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RESEARCH PAPER

Understanding Socio-Technical Impacts Arising from Software-as-a-Service Usage in Companies

A Mixed Method Analysis on Individual Level Data

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Abstract Given the advantages of Software-as-a-Service (SaaS), such as cost efficiency and flexibility gains, decision-makers increasingly deploy this technology for supporting business processes as well as core business processes. But the impact of SaaS integration on a company's IT organization often does not become apparent until the implementation is completed. Therefore, this paper examines the perceptions of IT professionals in internal IT departments regarding the effects of SaaS. In order to analyze the changes in the daily work processes of internal IT professionals in companies using SaaS, we start with the design and test of a suitable quantitative research model. In a second step, we conduct triangulation by investigating four SaaS cases from the perspectives of internal IT professionals and end users. This step constitutes the qualitative part of the study. From the empirical results we can deduce that with an increasing SaaS usage level a socio-technical instability emerges in the perceived individual job outcome (e.g., job satisfaction, job acceptance, job significance). This is especially true for IT professionals. Our valuable findings help management to understand the need for balancing both their willingness for SaaS adoption and the socio-technical consequences.

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1 Introduction

Despite the user-friendliness of Software-as-a-Service (SaaS)[1] and the benefits associated therewith (e.g., cost efficiency and scalability) (Youseff et al. 2008; Marston et al. 2011), the fact that SaaS may have far-reaching socio-technical consequences for a company's employees should not be neglected. Whereas end users might enjoy working with innovative and helpful SaaS solutions, internal IT professionals see themselves confronted with an abundance of tasks: it is in their responsibility to manage the entire infrastructure of diverse information architectures and distributed data as well as to manage software within the internal and external data streams (Leimeister et al. 2010; Hoberg et al. 2012).

When switching to SaaS, particular tasks such as software customizing and engineering, which have previously been completed internally, fall into the responsibility of the cloud computing (CC) provider (Marston et al. 2011). Yet, there are also several internal tasks that become more important or have to be modified, for example, the

[1] The National Institute of Standards and Technology communicates the following definition for cloud computing: "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell and Grance 2011). This paper focuses on a specific service model of cloud computing, namely SaaS, where the services range from simple supporting services, e.g., travel management, up to complex supply chain management systems.

management of IT security and IT architecture (Loske et al. 2014; Gupta et al. 2013).

It is therefore not unlikely that, according to the degree of SaaS usage, the company's existing IT competences and organizational IT structures will prove to be insufficient. And as internal IT professionals are in charge when SaaS processes have to be managed, it is especially their work that is subject to major changes and disruptions after the implementation of systems of this sort. This is particularly true when SaaS is applied to the more complex core business processes, for which mostly special knowledge is required. Hence, IT professionals may develop a negative attitude towards such a new system (Venkatesh et al. 2010; Boudreau and Robey 2005; Volkoff et al. 2007).

Thus, it is of crucial importance to gain a profound understanding of the IT professionals' perceptions with respect to changes in their scope of work due to SaaS implementation. With such knowledge, it is possible to comprehend the reactions as well as the associated consequences. Although already studies exist which focus on topics such as provider selection (e.g., Benlian and Hess 2011; Wind et al. 2012; Hoberg et al. 2012), or implementation processes (e.g., Low et al. 2011; Schneider and Sunyaev 2016), up to now authors often merely assume the organizational consequences of SaaS in an argumentative-deductive manner, and the issue is usually not given more than a cursory glance on macro-level (Morgan and Conboy 2013; Marston et al. 2011).

But apart from that, also the drivers of SaaS implementation and their specific socio-technical perspective cannot be ignored. Hence, the end users of SaaS (e.g., from sales or logistics departments) need to be equally included in order to comprehensively assess the impacts on IT professionals with help of a broader empirical base and to be able to compare the various perspectives.[2]

We have conducted an individual-level research (Bala 2013) and made use of the socio-technical systems (STS) theory. This is a powerful theory deriving from organizational behavior that is frequently applied to investigate IT implementations and IT enabled changes within organizations (e.g., Lyytinen and Newman 2008; Bala and Venkatesh 2013). We concentrate on the following research question: *Does SaaS, when used for core business processes, influence IT professionals' job perceptions; and if so, do these perceptions markedly differ from the perceptions of end users?*

Our paper is structured as follows: In the subsequent section, we evaluate existing research, debate the study's theoretical foundation, and deduce our research model as well as related hypotheses. In section three, we outline our quantitative research involving methodology, data analysis, and limitations. After that, we address the qualitative research. In section five, we merge the conducted research studies and highlight the important findings as part of a discussion. Finally, we conclude the paper in section six.

[2] Despite knowing that IT professionals might as well be end users, we strictly distinguish between the two roles because the respective preconditions differ fundamentally (e.g., fear of losing your job vs. external support).

2 Background

2.1 Related Research

First of all, we conducted a systematic literature review (Webster and Watson 2002). For this purpose, we searched the databases of the leading 30 IS journals as mentioned in the AIS journal ranking list, the proceedings of major IS conferences (ICIS and ECIS) as well as the Digital Libraries of ACM and IEEE for relevant articles. The terms employed for our search in the articles' titles and abstracts were: *(cloud OR saas OR outsourc*) AND (organization* OR social OR employ* OR professional).*

In this way, we discovered that although the papers characterize the different CC service types, the respective analyses and discussions remain on a macro-level. Hence, the papers also lack appropriate conclusions for the respective CC service models and deployments (Mell and Grance 2011). Nevertheless, we identified three fields of research that are relevant for the present study and are not independent from each other.

The first field concentrates on the overall effect that CC can have on a company's internal, organizational processes. Here, the social perspective constitutes only a small part of the whole. These overall business impact studies on CC tend to focus mainly on the end users' side. Thus, we name this field "*micro-level impact on end users*". In contrast, the second field – "*micro-level impacts on IT professionals"* – has received far less attention, and hence a larger backlog demand exists. The third field targets the interrelation between the various more mature information systems and IT organizational fits, accepting that organizations are *imperfect at IT implementing, maintaining, and using*. This field is assigned as "*lessons learnt from predecessor systems*".

Our analysis within the *micro-level impact on end users* (e.g., employees in cloud using companies) revealed that most of the papers rather emphasize the advantages of CC. Marston et al. (2011) and Leimeister et al. (2010), for example, stress the possible interoperability between employees of diverse functions. In addition, by involving mobile devices such as smartphones or tablets, end users are in a position to use the corporate information systems even more efficiently. Polyviou et al. (2014), who state portability to be the key implementation factor immediately after cost advantages, corroborate this view. Other researchers claim that the end users' job performance and ease of use increase when end users are less dependent on the in-house IT staff (Gupta et al. 2013; Meer et al. 2012).

With respect to the *micro-level impact on IT professionals*, a more differentiated picture emerges. Here, the authors see a strategic importance mainly because CC usage is accompanied by major modifications of the corporate IT structure, which results in a myriad of intra-organizational challenges. Morgan and Conboy (2013) applied the technological-organizational-environmental framework as theoretical foundation for their analysis of three case companies. On the organizational level, they detected that the fear of IT managers to lose control of their IT environment constitutes an important aspect in the decision making process for or against the usage of CC.

