How the Perception of Agile Software Development Affects Beta Users' Stress and Satisfaction

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Abstract

Agile software development (ASD) has been shown to alleviate stress and improve satisfaction levels in development teams. Since this development approach relies on strong user involvement, these effects might carry over to the users themselves. If users have a positive perception of the agile approach, they might be more receptive to the produced software. However, users are rarely aware of the underlying development methodology and are, therefore, only partly affected by it. Hence, this study develops a new construct to measure users' perception of the development methodology and to investigate the effects on technostress and user satisfaction. A survey with 117 beta users was conducted showing that perceiving a development process as agile lowers users' technostress and elevates their satisfaction levels. Our Results highlight the essential role of user communication in the development phase. We discuss our implications for theory and practice, and conclude with promising future research avenues.

Keywords: Agile software development, beta users, technostress, user satisfaction

1. Introduction

In today's increasingly digitized economies with ever-shortening innovation cycles, employees are routinely asked to adopt and employ new software in their daily operations. The reception of such software by the workforce is a core issue for many organizations. Ideally, newly introduced information systems (IS) improve user satisfaction. However, the speed of digital innovation can quickly become overwhelming. This may result in increasing technostress, which refers to stress as a consequence of IT usage (Ragu-Nathan et al., 2008). Notably, the reception of new technology, and whether it adds to the user's satisfaction or stress level, is not entirely driven by its objective usefulness. Instead, it may also be affected by their perception of the software development process similar to the way that organic food is typically assumed to be healthier because of the positive associations with its production process.

Stress is an important issue in modern workplaces, affecting the physical and mental health of employees and the health of organizations as a whole (Meier et al., 2018). The adverse effects range from higher turnover, over loss of productivity, to decreasing collaboration (Beehr & Newman, 1978; Meier et al., 2018). Furthermore, stress in software development has been linked to the "burnout" phenomenon, in particular stressors stemming from lack of control, high task requirements, and poor interaction within teams (Sonnentag et al., 1994). For these reasons, researchers strive to find out the underlying causes and possible ways to mitigate stress in employees.

The extant scientific literature shows that developers' stress and satisfaction levels are affected by the applied development methodology (JASP Team, 2018; Kujala, 2003; Lee & Xia, 2010; R. Thompson et al., 1995). ASD, which is an established approach to produce new software, has specifically been reported to have positive effects on developers. Mannaro et al. (2004), for instance, found that agile methods were associated with less stress and more satisfaction in software development teams.

While the effects on developers are well documented, the users' perspective has been largely omitted in the scientific discourse about software development approaches (Brhel et al., 2015, Schön et al., 2017). Yet, the success of software development projects heavily depends on strong user involvement (Bano & Zowghi, 2015), which is not coincidentally a key element of agile methods (Beck et al., 2001). It is, therefore, conceivable that users might be more receptive to new software if they feel that they participated in the development process. In the end, they might project their perception of the development

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method onto the software itself and thus find it either more satisfying or stressful to use it.

Beta users, which are simply defined as users engaged in beta testing newly developed software, represent an important part of such projects. Their main responsibilities include requirements engineering, daily meetings, and testing of the software (Bano & Zowghi, 2015). The relationship between developers and beta users, however, often features a mainly unidirectional information flow in that information is mostly relayed from users to developers. While the beta users' requirements and tests are very transparent for developers, the development process can be rather opaque to the beta users. Strong user involvement, however, improves the otherwise limited insight into the development process. This might influence beta users' perception of the development method and thus affect their stress and satisfaction levels. We define user perception of ASD as beta users' responses to software testing based on their assumptions about the applied developing method.

To date, no research has been conducted that investigates beta users and their reactions towards agile methodologies, although, they are an important group involved in software development processes. Yet, for organizations, it is essential to build an understanding of the mechanisms that could reduce employees' technostress and increase their satisfaction. Studying beta users' perception of ASD shines light on the user perspective, which is a significant research gap (Schön et al., 2017).

Addressing these research gaps, this paper investigates the influence of beta users' perceptions of the ASD methodology on their technostress and satisfaction levels. Consequently, our research is guided by the following two research questions:

RQ1: What is the influence of beta users' perception of ASD on beta users' technostress?

RQ2: What is the influence of beta users' perception of ASD on beta users' satisfaction?

To answer these research questions, we investigate the impact of beta user's ASD perception specifically on three technostress creators (i.e. work overload, job insecurity, and role ambiguity) and on user satisfaction. We developed corresponding hypotheses and surveyed 117 beta users in that regard. The produced data was used to develop a new scale concerning beta users' perception of the ASD methodology. Moreover, a structural model was created and evaluated using structural equation modeling with JASP (JASP Team, 2018).

Our results show that varying perceptions of ASD affect negative (i.e., technostress) as well as positive (i.e., satisfaction) user reactions. We find a significant negative correlation between ASD perception and all three technostress creators. Moreover, the findings reveal that a positive perception of the ASD methodology improves user satisfaction. Thus, our study provides valuable insights that inform theory and practice on factors that influence the mental well-being of employees in the workplace. Specifically, we expand the extant literature, which has focused on the developers' point of view, by addressing a beta users' perspective. Moreover, the proposed model enhances our understanding of individuals' adjustments to new IS and the impacts of IS use.

