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Enterprise resource planning systems induced stress: a comparative empirical analysis with young and elderly SAP users

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Abstract. In this research study we investigate whether and how ERP system characteristics cause its users to experience stress. In order to do so, we analyze a research model explaining enterprise resource planning systems induced stress with an empirical study in two organizations (N=227). The results reveal that usefulness, complexity, reliability, and pace of change are important ERP system characteristics leading to the perception of stressors and exhaustion. Furthermore, our comparative empirical analysis with young and elderly ERP users indicate that the elderly ones perceive ERP characteristics more negatively and are more stressed and exhausted than the younger users.

Keywords: Technostress, SAP, IT usage, ERP, age, elderly.

1 Introduction

Enterprise-wide information systems (IS), such as enterprise resource planning (ERP) systems, have been one of the greatest technological advances in organizations in the last decades [1]. ERP systems are "*comprehensive commercial software packages with embedded industry best practice business processes*" ([2], p. 1113). Some statistics show that ERP systems are used by up to 75 percent of medium to large manufacturing firms and by up to 60 percent of service organizations [1]. The ERP system industry has reached a volume of more than $60 billion and is still expected to grow [3-4].

The implementation of ERP systems causes significant changes in organizations and influences employees as it fundamentally changes the nature of tasks, workflows, and to some extent the jobs themselves [1]. It is common for ERP implementations to be accompanied by user resistance [5], lower job performance, lower job satisfaction, and higher turnover rates ([2]; [6-7]).

Also in the context of technostress, ERP systems are discussed as IS that can potentially cause employees to experience stress in the workplace [8-9]. Prior approaches have either focused on information technology (IT) in general ([10], p. A2) or on technologies like social networking sites [11-12], e-mails [13], smartphones [14], ambulance control systems [15] and virtual display units [16]. These approaches give no insight into whether ERP systems, and in this regard into which specific char-

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acteristics of an ERP system, are main contributors for technostress. Consequently, this research is intended to investigate technostress one-step further by asking the following research question:

RQ1: Are the characteristics of ERP systems stressful stimuli for IT users?

Even though IT provides specific user groups, such as elderly individuals, significant benefits from using IT (e.g., electronic health [17-18]), an age-related digital divide exists [19-20]. Among others, elderly individuals perceive the usage of IT more negatively than their younger colleagues do [21] and elderly individuals might be stressed more easily by technology than their younger counterparts. This phenomenon is important to be considered by IS research, especially in the light of the declaration of Riga by the Council of Ministers of the EU, in which e-Inclusion got a high priority on the political agenda [22]. E-Inclusion has the power to increase economic performance and an individual's quality of life [22]. In this context, it is important to understand whether younger and elderly employees are stressed differently and how they react to these stressful stimuli, especially since ERP systems are used by employees of all ages. Hence, based on this approach, it can be discussed whether these two groups need to be treated differently in regard to enabling countermeasures towards technostress. Therefore, the second research question of our paper is:

RQ2: How does age influence whether employees are stressed when using an ERP system?

To address these research questions, the article is structured as follows. In the next section we present some key findings in technostress research and research studying the IT usage of elderly people. Based on that, we develop hypotheses and derive our research model. We then present the research methodology and our results. Finally, we discuss the results and present contributions for research and practical implications.

2 Research background and hypotheses development

This section provides an overview of current technostress research and discusses the role of age to develop a research model and our hypotheses.

2.1 Technostress research

An increasing number of research has focused on the negative consequences of technology usage (e.g., [9]; [23]). One concrete downside of IT usage is technostress, which reflects an IT user's experience of stress while using IT [24].

In this stream of research, Ragu-Nathan et al. [8] first identified why IT users become stressed when using IT. In doing so, they reveal techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty as techno-specific stressors.

Afterwards, Tarafdar et al. [9] reveal that individuals react either psychologically or behaviorally to these stressors, which are summarized under the term of strain. Psychological strains are emotional and psychological reactions to stressful stimuli [9]. These include, among others, exhaustion, dissatisfaction, and depression. Next to

that, behavioral strains are, among others, the discontinuous usage of IT, doing work-arounds, turnover behavior, poor performance and productivity. Consequently, this type of strain includes behavioral changes, which are responses to the perceived stressors with the aim to avoid these stressful stimuli in future.

