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The Role of Gender, Age, and Technology Affinity in Experiencing Techno-Distress and Techno-Eustress

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Abstract

Digital technologies evolved into important tools in our lives, especially in the work context. However, their use is often associated with stress. This so-called technostress can be divided into two distinct dimensions, namely techno-distress, which is associated with negative consequences, and techno-eustress, which is linked with favorable outcomes. Despite its prevalence, the literature on these two dimensions of technostress is relatively new and lacks research, especially in certain work domains such as manufacturing. To deepen the understanding of the concept, the current article adopts an explorative approach to examine the roles of the demographic variables gender, age and technology affinity to both, techno-distress and techno-eustress. This article features the results of an online survey with a final sample of 90 employees within the manufacturing work context. The results for techno-distress yield a negative relation to gender, indicating that men experience more techno-distress, and a positive relation to age, meaning that older people felt more techno-distress. For techno-eustress, a positive relation to technology affinity was established, suggesting that people who are more technology-affine experience more techno-eustress. These insights contribute to the sparse literature and help to clarify the understanding of technostress. Future research should incorporate these demographic factors when examining further aspects of technostress and investigate their applicability to different work domains.

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Keywords: Techno-distress; Techno-eustress; Gender; Age; Technology Affinity; Manufacturing

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1. The role of gender, age, and technology affinity in experiencing techno-distress and techno-eustress

Digital Technologies became an integral part of everyday life, at home and in the workplace. Approximately 63% of German employees need digital competences in their jobs, and 13% of German employees already use artificial intelligence to facilitate their work [1]. Although the rapid evolvement creates new opportunities, it can also lead to challenges [2]. One widespread obstacle that almost every fifth employee in Germany experiences, is strong distress due to technical strains at work [3].

This stress, also called technostress is defined as the stress that individuals experience when they interact with digital technologies [4]. In this context, a further differentiation between the distinct dimensions of techno-distress and techno-eustress [5 as cited in 6] may be made. Techno-distress is characterized as threatening and hindering which mostly leads to negative consequences [6]. In contrast, techno-eustress is described as challenging and motivating and has been linked with positive outcomes [6]. It is important to note that most existing research refers broadly to the term technostress and does not differentiate between the two subcategories. However, these studies predominantly focus on the negative stress aspects. To get a better overview of the literature, these results are referred to as techno-distress in this article; the term technostress is only used to refer to the whole construct, including the aforementioned two dimensions.

Given that this two-dimensional construct of technostress has only received limited conceptual and empirical exploration [4], further investigation of the concept is necessary. Especially in manufacturing contexts, where humans frequently interact with machines in innovative and rapidly evolving workplaces, the risk of experiencing technostress appears particularly high. This vulnerability is further illustrated by the finding that employees in highly centralized and innovative organizations tend to experience elevated techno-distress levels [7]. Consequently, the manufacturing sector appears to be of great interest for the investigation of technostress. It is also important to consider the distinctive demographic features that might be observed in this field. For instance, women are underrepresented in STEM fields (Science, Technology, Engineering, and Mathematics) [8], which may also include roles in the manufacturing sector. Moreover, older employees tend to possess more extensive expertise due to their longstanding professional experience, and technology enthusiasts may be particularly drawn to technical professions that are often found in this context. Yet, the literature review did not reveal any findings on technostress itself and in relation to the three demographic variables in the manufacturing sector or similar operational contexts. Instead, studies on technostress were mainly conducted in the fields of information and communication technology (ICT), human resources (HR), and in academic/educational settings. Concluding, these demographic variables should be carefully considered when examining technostress in the manufacturing context, so that appropriate interventions can be developed to effectively support this workforce.

In this context, the Occupational Science Competence Center for Gainful Employment in Industry 4.0 (AKzentE4.0) in the Aachen region of Germany investigates the effects of digital and AI technologies on the productivity, physical and psychological well-being, satisfaction and learning development opportunities of manufacturing workers, aiming to derive evidence-based guidelines for the human-centered implementation of technologies in the workplace [9]. The following investigation into the role of gender, age, and technology affinity was conducted as part of this effort.