The remainder of the paper is structured as follows. Section 2 provides an overview of related literature. In section 3, we derive our hypotheses. Section 4 addresses the applied methodology. The findings are presented in section 5. Finally, we discuss our findings in section 6 and present limitations and future research avenues in section 7.

2. Related literature

Overall, literature on the effects of software development on stress and satisfaction is diverse and fragmented. Prior research found varying satisfaction levels in software developers depending on the applied development methodology (JASP Team, 2018; Kujala, 2003; Lee & Xia, 2010; R. Thompson et al., 1995). Agile methods in particular have been reported to have positive effects on stress as they, for instance, facilitate stress prevention (Begel & Nagappan, 2007; Bjerknes & Bratteteig, 1995; Chin et al., 1997; Hofstede, 1998; Lee & Xia, 2010). Moreover, Mannaro et al. (2004) explored the relationship between stress and the software development approach being used and found that agile methods were associated with less stress and more satisfaction in software development teams. Nevertheless, the 2017 Swiss Agile Survey reported that stress remains a core issue in ASD projects and thus requires more attention (Kropp & Meier, 2017).

2.1. User perception

The Theory of Reasoned Action (TRA) claims that much of the behavior of an individual is based on their beliefs or internal working models (Montano & Kasprzyk, 2015). Internal working models of attachment are a psychological concept that attempts to describe the development of mental representations, more specifically, the worthiness of the self and expectations of others' reactions to the self (Egeland & Carlson, 2004).

Bowlby (1973) implemented the concept of internal work models in his attachment theory to explain how infants act according to these mental representations. Such internal working models guide future behavior by generating expectations of how attachment figures will respond to one's behavior (Bowlby, 1973). Hence, internal working models are conceived of as playing a crucial role in the processing of attachment-relevant social information (Collins & Allard, 2004). As such, individuals are likely to use different rules to process attachment-relevant social information as a function of whether they have a secure or insecure internal working model of attachment (Egeland & Carlson, 2004). In the context of software testing, we can posit that receiving attachment-relevant information about a positive, user-oriented software creation and testing process by a peer group could influence individuals' behavior and reception of that software.

The social processing information literature states that individuals assume information or misinformation is true based on their internal working models (Bowlby, 1973; Crick & Dodge, 1994; Egeland & Carlson, 2004; Suess et al., 1992). However, individuals are often biased in assuming information or misinformation are true (Dykas & Cassidy, 2011; Scarr & McCartney, 1983). As TRA suggests, strong beliefs influence the individuals' actions, if they have a significant degree of control over their behavior (Dweck & London, 2004; R. A. Thompson, 2008). Regarding software testing, users may have a significant degree of control as they can navigate and operate freely within the newly developed IS. Thus, it can be assumed that their beliefs, and by extension their perceptions, affect their behavior.

The perception of new IS could be influenced by preconceived notions regarding the specific forms of software development approaches, such as "agile" methods. For example, if beta users perceive the developing method is agile, the user satisfaction might improve due to the presumption that they will be continuously involved in development and updating processes. After all, strong user involvement in software development is not yet the norm as highlighted by Schön et al. (2017).

2.2. Technostress

In recent years the incorporation of diverse information systems and the dependence of users on IS has increased dramatically (Srivastava et al., 2015). One result of this development is that users experience feelings of stress much more frequently (Tarafdar et al., 2011, 2015), a phenomenon also referred to as technostress (Ragu-Nathan et al., 2008). Technostress is a consequence of constant connectivity and information overload. It has been considered a modern disease of adaptation caused by an inability to cope with new IS in a healthy manner (Ayyagari et al., 2011; Brod, 1984; Tarafdar et al., 2007; Weil & Rosen, 1997).

Ayyagari et al. (2011) found that technostress consists of five contributors. 1) Work overload describes situations where IS forces users to work faster and longer. 2) Job insecurity refers to situations where users' believe their jobs to be jeopardy as a consequence of new IS. They may fear to lose their jobs as a result of increasing automation or to people, who have a better understanding of IS. 3) Role ambiguity refers to contexts where continuing changes and upgrades in IS unsettle users and create uncertainty in that they worry about continually learning and educating themselves about new IS. 4) Work-home conflict describes the blurring of work-home boundaries. As IS are available from multiple devices, they increase individuals' access to work-related information and blur the boundaries between professional and private life. 5) Invasion of privacy describes the invasive effects of IS in terms of allowing users to be reached at any time. Employees may feel the need to be always "connected."

Within our work, we focus on three technostress creators (work overload, job insecurity, role ambiguity). Work overload is included as more involved beta users can ensure that the newly developed software does not increase their workload. Job insecurity is studied because beta users' participation in the development process improves their understanding of the software and may, in turn, alleviate the feeling of other people being more capable regarding IS use. Lastly, we investigate role ambiguity in beta users. Due to the heavy involvement in the development process, beta users may guide or inform decisions regarding modifications or updates of the IS, which lowers their uncertainty about continuous changes. Notably, we excluded work-home conflicts and the invasion of privacy as these creators cannot be influenced by the degree of involvement of beta users. Hence, they do not fit the context of beta users' perceptions of ASD methodologies.