More recently, Ayyagari et al. [10] use the stressor-strain relationship, which extends the research from Tarafdar et al. [9] by identifying antecedents. Here, three categories of technology characteristics are generated, which are hypothesized as the influencing factors of stressors. The categories are usability features, dynamic features, and intrusive features, and reflect different perceptions such as usefulness, complexity, reliability (as a usability feature), presenteeism, anonymity (as an intrusive feature), and pace of change (as dynamic feature). Based on the person-environment fit model, Ayyagari et al. [10] theorize these characteristics of technologies as the causes of stressors. Notably, Ayyagari et al. [10] do not use the stressors identified by Ragu-Nathan et al. [8] but the stressors work-home-conflict, invasion of privacy, work overload, role ambiguity, and job insecurity. The authors discussing the well-known stressor-strain relationship use prior research, in order to hypothesize that these five stressors cause exhaustion.

Summing up, technostress research reveals that technology characteristics cause individuals to perceive stressors, which then induce individuals to react to these stressors psychologically or behaviorally. From a methodological point of view, the influence of stressors on psychological and behavioral reactions is measured using perceptive data and NeuroIS approaches [25-27].

These articles show important particular common grounds with one another. Each of them focuses on technostress when individuals use a collection of information, processing, storage, network, and communication technologies ([10], p. A2). This means that these results do not provide any statements concerning whether using one particular technology or whether the characteristics of one concrete technology even cause stress. The other way around, considering IT as a collection of different technologies limits the results, because the single characteristics studied in the research model of Ayyagari et al. [10] don't apply to each technology. In this context, prior research identifies that the usage of a concrete technology might also cause stress. In more detail, research reveals that users of social networking sites [11-12], e-mails [13], smartphones [14], ambulance control systems [15] and virtual display units [16] receive stress. Nonetheless, research has not studied whether and why enterprise resource systems, which are generally used for increasing employee job performance [7], might be perceived as sources of stress.

In the following, we base our research model on Ayyagari et al. [10] and apply it to the context of ERP usage. Aligning with Ayyagari et al. [10], we study the influence of techno-induced work stressors (e.g., work-home conflict, work overload, role ambiguity) on exhaustion as a psychological strain reaction and investigate how ERP specific characteristics influence these general techno-induced work stressors.

2.2 Stressor-strain relationship

While reviewing literature concerning stressor categories, Ayyagari et al. ([10], p. 835) propose five stressors relevant to an IT-usage context. First, the stressor work overload is used and reflects an IT user's perception of the workload exceeding its capabilities. Second, role ambiguity, which reflects the perception of lacking clarity about whether one should deal with IT-problems or work activities, is considered as a possible stressful stimulus. The third stressor used by Ayyagari et al. [10] is work-home conflict that focuses on blurring boundaries between the work and home domain. The two remaining stressors are job insecurity (an IT user's perception of threat of job loss) and invasion of privacy (an IT users' perception that its privacy has been invaded). These are not studied in this research, because these two stressors have the lowest – and partially an insignificant – influence on exhaustion [10]. Moreover, the organizations, in which we did our study in, do not want that these perceptions measured in the survey[1].

Since the influence of these stressors on exhaustion is well established in general stress literature as the stressor-strain relationship (e.g., [28-30]) and empirically validated [10], we hypothesize that:

H1: *The higher the* ***a)*** *work-home conflict,* ***b)*** *work overload, and* ***c)*** *role ambiguity are, the higher the exhaustion is when using IT.*

In the following, we focus on characteristics of an ERP system based on the stress model from Ayyagari et al. [10] and theorize how these influence the stressors.

2.3 The influence of ERP system characteristics on techno-stressors

ERP systems such as those provided by SAP are used by organizations across different industries to streamline business processes and to integrate an organization's information flows [1]. The implementation of ERP systems are typically accompanied with redesigning the business processes [31] and embedding them within the system [32]. An ERP system has several characteristics. In order to determine which of the initial characteristics investigated by Ayyagari et al. [10] are also relevant to ERP systems, we applied their model [10] to the ERP context and conducted interviews with four employees in the surveyed organizations. The following focuses on the four ERP system characteristics usefulness, complexity, reliability and pace of change, which has also been discussed in ERP literature.

