Workarounds in the Use of ERP System in SMEs

A Case Study from Automotive Industry in Norway

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***Abstract*— ERP systems constitute an important solution for most business enterprises. They are robust and effective in what they actually do, but can be hard to tweak for the special needs of Small and Medium Enterprises (SMEs). Alongside the professional use of Information technology (IT) through an ERP system, we therefore often find in-house solutions developed by creative or even ingenious individuals. Those workaround solutions become, however, usually non-standard, silo-prone and less robust than configured standard systems usually are. Sometimes, an in-house system becomes too dependent on individuals continued workplace presence. Sometimes a workaround is obviously ineffective, as when an individual has to take notes manually from one system window, only to feed the notes into a form belonging to another system. We caught interest in the investigation of those kinds of imbalances of IT exploitation, and picked a SME in Norway to execute our research.**

Keywords-workarounds; ERP system; workarounds, Automotive industry; SME.

I. INTRODUCTION

Enterprise Resource Planning (ERP) systems, such as SAP are systems that automate and integrate business processes. There is a general consensus that investments in such systems can have a profound impact on improving work process flow [1], in improving access to integrated data across functional units, and in better transparency at enterprise level [2][3].

There are differences in terms of what firms gained from such investments. While some firms achieved impressive benefits, others have had trouble in gaining the benefits and values they expected from their investment [4]. There also are studies that demonstrated ERP system implementation failures. For example, Alonini et al. [5] reported higher failure rates for ERP projects; Kwahk et al. [6] stated 90% of ERP implementations are late or over budget, and the success rate of ERP systems implementation is only about 33% [6][7].

Other studies conducted on ERP implementation also identified distinguishing differences between large enterprises and small & medium enterprises (SMEs). As Zach [8] indicated, SMEs represent fundamentally different environmental context from large enterprises, with a number of distinctive characteristics such as: market orientation, culture, structure, and ownership type [9]. According to a study in Europe, SMEs constituted 98.8% of the almost 19 million enterprises in the 27 EU countries' non-financial business economy (Eurostat, 2008). With the growing impact of SME in job creating and the associated social impact, ERP vendors are moving their attention to the SME market, and several SMEs are implementing ERP systems to leverage business performance [10]. However, despite the development of midrange and less complex ERP systems mainly intended for SMEs, ERP system implementation remains a challenge for many SMEs [11] [12] [44].

SMEs have been challenged by constraints of limited resources, limited Information Systems (IS) knowledge, and lack of Information technology (IT) expertise in adapting, implementing and maintaining IT/IS systems in general and ERP systems in particular [13]. Due to such limitations, compared to bigger enterprises, SMEs might have greater difficulties in overcoming an ERP implementation failure [14][44]. Despite the need to study and analyze the post-implementation impacts of ERP systems using different units of analysis, much of the existing ERP research focuses on the implementation process and gives insight on critical success factors for ERP implementation [15]. In particular, as Haddara et al. [16] indicated, extant research provides only scarce findings about the effect and characteristics of post-implementation of ERP systems in SMEs (e.g., [15][17]. More specifically, although there are calls for a deeper understanding of workarounds and their impacts in IS implementations [18], the issue of post-implementation workarounds for ERP systems has often been ignored by current literature. The term Workarounds can be defined as alternative procedures employed by users to accomplish a task in response to a misfit between computer-based and existing work processes [19]. As such, it is important to recognize the distinguishing characteristics of SMEs and consider how these influence the ERP implementation issues faced by SMEs operating in different contexts. The deployment of ERP systems can bring about unintended consequences that can lead to resistance and workarounds by users [20]. When a new ERP system is implemented, users

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may encounter hindrances in workflow caused by various factors including poor process design, complex system functionality, poor user interface, inadequate user training, and lack of proper user guides [15].

