demand planning process. This gave him immediate access and allowed him to interact directly with subjects during the data collection process.

3.2 Data Collection

For data collection we also followed the approach suggested by Klein and Myers (1999) who state that units of analysis can be at more than one level when subunits need to be focused on during the research. We identify the work systems around SCM as the main unit of analysis, with individual groups of users and their workarounds as relevant subunits within. We define work systems as a combination of business units (BUs) and regions. CeCo is a global multi-national company, which has three BUs and has separate branches in **Europe (EU)**, **Asia-Pacific (AP)**, and **North America (NA)**. These different BUs produce substantially different products and are situated within different geographic regions and business contexts. All work systems use SCM as their default system, whereas work systems improvise workarounds for fulfilling the local requirements. Table 1 contains an overview of the analyzed work systems.

	BU1	BU2	BU3
Europe	EU1	EU2	EU3
Asia-Pacific	AP1	-	-
North America	-	NA2	NA3

Table 1.   Location of work systems

The selected work systems do not cause any obvious bias for data collection, because all three BUs and all three regions are covered. We chose to conduct interviews (int) with key users, who have more solid knowledge about SCM and are expected to have more coping resources, as well as end users, who are likely to have limited ES-related knowledge and may face different problems when using SCM. We did take field notes based on observations or the discussion with users (Wolcott, 2005). We followed the guidance from Kvale and Binkmann (2009) for designing interviews and arranged interviews in two rounds. In particular, the second round of interviews was conducted to cover any unexplained conflicts among data from the first round of interviews (Glaser and Strauss, 2010). We conducted eleven interviews with eight people in two rounds. The average length of the interviews was around 35 minutes. Interview guidelines are available from the authors upon request. Moreover, users showed and explained their workarounds to the embedded researcher. The interviewees had at least

five years of experience in their job and in the firm. The interviewed key users are solution or project owners, while the end-users have an in-depth knowledge of the business processes in their area. We present the information about each interview in Table 2.

Interview	Interviewees		Experience of interviewees in the field	Work Systems
int 1/ int 6 / int 7	2 Key users	Global IT support	High knowledge and experience	EU1, EU2, EU3
int 2	Key user	Planner	High knowledge and experience	NA2, NA3
int 3	End user	Planner	Low knowledge, average experience	EU3
int 4 / int 10	End user	Sales representative	Low knowledge, average experience	EU3
int 5 / int 11	Key user	Planner	Average knowledge and experience	AP1
int 8 / int 9	2 End users	Sales representative	Low knowledge, average experience	EU3

Table 2.　　　　Overview of interviews

3.3　　Data Analysis

In our data analysis, we followed an inductive strategy and used the grounded theory method (Corbin and Strauss, 2015) for analyzing data and for identifying the set of categories that allow an extension of effective use theory. The grounded theory method is a widely accepted approach for interpretivist research (Eriksson and Kovalainen, 2008) and is suitable for an explorative case study (Myers, 2013). We used semi-structured interviews, which fit the philosophical paradigm of interpretivism (Kvale and Binkmann, 2009). Glaser and Strauss (2010) recommend multiple rounds of interviews because data collection and analysis should be conducted iteratively when following a grounded theory approach. Hence, before conducting the second round of interviews, we transcribed, coded, and analyzed the first round of interviews.

After transcription, we followed the two-steps coding process suggested by Glaser and Strauss (2010). First, starting with line-by-line analysis, we applied open coding for the first as well as the second round of interviews. The identified concepts were summarized into categories at a higher level, making sure that they sufficiently described the story of the case (Locke, 2001). Theoretical saturation was reached by constantly comparing the quotes and checking the transcripts (Glaser and Strauss, 2010). Second, we employed axial coding following Corbin and Strauss (2015), who propose a conditional/consequential matrix as a new tool for organizing concepts. During the analysis of the first round of interviews, we identified the conditions of the globally rolled out SCM, which impaired the execution of tasks on the level of regional work systems. For instance, planners often do not have direct access to all necessary information on screen in SCM because data necessary for the planning process is gathered at different system levels within SCM. In the second round of interviews, our questions aimed at discovering how users make sense of the different sources of information and how they link information in the SCM with workarounds. During the analysis of the first round of interviews, it became also evident that users' difficulties with learning the deep structure of the SCM system might result in the usage of workarounds. Thus, in our second round of interviews, we build our interview questions on the basis of Santhanam et al. (2007) and Bagayogo et al. (2014), who distinguish IT related knowledge into know-what, know-how and know-why. Our subsequent analysis of the interviews with open coding followed by further deriving the conditional/consequential matrix showed what was learned and the implemented workarounds that were used to be able to execute the given tasks in the business environment or to maintain given routines.