In general, organizations implement ERP systems to improve business process efficiency and to realize strategic advantages [32-33]. Individuals are expected to use

[1] The rationale for this is that it is rumored in both organizations that lots of employees will lose their job. In order to ensure that none of the employees will fear losing their job to a further extent, the organizations asked us to remove the stressor job insecurity. Concerning the stressor invasion of privacy, the work council of one organization worried about the stressor invasion of privacy as employees might misinterpret this and might receive the impression that the organization spies on an employee's daily life. Consequently, we also removed this stressor.

these systems when they are useful for their work ([1]; [34]). This means that individuals can increase their productivity and work faster [35]. Concerning individuals' daily workload, the usage of an ERP system causes them to handle their daily demands more effectively and efficiently [35-36]. When technologies like an ERP system are perceived as useful, they increase individuals' abilities to perform their work [10], resulting in a perceived decrease in their daily workload. Hence, we assume that:

H2: *The higher the perceived usefulness of an ERP system is, the lower the work overload is perceived.*

Moreover, an ERP system requires new skills and competencies for its users [1]. As a result, employees have to learn how to operate the ERP system, acquire new skills, and learn to work with new business processes [37-39]. Given the complexity of modern ERP systems, it is simply the desire to learn about the technology that is frustrating for ERP system users [40]. In this context perceived complexity represents "*the extent to which an employee perceives an [ERP system] to be relatively difficult to understand and use*" ([2], p. 1118). Complex technologies, such as ERP systems, reduce an individual's ability to perform a certain task [10]. Therefore, we assume that the individuals that find ERP systems to be complex, have difficulties to accomplish daily work demands. This results in a perceived increase of daily workload. Consequently, those employees may experience job stress associated with the complexity of an ERP system [1]. Therefore, we hypothesize:

H3: *The higher the perceived complexity of an ERP system is, the higher the work overload is perceived.*

The usage of an ERP system is sometimes accompanied with problems depending on the reliability of the system [41]. This means that users are confronted with a system that requires extra steps without adding value, introduces difficulty in entering or extracting information, or simply takes more time than the user is willing to invest [41]. Hence, the reliability of an ERP system in terms of "*the degree to which features and capabilities provided by the [ERP system] are dependable*" ([10], p. 837) reduce the ability of individuals to perform a certain task [41]. Therefore, we assume that individuals working with a non-reliable ERP system have difficulties to accomplish daily work demands, so that they perceive an increase of daily workload. Consequently, those employees may experience job stress associated with the ERP system ([1]; [41]). This brings us to our next hypothesis:

H4: *The higher the perceived reliability of an ERP system is, the lower the work overload is perceived.*

ERP systems are especially challenging because they require a radical and to some extent an ongoing change to business processes and technologies supporting these processes [1]. In addition, as ERP systems provide industry-sector- or even organization-specific features, some of these features change frequently and ERP systems have to be updated constantly. Hence, during the implementation and the usage of an ERP system employees feel that processes are different to previous ones and a new set of skills is required to adapt to the changing environment [2]. The ERP system related changes make an employee's work environment ambiguous and unstable ([32]; [40]). To deal with these changes and to reduce the associated ambiguity ERP users might put more efforts into understanding and learning to use the ERP system

and the corresponding processes [2]. However, this has at least two consequences for individuals. First, the daily workload increases as individuals have to do their daily work and learn to work with the updated ERP system, so that the overall workload increases. Second, individuals might be confronted with competing demands; either doing the daily work or learning to handle the innovative characteristics. This causes individuals to perceive the stressful stimulus role ambiguity. Hence, we assume that:

H5: *The higher the perceived pace of change of an ERP system is, the higher the* ***a)*** *work overload and* ***b)*** *role ambiguity are perceived.*

2.4 The role of age in stress research

Recent research identifies individuals to perceive IT characteristics [42] and stress-related perceptions [43] differently depending on their age. Because IT and ERP systems are used by employees of all ages, we also study the influence of age on the characteristics of ERP systems, stressors, and exhaustion.