1.1. Gender and technostress

It is a common belief that women are not able to handle technologies as well as men. Reflecting this common stereotype, women often perceive themselves as less capable when dealing with technologies [10]. This self-assessment might in turn lead to higher techno-distress levels among women. However, the direct link of gender and techno-distress has received contradictory support. Some studies support the assumption that women experience more techno-distress than men [11], while others ascertain that men experience more techno-distress than women [4]. Some evidence suggests even no significant relations between both genders in relation to techno-distress [12]. As of yet, no scientific articles could be identified that explored the interplay between gender and techno-eustress. However, studies on non-technological eustress indicated that men reported significantly higher eustress levels than women [13].

1.2. Age and technostress

Today, children are growing up with digital technologies. Those "Digital Natives" often intuitively use digital tools, whereas "Digital Immigrants" (individuals that did not grow up with technologies) must first learn how to use them [14]. This difference might enable younger people to handle technologies more easily and thus might reduce the likelihood to experience adverse consequences. Recent studies support this idea by showing that older people experience more techno-distress [12]. However, the findings do not seem to be consistent, as negative [15] and non-significant [16] relations were also detected. Likewise, the literature on techno-eustress does not provide many insights either. Only one study was identified that revealed a positive relation between age and techno-eustress [17].

1.3. Technology affinity and technostress

Another relevant factor that concerns the experience of technostress involves technology affinity, defined as a personality trait that reflects whether people prefer to approach or to avoid interactions with digital technologies [18]. People with high technology affinity possess more knowledge about technologies and generally adopt a positive view of them [19]. On the other hand, people that would rather avoid technologies might be overwhelmed when being required to use technologies which could then lead to feeling techno-distress. This suggestion is underlined by research showing that people experience techno-distress when they cannot adapt to the use of digital technologies [20]. Previous literature supports this negative relation by highlighting that people with high technology affinity experience generally less techno-distress [21]. Despite the lack of research on the relation between technology affinity and techno-eustress, it is plausible that people with high technology affinity view the technology use as challenge and in turn, might experience more techno-eustress.

1.4. Research goal

Summarizing the previously mentioned associations, research that explores the relationships between gender [4, 11, 12], age [12, 15, 16] and technology affinity [20, 21] with techno-distress is largely inconsistent. Thus, further investigations to clarify these associations are necessary. Especially the relationships between gender [13], age [17] and technology affinity [no literature found] with techno-eustress are largely unexplored and need further examinations. Using an exploratory approach, this paper examines how gender, age and technology affinity relate to techno-distress and techno-eustress in the work context, specifically in the manufacturing domain. To measure the aforementioned constructs, an online survey was administered. Data were then analyzed via linear regressions. Lastly, implications of the results were discussed.

2. Method

2.1. Sample

Data were collected via small and medium-sized manufacturing company partners of AKzentE4.0 [9], that mainly specialize in mechanical and plant engineering. These companies distributed generated SoSci Survey [22] links to their employees from various professions, inviting them to complete the online questionnaire. In total, $N = 203$ responses were obtained. After filtering for exclusion criteria such as too short or too long completion time (<10 minutes and >60 minutes), incomplete responses, respondents that did not use digital technologies in the workplace, and the removal of extreme outliers, $N = 90$ eligible responses from 13 different companies remained. A post hoc G*Power [23] analysis for each regression with $f^2 = .15$ (medium effect size), $\alpha = .05$ and $N = 90$ revealed a high power of .95. Of the respondents, 81.1% identified as male and 18.9% as female, with ages ranging from 21 to 64 years ($M = 41.66$, $SD = 12.02$). None identified as non-binary or chose not to indicate their gender. In addition, 4.4% were trainees, 52.2% were employees and 43.3% held leadership positions. The mean for technology affinity was $M = 4.74$ ($SD = 1.17$).