4　Findings

When working with SCM, users often experience situations in which their interaction with the system is impeded. However, the underlying reasons for the impediment are often beyond the users' control. Consequently, they conceive **workarounds (wk)** that help them overcome the system's impediments. As aforementioned, they have gathered the knowledge about possible solutions in various situations and developed a bricolage of knowledge on systems and tasks. They use this knowledge to implement

the workarounds with tools that they have control over in order to achieve the goals of their work system. As in our case, management and IT departments can also promote this process. Engaging with our data carefully, we observe that when a formal request of customizing SCM cannot be approved in a timely manner or it requires too much effort (thus effectively eliminating the chance for an individual user to engage with the problem in her/his personal context her/himself), users resort to developing workarounds. A key user shared his experience of how exhausting the customizations process can be: *"Sometimes it does not make sense to customize SCM [...]. [...] in the next version of SCM, this customization will not work any longer. Then you have to make another customization [...]"* (int 2). Consequently, users tend to search for more feasible solutions outside the system. We present the seven identified workarounds in the following three sections (see also Table 3).

Workarounds for Adaptation of Surface Structure

Workarounds for the adaptation of the surface structure, that is, the user interface of the SCM, are often necessary because it is cumbersome for users to access the desired data in SCM. Thus, they cannot interact with the system in a transparent fashion. For example, in Europe (EU) some necessary data is not displayed directly in SCM. Therefore, users have to compare the data, once obtained elsewhere, with the data from SCM: *"We get all business data, including invoice data, open orders, from [another system]. I compare [that data] with the demand forecast [which I get from SCM] in the Excel file"* (int 4, **wk 1**). This quote shows how users need to leverage another system to obtain the data and then go through the often difficult process of comparing the data against the data in SCM. In a second, even more common example, useful data is contained in separate interfaces within one system. It is very cumbersome for users to switch between different interfaces for checking the links between data. A sales representative in Europe explains this in the following way: *"[in the interface of our planning book,] we have the planning numbers at customer/article level. The volume of what we can sell every month is on customer group level. [...]You don't have the link anymore"* (int 4).To overcome this problem, the users created a workaround to compare data from the SCM: It is easier for users to generate an overview of the data by downloading data from SCM and displaying it in an Excel file. The user further illustrates this: *"[creating the Excel file] is the only way that you can have the overview and you can know about the numbers"* (int 4, **wk 1**). In effect, the Excel-based solution of wk 1 thus allows users to interact with the system more transparently, improving the effective use of the SCM.

Furthermore, users deploy Excel-based workarounds to design interfaces that present only necessary data. Even though users can select data relevant for their tasks from SCM's interface, the generated reports often provide unnecessarily detailed data. One planner described this in the following way: *"[The report from] SCM provides very detailed data [...], [but a planner] only needs three or four [columns from the SCM report] for planning"* (int 3, **wk 2**). As a result, users need to spend extra time and energy to locate the required data. To address this issue, planners adopt an Excel-based workaround that only contains necessary data in the interface. As explained by that planner: *"So we [download all the data from SCM and] create a pivot table [in Excel to show only the necessary data]"* (int 3, **wk 2**). The planner from Asia (AP1) illustrates the explanation of this solution, while sharing that he is also experiencing this problem: *"SCM offers a lot of detailed information. [...] We manually generate an Excel sheet to show data [, which is relevant for our region]"* (int 11, **wk 3**). In terms of effective use, such workarounds help to improve **transparent interaction (TI)** by allowing end-users to use an adapted interface of the system.