We argue that the perceptions about an ERP system's characteristics differ depending on the age of the users. Especially since ERP systems are difficult to use in general [2], elderly individuals in particular face difficulties exploiting the benefits of using these systems [21]. This results in them challenging the usefulness of ERP systems more often than younger users [44]. Moreover, Burton-Jones and Hubona [45] discuss that elderly individuals consider the usage of IT, such as an ERP system, as difficult to use, and therefore perceive IT as difficult and complex. Since Venkatesh et al. [46] argue the same, we assume that elderly people consider IT as more complex than younger individuals do. Furthermore, since the elderly in particular are assumed to fear technological advances and because they need high requisite knowledge for using them and have to rely on results produced by IT [47], we assume that elderly ERP users perceive the system as less reliable than younger users do. Finally, as elderly people show higher cognitive rigidity [48], they have difficulties in adapting to changes in the ERP system. This results in the fact that changes to the ERP system weight heavily in the brain of elderly individuals, because they consider ERP systems to be changed frequently. Hence, we assume that:

H6*: Elderly people perceive characteristics of an ERP system in terms of* ***a)*** *perceived usefulness,* ***b)*** *perceived complexity,* ***c)*** *perceived reliability, and* ***d)*** *pace of change more negatively than younger individuals.*

Next to the perception of ERP system's characteristics, prior research indicates that elderly people perceive stressors more heavily than young individuals [43]. Because elderly individuals tend to separate their work and home domain more than younger individuals do, this causes them to perceive techno-induced blurring boundaries between their workplace and home more negatively than their younger counterparts [49]. Furthermore, the perception of work overload differs due to the fact that an individual's cognitive, sensory, and physiological abilities change with the increase of age in a way that performance decreases [50]. Finally, as elderly people might have more difficulties in using IT [43], they are more often confronted with the decision whether to handle IT-induced problems or to complete daily work tasks, causing them to per-

ceive the stressful stimulus role ambiguity more often than young individuals. Hence, we assume that:

***H7**: Elderly people perceive IT stressors in terms of **a)** work-home conflict, **b)** work overload, and **c)** role ambiguity more negatively than younger individuals.*

Furthermore, it has been discussed that getting older is accompanied with a decline in an individual's cognitive abilities and capacity of working memory, so that elderly individuals consider performing IT-related tasks as more challenging than young individuals [50]. Due to this, elderly individuals are more easily stressed when using IT and report perceptions of fatigue and exhaustion [50-51]. We, therefore, assume that:

***H8**: Elderly people are more exhausted by using IT than younger individuals.*

2.5 Control variables and research model

Next to the hypotheses discussed above, we also consider alternative theoretical explanations studied in prior stress research as control variables. As prior research discusses user perceptions can be explained by usage behavior and personality traits [52-53]. This is why ERP usage and negative affectivity are considered as control variables. The resulting research model including characteristics of ERP systems, stressors, strain, and the control variable is illustrated in Fig. 1.

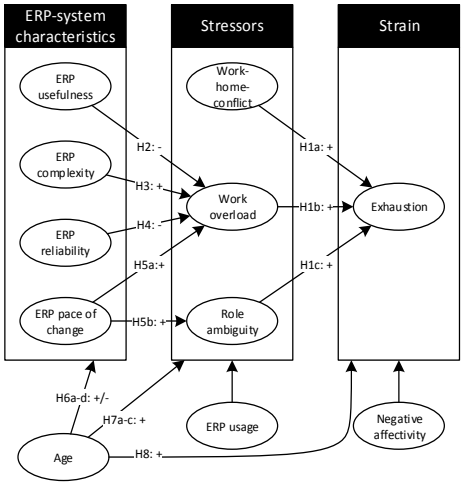

Fig. 1. Research model

3 Methodology

In order to gather empirical evidence for our proposed research model, we designed a survey to validate our hypotheses. The following sections explain the data collection procedure and describe sample characteristics.

3.1 Data collection

To collect perceptions about ERP systems, stressors and exhaustion, we undertook an empirical study in 2014, during which we surveyed 227 end users in two organizations. Organization I produces drivetrain and brake system applications for the automotive industry, has more than 3,000 employees, and a sales volume of around 400 million Euros. The organization has factories around the world including, among others, the U.S.A., Germany, China, Brazil, and Mexico.