2.2. Procedure

Before the start of the study, the proposal underwent a review and was approved by a German ethics committee. Subsequently, data were collected from employees of the manufacturing companies over a period of approximately three months in 2024 and 2025. Prior to filling out the questionnaire, participants gave their informed consent. The questionnaire further contained items on demographic data and various topics relevant to the project evaluation (safety, health, satisfaction, competence, productivity). The questionnaire was administered in German. The questionnaire took around 20-30 minutes to complete. Participants received no compensation. For the purpose of the current study, only the variables technostress, gender, age and technology affinity are reported below and in Appendix A (table 2). The procedure is also summarized and displayed schematically in Figure 1.

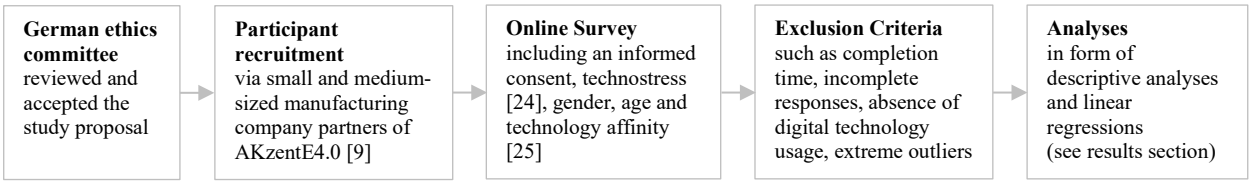


Fig. 1. Schematic outline of the study procedure.

2.3. Measures

The constructs technostress, including techno-eustress and techno-distress, as well as age, gender and technology affinity were measured (Appendix A, table 2).

2.3.1. Technostress

To measure techno-eustress and techno-distress as distinct dimensions, the German version of the Di-Eu-Stress State Scale (DESS) [24] was administered. To adapt the questionnaire to the context of working with digital technologies, the introductory sentence was modified. The scale with a total of 8 items included four assessments of perceived techno-distress (“Because of the digital technologies I use, I am feeling …” “… stressed/overwhelmed/exhausted/strained”) and four of techno-eustress (“… full of joy/challenged in a positive way/bursting with energy/enthusiastic”). Each item was measured using a 7-point Likert scale ranging from (1) strongly disagree to (7) strongly agree, with higher values indicating a greater level of technostress. With a Cronbach's alpha of $\alpha = .89$, the techno-eustress scale demonstrated good reliability, and the techno-distress scale excellent reliability with a Cronbach's alpha of $\alpha = .93$. For the subsequent analyses, the mean value of each subscale was calculated.

2.3.2. Gender

Participants were asked to specify their gender identity by choosing one of the given options “male”/“female”/“non-binary”/“I prefer not to say”.

2.3.3. Age

Age was assessed with an open question and the possibility to refuse this information.

2.3.4. Technology affinity

To assess technology affinity, a German version of the Inclusion of Technology Affinity in Self scale (ITAS) [25] was created. The single- item scale consisted of seven illustrations that depicted various degrees of overlap between a circle representing the self and another one symbolizing “digital technologies” (originally “technical systems”). The image without overlap (1) reflected a lack of technology affinity, whereas the complete overlap (7) stood for a high technology affinity level.

3. Results

The statistical software IBM SPSS Statistics version 29.0.0.0 (241) [26] was used to perform descriptive analyses (means, standard deviations, Pearson correlations) and linear regression analyses. Assumption tests revealed that the data was not normally distributed. Therefore, linear regressions were bootstrapped using 5000 samples with 95% bias-corrected and accelerated confidence intervals (95% BCa CI). In this linear regression context, significance is interpreted in terms of 95% BCa CI not including zero. Moreover, the confidence intervals are reported with three decimal places to present the results precisely without distortion.