Workarounds for Adaptation of Surface Structure and Representations

Another group of workarounds that we identified in the case organization does not only allow increasing the transparent interaction with the user interface, but also the representations of data in the SCM. The first aspect of a lack of transparent interaction is illustrated by a North American (NA) planner who explained that SCM is not intuitive enough for end users to obtain desired data: *"SCM is not user friendly for the sales representatives [who are] the end users"* (int 2). Consequently, this planner shares that he *"[...] extract[s] data out of SCM, and make[s] [an Excel file], which is more user friendly for sales representatives"* (int 2, **wk 4**). With the help of this workaround (**wk 4**), sales representatives do not need to go into SCM to check data while conducting their tasks. Instead, users can

obtain all required data directly from the Excel workaround, which is more intuitive to use. Consequently, *"sales representatives can [use Excel to] check which customers have not put the order yet"*, and *"planners can communicate [data] with sales representatives"* (int 2, **wk 4**). This first aspect of the workaround helps sales representatives to have a more transparent access to data in SCM, just likes the aforementioned workarounds Again, such an increase in transparent interaction has a generally positive overall effect on the users' level of effective use of the data in SCM. Sales representatives can make use of more current planning data and they can use it when talking to a customer about a delivery date. However, the use of this workaround (**wk4**) goes beyond simply allowing better access to SCM data. The North American key user also leverages this workaround (**wk 4**) to allow sales representatives to correct or modify data in the Excel file directly and return any modifications made by the planning department to the sales representatives. The process for forecasting data ends when the key user uploads the data back to SCM and ensures that the data in his Excel workaround and in SCM are consistent. Similarly, **wk 4** offers a way for sales representatives (end users) to access some master data in SCM (over which they would normally have no control) through the Excel file. Thus, sales representatives can suggest changes to the master data: *"Sales representatives [can check the data in Excel and] say which customers were left out, or what location of a customer is no longer used [...]"*. Subsequently, the key users can *"modify the data in the [Excel] sheet and maintain SCM accordingly"* (int 2, **wk 4**). In relation to the concept of effective use, **wk 4** therefore shows that these users do not just circumvent current surface structure to improve transparent interaction. **Wk4** also enables sales representatives to have a more direct influence on the system's representations, thus positively influencing the **representational fidelity (RF)**.

We identified another workaround with this combined effect in Europe (EU). This particular workaround helps to deal with the search function in SCM, which is perceived as very inconvenient. It leads to a heavy workload for users when they are trying to locate and maintain master data. As explained by one global key user in Europe: *"[If I use the default search function from SCM], it takes me a long time to get that data out of the system [...]"* (int 6). For this reason, the key users hired an external software company to develop an Access-based workaround, which provides more functional navigation of the interface. Therefore, *"it is easy and comfortable [...] to use the nice filter and sort function [in Access] to find relevant master data"* (int 6, **wk 5**). Compared to the default search function in SCM, which offers very limited possibility to narrow down and filter master data, users can take advantage of the extra functionalities from Access to more easily and quickly find the desired data in a large database. Primarily, this has a positive impact on users' ability to interact with the system in a transparent fashion by improving the interface for the user. Similar to wk 4, though, we see that **wk 5** also has an impact on the representational fidelity. In the current process of managing master data, key users are first informed by the business functions about what data should be changed via email, and they change the respective data in SCM accordingly. However, the SCM key user for Europe explains that *"data in emails is not always correct"* and *"if I just upload the data without doing a double check, I might change something that should not be changed"* (int 6). As a result of an imbalance between manpower and the volume of master data, it is very stressful and time consuming for global key users to maintain the master data. In order to more effectively and efficiently maintain master data, key users leverage the Access-based workaround (**wk 5**) to considerably reduce the difficulties of searching data and updating data. Furthermore, key users also use this workaround to involve end users in correcting the master data. One key user explained that it is effective for end users to use this workaround to correct master data because *"[with this workaround] end users do not need to deal with the complex [logic of] tables; [...] If they enter a new entry in one table, data will be updated in the related tables"* (int 5, **wk 5**). Another key user added that *"[with the drop-down function in Access], [end users] are not able to change the wrong data, because they cannot change customers who are not linked to [them]. So the quality of master data will be improved automatically"* (int 6, **wk 5**). This workaround illustrates that users can design a collective solution to involve more actors into the task for correcting the data in the system. While adding to **wk 5**'s positive effect on transparent interaction, this will also help to improve the quality of the representations users work with, thus improving representational fidelity.