2.3. User Satisfaction

In comparison to the negative user reactions described, the ubiquity of diverse IS also induces positive reactions in users. The well-established concept of user satisfaction in IS literature describes an individual's positive attitude to the IS that s/he uses in the course of performing day-to-day work processes

(Doll & Torkzadeh, 1989). User satisfaction includes factors such as the relevance and accuracy of the information provided by an IS and its ease of use (Hofstede, 1998).

Also, Bhattacherjee (2001) found that user satisfaction is enhanced if users believe that the IS will help them perform their job better. Hence, the perception of the IS plays an important role for satisfaction levels. Furthermore, said perception might be influenced, in part, by the used development method. For instance, users could have a more positive view of ASD than of other development methods because of its characteristically user-centric approach. After all, a large share of software development projects are still carried out without any user involvement according the study of Schön et al. (2017). Since user involvement is strong in ASD projects, users might feel their input is valued and their specific requirements are taken into account. Ultimately, this might result in higher satisfaction than in other methodologies (Wixom & Todd, 2005).

3. Hypotheses development

Prior research stated that users' system acceptance is increasing the more the users are involved in software development projects (Kujala, 2003). More specifically, several studies showed that that if a system is developed according to users' workplace needs and requirements, it can decrease work overload (Torkzadeh & Doll, 1994; Wagner & Newell, 2007; Wu & Marakas, 2006). ASD entails heavy user involvement (Beck et al., 2001), which facilitates user friendly software design and thus could reduce the perceived work overload. Therefore, we hypothesize:

H1a: The more positive the perception of ASD, the lower the beta users' perceived work overload.

Igbaria and Guimraes (1994) found in their study that users, who are involved in the development process, tend to perceive the IS as more relevant to their work. Moreover, involved users consider themselves better informed about the new software as they actively contribute and help to carve out the required system capabilities. In the process, users acquire comprehensive knowledge about the IS and improve their proficiency in its use. The resulting feeling of being less replaceable might alleviate job insecurity, which is defined as perceived powerlessness to maintain desired continuity in a threatened job situation (Greenhalgh & Rosenblatt, 1984). Since user involvement is an integral part of ASD, this development method may help reduce job insecurity among employees (Beck et al., 2001). Therefore, we hypothesize that:

H1b: The more positive the perception of ASD, the lower beta users' perceived job insecurity.

According to classical theory (Begel & Nagappan, 2007), software development projects with more user involvement help users in developing a realistic expectation of the new IS. Users will have a more informed idea of the exact software features (Baronas & Louis, 1988; Bjerknes & Bratteteig, 1995). This could prevent the new system from creating role ambiguity as users have the ability to contribute and guide decisions during development. Consequently, the uncertainty about one's role when using the new IS would be reduced, which could prevent ambiguity from arising (Jarvenpaa & Ives, 1991). Since ASD proposes strong user involvement (Beck et al., 2001), we hypothesize that:

H1c: The more positive the perception of ASD, the lower beta users' perceived role ambiguity.

Prior research states that users are more satisfied with a system if they are heavily involved in its development (Amoako-Gyampah & White, 1993; Lawrence & Low, 1993; Olson & Ives, 1982; Rondeau et al., 2002). Mann and Mauer (2005) investigate the impact of Scrum on overtime user satisfaction and discovered that users believed daily meeting keep them up to date and reduce the confusion. In addition, Begel and Nagappan (Begel & Nagappan, 2007) found that most team members perceive ASD favorably due to improved communications. Thus, ASD might increase user satisfaction due to the focus on user involvement during development. Hence, we hypothesize that:

H2a: The more positive the perception of ASD, the higher the beta users' satisfaction.

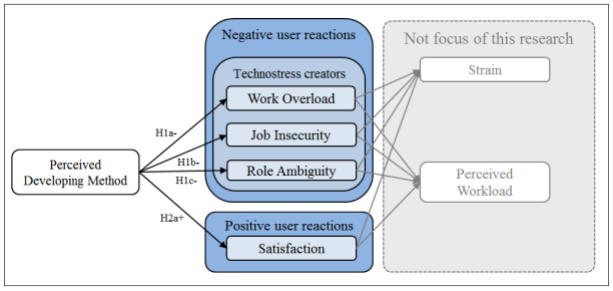

Figure 1. Research model

Moreover, we included beta users' strain and perceived workload in the model (see Figure 1). However, the influence of stress and user satisfaction on the emotional strain and perceived workload has been extensively studied (Ayyagari et al., 2011; Bhattacherjee, 2001; Davis, 1989; Tuomivaara et al.,

2017). Thus, we did not hypothesize these relationships. We merely included these constructs to evaluate and validate our research model with respect to previous research.