Moreover, IT professionals are afraid that they could be made redundant. Morgan and Conboy (2013) come to the conclusion that it is indispensable to correspondingly adjust skills and capabilities in order to match the cloud landscape. Some authors, e.g., Janssen and Joha (2011), and Venters and Whitley (2012), open a comprehensive debate on the newly arising requirements profile for IT professionals. Further, Winkler and Brown (2013) found IT governance drifts towards *shadow IT* that encapsulate IT departments from other stakeholders. Interestingly, though, Lee et al. (2013) revealed that social factors such as IT qualification and culture, even more so than risk concerns, were the main reasons put forward against CC adoption in South Korea. As a preliminary work to the present paper, Jede and Teuteberg (2015) analyzed the influence and effect of SaaS on internal IT professionals and found significant changes in perceptions following a SaaS implementation.

Thus, as a conclusion of the mentioned articles, it is essential to differentiate between the CC effects on different stakeholders as there is a considerable disparity in the respective preconditions. Compared to the paper by Jede and Teuteberg (2015), this work aims at a more holistic approach by integrating end users via a method triangulation and by deriving more differentiated implications from the empirical results.

The third field, *lessons learnt*, is quite broad and covers the impacts that more advanced IT systems have on organizational transformation and business performance. Hong and Kim (2002) determined that in the 1990s an exceptionally high number of efforts to implement enterprise resource planning (ERP) systems failed. With their study, the authors investigated the causes which were responsible for this high failure rate from an "organizational fit of ERP" perspective. The causes lie in the fact that, instead of using internally developed software, the companies began to apply purchased software applications, which are often insufficiently adjusted to the internal IT requirements. Similar reasons led to a high failure rate (75 %) of IT-based business process re-engineering initiatives (Bashein et al. 1994). The importance of a social and technical alignment was also emphasized in the studies of Sykes et al. (2014), Benlian (2013), Bala (2013), Wang (2010), Wang et al. (2006), and Lee et al. (2004). This indicates that the need for social and technical alignment in the course of implementing new IT systems has so far been underestimated.

2.2 Socio-Technical Systems Theory

STS theory assumes that an organizational unit is a combination of two interrelated subsystems – the social subsystems (people and social/psychological structures) on the one hand and the technical subsystem (techniques and task) on the other – that have independent origins but one common goal (Venkatesh et al. 2010; Rousseau 1977; Bostrom and Heinen 1977).

Because the social and technical subsystems must recursively interact to accomplish tasks, work systems involve both physical products and social outcomes. The key issue is to derive a system equilibrium that involves stable interrelationships within and across the components of the two subsystems for a so called "joint optimization" (Rousseau 1977; Lyytinen and Newman 2008).

One specific thesis of STS theory is of particular interest. According to the theory, any internal or external modification in the shaping of one of the subsystems inevitably leads to an instability in the whole system. This may result in a high degree of individual negativity towards the system and in "productivity losses". Thus, whenever modifications are made in one of the subsystems, it is important to take the individual perceptions and anxieties into consideration (Holman et al. 2005).

In line with Marston et al. (2011), we presume that there will be organizational misalignments and/or instabilities in the STS equilibrium as direct consequence of implementing public SaaS and associated IT processes for core business processes. We argue that there are different levels of task changes between IT-professionals and end users when implementing SaaS. In addition, undesired instabilities are more probable for a company's IT professionals than for end users.

Hence, in order to understand how especially IT professionals react to the SaaS trend and in order to compare the perceptions of IT professionals with the perceptions of end users, we adopt STS theory for our study. The STS theory aims at performing analyses at the individual level, which corresponds well with our intention to capture the perceptions and behavior that result from already implemented SaaS as well as from the general trend to increase SaaS usage.

Although some time has elapsed since the establishment of the STS theory's hypotheses, we are convinced that especially STS builds an adequate theoretical foundation for our paper. Therefore, we consider most of the topical theoretical and empirical research on STS theory and link it to SaaS research that is relevant to our context.

2.3 Research Model and Hypothesis for Internal IT Professionals

In this section, we derive the research model that aims to answer the first part of our research question, namely IT professionals' perceptions on changes resulting from SaaS adoptions. Here, we expressly consider public SaaS. We separate the four major STS constructs organizational structure, people, tasks, and technology (Bostrom and Heinen 1977; Venkatesh et al. 2010), and based on existing studies we derive essential predecessors. By integrating a conceptualization of all relevant constructs, we further refine our model and the underlying hypotheses (cf. Fig. 1).

From our perspective, the alignment between the social and the technical sub-system can be assessed by two dependent variables: *perceived individual process performance* (*PIPP*) and *perceived individual job outcomes (PIJO)*. For this reason, we start with the two focal constructs of our study. Then, we revert to the antecedents. (For all of our constructs, except CISU, we employ the term *perceived*, which is supposed to express that the analyses take place on an individual level).

Starting with *PIPP*, we propose that modifications (increases or decreases) in the perceived process complexity will have an effect on the individuals' *PIPP*. We follow Bala (2013) and define process performance as the degree to which an individual thinks that he or she is in a position to perform *effectively* and *efficiently*, which at the same time constitutes two items of construct *PIPP*. Despite the fact that this is a subjective assessment, we attach great importance to the understanding which changes in work processes have regarding impacts on the IT professionals' self-assessment (with respect to their effectiveness, efficiency and performance). This provides an opportunity to detect imminent productivity losses.

As to *PIJO*, we assume that perceived technical and organizational changes will have an effect on the individuals' job outcomes directly after the implementation of SaaS. It is very challenging to cope with increasingly complex work tasks while the number of components is rising and the interdependencies among the components are conflicting. This situation is even aggravated by the prevailing uncertainty and lack of understanding (e.g., knowledge and skills) as to the components (Blecker and Kersten 2006).

Within our research model (cf. Fig. 1), we analyze the individuals' perceived job outcomes by taking into account the following soft facts as items (e.g., Sykes 2014; Venkatesh et al. 2010): *job satisfaction, job acceptance*, and *job significance*. If IT professionals perceive a drastic change in their work duties, it is highly probable that this will affect their work results. As already mentioned, a completely different work field requires a new and/or different set of tasks and/or different information and resources. Some IT professionals may find it troublesome to cope with their radically changed work processes.