3.1. Descriptive analyses

Descriptive statistics such as means (*M*), standard deviations (*SD*) and Pearson correlations of all variables of interest are depicted in Table 1.

Table 1. Descriptive Statistics and Pearson Correlations.

Variables	*M*	*SD*	1	2	3	4
1. Gender[a]	-	-				
2. Age[b]	41.66	12.03	.00			
3. Technology affinity[c]	4.74	1.17	-.09	-.06		
4. Techno-eustress	4.38	1.21	-.03	-.08	.41***	
5. Techno-distress	2.72	1.34	-.32**	.22*	-.15	-.24*

Note. N = 90. [a]Gender was coded as 0 = male, 1 = female. [b]Age was measured in years. [c]Technology affinity was indicated by 1 = no overlap; no affinity to 7 = full overlap; high affinity.
*p < .05, **p < .01, ***p < .001

3.2. Linear regression main effects

The main effects will be described below. All significant relations are graphically illustrated in Figure 2.

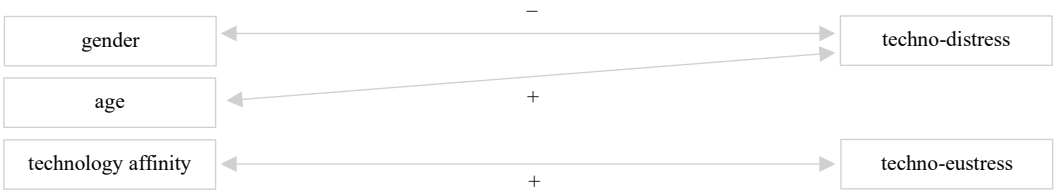


Fig. 2. Significant relationships of the demographic variables (gender, age, technology affinity) with techno-distress and techno-eustress.

3.2.1. Gender

The negative association of gender with techno-distress was significant (B = -1.09, SE = 0.24, 95% BCa CI [-1.547, -0.606], $R^2 = 0.10$), suggesting that, on average, women tended to report lower distress scores than men. However, the relation between gender and techno-eustress was not significant (B = -0.09, SE = 0.42, 95% BCa CI [-0.955, 0.711], $R^2 = 0.00$).

3.2.2. Age

A positive, significant relation between age and techno-distress was identified (B = 0.03, SE = 0.01, 95% BCa CI [0.001, 0.047], $R^2 = 0.05$). This implies that techno-distress tends to increase with age. In contrast, the linear regression between age and techno-eustress revealed no significant results (B = -0.01, SE = 0.01, 95% BCa CI [-0.028, 0.013], $R^2 = 0.01$), indicating that techno-eustress remained relatively stable across different ages.

3.2.3. Technology affinity

No significant relation was found between technology affinity and techno-distress (B = -0.17, SE = -0.12, 95% BCa CI [-0.379, 0.044], $R^2 = 0.02$), which points out that different levels of technology affinity do not impact techno-distress. But technology affinity was significantly and positively linked to techno-eustress (B = 0.43, SE = 0.11, 95% BCa CI [0.210, 0.637], $R^2 = 0.17$). Consequently, people with more pronounced technology affinity reported higher techno-eustress levels.

4. Discussion

Higher, faster, farther - the digital transformation is progressing rapidly and became an integral part of our lives, especially at manufacturing workplaces with the transformation towards Industry 4.0. Those digital technologies hold opportunities but also challenges [2]. For instance, in a representative sample of German employees, more than half indicated that they experience (di)stress when working with digital technologies [3]. Even though many people experience this type of stress, research on techno-distress yields inconsistent findings and techno-eustress remains largely unexplored. To provide deeper insights, this paper examined the relationships between gender, age and technology affinity with techno-distress and techno-eustress.