In this study, we focus on workarounds because of a misfit between the new ERP system implemented and the new systems being used to support daily tasks and work processes in a medium sized automotive industry. The study tries to address the existing gap in literature by examining a case study of a problematic ERP implementation, where users had to use the system nevertheless to perform their daily tasks. The study particularly tries to contribute to this research void by exploring both the intermediate and corporate impacts of a problematic ERP implementation in an automotive manufacturing plant in Norway. The end-users in the different functional units (even at the executive level) of the plant were forced to use the system despite the many flaws and incompleteness they observed in their daily tasks.

The paper is organized as follows: Section II gives a brief background about the company (Kongsberg Automotive), while section III presents the theoretical framework on workarounds and IS implementation. Section IV is about the research approach and method, while section V presents the findings. In section VI, we present the discussion and concluding remarks.

II. COMPANY BACKGROUND

KA is a global organization operating in different countries, and in Norway in different cities. This study addresses the experiences, challenges, and workarounds in implementing and using an ERP system in a plant situated in one of the cities of Norway.

At the time of the interviews, KA had been using the SAP R/3 ERP system since 1996. KA uses SAP to manage financial transactions, requirements planning, inbound and outbound logistics including stock piece registration, and management tasks.

We approached the Hvittingfoss Plant at Kongsberg Automotive Company to conduct the present case study. The Hvittingfoss Plant is situated in Norway, while Kongsberg Automotive as a whole has thirty production facilities worldwide. They produce powertrain systems and chassis related products for both heavy and light duty commercial vehicles, and many related products. Kongsberg Automotive employs 10 000 workers in 18 countries. Annual revenues are roughly 1 billion EUR in 2018 according to Q2 reports. The revenues have slightly but steadily risen during 2016 and 2017.

The factory at Hvittingfoss produces gearshift- and clutch actuation systems, chassis roads and gearbox components and related products. Thus, the plant is a part of the business segment Powertrain & Chassis. They also have a driver control unit, and a distribution department situated in Raufoss. The factory hall is equipped with some robots and some manually operated units. The Hvittingfoss plant started up in 1976 and now employs around 140 people.

III. THEORETICAL FRAME: WORKAROUNDS AND IS IMPLEMENTATION

The notion of workarounds in the context of IS implementation has often been treated as a form of resistance from the end-users and a significant hindrance to system designers and developers in meeting the objectives of the system [21]. However, there is also literature that addresses workarounds from the perspective of accommodation to misfit [22], [23]. Gasser [23] posits that a misfit would typically exist because tasks can change in unforeseen but important ways when a new information system is introduced in organizations. Hence, users see workarounds as a response when a task is in particular not supported in the desired manner due to the misfit between computing and work processes, rather than a resistance to the new system. In this way, workarounds are performed with the intention to complete tasks, extend functionality, and evade designed limits that are embedded into the new system [19]. According to Gasser [23], such readjustment of work practices and tasks is often performed to accommodate the misfit and is classified into three types of strategies, i.e., Augmenting, Working around, and Fitting. Table I provides a description of the three workaround strategies:

TABLE I. STRATEGIES TO ADAPT MISFITS ADOPTED FROM [23]

Strategy	Definition	Example
Augmenting	Undertaking additional work to make up for the misfit	Having to print and submit a form manually though online submission was already performed due to unreliability of the system
Working around	Intentionally using computing in ways for which it was not designed or avoiding its use and relying on an alternative means of accomplishing work	Calling a purchasing officer to request purchase instead of entering request through system due to tedious process of filling up details
Fitting	The activity of changing computing or changing the structure of work to accommodate for the computing misfit	Improving the user interface of the system to address usability issues faced by users

The use of workarounds by end-users can also be conceptually linked to Orlikowski's notion of 'interpretive flexibility' [24], which extends HCI aspects to the relationship between human, organization and technology. As such interpretive flexibility can be manifested and influenced by several attributes including: the characteristics of the material artefact (e.g., hardware and software), the characteristics of the human agents using it (e.g., experience, motivation), and the characteristics of the context where the technology is used (e.g., social relations, resource allocations, task assignments).