Furthermore, we detected a third workaround that provided the functionality to adapt the surface structure as well as improve the representations of data. We observed that it is very difficult to clean up and maintain the data in the location mapping table, which is a special master data table in SCM. It connects SCM to an underlying enterprise resource planning (ERP) system. However, if location data are changed manually in ERP, an inconsistency can arise between these two systems. Subsequently, key users need to manually change the data in SCM. However, there is no one-to-one relationship between the data in the two systems, and key users have no clue how to make a correct change based on SCM's information. As a result, key users tend to leave the inconsistency in the system. Unless *"planers complain something is missing, or [a] wrong simulation location [is included], [then] we update location mapping"* (int 6). In order to improve the key users' overview of the data, a workaround (**wk 6**) was established to load data from both SCM and ERP into a special Access database. In this tool, key users receive information which location data needs to be updated to address the data inconsistency. One key user stated that this workaround *"reduces the workload and leads to more accurate data [...]"* (int 7, **wk 6**). Like **wk 4** and **5, wk 6** can also be seen to have a dual effect. First, it allows key users to interact with the system in a more transparent fashion which, in turn, helps to improve representations in the system and it improves representational fidelity.

Workaround that enables Informed Action based on Adapted Representations

Finally, we observe a workaround (**wk7**) in relation to the generally dramatically inaccurate forecast numbers in SCM. The severity of the issue is illustrated by a quote from a sales representative: *"statistic forecasting is really a disaster"* (int 9). **Wk7** allows to adapt representations in order to improve forecast numbers, which enables better informed action. This is necessary because the default forecast model in SCM cannot capture typical demand patterns in CeCo's industry: *"We know that the big part of business is done between January and June, and [demand in] July and August is always very low. However, statistic forecast cannot show [this pattern]"* (int 8). After a thorough investigation, key users in Europe figured out that the default forecast model in SCM cannot effectively predict time-series data. As a consequence, the accuracy of forecast numbers is always low. In response, key users in Europe collectively work around this issue by using the software of R-studio in **wk7**. In particular, key users download the historical data from SCM and use a more advanced forecast model which was build in R-studio according to their requirements by central IT support (**wk 7**). R-Studio is then used to calculate the forecast for the next 6 to 12 months. Subsequently, the forecast data is uploaded back into SCM. Now users can have a more precise reference concerning historical demand patterns. Looking at this workaround's impact on effective use, we see that key users are leveraging **wk 7** to adapt representations by looping them through a different system (R-studio). Once these numbers are back in SCM, this does not only improve the level of representational fidelity in the respective representations among end users, but also improve end users' ability to truly leverage that data in their work; thus, improving their ability to achieve **informed action (IA)**.

wk	Technology	Work System	Type of Workaround	Effective Use
wk 1	Excel	EU3	Adaptation of surface structure	TI
wk 2	Excel	EU3	Adaptation of surface structure	TI
wk 3	Excel	AP1	Adaptation of surface structure	TI
wk 4	Excel	NA2 / NA3	Adaptation of surface structure and representations	TI, RF
wk 5	Access	EU1 / EU2 / EU3	Adaptation of surface structure and representations	TI, RF
wk 6	Access	EU3 / NA2 / NA3	Adaptation of surface structure and representations	TI, RF
wk 7	R-studio	EU3	Adaptation of representations / enable informed action	RF, IA

Table 3.   Identified Workarounds

5   Discussion

All workarounds presented above relate to end users' attempts to make their routine use of SCM more effective, the key aspect of our research question. In the following, we explain the effects of worka-

rounds on effective ES use. We propose that workarounds are an outcome of users' sensemaking when leveraging a system for a specific task within a work system. Users improvise when discrepancies occur and adapt their ES use for better performance. A workaround is very likely to enhance the effective use of the formal standard system when the workaround is designed in line with the goal shared in the work system. In such a case it complements the use of main ES such as SCM. As shown above, workarounds positively influence effective use and its sub-constructs of transparent interaction, representational fidelity, and informed action (Burton-Jones and Grange, 2013). In terms of transparent interaction, when using a workaround in a separate system, users can redefine surface structures such that they can access the principal system's (SCM in our case) representations more easily (**wk 1-6**). These workarounds are adaptations of the surface structure to improve the user's ability to obtain transparent interaction (see Figure 1). Beyond the improvement of transparent interaction alone, a number of the observed workarounds had a ripple effect on representational fidelity as well (Burton-Jones and Grange, 2013). Especially **wk 4-6** helped users to engage with the system's representations in some way, ultimately improving the overall level of representational fidelity. This effect is constituted by allowing users to adapt representations more easily, thanks to an increase in transparent interaction, thus improving the quality of the representations they ultimately work with. These workarounds lead to a changed surface structure as well as adapted and thereby improved representations (Figure 1, Table 3). **Wk 7** also helps to improve representational fidelity, however in a way that is not primarily connected to SCM's surface structures, but rather its deep structures (i.e., functionality of the forecasting algorithm). Beyond this, **wk 7** also improves the ability to take informed action, as the new statistical forecasting abilities obtained through the workaround allow end users to more accurately predict and plan their sales (e.g., through taking into account typical seasonal deviations in their industry's sales patterns, a functionality that SCM does not offer).