Matured literature and STS theory have detected that individual employees prefer to preserve the status quo of their daily routine in order not to lose the adopted profound

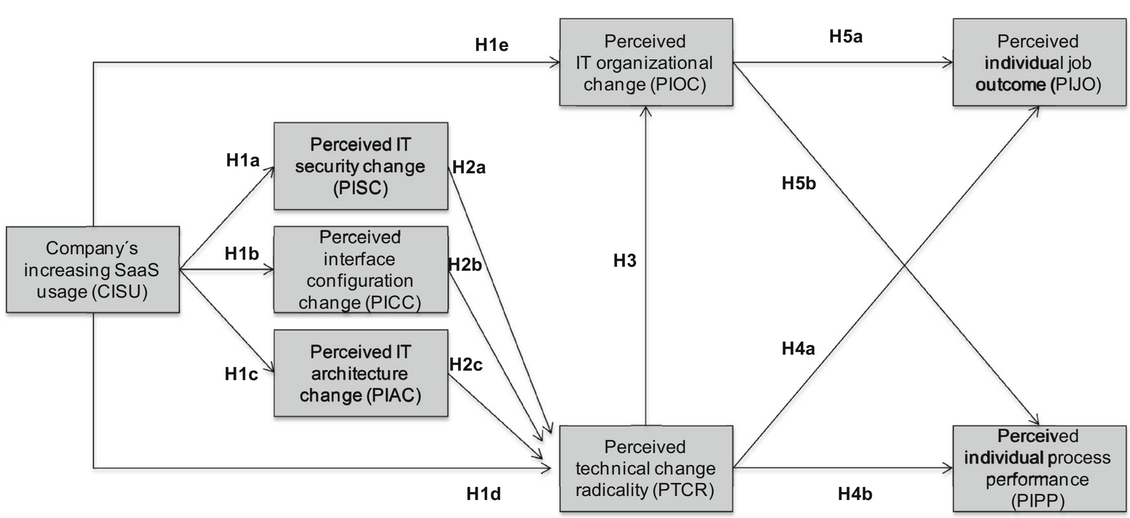

Fig. 1 Research model

understanding of the working processes and structures (e.g., habits; Gersick 1991). Any modification to their working habits inevitably influences their individual job performances, because they are trying to cope with the new situations (Beaudry and Pinsonneault 2005). In addition to this, drastically modified working tasks and structures most likely entail negatively affected reactions of IT professionals. This is because the professionals are forced to deviate from their previous routines, habits, and relationships which have been developed over time and build the basis for their success (Bala 2013). Thus, we hypothesize:

H1: *The higher the perceived IT organizational change caused by SaaS adoptions, the higher the negative influence on (a) perceived job outcomes and (b) perceived process performance will be.*

H2: *The more radical the nature of the perceived technical change caused by SaaS adoptions is, the higher the negative influence on (a) perceived job outcomes and (b) perceived process performance will be.*

Based upon the social perspective of STS theory, we expect some internal IT professionals to undergo larger changes with respect to the complexity of their working procedures, whereas others may experience only minor modifications compared to their focus of work prior to the implementation (Marston et al. 2011; Bala 2013). Traditional STS-theory presupposes that through the implementation of new IT, the diversity of capabilities will increase. The nature of a job changes especially through the broadening of tasks, the adoption of responsibilities, and changes in individual task relationships (Steers and Porter 1991; Venkatesh et al. 2010).

However, in view of SaaS, these traditional thoughts are not directly transferable as some tasks will be extended (e.g., provider management, IT security management), whereas other duties will be transferred to the CC provider (e.g., server administration). To refine this, we follow Bala (2013) and determine that the complexity is modified in terms of “component complexity”. An IT professional, who is integrated in the implementation process and the operation of SaaS, may experience a growing amount of distinctive elements or components in his or her area of responsibility. This leads us to the items of *changing activities, information* and *resource requirements* related to SaaS usage, which we aggregate to the construct *perceived IT organizational change* (*PIOC*). At the same time as the number of components of an employee’s field of duty increases, the job requirements needed for the new field of work change. This could result in an information overload or task conflicts (Wang 2010; Campbell 1988; Wood 1986).

Beyond that, modifications that affect various components of work duties can even involve a shift of the overall requirements profile for the respective position (Wood 1986). Thus, it is mandatory that the organization suitably responds to such a misalignment in the socio-technical state. Particularly at the outset of SaaS implementation, as long as the existing knowledge is still limited, it is quite difficult to identify the correct level of adjustment (Wang and Ramiller 2009). We take the mentioned component complexity aspects into account with the variable *PIOC* and thus hypothesize:

H3: *The more radical the nature of the perceived technical change caused by the public SaaS implementation is, the greater the influences on the perceived IT organizational change of the company will be.*

As to the perceived technical change, we distinguish three major topics derived from literature: *IT security*, *IT architecture*, and *interfaces*. However, with growing numbers of SaaS changes and SaaS implementations, these three factors will further reinforce the dependent variable *perceived technical change radicality (PTCR)*, which refers to the ability of an individual to comprehend and assess the respective measures in specific core work processes. Thereby, radicality represents the level of novelty, limited experience, or deviation from consisting knowledge and practices (Aiman-Smith and Green 2002). Therefore, we conceptualize this construct by means of the items *understanding the sequence of the relevant steps*, *predicting relevant steps*, and increasing *rate of technical change* (Gupta et al. 2013; Cegielski et al. 2012).

In virtually all papers broaching the issue of CC risks and technical challenges, it is confirmed that security tasks are subject to substantial changes (e.g., Marston et al. 2011; Cegielski et al. 2012; Benlian et al. 2010). We go in line with the understanding of Ackermann et al. (2012), who define perceived security risks in the context of CC as a “perceived risk related to the IT security of a company’s systems and data if CC is utilized as delivery model”. Especially in cases where CC providers act globally and run their networks of datacenters worldwide, there are particular security risks. In addition, it seems not that such CC providers present a very special legal framework as to the liability for breaches of security (Marston et al. 2011; Brender and Markov 2013). In order to correctly assess these risks and to advise the respective process owners correspondingly, a fundamental IT security knowledge is indispensable. The security changes that come along with any offsite hosting of data and services (i.e., various kinds of outsourcing) involve assigning responsible people who have access to customer data, and who are proficient in omit service attack prevention, perimeter security policy, resource starvation, data backup, and compliance.

Based on the paper of Ackermann et al. (2012), Loske et al. (2014) found break of *confidentiality*[3] to be the most important IT *security risk*. Prior works and STS theory determine *uncertainty* as to the assessment of negative security consequences to be a critical factor in this context (e.g., Featherman and Pavlou 2003). Hence, on the basis of these valuable papers we grouped the mentioned items to the variable *perceived IT security changes (PISC)* induced by the adoption of SaaS.

In order to achieve a convenient data exchange, it is vitally important to obtain transparent and lucid interface configurations between the corporate and the provider system. The SaaS provider supplies its service via a standard interface. Customer-specific configurations are only possible at the meta-data layer above the common code using interfaces which are provided by the vendor (Benlian et al. 2010). This operational issue is further complicated when customized cross-company SaaS is used. It is through the interfaces with the external environment that organizations expose themselves to the associated technical uncertainty (Cegielski et al. 2012). Referring to the key issue as determined by Benlian et al. (2010), CC users have no choice but to adopt the upgrades and updates by the provider, because in most cases interfaces are not backward-compatible. This brings us to the variable *perceived interface configuration changes (PICC)*. To be more specific, we aim to investigate this issue via the STS standard approach (e.g., Bala 2013). Thus, in order to look into the interface configurations, we analyze the changes in *needed resources, needed information*, and *required work processes*.