4.1. Implications

4.1.1. Gender and technostress

The result that women report lower techno-distress levels than men clarify previous contradictory findings in this research area [4, 11, 12]. The results suggest that even though women might perceive themselves as having less technical competence [10], this perception does not need to translate into high techno-distress levels. A possible reason for this could be that women address their perceived stress directly. Women were found to use more coping strategies of different approaches, including both problem and emotional regulations, while men did not seem to use coping strategies related to problem solving [27].

Although eustress in general seems to be higher in men [13], this pattern could not be transferred to the techno-eustress context, since no gender differences were identified in the current study. Nevertheless, non-significant findings also remain important and can contribute to the poorly researched domain of techno-eustress. A plausible explanation for the null result could arise from the sample, in which less than one-fifth of participants identified as female in this male-dominated manufacturing sector. Since this skewed sample might have obscured potential differences among genders, future studies should involve samples with equal numbers of men and women to confirm that there are indeed no gender differences in techno-eustress.

4.1.2. Age and technostress

Support for the “Digital Natives” vs. “Digital Immigrants” paradigm [14] and the resulting assumption that older people have more difficulties to adapt to fast emerging and evolving technological environments was supported by the current results. The analyses revealed that the older people are, the more techno-distress they experience. This finding also brings more clarity into the previous mixed literature, that assumed various relationships between the two constructs [12, 15, 16].

Contrary to this, no significant age differences were found for techno-eustress, revealing that techno-eustress remains consistent throughout all age groups. This insight suggests that while older people may have difficulties adapting to digital technologies, they might also be able to derive the same motivational benefits from mastering new technologies as younger people. This insight diverges from the rare literature that identified a positive relation between age and techno-eustress [17], highlighting the need for further studies to clarify the role of age in the techno-eustress context.

4.1.3. Technology affinity and technostress

In contrast to current literature [21] and the initial expectation that people with higher technology affinity would experience less techno-distress, this study obtained no significant relationship between technology affinity and techno-

distress. The predisposition towards approaching technologies does not seem to protect people from experiencing techno-distress. One possible explanation for the finding could stem from the relatively low techno-distress levels (*M* = 2.72 of 7 possible scoring points) that were observed int the sample. Possibly the technology affinity only displays buffer effects when the techno-distress is high. Furthermore, possessing a strong affinity for technologies might not automatically translate into accepting or being willing to use technologies. Even individuals with high technology affinity might be reluctant to engage with technologies in practice. Following, the experience of lower techno-distress levels might be more closely related to technology acceptance rather than technology affinity. Future studies should pay attention to these potentialities when testing people that are distressed by using technologies.

To our knowledge, this paper is among the first to demonstrate that a significant relationship between technology affinity and techno-eustress exists. Individuals with higher technology affinity ratings also report higher techno-eustress. This indicates that high affinity for technologies helps to motivate and challenge people.

4.1.4. Practical implications

Companies can gain valuable insights from the current study on how to improve the working environment by minimizing techno-distress and increasing techno-eustress. Men and older people in particular appear to be at higher risk of experiencing high techno-distress and should be targeted with interventions, such as stress-management trainings, to help them to cope with techno-distress. Further implications could potentially include an open corporate culture, in which coworkers can share their experiences with digital technologies, particularly with more experienced colleagues. IT professionals could perhaps also assist by offering introductory workshops and simplified manuals that present and explain the features of their digital technologies so that people are not overwhelmed when using the digital tools for the first time. It should be noted, however, that anyone, regardless of gender or age, can be affected by techno-distress and that they should all have access to similar support. Although technology affinity might be a personality trait, organizations should still try to nurture enthusiasm for digital technologies, for example, by offering professional trainings, to foster the positive benefits of techno-eustress for the employees and the company itself. Overall, the adoption of a human-centered approach, that is, involving employees, when developing and introducing new digital technologies, could be essential in reducing techno-distress and enhancing techno-eustress.