Integrating our observations from the case and our conceptual abstraction of the workarounds' impact on effective use, Figure 1 offers a conceptual synthesis of our results. Workarounds to adapt the surface structure improve the ability to obtain transparent interaction with a system. In turn, a higher level of transparent interaction improves a SCM user's ability to obtain representational fidelity. As described above, some workarounds for adapting the surface structure can (in part) be used to improve the representational fidelity of SCM for the end user as well. A higher level of representational fidelity improves a SCM user's ability to take informed action. Furthermore, we also identified a workaround that helps to improve representational fidelity and the ability to take informed action directly. We illustrate the overlap of the different type of workarounds in Figure 1.
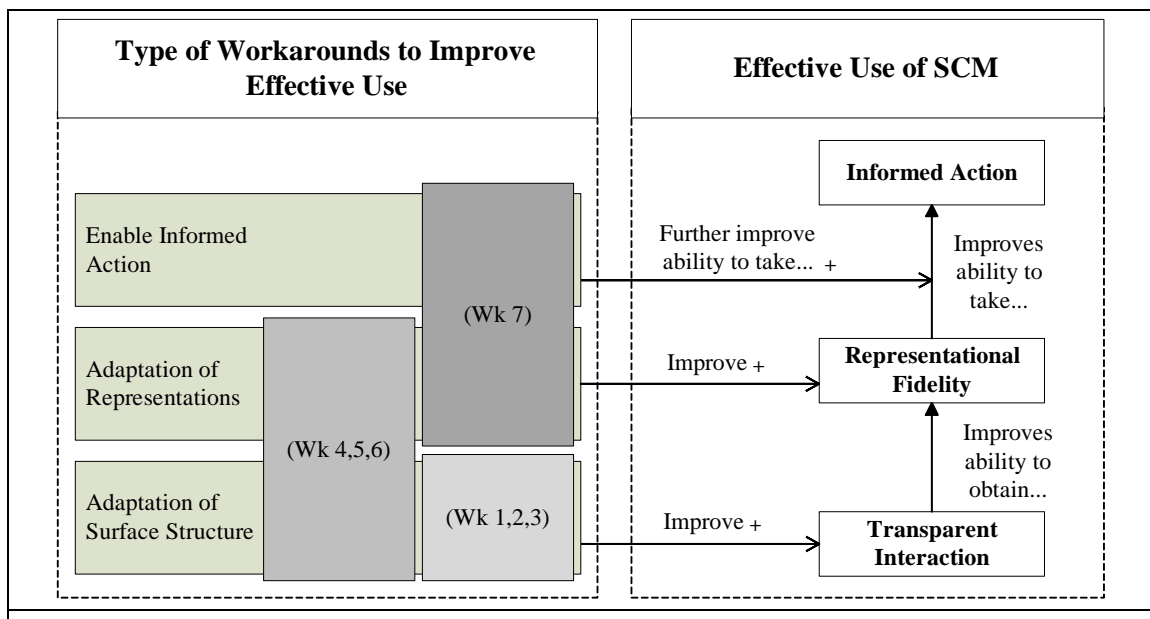

Figure 1.   Workarounds and Effective Use

Beyond this conceptual integration, we believe that our observations also provide an opportunity to critique some of the underlying arguments in the effective use conceptualization proposed by Burton-Jones and Grange (2013). While they argue that workarounds generally reflect uneducated adaptations, much of the positive effects we observe seem to suggest that users develop workarounds that are educated adaptations in their own right. For instance, **wk 4** allows end users to enter more accurate data in SCM and thereby to use SCM more effectively thanks to the workaround. Thus, workarounds can positively influence the effective use of an SCM system. We explained this in our rich description of the relationship of workarounds and effective use of an IS on an organizational level. This is the first part of the contribution of our study. We also extend the theory of effective use with a positive theoretical perspective on how workarounds can lead to an efficient and effective use of an IS in an organization, thus recasting workarounds as adaptation acts in their own right. Understanding workarounds in supporting systems as potentially beneficial for the effective use of a principal system also opens up the discussion on effective use as proposed by Burton-Jones and Grange (2013) to the increasing emphasis on the feature level (e.g., Sun, 2012; Benlian, 2015). For example, Sun (2012) suggests that users generally build a bricolage of features from different systems to achieve a particular goal, rather than looking at a principal system in isolation. Logically then, adaptations in the sense of Burton-Jones and Grange (2013) must not necessarily occur in the surface structures of that principal system directly (SCM in our case), but could also manifest in other systems (Excel and Access in our case). Rather than jeopardizing effective use of SCM by reducing transparent interaction with the principal system directly, such adaptations seem to improve users' ability to effectively use SCM overall. Again, this emphasizes the nature of the workarounds we conceptualize here as rather skillful and educated adaptations that allow users to achieve or improve effective use of a system that would otherwise impose on the ability to achieve users' business goals.