4. Research methodology

4.1. Scale development and measures applied

We developed a new scale for beta users' perception of ASD. Hence, the questionnaire consists of statements aligned with ASD (Hummel, 2014; Lee & Xia, 2010). If individuals score high values for a construct, they assume that the software they are dealing with has been developed using agile methods.

We adopted the core values of ASD, i.e. dynamic, evolving, and autonomous (Beck et al., 2001) and paraphrased them into nine statements (Table 1). Agile development involves *dynamic* cycles with changing requirements from stakeholders, continually *evolving* software, and *autonomous* teams with organic structures (Beck et al., 2001; Lee & Xia, 2010).

The first three statements in the questionnaire refer to the *dynamic* value of ASD. They address the permanent incorporation of changing user requirements and user involvement as a crucial part of the development process. The statements regarding the *evolving* core value of ASD focus on the constant release of updates, the software's life cycle, and the continuous improvement of the user experience. *Autonomy*, as the third value of ASD, is concerned with autonomous development teams that are free to make decisions without having to involve senior management (Beck et al., 2001).

The items in Table 1 are generic, as they measure beta users' perceptions of ASD over all kinds of IS used. Overall, the measurement of the beta users' perception of ASD contained nine statements regarding agile practices. A five-point Likert scale ranging from strongly disagree (= 1) to strongly agree (= 5) was applied for each statement.

Once a scale for beta users' perception of the ASD method has been developed, it is subjected to further refinement. One individual involved in academic research and well versed in scale development participated in carefully analyzing the wording of the items in the scale. Furthermore, detailed interviews were conducted with two full-time working beta users to assess the readability of the survey items. Each interview lasted, on average 15 minutes. Minor changes were made to the wording and design of the scale. Overall, the feedback suggested that all participants understood the scale well.

As discussed before, we adopted three out of five technostress creators proposed by Ayyagari et al. (2011). For the evaluation of user satisfaction, we adopted the measures developed by Spreng et al. (1996) (see Table 2). This scale captures respondents' technostress and satisfaction levels along a five-point Likert scale ranging from strongly disagree (= 1) to strongly agree (= 5).

Table 1. Items

Dynamic	Evolving	Autonomous
Software development should incorporate changing user requirements in the whole development process.	New software should be enhanced after some weeks.	New software should be developed by an autonomous team.
The highest priority for software development should be to continually incorporate all my requirements.	New software should be able to be used permanently.	The development team should be able to take project decisions without involving senior management.
I want to be a crucial part of the development of new software.	The interface should be well designed and constantly improved.	New software should be created with the users' department if needed.

To understand the impact of beta users' perception of ASD, it was critical that the individuals of the surveyed population currently act or have acted as beta users in their organizations, and use IS in their work environment. To account for the difference between varying development methods and their impact, we selected individuals who have advanced knowledge about software development.

Table 2. Items for technostress (Ayyagari et al., 2011) and user satisfaction (Spreng et al., 1996)

Technostress	User satisfaction
I believe that software makes it easier for other people to perform my work activities.	I enjoy using the software.
I feel busy or rushed due to the software.	I am satisfied with the software.
I am unsure whether I have to deal with software problems or with my work activities.	I am delighted by this software.

4.2. Data collection

We collected data by distributing a printed version of our questionnaire to three international operating organizations of varying sizes. Furthermore, we collected data in seven groups on LinkedIn, XING, and Facebook. Additionally, an online questionnaire

Table 4. Scale properties and correlations

	Nr. items	CR[a]	AVE[b]	POAS	WO	RA	JI	US	ST	PW
POAS	8	.80	.57	**.75**						
WO	3	.78	.58	-.04	**.76**					
RA	5	.86	.55	-.38	.45	**.74**				
JI	3	.79	.57	-.51	.31	.57	**.76**			
US	3	.77	.61	.21	-.10	-.25	-.16	**.78**		
ST	4	.81	.56	-.22	.41	.48	.45	-.50	**.75**	
PW	3	.78	.54	-.17	.38	.56	.28	-.26	.57	**.74**

Legend: WO = Work overload, RA = Role ambiguity, JI = Job insecurity, US = User satisfaction, ST = Strain, PW = Perceived workload

[a] Composite reliability computed as: $P_c = (\Sigma)2 /[(\Sigma)^2 + \Sigma \text{ var}(\varepsilon)]$; λ and ε estimates

[b] AVE is the average variance extracted (i.e., proportion of variance in construct that is not due to measurement error)

was created to collect data in eight online forums that provide an exchange platform for beta users and deal with various topics concerning software development. The printed questionnaire yielded 60 responses while 57 responses were received for the online questionnaires. 31 participants did not complete the questionnaire. Consequently, we excluded them from our analysis. In total, 117 people answered the survey thoroughly. Notably, the study also captured gender and age of the participants. Table 3 presents more detailed information about demographics of the studied population. On average, respondents had a high interest in digitization with a mean of 4.18 (median 4.00) on a five-point scale.

