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ORIGINAL PAPER

PSYCHOMETRIC PROPERTIES OF THE POLISH ADAPTATION OF *TECHNOSTRESS CREATORS AND TECHNOSTRESS INHIBITORS SCALE*

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Abstract

Background: The use of information and communication technologies by employees of organizations may cause technostress for their users. The sources of technostress in organizations are techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty. An organization may also have technostress inhibitors that counteract the experience of technostress. **Material and Methods:** The purpose of this research was to determine the psychometric properties of the Polish adaptation of *Technostress Creators and Technostress Inhibitors Scale*. **Results:** In the first study (N = 632), the 8-factor structure of the questionnaire was confirmed by the use of confirmatory factor analysis (CFA). Furthermore, a high internal consistency of the adapted method was obtained. The second study (N = 451) confirmed the external validity of the adapted method by correlating it with the *Perceived Stress Scale*. The third study (N = 123) confirmed high stability at the time of results obtained in 2 measurements with the adapted scale. **Conclusions:** To conclude, it can be stated that the Polish adaptation of the *Technostress Creators and Technostress Inhibitors Scale* is characterized by good psychometric indicators and can be successfully used in various organizations in the diagnosis and reduction of technostress. Med Pr. 2022;73(4):277–93

Key words: reliability, information and communication technologies, technostress, technostress creators, technostress inhibitors, Polish adaptation

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INTRODUCTION

Technology advancement has caused the inclusion of information and communication technologies (ICT) to different areas of our life, e.g., social relations, health, science, work [1,2]. The ICT represents a complex of systems, devices (computers, tablets, servers), communication media (Bluetooth networks, internet, wireless networks, mobile and satellite telephony), tools (software) and services that process, collect and transmit information in electronic form. The ICT contributes to the distribution of information and knowledge through the separation of content from physical location [3]. Geographical boundaries are not an obstacle to the flow of information. The development of ICT helps to overcome cultural and language barriers. Thanks to ICT, individuals and social groups can live and work in any part of the world and participate in creating a global network economy regardless of nationality [4]. They allow remote communities to integrate, in theory making information, knowledge and culture accessible to everyone.

The ICT streamlines supply and production networks and makes business and transaction processes more effective [5]. Productivity gains followed by ICT-induced cost reductions lead to the production of new goods, services, distribution channels within traditional economic sectors, as well as innovative business models and the creation of entirely new industries [3]. The adoption and use of ICT in most cases has not only made life easier, but increased the level of user dependence on these technologies [6]. The excessive development of ICT is accompanied by globalization, blurring of national and organizational cultures, and widening of the technological gap between digital societies and those at a weaker level of technological development [5].

Organizations are often implementing information and communication technologies to achieve a competitive advantage [4]. Despite various benefits from

the use of new technologies, there emerge reports of their negative impact on the everyday functioning of people in terms of productivity, social relationships, physical health, and well-being [7]. Continuous change and the introduction of new technological solutions requires employees to adjust to new expectations. Functioning in the environment of the constant presence of ICT devices and technologies can cause users to feel stressed, overwhelmed or even exhausted [7–9]. In order to help Polish employees and organizations diagnose technostress, this article describes the adaptation procedure of the *Technostress Creators and Technostress Inhibitors Scale* [9].

Technostress

The psychological stress associated with the use of technology has been called technostress. The author of this term emphasizes that technostress is a contemporary adaptative disease induced by the inability to cope with new computer technologies in a healthy way [10]. Hwang and Cha [7] have greatly extended the concept of technostress as understood by them as any direct or indirect negative impact of technology on human relationships, ideas, behavior or psyche. Ragu-Nathan et al. [11] equate technostress with the work environment. Technostress describes stress sensed by employees as the outcome of multitasking, constant connectivity, information overload, frequent system updates and the resulting uncertainty, the need for continuous learning and the resulting job uncertainty, and technical problems related to the organizational use of information and communication technologies (ICT) [6]. It is a state of agitation observed in some employees whose work is to a large extent associated with the use of new technology. It may be caused by the fear of the necessity to use technology or, on the contrary, result from unexpected restriction of access to it (e.g., failure, end of work) [12].

While in the 1980s and 1990s technostress manifested mainly as fear of using computers and technology and learning how to cope with it [6], in recent years the role of stressors has frequently manifested due to the excessive use of ICT, which sometimes takes the form of addiction [2]. The more an employee is dependent on ICT in their work, the greater their discomfort [7].

Technostress can have severe negative consequences for employees and organizations, such as poor organizational commitment, limited productivity, job dissatisfaction and, consequently, high employee turnover [6]. The presence of technostress also increases the overall level of occupational stress and may translate into a lower job satisfaction [13,14] which is strongly associated with the overall well-being of an individual. Stress linked with professional work can lead to the overload of mutually dependent systems: biological, mental and social, which results in the occurrence of negative psychological and somatic symptoms [9].