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In this paper, we would like to use the concept of workaround to explore how end-users assign their own meanings and interpretation to the functions of the ERP system in response to the misfit and changes encountered between work processes and the new system implemented. The three types of strategies developed by [23] are also used as initial categories to identify the different accommodation misfits in our case study. In order to complement [23] strategies for accommodation of misfits, we used [25] perspective of workarounds based on IS evolution. They suggested that organizational routines and IT/IS constantly evolve and when there are shortcomings in existing IS, ad hoc adjustments (or workarounds) can occur in two dimensions, i.e., process or IT/IS. Such gradual changes to process and IT/IS are termed by McGann & Lyytinen [25] as process embellishment and IT modification respectively. Process embellishment is a stage in the IS evolution whereby current ineffective processes are improved through leveraging the routines supported by the system and are extended for use across the organization. Whereas, IT/IS modification refers to the change in IT systems where ad hoc IT improvisations are integrated into current systems to improve alignment with current processes [25].

IV. Research approach

This section presents the broader research approach and the specific data collection and analysis techniques applied to collect data relevant for the study.

A. Interpretive case study

As a research approach, we adopted an interpretive case study approach [26]. In interpretive studies, researchers try to understand phenomena by examining the meanings that participants assign to them, within particular social or organizational contexts [28][26][27]. Besides, the interpretive case study approach is appropriate because one can study IS in their natural setting, it allows answering ‘how’ and ‘why’ questions, and it is also appropriate when few previous studies in the same area have been carried out [29]. Similarly, in this paper, we adopt the interpretive approach to collect rich data about the context where managers, engineers, and supervisors daily interact with an ERP system, to understand their choices and rationale for the actual use of the system, and how misfits in the ERP system and their interests addressed. In interpretive studies in Information Systems in particular, neither technologies nor human exert direct causal impact [30]. Rather, outcomes are results of the interplay of computing infrastructures, and objectives and preferences of different social groups [31].

B. Data Collection approach

As Walsham [26] pointed out, the primary data sources in interpretive studies are interviews. The data collection for this research has been conducted through face-to-face semi-structured interviews with employees in a medium-sized automotive company. Ten interviews with engineers, operation managers, and CEO carried out between February and March 2017 at the company’s premises. All interviews were voice recorded and transcribed. We took notes during the interview. The profile of the persons interviewed is presented in the following table.

TABLE II. Respondents to the Interview

classification	**#**	**operational responsibility**
Plant manager	1	CEO
Engineer	3	Various operations
Supervisor	6	Foreman, hour registration

The interviewees were asked some open-ended questions, but they were free to elaborate on their own thoughts and reflections whenever necessary. When there are digressions, the researchers (both are the authors of this paper) then adapted the questioning, in order to make the interviewees elaborate more on their views and ideas.

C. Data Analysis

For data analysis, we configured assisting tools (AT) and NVivo software [38]. We used the AT for transcribing activities, the NVivo software for coding and classifying. NVivo is a specialized tool for qualitative research [32].

Only two interviewees did not consent to audio recording in English, so we had to rely on handwritten notes. Apart from those two, most data collection is from audio interviews in English. We will therefore discuss some HCI and similar aspects of AT supported audio transcription related to our contextual approach to the audio analysis.

While transcribing audio was, both interesting and demanding, it is also resource consuming. Many researchers outsource the transcribing activities to professionals. Other researchers use Voice Recognition (VR) software [39], to keep better control over interpretations. In some practical investigation designs, researchers prefer to conduct the entire transcription process themselves, to perform interpretations based on their special knowledge and familiarity with the domain under investigation. To achieve the same level of control, while utilizing a more recent technology of VR, we developed ATs (assisting tools) to help us with the transcription.

For the interviewing, we first used dedicated sound recorder equipment, then an iPhone. We found the sound quality to be equal in each setup, the phone being easier to operate in overall use. We produced more than two hours of interviews of varying audio and speech quality. The quality varied mostly because we did not protect our environment against sudden irrelevant sounds that ruined potentially important fragments of the speech. The varying noisy environments in the plant is a contextual condition we should have considered. The variation in quality also pertained to execution of native English language. The most difficult to interpret and transcribe was surprisingly native English speech. The Norwegian interviewee’s English was deliberately spoken and therefore in fact the easier to interpret.