Eventually, it is essential that the services and systems can be accessed across platforms and infrastructures and function smoothly together (beyond operational interface configuration). Thus, the basic precondition for taking advantage of features like easy data exchange, smooth access across physical servers, multiple entry points for users, and a system supporting a large selection of data types, is an appropriate IT landscape (Malladi and Krishnan 2012; Venters and Whitley 2012; Susarla et al. 2010). We operationalize this point as *perceived IT architecture changes (PIAC)*. And again, the single items of the construct aim to analyze *changes in needed resources, needed information*, and *required work processes* with regards to PIAC.

Returning to the initial point in Fig. 1, companies expect major benefits from public SaaS, for instance, cost benefits, a capable cross-company coordination, process performance increases, as well as a more process flexibility (Bharadwaj et al. 2013; Wind et al. 2012). There are several researchers who anticipate completely new and innovative capabilities for companies that adopt public SaaS (McAfee 2011; Marston et al. 2011). Therefore, the stimuli for the implementations of SaaS are diverse and cannot be generalized.

Yet, our study is not oriented towards macro-level findings; it rather aims at the individual level. At the organizational level of the study, the independent variable that mirrors the increased usage is operationalized as the *company's increasing SaaS usage (CISU) for core business processes*. There is a variety of public SaaS solutions on the market, covering the wide spectrum from elementary supporting services to the extensive services which can support a company's core processes. Next to the wish to become *more efficient* and *address key concerns* through CC, it is also possible that companies are forced to implement CC because of end users' requests (in terms of the items *lower internal/mental effort for end user* and *clear processes*). We assert that internal IT departments that apply public SaaS for their core processes face even greater modifications and challenges. In addition to SaaS usage in general, we claim that our subsequent constructs and causal relations hold especially true for cases where SaaS is applied for core business processes. Hence, we hypothesize:

H4: *The higher the perceived task changes in (a) IT security, (b) interface configurations, and (c) IT architecture due to SaaS usage are, the more radical the perceived technical change will be.*

H5: *The more intense the company's public SaaS usage is, the higher will be the perceived changes in (a) security, (b) interface configurations and the overall (c) IT architecture, as well as (d) the perceived technical change radicality, and (e) the perceived IT organizational change.*

2.4 Research Model for Internal IT Professionals and End Users

In the prior Sect. 2.3 we considered IT professionals only. As we assume that the implementation of SaaS has a particularly strong influence on the IT professionals' individual perceptions, we have deliberately chosen to adapt the research model to their specific working environments. However, as a result of this approach, we also risk an elite bias by neglecting the perceptions of other related individuals in user companies, e.g., end users.

Therefore, we extended the already presented research model (cf. Fig. 1) to the dimension "end users". Thus, we

[3] Ackermann et al. (2012) define confidentiality as "data can be read only by authorized users".

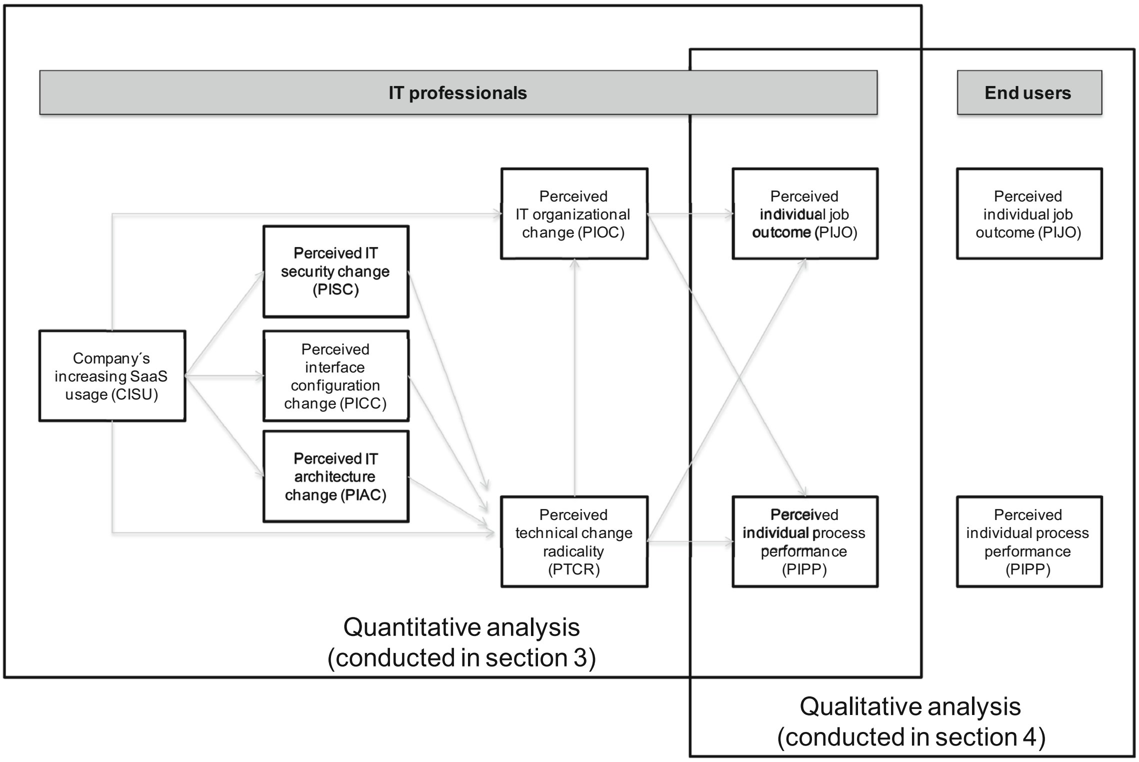

Fig. 2 Relation between research models

predefine the final constructs PIJO and PIPP as a basis and analyze these constructs from the two perspectives of internal IT professionals and end users. The important relation between the initial research model (cf. Fig. 1) and the add-on research model is depicted in Fig. 2.

Moreover, in Sect. 2.3 we developed and derived hypotheses which we aim to test in a quantitative manner. Following Danermark (2002, pp. 153), in a second step, we applied qualitative research to "give a more profound description of some elements of what has been analyzed with the help of a quantitative method".

3 Quantitative Research

3.1 Quantitative Research Methodology

We consider the quantitative research to be the dominant study in our paper, while the qualitative study may be seen as an add-on explanation that also involves end users. In order to answer the research question and test our research model (see Fig. 1) in a quantitative manner, which allows for a statistical generalization of the outcomes, we performed a cross-sectional survey (Pinsonneault and Kraemer 1993).

Where feasible, we employed measurement items of the constructs based on existing research (cf. references in Table I in the appendix; available online via http://link.springer.com) and matched these with our context. All constructs are operationalized in the determined model as reflective constructs following the proposed decision criteria presented by Jarvis et al. (2003) and Petter et al. (2007). The constructs were measured with multiple items on five-point Likert scales (cf. Online appendix for details on single constructs).

The data collection was carried out online (via two social network platforms for professionals) and took place between April and August 2014. In particular, we sought IT professionals with at least 2 years' practical experience with SaaS implementations at companies using SaaS in German speaking countries (Germany, Austria, and Switzerland). Due to the fact that our research model is not adapted to the job situation of IT professionals of SaaS providers, we excluded them from our search.