Table 3. Demographics

	Participants (N = 117)	
Gender	n	%
Male	80	68
Female	37	32
Age		
18 – 20 years	4	3
21 – 30 years	57	49
31 – 40 years	25	21
41 – 50 years	12	10
51 – 60 years	15	14
> 60 years	4	3

5. Results

In order to analyze the proposed research model and to validate the derived hypotheses, the model was transferred into a structural equation model (Fornell & Larcker, 1981). To evaluate the research model, we made use of the software JASP (JASP Team, 2018) to examine the relationships.

5.1. Measurement model

A confirmatory factor analysis (CFA) using the JASP software (JASP Team, 2018) was carried out. Each scale item was modeled as a reflective indicator of its hypothesized latent construct. The eight constructs were allowed to covary in the CFA model. Model estimation was done using the maximum likelihood technique, with the item correlation matrix used as input. Table 4 presents the results of the CFA analysis with a focus on the newly developed construct perceived development method. The beta users' perception of the development method was modeled as a first-order and second-order reflective construct consisting of three factors (dynamic, evolving, and autonomous).

The first step in scale validation was to examine the goodness-of-fit of the overall CFA model. For an excellent fit, it is suggested that chi-square normalized by degrees of freedom (χ^2/df) should not exceed 5 (Bentler, 1990), and Bentler-Bonett Non-Normed Fit Index (NNFI) and Comparative Fit Index (CFI) should both exceed 0.9. For the current CFA model, we find χ^2/df = 2.504 (χ^2 = 1390; df = 555), NNFI = 0.951, and CFI = 0.956, suggesting an adequate model fit. The NNFI is sensitive to sample size and may indicate a poor fit with small samples even when the model is correct and is, therefore, not a completely reliable indicator of model fit for small sample sizes (Bentler & Bonett, 1980). Despite the small sample size of 117 respondents, the χ^2/df value suggests an adequate model fit.

Second, convergent validity was evaluated for the eight measurement scales using three criteria, as suggested by Fornell and Larcker (Fornell & Larcker, 1981):

- all indicator factor loadings (λ) should be significant and exceed 0.7,
- composite reliability should exceed 0.80,
- and the average variance extracted (AVE) for each construct should exceed the variance due to measurement error for that construct (i.e., AVE should exceed 0.50).

Regarding the factor loading criteria, different thresholds have been proposed in the literature. Some

studies reported that factor loadings should be higher than 0.5 for better results (Hulland, 1999). Ertz et al. (2016) have considered values ≥0.4 for their confirmatory factor analysis. Chin et al. (1997) stated that factor loadings should exceed 0.6, which was applied as the factor loading threshold for this study.

In the CFA model, 34 standardized factor loadings exceeded 0.6 and were significant at $p < .001$ (see Table 4), which are sufficiently high values according to Chin et al. (1997). One standardized factor loading exceeded 0.5 (x7 of beta users' perception of ASD). It was significant at $p < .001$, which is in line with the work of Ertz et al. (2016).

The values for composite reliability (CR) and Average variance extracted (AVE) can be viewed in Table 4. The CR of constructs ranged from 0.77 to 0.86, which is in line with the thresholds proposed in the literature (Hair et al., 1998; Nunnally, 1975). AVE varied between 0.54 and 0.61 and thus met established target values as well (R. Thompson et al., 1995; Urbach & Ahlemann, 2010). Since the condition for the AVE was met, convergent validity was achieved (Cheung & Wang, 2017). Finally, all three conditions for convergent validity were met. The discriminant validity was assessed using Fornell and Larcker (Fornell & Larcker, 1981) by comparing the square root of each AVE on the diagonal with the correlation coefficients of each construct in the relevant rows and columns (Hair et al., 1998). Overall, discriminant validity can be confirmed for this measurement model. Notably, the strongest correlation between any pair of constructs was 0.57 (role ambiguity and job insecurity), whereas the square root of AVE for this construct was 0.75.

5.2. Structural model

This approach is particularly appropriate for testing theoretically justified models (Bentler & Bonett, 1980), as was the case in this study. The eight constructs were linked as hypothesized and model estimation was done using the maximum likelihood technique. All of the constructs were correlated. In the structural model, all the factor covariances were removed, and structural paths were added, reflecting the proposed hypotheses. The goodness-of-fit for the structural model χ^2/df was 2.808 ($\chi^2 = 1606$; $df = 572$), CFI was .956. The fit indices shown in Table 5 suggest that the data fit the model well. All values are above the cutoffs suggested by Kline (2005), which lie at 0.9 for CFI, somewhat below 0.1 for SRMR, and at 0.1 for RMSEA.

The finished structural model is shown in Figure 2. The calculated path coefficients are used to test the hypotheses. For each hypothesis, standardized coefficients and their significance levels are displayed in accordance with JASP (2018).