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To overcome some challenges and even make transcribing a little more interesting, we created artifacts of ATs to utilize the Google Speech API. We selected the API after having investigated several others, except older VRs. Google's speech API builds upon AI/ML trained for quite many different languages as well as several English native and exported dialects.

In practical use, we found that the API worked best if we fed it with chunks of speech of five to seven minutes duration at a time. We used the GoldWave software to section the recordings, and applied a numbering scheme to keep track of the chunks. After the automatic transcription, human audio perception and interpretation refined and edited the transcription into a satisfactory state. The editing process demanded high concentration and a considerable amount of time. Some parts of the audio were indeed difficult to interpret, and the process inferred interesting observations in terms of audio perception. You can interpret visual images very differently dependent of how you keep staring at them. We observed that speech fragments could behave likewise. Once we had edited a specific transcription fragment correctly, the correct perception of the same fragment became just as easy as it was incomprehensible before. The observation is very similar to the famous Yannie-Laurel phenomenon. A technological approach to the phenomenon suggests that shifts in pitch would infer different interpretations [41]. The phenomenon demanded an AT with HCI considerations, such as being easy to configure for re-listening and re-pitching of sound fragments.

What we constructed was an AT for producing an automatic text suggestion for a chunk of speech, with controllers to play parts of the speech repeatedly (A-B playback) or from an A-position, and with symbols to mark audio positions directly in the transcription text under improvement. The AT had facilities for adjusting the A and B positions in very fine steps after initial settings, as well as each symbol's audio positions. Text styling helped visualizing what parts of the text that was already good, and what parts remained incomprehensible, as well as yet unexplored text fragments. A pitch change tool operated A-B sequences playback. Each of those facilities proved invaluable for refined interpretation. The method was to let some incomprehensible fragments rest for a while, and then revisit them repeatedly. The various facilities to revisit and repeat fragments actually helped us transfer many fragments from incomprehensible to good.

The AT published xml-coded fragments continuously and unobtrusively, as well as comprehensive word and web content from the transcription text in progress. We used Altova XML Spy to construct useful and relevant XML schemas to support the system design. Likewise it was important to let the AT be able to switch between both interview files and chunks within the files. The AT even had to save the work in progress both risk-free and continuously. The importance of the unobtrusiveness stems from the need to avoid wearing out the human resource, and leave the greatest possible amount of capacity to the transcription, and audio perception capacity. It also stems from the need to maximize concentration on the interpretation, which is only possible when the tools don't distract the interpreter. In short, the AT must keep the workflow intact. In the field of system development and fault detection tools, Fichman et al. [33] convey that any interruption generated by an automated tool forces a developer to context-switch away from her primary objective. Even very good tools remain unused if they disturb the workflow too much. [42].

We constructed the domain AT in order to utilize the Google Speech API. The API reads the audio and deliver text. Google's APIs also have pricing plans. Google offers a resource of around 300 days and an amount of money to use on Google APIs in general. We spent only a trifle amount of the money, and almost 100 days, development and AT testing included.

The method for transcribing interviews shortly outlined here was not time saving. The reason is the parallel development of the AT and investigation of other relevant assisting technologies. Even if we primarily performed the development to better understand the content of the audio interviews, it quite naturally contributed to insight in several technical and perceptional fields, which we consider a collateral reward.

The transcription and note composition phase produced three text files. Our method used NVivo, which is why we will mention a few example findings here. We let NVivo import the three files so we could begin the analysis. From NVivo we conducted the labelling and classification of findings in the interviews. Examples of main labels identified by NVivo are subsystems and ATs, user's wishes and missing facilities statements, and labels like business processes and stock management statements. Categories of interviewees and various corporate departments are among main classifications from NVivo operations.