In the case of technostress, the stressor is maladjustment between organizational expectations and the individual possibilities regarding the use of ICT technology. The presence of a technostress creator causes employees to feel tension due to technology and experience negative consequences in organizations [14]. In the light of the continuous technological and civilizational development, the presence of stressors associated with ICT becomes an inevitable part of the functioning of employees in almost every organization [13]. Ragu-Nathan et al. [11] identified 5 groups of factors causing technostress in organizations. Those include: techno-overload, techno-invasion, techno-complexity, techno-insecurity, techno-uncertainty.

Technostress creator factors

Techno-overload references to a situation in which the use of a new technology requires from employees even longer, faster and more intensive work than before the introduction of ICT [14]. For example, in the past the director's office hired several secretaries responsible for answering phone calls, preparing paper correspondence, organizing the work of the office, while nowadays this is the responsibility of one person who can use various office equipment. Technology park at the workplace (e.g., faxes, printers, telephones, computers) becomes distracting and often steals the time that employees were supposed to save. The ICT technology provides considerably more information (e.g., mobile phones, emails, new software) than the employee is able to effectively assimilate and use [12]. This results in an information overload, forced work in a multitasking environment, imposed downtime at work for health reasons. Forced multitasking results in insufficient concentration of attention, ineffective information processing which, in the absence of time, causes tasks to be performed very superficially and in a non-innovative way [7]. What can also be stressing is an opposite situation, in which a device available unexpectedly fails to work as employee would have wished it to (e.g., the lack of internet when employee are waiting for an important email) [15].

Techno-invasion refers to a situation in which, thanks to technology (laptops, cellphones, quick data

transmission), employees can be available to the employer at any place and any time. Additionally, by providing technical capabilities, they feel the need to constantly connect with the workplace, even after they have finished their shift [14]. On the other hand, the fact that the employee has constant contact with the organization enhances his feeling of control over performed tasks, but on the other it affects his life work–life balance negatively [8]. The individual is carrying out professional activities or constantly preparing to perform their duties outside of working hours during the time that should rather be spent with family or friends and he cannot relax and regenerate properly. Thus, the boundaries related to work and personal life are blurred [4]. This situation is particularly in the recent times, when due to the pandemic many people have been forced to work remotely from home [16].

Another technostress creator is *Techno-complexity*. With each year, technology is becoming more and more complicated and begins to take over new areas of activity in the workplace [4,8], e.g., in Company X, there was only 1 computer program used previously for accounting purposes and it was operated by 1 person, and now because of the massive introduction of ICT even regular employees must use various software, ranging from working time records to ordering materials at the workstation for precise production. People usually feel stress of what they don't know or don't understand, as it may exceed their possibilities of coping [17]. The ICT features such as usability (reliability complexity, usefulness), intrusiveness (anonymity, presenteeism) and dynamism (pace of change) can be significant stressors in the workplace [8]. The complexity of ICT used at the workplace fosters in users a sense of a low level of technical competencies. Assessing one's skills as insufficient to cope with the challenges posed by a new technology is a source of stress. The technology used in organizations is now rapidly changing; it is subject to modification and updating, which requires more and more competencies from employees [11]. Although employees are spending plenty of time on education and are putting effort into understanding various aspects of new technologies, they are constantly seeing their ICT skills as insufficient, as technology is changing very fast [5].

Techno-insecurity is associated with situations in which employees, due to the progressive development of ICT in organizations, feel threatened with losing their jobs to other people who have greater knowledge and are able to use modern technologies more effectively [14]. The currently hired employees may feel uncertain in relation to potential employees from the younger generation, in whom the general knowledge of technological innovations is at a higher level [9]. Younger generations are familiar with new technologies from birth, which is why they are more enthusiastic about them. On top of that, they see the use of new technologies as something more natural and it comes to them with greater ease than to people who have learned to use new technologies at a later age [16]. The increasing number of intelligent and independent machines and devices is also treated as a threat that can drive people out of the workplace; leading to increasingly higher automation of production or service processes, they reduce the need for human labor [11].

Techno-uncertainty refers to the short life cycles of ICT solutions. Due to quick technological development, many work environments are experiencing frequent technological changes. This requires not only the introduction of more and more new devices, software and applications, but above all, it forces frequent modifications to the usual work patterns, which makes it difficult for employees to gain experience for a specific application or system. Ongoing changes and advancements of information and communication technologies cause employees to feel uncertain about their competencies and the need for continuous education to keep up with technological innovations used in the organization [14]. Often times, despite their initial enthusiasm for education and acquiring new skills, employees are quick to discover that their knowledge and skills are constantly getting outdated and need to be updated on an ongoing basis. Awareness of the need for continuous learning and updating of knowledge as well as the lack of job stability may be frustrating and demotivating [9].