Table 5. Fit statistics

Model	SRMR	CFI	RMSEA	Chi-Square
Measurement Model	.105	.956	.114	1,390 with 555 df
Structural Model	.113	.946	.125	1,606 with 572 df

6. Discussion

The objective of this study was to explore the influence that beta users' perception of ASD has on their experienced technostress (RQ1) and satisfaction (RQ2). We find that beta users' perception of ASD is negatively correlated with all three negative user reactions (Fig. 2). While the impact on work overload is not as significant, the effects on job insecurity and role ambiguity feature high significance levels. Therefore, we can confirm H1a, H1b, and H1c. Furthermore, the results reveal a positive correlation between the ASD perception and positive user reactions, namely user satisfaction. This relationship is also characterized by high significance, which allows us to confirm H2a as well. Overall, the confirmation of all hypotheses answers both research questions as we find that a more positive perception of ASD significantly reduces technostress (i.e., work overload, job insecurity, role ambiguity) and improves user satisfaction.

The results of our study help to address an important research gap. Nelson (1990) criticizes that many studies of individual adjustments to IS do not differentiate between studied technologies. Ayyagari et al. (2011) started to address this undifferentiated view of IS in this research field by identifying characteristics such as usability features, intrusive features, and dynamic features that potentially affect users' adjustments to IS. Our findings expand on this view as they provide evidence that not only the technology itself but also the perception of the developing method can have an impact on technostress, user satisfaction, and, by extensions, on users' abilities to adjust to new IS.

As mentioned in prior literature, the connections of strain and perceived workload with technostress and user satisfaction is well established. Our study confirmed and extended the results for beta users in software development. Role ambiguity, job insecurity, work overload, and satisfaction were proposed as antecedents of strain. Thus, our study contributes to

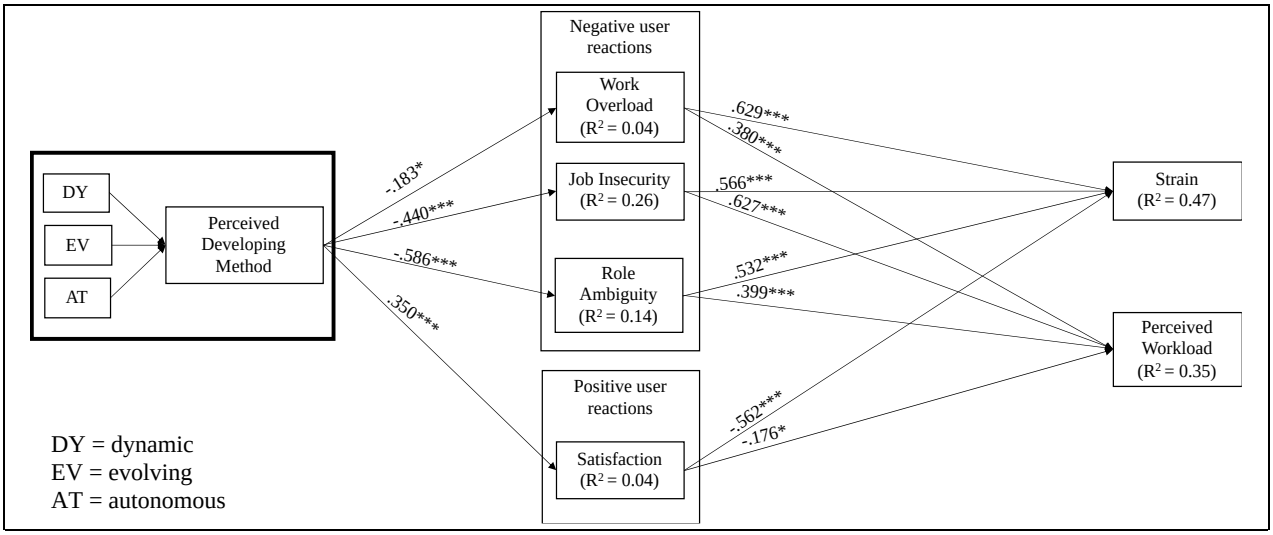

Figure 2. Structural model with results

the existing body of knowledge by explaining three technostress creators with beta users' perceptions of ASD (Ayyagari et al., 2011). Our newly developed construct perceived development method also informs research on system quality and its impact on user satisfaction. System quality measured in terms of ease-of-use, functionality, reliability, flexibility, data quality, portability, integration, and importance (Delone & McLean, 2003) may be enriched with the findings of our study. Moreover, the proposed model extends the findings on individuals' adjustments and the impacts of IS use (Ayyagari et al., 2011; Nelson, 1990).

Our results also have important implications for practice. Organizations could use the developed model to assess beta users' perception of ASD and assess the technostress and satisfaction of beta users in their company. Since the model is not technology-specific, it can be customized to fit different organizational needs. Organizational groups can focus on specific technologies or a set of technologies to gain insights into the role of beta users' perceptions of the ASD methodology. Our findings indicate that management and project managers should promote methods that focus on the evolving, dynamic, and autonomous aspects of ASD to reduce technostress and foster satisfaction among beta users.

7. Conclusion

This study explores how beta users' perception of ASD impacts their technostress and satisfaction levels. By investigating the beta users' perspective, we contribute to the existing literature, which strongly focuses on the developers' reactions towards development methodologies. To address these research gaps, we consider the effects of beta users' ASD perception on three technostress creators (i.e. work overload, job insecurity, and role ambiguity) and on user satisfaction. Respective hypotheses were proposed and a new scale concerning beta users' perception of the ASD methodology was developed. Subsequently, a survey with 117 beta users was conducted. The results yielded a structural model, which was evaluated using structural equation modeling in JASP (JASP Team, 2018).