V. CASE DESCRIPTION & ANALYSIS

The section presents findings of our exploration on the workarounds in the customization, implementation and use of ERP systems in a medium sized automotive company in Norway. Our findings revealed that during the initial stage of customization and implementation, there was an effort by the vendor and the IT department at the head office of KA to address the local needs of the different functional units. One of the supervisors, who was there at the time of the system implementation, reported no resistance from the users on the new system. The challenge was complexity of the system to learn and master most of the functionalities in a short period. He stated the following:

> *"Everyone was willing to learn and use the new system. There was a good motivation from all staff members. The problem was the difficulty to learn too much in a short period of time."*

Despite the difficulty to learn the new system by most of the staff members, the management insisted that no matter how difficult to learn and no matter how long it took to learn, using the new system was set to be mandatory.

According to the CEO, the motive for introducing SAP at KA was initially to achieve integration and manage all its operational activities. In our interview with the manager of the plant, we realized that there are several other applications that are also in use by different units of the company. Some of them are the following: a strategic planning tool that gives strategic information about customer's volumes projections over a period of time, a human resource (HR) system called Zalaris mainly used for staff time registration, an automated invoice handling system, and a web portal to support aftermarket customers. A maintenance system is also used for different security and maintenance related tasks such as emergency lights, fire detection, diesel monitoring.

One of the biggest challenges of ERP systems is their complexity and the rigidity of some of the modules to customize to local requirements. In principle, ERP systems are customizable, but there are features that you can't customize. Those features are designed to be standard for some industries like pharmaceutical, retail. Asked about if the existing ERP system fits well to the needs and requirements of the plant, the plant manager stated the following:

> *"SAP is a complex system! It's very, very complex. In most of the cases, we end up with something that's not really what we want, because we are tied to reusing SAP. We have to do it the SAP way. If we want to do warehouse management in SAP it has to be done the SAP way, not our own way. That creates gaps in using the system to address some specific local needs at the plant. In our case, the system fails to support some of the operational tasks, and this forced us to use some additional applications like MS Excel to prepare production plan or in some cases do things manually like the time punching to register how many hours employees work. "*

When the company initially introduced the ERP system, the head office's IT department selected, customized and implemented it in collaboration with the local SAP vendor. However, follow up support that emerge from local plants was not sufficient. As the plant manager noted:

> *"IT is a centralized service; so I don't have an IT department here. I also do not know if there is any IT strategy at the company level. We requested on several instances about our needs and limitations of the SAP system to address our needs. "*

In our interview, we have also noticed that there were some smaller applications developed on top of SAP over the years to address emerging local demands even without the knowledge of the head office of the IT department at the head office. We asked why it is difficult to integrate the applications to the ERP system and if they are worried about future silo systems running at different units without sharing data and process outputs. The manager gave the following answer:

> *"… In fact I informed the IT department at the head office about the problems we encounter on the existing systems and the new applications we are using. But, you know, at the end of the day either somebody needs to come and give me some support and fix these things for me, or I need to find someone else to do things. I do know that we have had a small application done for recording machine downtime, and measuring it. That was done by a guy in Drammen. It never was completed. But it was sort of semi operational. »*

Asked about why they use MS Excel to analyze data generated by the SAP system, one of the engineers replied:

> "*When we produce parts, all our working hours from the production is filled in SAP interface. You can also register all parts produced in the SAP system. You can display that data in SAP. But, you can't do anything with that data. You can't work with them. You can't divide them on different lines, you can't present them in graphs…»*

Another engineer also stated the following:

> *"Since we had the Excel system which is more useful to my tasks, I have never used SAP for data analysis or presentation. I have only used it in Excel. But, still SAP is needed to register the numbers which will give the figures for analysis."*

We also have come across during our interviews that there are some processes and tasks that are still done manually. Registering the time sheet for non-permanent staff is still handled manually. Check-in (punching-in) system for regular employees is done manually. Lack of a planning system to project new part-time employees needed in the plant is also identified as one problem. Stock management for internal housekeeping and warehouse stock tracing are also not currently supported by the SAP system. Though all the parts coming to the plant are registered into SAP system mainly to communicate with the accounting department and finalize payment of invoices for the parts ordered. After registration, the parts will be distributed to the two warehouses and they will be sorted manually. There is no system to trace those parts once they are dispatched to the warehouses and assembly lines. Lack of stock trace system has been identified as one of the main problems by all the people we have interviewed. According to one of the operations supervisors, there are about 11000 different incoming parts that are currently in use by the plant. Once they arrived they will be shelved and the job of tracing parts when they are needed is currently done manually. This is what the supervisor stated:

> *"…stock management is a disaster… this is the biggest problem for the department. If customers make complaints about parts we have to manually search the item using part number on the shelf and get the details afterwards. This took too much resources, too much workload on staff doing it, and so many errors."*

We asked why traceability is a problem and why it is difficult to use SAP to address this challenge. The answer was simply:

> *"SAP doesn't support it as there is no any module in SAP to support this task. While SAP was implemented this was not included as part of the requirements as there was no an issue of traceability at that time."*

Stock management is also problematic and is not supported by the SAP system. As one of the supervisors in this section noted the principle of FIFO can't be applied mainly due to lack of a system that can help to identify which item is old and which item is new. The plant has a rule to use old batch before new batches, but it has become very difficult to apply this rule as it is problematic to sort manually which parts are new and which are old just by using their 6 digits part numbers. The supervisor concluded:

> *"We have to have a system that supports our internal housekeeping"*

Planning or projecting number of new part-time employees that are needed in the coming months is an important managerial duty of plant. To address this need, different departments are using MS Excel to project the different categories of people (with their skill and knowledge) at departmental and/or monthly basis. The estimation is made by breaking down the hours for the work or material to be produced divided by the weeks needed to produce the material(s). But, doing this task using MS Excel is problematic as error checks are time consuming. Manual data registering to Excel sheet is hard and error prone. It requires skills to configure Excel for planning and forecasting. As the head of the logistics department stated:

> *"we can not plan future jobs in SAP. We are currently using Excel by copying some data from the SAP system. This is a double work and at times cumbersome."*

Human resource department also uses a different system for individual appraisal and performance management. The foremen use the Zalaris tool for hour registration and over-time work registration. There is also the automatic invoice handling system Workflow in use.

Integrating new demands to existing SAP system is a challenge. Demands could come from new requirements. It is difficult to integrate the new demands to the system that was implemented some 20 years ago. There are also SAP standards to respect. So, as some of the supervisors explained to us, it is now becoming a common practice that new customized applications are in use to address internal demands and requirements. This creates a silo system where different smaller applications are running at different units even without any integration and sharing of data. This will compromise the consistency and reliability of data generated by those units.

VI. CONCLUSION

What we have found to be true for the SME plant under study is that its IT activities apply to several of the strategies and references in our theoretical frame. Several findings support that fact. The plant is therefore likely to be in the same situation as many other SMEs globally, which makes us interested in identifying and solving problems with software misfits.

When the management level first introduces a main ERP system like SAP in a location, we can appreciate corporate expectations to employees to learn and begin to use the system as soon as possible. Likewise, we can easily understand the social and profession related stress felt by each individual. Even if some of the misfits were present already at the implementation stage, they could easily be overlooked, and maybe deemed as improper to pinpoint since the management level has already completed the planning phase.

We will therefore conclude that an implementation of ERP often starts out with misfits and missing tools. We also found evidence for the widening of the gap between services and needs as time passes. The evolution of the plant and even the enterprise as a whole go through several phases and changes over time. The customers, for instance, become increasingly aware of materials leading to health issues, which makes it important to store and retrieve information about specific stock details, not to mention the stock relocation itself. The missing possibilities to trace parts is a main theme in the findings, and therefore identifies a severe gap between enterprise implementation of SAP and the specific needs of the plant or the company at large.