Organization II is a German health insurance company with more than 5 million customers. Distributed over circa 800 offices, the organization employs about 15,000 employees.

Working together with the CEO office in both organizations, we conducted a survey with selected employees. In more detail, we invited 163 employees of organizations I and 81 employees of organization II to our survey. The number of invitations was limited by the CEO office and employees were selected randomly, but all of them work in the same branch and have to use SAP for their daily work.

152 individuals of organization I (response rate: 93.25%) and 75 individuals of organization II (response rate: 92.59%) completed our survey with less than five percent missing values. The surveyed employees in both organizations were knowledge workers, who use SAP as part of their daily working processes. Particularly, SAP (e.g. SAP BP, BP CRM, BP ECC, MM, SD, PP, FICO, etc.) is the only ERP system used in both organizations so that it is mandatorily and frequently used by the employees of these organizations.

3.2 Sample characteristics

A total of 227 employees participated in our survey. The demographic characteristics of the data sample are presented in Table 1.

Age (mean=49.81; sd=10.76; min=24; max=71)					*Gender*		*IT Usage (mean=6.04; sd= 2.91; min=1.00; max=14.00)*			*ERP Usage (mean= 3.80; sd= 3.50; min=1.0; max=9.0)*		
< 25	25-34	35-44	45-54	> 54	Men	Women	< 3h	3h-6h	> 6h	< 3h	3h-6h	> 6h
2.70	21.40	19.70	36.60	19.60	45.60	54.40	16.40	19.40	64.20	39.60	22.00	38.40

Table 1: Sample characteristics

4 Research results

In order to evaluate the research model, we transferred the research model into a structural equation model [54] and use the partial least squares (PLS) method and

SmartPLS 3.1.2 [55] to perform our data analysis splitting the overall data set into a subset containing 127 elderly and another subset of 100 younger employees. The split is done based on the age of the participants, whereby elderly employees are individuals who are at least 50 years old and young employees include individuals who are 49 years old or younger. This threshold is used to split the data as it is also chosen by prior research [56] and it represents the mean value in our data.

PLS is used due to the relative small data sample and because it does not require normally distributed data. Particularly, negative perceptions such as stress are a cause of distributed data [57], so that the PLS method is superior to tools using covariance-based methods. Consequently, we discuss next whether the common method bias (CMB) is an issue in our data and then describe the measurement and structural model of the research model tested for elderly and younger employees.

4.1 Common method bias

As empirical research using self-reported data has to consider the CMB [58], we performed the Harman's single factor test [58] and the unmeasured latent marker construct (ULMC) method [59-60], while acknowledging the critique of Chin et al. [61]. Results of Harman's single factor test indicate whether the majority of the variance is explained by one factor. Specific to our study it indicates that CMB is not an issue in our data (younger individuals: 26.2%; elderly individuals: 23.4%). The ULMC method compares the coefficient of determination (R^2) with a CMB factor to the R^2 without a CMB factor, and reveals a ratio of 1:158 for younger individuals and of 1:174 for elderly individuals. Comparing this to results of prior research [59], we cannot observe any signs of a CMB influence.

4.2 Measurement model

Each construct is measured by reflective indicators. Hence, content validity, indicator reliability, construct reliability, and discriminant validity have to be observed for validating the measurement model [62].

In order to ensure content validity, we use the same existing measurement items of Ayyagari et al. [10], which are proven to be robust. We only adapt the characteristics used in Ayyagari et al. [10] to the context of ERP systems. Indicator reliability reflects the rate of variance of an indicator that comes from the latent variables. As more than 50 percent of a latent variable's variance has to be explained by the indicators, values should be 0.707 or higher [63]. Tables in the appendix indicate that each loading exceeds this threshold. To assess the construct reliability, the composite reliability (CR) should be at least 0.7 and the average variance extracted (AVE) at least 0.5. As the square root values of AVE are greater than the corresponding construct correlations [64], we can state that discriminant validity is not an issue.

Based on these tests, we confirm that our measurement model is valid.

4.3 Structural model

For evaluating the structural models (see Table 2), R^2 and significance levels of path coefficients are used [65].