Also, we concentrated on cases in which SaaS is employed for core business processes, as we judge such cases to be more sophisticated and consequently of greater interest not only for the company but also for IT departments. As we know that it is difficult to make the distinction between a core and a non-core business process, we left this decision to the IT professionals. Furthermore, we requested the interviewee to consider only "public" SaaS, as the other deployment models (Mell and Grance 2011) show a lower degree of outsourcing (private, hybrid, and community) and thus organizational changes of a minor nature.

Due to these tight searching restrictions, we only received 102 completed questionnaires from IT professionals. However, we had to exclude 21 of the respondents from our sample as they were insufficiently conversant with SaaS usage; they had had less than 2 years SaaS experience in their workplaces. Due to unreliable responses (i.e., answering all questions with 5), we excluded another 15 from the remaining 81 respondents during data screening (Marcoulides and Saunders 2006).

Eventually, a sample of 66 usable and completed questionnaires was subjected to the data analysis, which corresponds to an actual response rate of 22.0 percent. The calculation of the statistical power [at least 80 % according to Muthén and Muthén (2002)] indicated that the underlying sample has a sufficient size. Table 1 gives an overview of the respondents' profiles. Herein, the "IT" industry sector includes various industries, e.g., the printing industry.

For testing common method bias (CMB), we conducted a Harman's single factor test in order to investigate if the majority of the covariance among the measures can be explained by one factor (Podsakoff et al. 2003). The outcome yielded 6 factors; the highest of these involves 36.12 % of the variance, indicating that CMB is not an issue in our study.

3.2 Data Analysis of the Quantitative Research

We employed the structural equation modeling (SEM) to test the measurement and structural models. In order to assess the measurement scales and to test the research hypotheses, we selected the component-based partial least squares (PLS) procedure. Contrary to other SEM procedures (e.g., LISREL), the PLS procedure does not necessarily presuppose that the response data follow a normal distribution (Chin 1998). Since this is not the case with our data, we deliberately chose the PLS approach for the analyses. For evaluating the distribution of our construct indicators, we performed the Kolmogorov–Smirnov test as well as the Shapiro–Wilk test. To assess our model, we strictly adhered to the approaches of MacKenzie et al. (2011) and Burda and Teuteberg (2013).

For the evaluation of the measurement model assessment, we started to assess the individual item reliability and convergent validity of the defined constructs. To this effect, we examined the factor loadings of the respective items on their hypothesized constructs and the average variance extracted (AVE).

The next step was to analyze the discriminant validity of the defined constructs by comparing the square root of the AVE of each construct with all other inter-construct correlations. Thirdly, we explored the internal consistency and scale reliability by calculating the composite reliability (CR) and Cronbach's alpha (CA) values (cf. Table 2). The tests undertaken reveal a sufficiently high degree of validity as well as an adequate reliability (Chin 1998; Fornell and Larcker 1981; Gefen et al. 2000). (cf. Online appendix for more details on the measurement model assessment).

For the purpose of testing the significance of our loadings and coefficients, we carried out the bootstrapping re-sampling technique with 66 cases and 5000 samples (Hair et al. 2013). The estimates obtained within the framework of the PLS analysis are depicted in Fig. 3. Also involved are the standardized path coefficients, the significance of the paths (two-sided testing), and the amount of variance explained (R^2).

Figure 3 demonstrates that, with respect to the R^2 values, the determined model accounts for 49.2 percent of the variance in job outcome, 17.1 percent of the variance in process performance, 61.9 percent of the variance in perceived technical change, and 46.4 percent of the variance

Table 1 Profile of respondents ($n = 66$)

Factor	Distribution							
Gender	Male: 63.6 %			Female: 36.4 %				
Age	20–29: 13.6 %	30–39: 27.4 %	40–49: 34.9 %	50–59: 21.1 %	>60: 3.0 %			
Position	Professional staff: 42.4 %	First line supervisor: 16.7 %	Chief manager: 27.3 %	Others: 13.6 %				
IT job	IT consulting: 22.7 %	IT infrastructure: 18.1 %	IT architecture: 13.6 %	Software engineering: 9.1 %	IT service management: 9.1 %	IT security: 9.1 %	IT controlling: 7.6 %	Others: 10.7 %
Industry sector	Automotive: 22.7 %	IT: 21.2 %	Mechanical engineering: 16.7 %	Banking: 12.1 %	Chemical: 7.6 %	Consumable goods: 7.6 %	Others: 12.1 %	

Table 2 AVE, reliabilities and latent variable correlations

	AVE	CR	CA	PIJO	PIPP	PTCR	PIOC	PISC	PICC	PIAC	CISU
PIJO	0.75	0.90	0.83	*0.86*							
PIPP	0.77	0.91	0.85	0.53	*0.88*						
PTCR	0.72	0.89	0.81	0.65	0.34	*0.85*					
PIOC	0.59	0.85	0.77	0.62	0.40	0.64	*0.77*				
PISC	0.66	0.85	0.74	0.69	0.43	0.76	0.68	*0.81*			
PICC	0.64	0.85	0.75	0.48	0.32	0.40	0.33	0.45	*0.80*		
PIAC	0.65	0.85	0.73	0.49	0.42	0.51	0.48	0.56	0.68	*0.81*	
CISU	0.65	0.88	0.82	0.53	0.36	0.62	0.58	0.64	0.29	0.35	*0.80*

AVE average variance extracted, *CR* composite reliability, *CA* Cronbach's alpha, italic values: Square root of AVE

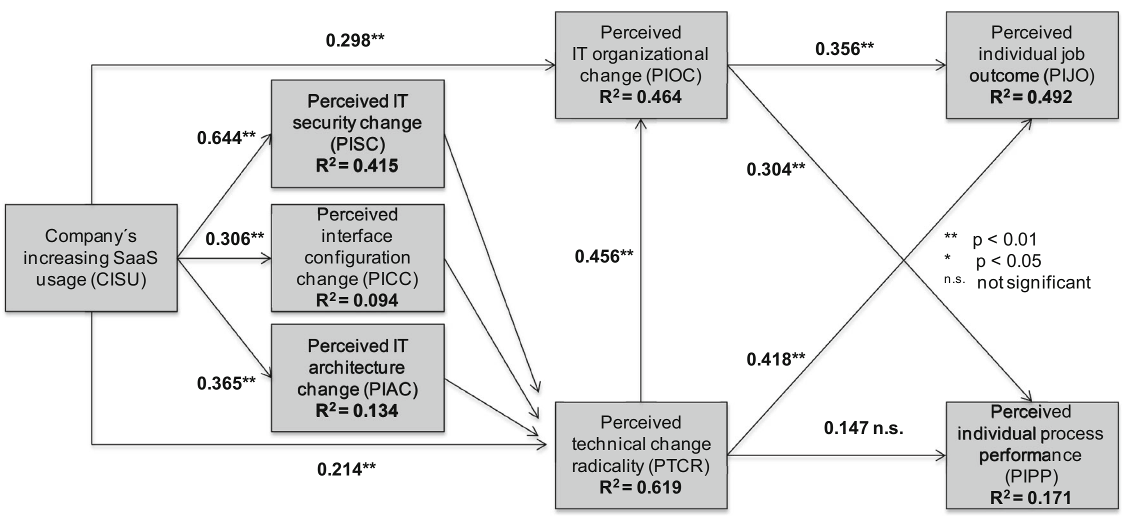

Fig. 3 Results of the research model

in perceived organizational change. The profiles of the respondents served as control variables: added up, they account for an additional 2.9 percent in perceived job outcome and 0.9 percent in perceived process performance. Nevertheless, none of the path coefficients of our control variables on job outcome and process performance are significant.