From our findings, we have evidence that there are SAP standards to respect. We must further consider how the long and solid almost 50 years of history influence the SAP core code and the SAP framework. The system was born in Germany around 1972; several years before the introduction and general use of object orientation as a method of system development. Much later, developers found object oriented code easy to maintain and reuse, at least in contrast to older types of code bases [34]. We argue that the SAP system implemented for KA in 1996 consisted of code core and frameworks that were hard to change. We further argue that the implementation still is hard to refurbish. This infers the assumption that SAP is hard to accommodate to fill demand gaps [35], and therefore forces other strategies.

The strategies applied for filling the gap in our study were actually at least two of our three-fold Gasser adoption list [23]. The one we did not find was the Fitting Strategy. The Augmenting Strategy is relevant when the supervisors have to fill in hour registration manually. The supervisors and plant manager used the data in HR software, invoices reference, and even to assess performance with key performance indicators. A KPI is to assess the time taken to produce standard components. Our findings reveal that both supervisors and plant manager deem hour registration as time waste in the form they practice it. It is obvious that several other services, like those just mentioned, would benefit from augmented integration in the core system, to reduce augmenting personnel strategy. The KPI just mentioned would demand data flow between standard, or historical, timing measures for the producing of parts and the actual hour registrations.

The Working Around Strategy is, however, the dominant strategy in the SME under study. Individuals in the company needed several electronic services that were missing from SAP. Competent individuals then developed several ATs (assisting tools) which the plant manager referred to as query tools. The versatile Excel tool accepts data to the purpose of organizing, analyzing and graphing for use in for example periodic staff meetings. These tools are in several ways essential for executing important business processes.

During the years after the implementation of SAP, purchasing officers have acquired several OTS workstation tools or web based systems. We found systems like Zalaris, Amigo, Mitrol, Workday and Workflow, all of which being part of important business processes. We also found specialized tools for detecting machine downtime, and tools that addressed prioritized wishes like registering of parts locations. Each of those systems have unique user interfaces, and seldom respect best practices or HCI principles. They therefore demand resources to learn, which after a while infers resistance to stop using, even if the headquarter eventually suggests better software. We do not argue that individuals would explicitly deny using new software, only that it is likely to disturb the individual's existing workflow and routines. In some cases, temporary employees create system solutions for specific areas, like part-location registration. The importance of documentation and maintenance becomes critical once that individual leaves premises.

A more problematic characteristic is that most workaround systems also usually create silos and duplicated information captured in varying data formats. Such data sets are sometimes hard to interchange or use in any other systems, at least without resource demanding modifications. We are also aware of the dangers of duplicated data sets that may differ over time, inferring risks to business processes in the organization. The risks are for example faulty decision base caused by erroneous data sets and wrong information. With workarounds like those mentioned here, suppliers of workaround systems should take extra care to observe possibilities of singular data origins, that is, avoiding duplication of data.

From our findings, we also realized that the nature of task structure contributed to the post-implementation workarounds and shadow systems that are developed in response to the changes in work practices and the long-term implications of organizational processes. By task structure we are referring to the complexity of the task, the amount of discretion or autonomy allowed to perform the task [36], and the degree of interdependence among other groups to accomplish the task [37]. A good example from our case on task structure complexity related workaround is the check-in or punching-in system, which is currently performed manually. This task structure is complex and very difficult to automate by using conventional ERP systems. The company considered to let a device monitor the time tracking of part time employees. There are automated time tracking systems in the market that KA can use to automate its time-tracking tasks. Such systems can offer real-time access to data, ensure efficiency, and provide the company and its employees an advanced and alternative solution to the existing manual time-tracking processes. In our exploration, we observed that the strategies adopted by different groups to deal with the limits of the ERP system contributed for new workarounds and new shadow systems to the ERP system. Integrating the new application to the old ERP system would require costly customization that is also the cause of all the new shadow systems developed over a period of 20 years.

Our main contribution lies in providing empirical evidence and insights on post-implementation complexities and challenges of an ERP system, the workarounds carried out by users of the system, and the impact on the overall performance and efficiency of the organization. By doing so, we underscored the importance of workarounds in IS implementation to create viable organizational processes [43]; provide empirical evidence on the impact of workarounds in IS use; and explore how workarounds are actually re-enacted by end users.

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