Focusing on younger individuals, results show that complexity influences the stressor work overload significantly. However, none of the other hypothesized influences of SAP characteristics on stressors is significant. Furthermore, the three stressors work-home-conflict, work overload, and role ambiguity are significant explanatory variables of exhaustion. With respect to the control variables, neither SAP usage influences any of the three stressors significantly ($\beta_{\text{work-home conflict}} = 0.085^{NS}$; $\beta_{\text{work overload}} = -0.148^{NS}$; $\beta_{\text{role ambiguity}} = -0.104^{NS}$) nor does negative affectivity the exhaustion ($\beta = 0.101^{NS}$). Concerning R^2, 17.0 percent of the variance in work overload, 2.9 percent of role ambiguity, and 46.7 percent of exhaustion is explained in our research model.

For elderly individuals, usefulness, complexity, and pace of change have a significant impact on work overload. However, no significant impact of reliability on work overload and pace of change on role ambiguity could be observed. Concerning the control variables, usage has a significant influence on work overload ($\beta_{\text{work overload}} = -0.224^{*}$), but not on work-home conflict ($\beta_{\text{work-home conflict}} = -0.087^{NS}$), and not on role ambiguity ($\beta_{\text{role ambiguity}} = -0.033^{NS}$). Further, negative affectivity has a significant influence on exhaustion ($\beta = 0.194^{*}$). Moreover, the three stressors significantly influence exhaustion. In the end, the model explains 38.0 percent of variance of work overload, 3.0 percent of role ambiguity, and 78.4 percent of exhaustion.

Table 2: Structural model validation (^{NS} p > 0.05. * p< 0.05, ** p<0.01, *** p<0.001)

Hypotheses	Young individuals (N=100)	Elderly individuals (N=127)
H1a: Work-home conflict -> exhaustion	0.200*	0.188*
H1b: Work overload -> exhaustion	0.494*	0.209**
H1c: Role ambiguity -> exhaustion	0.291**	0.271***
H2: Usefulness -> work overload	-0.139^{NS}	-0.207**
H3: Complexity -> work overload	0.396***	0.144*
H4: Reliability -> work overload	-0.160^{NS}	-0.008^{NS}
H5a: Pace of change -> work overload	0.012^{NS}	0.159*
H5b: Pace of change -> role ambiguity	0.104^{NS}	0.053^{NS}
younger individuals: R^2: work-home conflict = 1.0%; work overload = 17.0%, role ambiguity = 2.9%, exhaustion = 46.7%		
elderly individuals: R^2: work-home conflict = 4.0%; work overload = 38.0%, role ambiguity = 3.0%, exhaustion = 78.4%		

4.4 Mean comparison

For determining whether ERP system characteristics, stressors, and exhaustion is perceived differently by young and elderly individuals, Table 3 provides the mean value of each perception and the results of a t-test to determine whether significant different perceptions exist.

Table 3: Comparison of younger and elderly employees (* p< 0.05, ** p<0.01)

Perceptions	Mean values of … users		Comparison of means	
	Young	Elderly	Difference	Significance
ERP usefulness (1:=useless; 7:=useful)	4.93	4.59	0.34*	0.03
ERP complexity (1:=complex; 7:=uncomplex)	5.12	4.70	0.42*	0.01
ERP reliability (1:= unreliable; 7:=reliable)	5.28	4.86	0.42**	0.00
ERP pace of change (1:=less changes; 7:=many changes)	3.74	4.20	-0.46*	0.01
Work-home-conflict (1:=no conflict; 7:=conflict)	3.26	3.63	-0.37*	0.04
Work overload (1:=no overload; 7:=overload)	3.27	3.62	-0.35*	0.04
Role ambiguity (1:=no role ambiguity; 7:=role ambiguity)	2.68	2.69	-0.01	1.00
Exhaustion (1:=not exhausted; 7:=exhausted)	2.28	2.73	-0.45*	0.01

Results indicate that young and elderly individuals differ in their perception of each of the ERP systems' characteristics, two out of three stressors, and exhaustion. In more detail, elderly individuals as opposed to the younger ones consider using ERP systems as less useful, more complex, less reliable, and as a technology that changes frequently. Moreover, elderly individuals perceive that using IT causes high workloads and blurring boundaries between work and home. Finally, elderly individuals also report being more exhausted by using IT than younger individuals. Summing up, our data confirms hypotheses H6a-d, H7a-b, and H8.