Acknowledging the significant path coefficients in Fig. 3, Chin (1998) considers a range of above 0.2 to be substantial. For the significant path coefficients, we tested the related confidence intervals with a 95 % level (i.e. significance level $\alpha = 0.05$), and none of the parameter values could be rejected. However, three paths (PICC $\gg$ PTCR, PIAC $\gg$ PTCR, PTCR $\gg$ PIPP) do not comply with Chin's above stated condition. While the sizes of two of these paths coefficients present minor but significant effects, we performed pseudo F-tests to analyze whether the increase in the variance explained in PTCR and PIPP is considerably influenced by PIAC and PTCR, respectively. The test demonstrates a small but significant effect size of 0.040 ($F = 4.19$, $p < 0.050$) for the path PIAC $\gg$ PTCR. Herein, with a 95 % level of confidence the parameter effect size ranges from 0.032 to 0.042 (confidence interval). Further, the path PTCR $\gg$ PIPP has no significant effect size. Summing up, hypothesis H4b and H2b (marked with "n.s." in Fig. 3) are not supported, whereas the remaining hypotheses are supported.

Drawing a preliminary conclusion, we examined the influence of the perceived technical task changes (*security, interfaces, architecture*) and *the company's increasing SaaS usage* on *perceived technical change radicality* and *perceived IT organizational changes,* before analyzing the impact on individual IT professionals' *perceptions of job outcomes* and *work process performance.*

It comes as no surprise that the *perceived IT organizational change* seems to have a trailing effect on *perceived technical change radicality* which shows the third highest significance path coefficient in our model. The modifications represent a general evaluation of the degree of perceived socio-technical change as a mechanism by which particularly the *perceived individual job outcomes* are adversely affected.

In addition, when the degree of perceived organizational changes rises due to SaaS usage, IT professionals notice that their *perceived individual process performance*, which is another subjective construct, diminishes. However, since this construct has a quite low R^2, it stands to reason that other factors, like "perceived usefulness", are liable to affect the job performance far more severely. At any rate, in conformity with the STS theory and our research model, we detect that the use of public SaaS for core business processes has a significant negative affect on the social subsystem.

3.3 Major Limitations

One of the major limiting factors is that the sample is based on data which stems from interviewees from different German-speaking countries. Even if the survey sample shows a broad set of data with reference to the respondents' characteristics, the findings should not be *generalized to other regions and countries*.

Furthermore, the survey did not distinguish between the *various points in time* following the implementation. Additionally, despite the fact that SaaS is a particular development within the realm of CC, it is a relatively new IT paradigm whose exploitation is rising excessively (Van der Meulen and Rivera 2014). Thus, at this stage, the majority of companies has no or only little experience with SaaS "cultures and strategies" (Marston et al. 2011). According to existing research, the benefits from innovative information systems only occur after a certain time lag (Sykes et al. 2014). It is therefore likely that the perceived degree of changes due to SaaS in the perceived individual IT professional's situation return to the level prior to the implementation after some time.

Moreover, we differentiated between SaaS when used for core and non-core processes, whereas we *neglected any further service variations*. For this purpose, supply chain services could lead to other findings than SaaS for financial services. The single-informant method in the survey will be triangulated by investigating four SaaS cases from the perspective of IT professionals and end users in the next section.

4 Qualitative Research

4.1 Qualitative Research Methodology

As mentioned before, in Sect. 3 we exclusively analyzed IT professionals. However, by doing so we risk an elite bias as we neglect the perceptions of other related individuals in companies using SaaS, e.g., end users. Therefore, we aim to equally consider the perspectives of end users and those of internal IT professionals in Sect. 4. Subsequently, after having conducted a quantitative study in order to provide a more profound and comprehensive description of quantitative findings, we followed Danermark (2002) in applying a qualitative method. For the qualitative research we gathered data from in-depth expert interviews.

We followed the model by Kirsch (2004) that consists of three requirements: (1) identifying project cases, (2) identifying whom to interview, and (3) determining how the interviews are to be conducted. To gain a holistic picture, we interviewed an end user as well as an IT professional from each company. We found four case companies with headquarters in Germany that use SaaS for core business processes, and we interviewed the two related parties separately.

The eight interviews took place in March 2015 and lasted on average 70 min. We used a semi-structured guideline with open-ended questions (cf. Online appendix for details on questionnaire guideline). The questionnaire consisted of three phases: whereas phases one and two aimed at personal information and underlying SaaS context, phase three focused on the individual perceptions. Regardless of their profession, we applied the same questionnaire guideline for all interviewees, which is in line with the two fully dependent constructs of our research model: *PIJO* and *PIPP*.

The transcribed interviews were used for the analysis by means of open-coding processes that consisted of fracturing, reordering, and constant comparison (Locke 2001; Strauss and Corbin 1998, pp. 102). To do so, we selected the main statements in each transcript. Subsequently, we grouped these statements in order to reveal categories and subcategories. By relating categories to their subcategories a file of codes began to emerge, which facilitated the understanding of the relationships (Strauss and Corbin 1998, pp. 123) and enabled a more comprehensive evaluation of the constructs' single items. Some excerpts of the interviews will be quoted below. The profile of the four cases is presented in Table 3.

4.2 Data Analysis of the Qualitative Research

As mentioned before, we conducted eight expert interviews at four case companies for the qualitative data analysis. All four cases facilitate helpful empirical insights and fulfil the requirement of SaaS covering their core business processes.

In the *first case company* (cf. Table 3), the sales responsible initiated a SaaS implementation for customer relationship management (CRM). "*I was impressed by the idea of showing the customers on-site real time sales figures and developments*", and he continued "*I feel that this*

Table 3 Profile of SaaS using cases

Characteristics	Case 1	Case 2	Case 3	Case 4
Industry sector	Consumable goods	IT service provider	Automotive	Automotive
SaaS field	Customer relationship management	Digital payment and invoicing	Supply chain management	Transportation and freight management
SaaS usage duration	3 years	2 years	3 years	2 years
Job of IT professional	IT infrastructure responsible	IT consultant and key user of SAP FI/CO module	Key user SAP SD module	Senior IT consultant
Job of end user	Regional sales director	Accountant	Customer service agent	Junior logistics manager

Table 4 Results of the expert interviews

Case #	Job role	Perceived individual job outcome (*PIJO*)	Perceived individual process performance (*PIPP*)
Case 1	End user	Increase +1	Increase +1
	IT professional	Decrease −1	Unchanged +/−0
Case 2	End user	Increase +1	Increase +1
	IT professional	Unchanged +/−0	Increase +1
Case 3	End user	Decrease −1	Unchanged +/−0
	IT professional	Decrease −1	Decrease −1
Case 4	End user	Increase +1	Unchanged +/−0
	IT professional	Decrease −1	Unchanged +/−0
Sum	End user	Increase +2	Increase +2
	IT professional	Decrease −3	Unchanged +/−0

data availability and the easy short term data processing increased my professional recognition by the customers". The IT professional confirms that the adopted SaaS outclassed the prior e-mail application based CRM tool. But at the same time he argues that huge efforts are needed for managing the data interfaces between the ERP system and the ever changing external CRM service requirements.