Our findings reveal that beta users' perception of ASD influences negative as well as positive user reactions. The calculated path coefficients show that a more positive perception of ASD has an alleviating effect on all three technostress creators. Moreover, we find that user satisfaction can profit from a more positive perception of ASD. These effects are driven by heavy user involvement, which is a key concept in ASD. Overall, our study provides valuable insights on factors that influence the mental well-being of employees in the workplace and thus informs theory and practice alike. Specifically, we expand the scientific literature by offering a different perspective that centers around users instead of developers. Moreover, our work is relevant to research on IS adoption and on the impacts of IS use. The results also provide guidance to practitioners by highlighting the benefits of strong user involvement in software development projects.

This study, however, is subject to some limitations. To test for non-response bias, we compared the demographics of early and late respondents (e.g., age, gender, interest in digitization, and education). Late respondents are likely to be similar to non-respondents as they are presumably less eager to participate (Armstrong & Overton 1977, Compeau & Higgins, 1995). The two groups did not display significant

differences indicating that our results are not driven by non-response. Additionally, our study did not control for the amount of IS used. Some beta users, who are part of several development projects, could have a variety of perceptions regarding ASD as opposed to beta users who are only involved in one project. Moreover, the effects of the Corona 19 pandemic on the work environment may have an impact on technostress and user satisfaction. With ever more people working from home, the dependency on IS increases, which might make employees more sensitive to related drivers of stress and satisfaction.

Our study also establishes new directions for future research. Technology characteristics are currently conceptualized as antecedents to stressors, which act as predictors of strain and perceived workload. In this study, we extended the characteristics of technologies by incorporating the perception of the developing method as an explanation of technostress and user satisfaction. The findings imply that individuals' perceptions of the developing method are crucial. Thus, researchers should go beyond the traditional view on usability features and incorporate users' perceptions of the developing method.

References

Amoako-Gyampah, K., & White, K. B. (1993). User involvement and user satisfaction: An exploratory contingency model. *Information & Management*, *25*(1), 1–10.

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of marketing research*, 14(3), 396-402.

Ayyagari, R., Grover, V., & Purvis, R. (2011). Technostress: Technological antecedents and implications. *MIS Quarterly*, *35*(4), 831–858.

Bano, M., & Zowghi, D. (2015). A systematic review on the relationship between user involvement and system success. *Information and Software Technology*, *58*, 148–169.

Baronas, A.-M. K., & Louis, M. R. (1988). Restoring a sense of control during implementation: How user involvement leads to system acceptance. *Mis Quarterly*, 111–124.

Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., & Jeffries, R. (2001). *Manifesto for agile software development*.

Beehr, T. A., & Newman, J. E. (1978). Job stress, employee health, and organizational effectiveness: A facet analysis, model, and literature review 1. *Personnel Psychology*, *31*(4), 665–699.

Begel, A., & Nagappan, N. (2007). *Usage and perceptions of agile software development in an industrial context: An exploratory study*. 255–264.

Bentler, P. M. (1990). Fit indexes, Lagrange multipliers, constraint changes and incomplete data in structural models. *Multivariate Behavioral Research*, *25*(2), 163–172.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*(3), 588.

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly*, 351–370.

Bjerknes, G., & Bratteteig, T. (1995). User participation and democracy: A discussion of Scandinavian research on system development. *Scandinavian Journal of Information Systems*, *7*(1), 1.

Bowlby, J. (1973). *Attachment and loss, vol. II: Separation*. Basic Books.

Brhel, M., Meth, H., Maedche, A., & Werder, K. (2015). Exploring principles of user-centered agile software development: A literature review. *Information and software technology*, 61, 163-181.

Brod, C. (1984). *Technostress: The human cost of the computer revolution* (Vol. 13). Addison-Wesley Reading, MA.

Cheung, G. W., & Wang, C. (2017). *Current approaches for assessing convergent and discriminant validity with SEM: Issues and solutions*. *2017*(1), 12706.

Chin, W. W., Gopal, A., & Salisbury, W. D. (1997). Advancing the theory of adaptive structuration: The development of a scale to measure faithfulness of appropriation. *Information Systems Research*, *8*(4), 342–367.

Collins, N. L., & Allard, L. M. (2004). *Cognitive Representations of Attachment: The Content and Function of Working Models.*

Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS quarterly*, 189-211.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin*, *115*(1), 74.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319–340.

Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems*, *19*(4), 9–30.

Doll, W. J., & Torkzadeh, G. (1989). A discrepancy model of end-user computing involvement. *Management Science*, *35*(10), 1151–1171.

Dweck, C. S., & London, B. E. (2004). The role of mental representation in social development. *Merrill-Palmer Quarterly*, *50*(4), 428–444.

Dykas, M. J., & Cassidy, J. (2011). Attachment and the processing of social information across the life span: Theory and evidence. *Psychological Bulletin*, *137*(1), 19.