4.5 Limitations

The results of this article are limited in some ways. Firstly, even though we surveyed employees in two different organizations, we focus on one particular ERP system in terms of SAP. This limits the results as employees working in an organization using another ERP system might perceive ERP characteristics differently. Secondly, we differentiate young and elderly employees by splitting the data sample according to whether they are younger or older than 50 years. Here, results might differ when splitting data depending on another age. Last of all, exhaustion is captured with perceptual data instead of using NeuroIS approaches.

5 Discussion and Implications

Acknowledging the limited focus of prior technostress research we contribute to the general technostress literature [8-10] by focusing on employees' stress when using ERP systems. Hence, the characteristics of ERP systems are responsible for whether employees are stressed. When using an ERP system employees in the two organization of our research report that usefulness, complexity, and the pace of change are important ERP system characteristics that lead to the perception of stressors by em-

ployees which in turn increase exhaustion. Consequently, in regard to our first research question we can conclude that the characteristics of ERP systems are perceived as a source and symbol of daily stress that lead to negative consequences such as exhaustion. This result has implications for both theory and practice. From a theoretical point of view we can contribute that the ERP characteristics complexity, usefulness, and pace of change are important. As in other contexts such as enterprise content management [66] or enterprise social networking [67] the characteristics might be different, which has been shown in some contexts [11-16]. With future studies analyzing the influence technology characteristics on stress for additional IT systems – rather than just ERP systems – it would be possible to theorize the influence of the technology usage context on employees' stress more precisely. This result would also be important from a practical point of view. Only if the relevant characteristics of each usage context are identified, measures can be implemented to reduce the negative consequences of the respective technology usage context. In our study it is obvious that reducing employees' stress can be achieved by reducing ERP systems' complexity or pace of change and by increasing their usefulness. In order to find out whether these characteristics are also the relevant ones for implementing measures in different usage contexts, it has to first be analyzed by future research focusing on different IT usage contexts than merely the ERP system usage in an organization.

Moreover, our research has a second contribution as it reveals the importance of age when analyzing and discussing technostress, which has been identified as a research gap in Tarafdar et al. [68]. Our results reveal that elderly employees perceive to a greater extent that ERP systems are a stressful technology in terms of its usefulness, complexity, and pace of change characteristics. Furthermore, elderly employees are more exhausted by using IT at work. Regarding our second research question, this reveals that age is an important variable that needs to be controlled when analyzing technostress. This is in line with technology adoption research which also reveals that age is an important moderating variable for the influence of effort and performance expectancies, since the efforts required to operate an IT system are more important for elderly users [21]. This result is especially important in the light of the declaration of Riga by the Council of Ministers of the EU. In this context, our article can contribute to e-inclusion strategy-making in practice since on the one side we can reveal the technology usage settings in which differences between younger and elderly individuals exist and on the other side we are able to identify those characteristics that are relevant and need to be focused with respective measures to reduce elderly users' stress perceptions. Since the complexity and the pace of change of ERP systems can be revealed as significant characteristics leading to the perception of stressors and exhaustion in our study, it is important to constantly train elderly employees to use ERP systems. Hence, it is not only important to train elderly employees when an ERP system is implemented [6]; it is also important to address the pace of change of these systems by training elderly employees on a regular base.

In summary, we propose a research model for an ERP system usage context and we identify those ERP system characteristics that are relevant for an increasing stress perception by employees. Here, future research might investigate whether there are other system characteristics relevant for ERP usage, which go beyond the ones identi-

fied by Ayyagari et al. [10]. Furthermore, we provide evidence that age is an important moderation variable in technostress research as elderly people are more stressed by IT. Hence, future research can build on our results by focusing on different IT usage contexts in organizations to identify those characteristics that are relevant for younger employees and those for the elderly ones. This reduces the negative consequences IT usage is accompanied with and increases the well-known benefits.

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Online-Appendix

http://isdl.uni-bamberg.de/online-appendix/appendix-erpstress.pdf