In the *second case*, the company implemented a SaaS for e-invoicing mainly in order to decrease the labour costs for leasing personnel who was responsible for manual billings and payments. The adoption of the SaaS arose from the company's lean office initiative. The interviewed accountant was glad that the company used the service, because for the standardized invoices the manual workload had predominantly been replaced by the service. She stated "*to some degree my job switched from task work to coordination work*". In this case, the IT professional perceived no major changes compared to the state prior to SaaS usage. Even though he had data security concerns during the implementation phase, he experienced useful outsourcing of cumbersome IT tasks. Furthermore, he stated that "*with the standardized invoice formats, we have made a big step in the lean thinking process*".

In the *third case*, the OEM required the supplier case company to use a common SaaS in order to improve the supply chain stability. Using SaaS, the customer service agent was able to carry out the data administration online (delivery dates, article type, article amounts etc.) instead of sending and receiving specific Excel-files and using point-to-point EDI. The IT professional complained that "*they [the OEM] started with some minor administration requirements… and now we have created an online monster*". He expressed his concern about the fact that he now has to handle new, time-consuming tasks.

In the *fourth and last case*, the company used SaaS for outbound shipments of finished goods. The flexible access to the data of the goods increased the transparency between the production and the selling sub-units of the company. Also, it helped to decrease freight costs due to efficient bundling. While the logistics representative experienced a strong support in his daily work and liked the "*fancier package*", the IT professional was extremely frustrated and stated that "*they [end users] come up with new concepts every week*". He set forth that "*we have been using cloud-like services for more than 15 years and nobody cared. Now, the massive marketing tours of CC providers and variety of online services create excessive expectations of end users*." Table 4 summarizes the results of the expert interviews.

Based on the coding (cf. Sect. 4.1), we valued the single items of the two constructs *PIPP* and *PIJO* prior to and following the SaaS implementation according to the experts' statements (1 for increase, 0 for unchanged, and −1 for decrease). Afterwards, we asked the interviewees whether they agreed with that valuation. For each expert, we aggregated the individual answers to the overall construct perceptions (average of three single items). Finally, we added up the scores of all cases in order to obtain an overall picture.

5 Complementary Qualitative Findings and Discussion

5.1 Integration of Empirical Results

The empirical investigations provide several valuable insights. Venkatesh et al. (2013) propose a meta-inference analysis path for explaining the findings of mixed methods (quantitative findings > qualitative findings > meta-inferences). While we have already presented the quantitative and qualitative findings (cf. Sects. 3.2 and 4.2), we now aim to derive the integration of both via meta-inferences.

As mentioned before, the quantitative analysis is our major field of study, while the qualitative analysis provides a differentiated perspective. When aiming to align both studies, there is one point of contact in the beginning of Fig. 1, namely the starting point *CISU*; and there is a clear intersection of both studies, namely the ending points *PIJO* and *PIPP* (cf. Fig. 2). However, the relationships between all the other constructs (apart from *CISU*, *PIJO*, and *PIPP*; cf. Fig. 1) are exclusively valid for IT employees and hence, the intended encapsulation of both studies makes it hard to align these other constructs.

For *CISU*, the qualitative study confirms that there is an increasing willingness of the investigated companies to implement SaaS. But the qualitative study reveals the important aspect that this willingness might be proactive (cases 1 and 4), reactive (case 2), or externally driven (case 3). These three variants may of course have strongly varying influence on the constructs within Fig. 3. For instance, externally driven SaaS implementations may not necessarily constitute the best solution for a company in itself (in terms of *PISC*, *PICC*, and *PIAC*), but it might be seen as a requirement for acting within the underlying supply chain network.

Considering *PIJO* and *PIPP*, we conclude that in fact there are significant differences between IT professionals and end users. IT professionals experience the effects of SaaS implementations and ongoing data migrations more keenly. Looking at the four cases, there is only one "increase" in performance with the IT professionals. In contrast, end users have mainly positive perceptions towards SaaS or tend to have neutral perceptions when the service was not initiated by them. Therefore, our research clearly shows: the negative impacts of a SaaS usage are particularly true for the perceptions of *internal IT professionals*.

From the methodological point of view, this result justifies the chosen mixed method research design. The *PIJO* and *PIPP* of IT professionals build the two intersections between the qualitative and quantitative analysis and at the same time represent the origins of the negative impacts, which cannot be considered independently from each other: On the one hand there is the increasing SaaS demand of end users (cf. *CISU* and Table 4), and on the other hand there are the internal structural changes (cf. Fig. 3).

5.2 Implications for Theory

Starting with the *usefulness of STS* theory for our research, the theory postulates that systems are networks of people that are primarily concerned with the impact on themselves and their work (Bala 2013). Our results show that the individuals have various preferences that are mostly not in line with each other. This mismatch can be explained by the individuals' cognitive limits and internal role/goal conflicts (e.g., using a new SaaS for short term tasks vs. adopting the SaaS with the goal of high quality). Against the background of normally *imperfect* SaaS implementation and use (cf. Sect. 2.1), the task conflicts are even more intense. Herewith, STS theory constitutes a quite suitable framework for understanding these kinds of conflicts on an adequately detailed level.

Further, IT research stimulates authors to conduct more empirical studies with mixed-method approaches and calls for data and method triangulation in IT research (e.g., Loos et al. 2011; Venkatesh et al. 2013). We experienced *triangulation* to be extraordinarily important for our research, especially because of the selected design on individual level. This helped us to achieve a more comprehensive understanding of perceptions, and yet, to remain sensitive to different perspectives from the two related roles.

Our approach enabled us to switch between the perspectives of IT professionals and end users and to compare the respective results. By considering diverse kinds of core SaaS solutions, various organizations, as well as two specific roles, our study obtained a greater *robustness*. Consequently, we are in line with the purposes of Venkatesh et al. (2013) for mixing research methods (e.g., ensuring complementary views, deriving a developmental design, compensating weaknesses).

Looking at the results, we would like to start with the two paths that are not significantly impacted by the increasing number of SaaS introductions (cf. $PICC \gg PTCR$, $PTCR \gg PIPP$ in Fig. 3). Considering the required interface configurations, we assume that this factor is more dependent on the *service update rate* of the respective SaaS than on the other constructs. We have, however, not investigated to what extent the update rates of the respondents differed from each other.

Regarding the insignificant influence on decreasing individual performance, there are various possible argumentation lines. E.g., the SaaS success within the overall company might lead to an *attenuating effect*, for instance driven by loyalty with the benefitting departments and the overall company. And as mentioned before, there may be other important factors (such as usefulness) which we did not test.