6   Conclusion

Based on an explorative case study at CeCo, we expanding the theory of effective use. We explain how and why workarounds can have an impact on the effective use of an ES (an SCM system in our case). In this, we particularly discuss how the various workarounds we identify in our case impact the sub-constructs of effective use proposed by Burton-Jones and Grange (2013), that is, transparent interaction, representational fidelity, and informed action. We show that users conceived most of the workarounds we identified (**wk 1-6**) in order to improve their transparent interaction with the system. However, a number of these workarounds (**wk 4-6**) also have a ripple effect that allows users to leverage their improved transparent interaction to adapt the system's representations. While many of these workarounds will only have an indirect effect on informed action, we also identify a workaround (**wk 7**) that directly supports users' ability to leverage the system's representations and, thus, the ability to take informed action.

To enable a better interpretation of our findings, we advise the reader of our work's limitations: First, as discussed by Burton-Jones and Grange (2013), ineffective use often stems from feelings of lost control or frustration. In our work, here, however, we did not account for these factors and future research in this domain could include this, especially in light of to the relevance of emotional and affective responses (Beaudry and Pinsonneault, 2010). Second, a more extensive longitudinal case study might be necessary to explore more fully how workarounds are triggered, built, optimized, and – eventually – abandoned. Such research may involve the investigation of the role of the individual abilities and knowledge in the origin and development of workarounds. This was not within the scope of our current research because we focused on workarounds that are already in use. Furthermore, our work is constrained by the access to the case site and the timing of the overall project. Third, we suggest that the effective use theory needs to be extended and elaborated further. Our proposed concepts can only provide explanations for the specific SCM context. To be generalizable to ES overall, more process-oriented systems than the SCM need to be studied (Grubljesic and Jaklic, 2015).

Nonetheless, our work and proposed model contribute to research in the following ways. First, our work picks up the nascent stream of research on effective use. In particular, we show how users work

around a SCM system by leveraging other systems while maintaining some level of integration with the principal system, thus improving the SCM's effective use overall. Such an integration is important to maintain the key benefits usually associated with the introduction of an ES (such as SCM) – that is, the integration of data across a company's multiple vertical and horizontal layers (Markus and Tanis, 2000; Devadoss and Pan, 2007; Staehr et al., 2012). Second, our work offers opportunities to not only consider workarounds as uneducated adaptations (Burton-Jones and Grange, 2013), but to think of them as rich, informed, and purposeful attempts to improve the effective use of an information system. We explicated the characteristics of workarounds and argued that workarounds are beyond good or bad per se (Cabitza and Simone, 2013), but that some of them have the potential to positively impact effective use. Future research should improve our ability to differentiate between functional and dysfunctional workarounds from an effective use perspective. Studies like Haag et al. (2015) also suggest that users who work around specific aspects of an ES make more effective use of the ES overall. This supports our reasoning that workarounds are enabling rather than constraining users' ability to use an information system effectively.

Beyond these conceptual implications, we also see a set of practical contributions that can arise from our work. First and foremost, we clarify why workarounds of SCM occur and their impact on effective use. It is often necessary to use customization to enhance end users' performance (Grabski et al., 2011) or their outright ability to use a system at all. But customization can be costly (Gattiker and Goodhue, 2005; Malaurent and Avison, 2016) for all kinds of ES. Hence, leveraging readily available systems to build functional workarounds is a potential solution for organizations to enable their employees to interact with an ES more effectively. As such, systems like Excel or Access might best not be seen as unwanted diversions, but should be explored more purposefully to see how they can help end users to use a company's core systems more effectively.

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