4.2. Limitations and outlook

This study had some limitations that should be kept in mind when interpreting the results. Specifically, one limitation concerned the limited generalizability. Since data were collected within the AKzentE4.0 project [9], a restricted participant pool with a final sample of 90 respondents from 13 manufacturing companies in the German region of Aachen was recruited. Although the post hoc G*Power [23] analysis revealed a relatively high power, the effect size was only small to moderate with respect to most effects. Additionally, AKzentE4.0 [9] focused only on workplaces within the manufacturing context. Future studies should investigate the generalizability of these findings by comparing them to a sample of employees from different sectors.

Furthermore, the limited variance explained by the models should be considered. In total, 17% of the variance of techno-eustress was attributed to technology affinity ($R^2 = 0.17$), whereas gender ($R^2 = 0.10$) and age ($R^2 = 0.05$) accounted for 10% and 5% of techno-distress, which can be classified as small to medium values. Even though an attempt was made to capture the most salient variables, other aspects, such as job position may also be related to technostress [28]. Additionally, the current study did not examine the extent, or the type of technology employed that led to the perception of technostress. To obtain a greater explained variance and thus a more holistic understanding of the topic, future research should extend the model by including further person-related factors that may relate to technostress as well as measurements of the utilized technologies.

Finally, no causality can be inferred from the results. As the data were collected through self-reported questionnaires and then analyzed via linear regression analyses, they only reveal relationships, not causal mechanisms. Nevertheless, future studies could strengthen the presented results by replicating the study or by adopting longitudinal designs.

5. Conclusion

Digital technologies have become a major part of our daily lives, but especially in the work context, they can trigger techno-(di)stress [3]. In particular, the rapidly evolving manufacturing context with frequent human-machine interactions could facilitate technostress. However, the distinction of technostress in techno-distress and techno-eustress is relatively new, so that literature on this topic remains scarce. To address this research gap, the current study examined the relationships of the demographic variables gender, age, and technology affinity with techno-distress and techno-eustress in the manufacturing context. The results reveal a negative association between techno-distress and gender as well as a positive relation between techno-distress and age. In addition, a positive relation between techno-eustress and technology affinity is identified. These insights contribute to the clarification of the technostress domain. Nonetheless, more research is needed in the future to establish an overarching picture of the constructs and to develop approaches that could reduce techno-distress while enhancing techno-eustress.

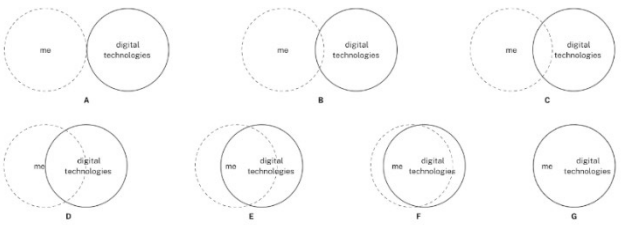
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Appendix A. Questionnaires

Table 2. Questionnaires of the measured constructs (translated from German to English).

Construct	Items	Scale
Techno-distress * Adapted from the Di-Eu-Stress State Scale (DESS) [24]	Because of the digital technologies I use, I am feeling … • … stressed • … overwhelmed • … exhausted • … strained	7-point Likert scale o o o o o o o strongly disagree … strongly agree
Techno-eustress * Adapted from the Di-Eu-Stress State Scale (DESS) [24]	Because of the digital technologies I use, I am feeling … • … full of joy • … challenged in a positive way • … bursting with energy • … enthusiastic	7-point Likert scale o o o o o o o strongly disagree … strongly agree
Gender	Which gender do you identify with? • Male • Female • non-binary • I prefer not to say	-
Age	How old are you? • I am _____ years old. • I do not wish to disclose this information.	-

Technology affinity * Adapted from the Inclusion of Technology Affinity in Self scale (ITAS) [25]	How comfortable are you with digital technologies?  	Please select the image that best describes your relationship with digital technologies. • A • B • C • D • E • F • G

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