With reference to our research question (cf. Sect. 1), there is obviously a *clear separation* between IT professionals and end users. Although it is only natural that a certain separation can be discovered in all IS matters, an implementation of SaaS seems to largely increase the gap between internal IT professionals and end users. However, the access to IT has been "democratized" and end users are becoming increasingly demanding as to functionalities (cf. *CISU* in Fig. 3). And while the use of more intuitive, mobile, up-to-date, and real-life IT can delight end users, it can at the same time *frustrate* IT professionals (cf. *PTCR* in Fig. 3). Moreover, this study goes in line with prior work (e.g., Benlian et al. 2010) by indicating that security and architectural changes constitute major challenges for internal IT employees (cf. *PISC* and *PIAC* in Fig. 3).

This research provides *literature on STS theory and CC* with an interesting finding. From the ideological view point, it is characteristic for IT professionals to proactively strive for the latest IT, to have innovative ideas, or to approach tasks open-mindedly. But this study indicates that the IT employees are particularly affected by the structural and organizational changes following a SaaS adoption, which leads to disruptions between the technical and the social subsystem. Thereby, the gap between the "ideal" and the affected IT employee might increase. As we have seen in the introductory section, these impacts have so far been assumed to be mainly argumentative-deductive. On the basis of prior research, this paper provides an empirical base for that assumption.

In accordance with STS theory, Burns and Stalker (1961, p. 120) provide a valuable concept that might encourage the understanding of this discovered separation phenomenon between IT employees and end users. They differentiate between *organic and mechanistic structures*. While organic forms are characterized by being more unstructured, more uncertain, and more flexible, mechanistic structures possess a lower rate of changes and are more formal.

Burns and Stalker (1961) believe that mechanistic structures are more effective for *administrational functions* such as finance and sales. Transferring this concept to our results, we argue that end users do not have to change between organic and mechanistic structures, as the usage of SaaS brings about only minor (and in most cases helpful) changes for their daily tasks.

In contrast, due to the new daily tasks they are confronted with, IT professionals experience a higher rate of changes, which means that their existing organizational structure *becomes unsuitable* (cf. *PIOC* in Fig. 3). The probability that the new tasks will require a more organic structure is high, which, of course, involves some undesired and hidden changes for IT professionals. When working within a mechanistic structure (e.g., clear definition of rights and responsibilities; mainly vertical interaction; jobs perceived as distinct from an organization as a whole), although task fulfillment would require a more organic structure (e.g., working in networks for a common goal; more contacts with external partners; tasks with mutual adjustments), this might result in a lower individual job outcome (cf. *PIJO* in Fig. 3) and hence reinforce negative consequences such as dissatisfaction or lower job significance.

As mentioned before, companies typically do not succeed in managing organizational IT changes effectively (cf. Sect. 2.1). The findings of this study show that organizational modifications are absolutely necessary when SaaS is intensely employed for core business processes, because the new SaaS tasks differ significantly from the previous tasks (cf. *PIOC* in Fig. 3). To a certain degree, the use of SaaS solutions involves a loss of authority/control in internal IT departments, and a *hidden and reactive* internal reorganization commences.

This can be detected from the individual perceptions within our model and is simultaneously in accordance with the established job characteristics of Probst (2003). For these reasons and given the countless changes, deliberate or hidden, we assert that the implementation of SaaS is far *more challenging* for companies than originally assumed.

5.3 Implications for Practice

However, in order to prevent productivity losses (cf. Sect. 2.2), an active and adequate IT organizational *restructuring process* is required, which in turn is highly dependent on the degree of SaaS usage. For the redesign of affected IT jobs on an individual level, STS theory discusses three major areas (e.g., Venkatesh et al. 2010; Bala 2013): (1) control, (2) working in groups, and (3) multiskilling. We would instead like to distinguish short-, mid-, and long term actions.

With respect to the first area covering the short-term action, we suggest to create a joint-optimization-usage-guideline for affected IT professionals and end users prior to the use of SaaS in order to reduce the radical nature of the perceived change. This includes a kind of social-technical risk management with *variance control*, which could enhance the understanding between related individuals around a common core SaaS process and may smooth the demanding position of end users.

Considering the second area, the interviews indicate that IT professionals mainly feel left alone with the new issues. Therefore, we propose to form mid-term SaaS *group councils* in which members discuss issues and refine best practices and standards (e.g., checklists). In smaller enterprises, these councils could be implemented across companies. This can help to reduce job uncertainties.

Third, a long term *multi-skilling strategy* has to be introduced. Although the expert interviews did not reveal a lack of SaaS knowledge, which might be explained by the lower personal distance between interviewee and interviewer, the survey underlines the radically changed knowledge requirements. As the number of SaaS usages increases, organizations need to prepare themselves for the changed skill profiles which will become necessary. The importance of developments and operations will decrease while the demand for security and integration experts, service management specialists, and people with a thorough knowledge of the SaaS market will significantly increase. Companies have to address this in their long-term personnel and organizational development strategies. Due to the fact that more and more business processes will bypass the internal structures, it is of great importance to continually educate related stakeholders such as end users who are usually not IT professionals) about the risks of SaaS applications.

We want to conclude the implications with a lesson learned from prior IT outsourcing trends. The third field of related research (cf. Sect. 2.1) has shown that in the 1990s the number of IT outsourcing arrangements was unreasonably high, which later led to a strong "*backsourcing*" trend (Hirschheim and Lacity 1998). Thus, at some point in time, companies started to re-introduce their functions back in-house as soon as the outsourcing contracts ended. The reasons were, e.g., cost increases, poor services, or strategic directions. These companies experienced an insidious loss of IT competencies. The efforts needed for the rebuilding of internal knowledge and structures were excessively high. Looking at the present strongly increasing rates of SaaS adoptions, it is impossible for a company to predict its future IT structure. Hence, when investigating organic or mechanistic structures as well as areas for redesigning IT jobs, companies should always keep the backsourcing option in mind.

6 Conclusion

Research on SaaS and CC started with technical investigations, assessing risk factors such as data security and benefits such as scalability and virtualization (e.g., Youseff et al. 2008). This strictly technical view was criticized as soon as research started to include also the economic perspectives (e.g., Leimeister et al. 2010), discussing financial benefits such as the pay-as-you-go model.

Marston et al. (2011) wrote one of the first papers that motivated researchers to equally involve the environmental, cultural, and especially social perspective. So far, this has been done only occasionally and mainly in an argumentative-deductive manner. Our paper encourages the understanding that there are not only technical as well as economical risks and chances, but also social risks and chances.

Our empirical results indicate that especially individual IT professionals, who deal with such implementations, experience significant changes. SaaS is accompanied by advantages such as interoperability, performance increase, or updates for the internal IT professionals as well as for the remaining stakeholders. With this study we point to the circumstance that at present IT professionals are extremely aware of the risks that SaaS entails. This is why it is absolutely essential that management comprehends the two STS sub-systems to prepare a profound basis for a successful SaaS implementation and a sustainable SaaS usage. Therefore, when decision makers are about to adopt SaaS for core business processes, the social and organizational consequences have to be considered as one important decision dimension. This might ensure outsourcing services "without outsourcing social aspects".

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