Egeland, B., & Carlson, E. A. (2004). Attachment and psychopathology. *Attachment Issues in Psychopathology and Intervention*, 27–48.

Ertz, M., Karakas, F., & Sarigöllü, E. (2016). Exploring pro-environmental behaviors of consumers: An analysis of contextual factors, attitude, and behaviors. *Journal of Business Research*, *69*(10), 3971–3980.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Greenhalgh, L., & Rosenblatt, Z. (1984). Job insecurity: Toward conceptual clarity. *Academy of Management Review*, *9*(3), 438–448.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (1998). *Multivariate data analysis* (Vol. 5, Issue 3). Prentice hall Upper Saddle River, NJ.

Hofstede, G. (1998). Attitudes, values and organizational culture: Disentangling the concepts. *Organization Studies*, *19*(3), 477–493.

Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal*, *20*(2), 195–204.

Hummel, M. (2014). *State-of-the-art: A systematic literature review on agile information systems development*. 4712–4721.

Igbaria, M., & Guimaraes, T. (1994). Empirically testing the outcomes of user involvement in DSS development. *Omega*, *22*(2), 157–172.

Jarvenpaa, S. L., & Ives, B. (1991). Executive involvement and participation in the management of information technology. *MIS Quarterly*, 205–227.

JASP Team. (2018). *JASP (Version 0.8. 6)[Computer software]*.

Kline, R. (2005). *Methodology in the social sciences*.

Kropp, M., & Meier, A. (2017). *3. Swiss Agile Study: Agile und hybride Software-Entwicklung in der Schweiz*.

Kujala, S. (2003). User involvement: A review of the benefits and challenges. *Behaviour & Information Technology*, *22*(1), 1–16.

Lawrence, M., & Low, G. (1993). Exploring individual user satisfaction within user-led development. *MIS Quarterly*, 195–208.

Lee, G., & Xia, W. (2010). Toward agile: An integrated analysis of quantitative and qualitative field data on software development agility. *Mis Quarterly*, *34*(1).

Mann, C., & Maurer, F. (2005). *A case study on the impact of scrum on overtime and customer satisfaction*. 70–79.

Mannaro, K., Melis, M., & Marchesi, M. (2004). *Empirical analysis on the satisfaction of IT employees comparing XP practices with other software development methodologies*. 166–174.

Meier, A., Kropp, M., Anslow, C., & Biddle, R. (2018). *Stress in agile software development: Practices and outcomes*. 259–266.

Montano, D. E., & Kasprzyk, D. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. *Health Behavior: Theory, Research and Practice*, *70*(4), 231.

Nelson, D. L. (1990). Individual adjustment to information-driven technologies: A critical review. *MIS Quarterly*, 79–98.

Nunnally, J. C. (1975). Psychometric theory—25 years ago and now. *Educational Researcher*, *4*(10), 7–21.

Olson, M. H., & Ives, B. (1982). Chargeback systems and user involvement in information systems-An empirical investigation. *Mis Quarterly*, 47–60.

Ragu-Nathan, T., Tarafdar, M., Ragu-Nathan, B. S., & Tu, Q. (2008). The consequences of technostress for end users in organizations: Conceptual development and empirical validation. *Information Systems Research*, *19*(4), 417–433.

Rondeau, P. J., Vonderembse, M. A., & Ragu-Nathan, T. (2002). Investigating the level of end-user development and involvement among time-based competitors. *Decision Sciences*, *33*(1), 149–160.

Scarr, S., & McCartney, K. (1983). How people make their own environments: A theory of genotype→ environment effects. *Child Development*, 424–435.

Schön, E. M., Thomaschewski, J., & Escalona, M. J. (2017). Agile Requirements Engineering: A systematic literature review. *Computer standards & interfaces*, 49, 79-91.

Sonnentag, S., Brodbeck, F. C., Heinbokel, T., & Stolte, W. (1994). Stressor-burnout relationship in software development teams. *Journal of Occupational and Organizational Psychology*, *67*(4), 327–341.

Spreng, R. A., MacKenzie, S. B., & Olshavsky, R. W. (1996). A reexamination of the determinants of consumer satisfaction. *Journal of Marketing*, *60*(3), 15–32.

Srivastava, S. C., Chandra, S., & Shirish, A. (2015). Technostress creators and job outcomes: Theorising the moderating influence of personality traits. *Information Systems Journal*, *25*(4), 355–401.

Suess, G. J., Grossmann, K. E., & Sroufe, L. A. (1992). Effects of infant attachment to mother and father on quality of adaptation in preschool: From dyadic to individual organisation of self. *International Journal of Behavioral Development*, *15*(1), 43–65.

Tarafdar, M., Pullins, E. B., & Ragu-Nathan, T. (2015). Technostress: Negative effect on performance

Tuomivaara, S., Lindholm, H., & Känsälä, M. (2017). Short-term physiological strain and recovery among employees working with agile and lean methods in software and embedded ICT systems. *International Journal of Human–Computer Interaction*, 33(11), 857-867.