Technostress inhibitors

Apart from the technostress creator factors, Tarafdar et al. [14] also indicated factors that protect the organization's employees from experiencing technological stress. Those included *Literacy facilitation*, *Technical support provision*, *Involvement facilitation*. The listed technostress inhibitors can balance the intensity and effects of technostress creator.

Literacy facilitation includes equipping employees with the necessary know-how, skills and competencies necessary to deal with ICT in the position they are employed in. This involves not only the current requirements of the position, but also the organization of trainings, apprenticeships and internships of employees for

the introduction of new technological solutions. Systematic distribution of knowledge in the area of emerging technological innovations reduces the diametrical nature of the changes [9]. Properly trained and equipped employees feel better prepared for changes, and therefore sense less stress, hence the very process of implementing changes runs smoothly and takes place with a much smaller number of employee errors in the context of using ICT [15]. It also includes the promotion by the organization of informal support from more experienced and competent employees for those with lower ICT skills. Sharing knowledge associated with technologies within the organization by colleagues often yields better results than participation in official trainings. This is done in a more accessible form, which reduces the impact of technostress creator and speeds up learning [6].

Technical support provision refers to the provision by an organization of quick and effective assistance from the technical support department in the event of problems in the ICT area. Awareness that an employee can count on professional assistance from the help desk during the execution of his everyday tasks reduces technostress and the fear of using ICT [14]. When, in the event of difficulties, an employee can count on friendly technical support, he will be more likely to use it more often, avoiding any attempts to intervene on his own, which may exacerbate problems. Smooth cooperation with the technological department limits the range of disruptions in the work process and reduces the effects of possible downtime. It also encourages staff to quick implementation of new solutions which may be innovative and creative for the production process [9].

Another factor reducing technostress in the organization is the *Involvement facilitation*. Building employee engagement is done by encouraging and involving them at various stages of implementation of the new ICT. First of all, employees are prepared for the introduction of new ICT solutions so that the introduced changes are not a surprise to them. This takes place through the prior informing of employees about the planned changes, their scope and how these changes will affect not just their job, but also the performance of individual departments and the entire organization. The optimal situation is when changes in ICT are not imposed by the management, but result from bottom-up suggestions and needs reported by the employees who use these technologies on a daily basis and who know the areas in which they require improvement [14]. The consultation process justifying the legitimacy of the introduced changes is followed by training on the technical aspects of the introduced solutions. It is important that after the completion of such training, employees are given time for independent test use and learning about the functions offered by new ICT solutions, until they gain confidence and skill in their use. Employees who feel personally involved in implementing and using ICT asses it more positively, use it more willingly, and experience less concern about it.

Technostress creators and technostress inhibitors identified by Ragu-Nathan et al. [11] have been confirmed in studies by, among others [6,7,13,15,18]. The *Technostress Creators and Technostress Inhibitors Scale* [11] is used to measure stress factors and protection factors. The scale is characterized by good psychometric properties. Cronbach's α for individual subscales is in the range of 0.77–0.87. There are other methods to measure technostress [15,19], but this one seems the most comprehensive.

Present research

In the recent years, owing to the previously unknown development of ICT on such a scale, the work environment has become a place of a large accumulation of stressors [8,15]. In the face of continuous development of ICT technology impacting the functioning of employees in the workplace, it is necessary to dispose of useful tools for measurement of both factors causing stress as well as those protecting from its impact at the workplace. One of the main reasons that have so far hindered research into occupational stress in the form of technostress in Polish organizations was the lack of a reliable and validated measurement tool on the Polish sample. For this purpose, a series of 3 studies was conducted to prepare the Polish adaptation of the *Technostress Creators and Technostress Inhibitors Scale*, proven in various countries [11]. Before starting the research, the authors' consent was obtained for the adaptation of the method.

The first issue considered in this series of studies is verification of the factor structure and internal cohesion of the Polish adaptation of the *Technostress Creators and Technostress Inhibitors Scale*. The simplest models of stress approach it as a nonspecific reaction of the organism assuming its general effect on human behavior [20]. More complex models involve a binary differentiation into sources of stress and factors of protection or internal and external factors [17]. Currently, the most common are multivariate models of stress that take into account in one model both sources, protection factors as

well as other variables such as individual variables, environmental properties [11,21]. The original version of the *Technostress Creators and Technostress Inhibitors Scale* has 8 factors [11]. This study also assumes that the optimal factorial solution is the 8-factor solution. The presented theoretical approach to stress served the construction of models of tools verified in the study: 1-, 2- and 8-factor.

Another goal of the research is to determine the validity of the measure and to check its equivalence and its measurement invariance [22]. So far, the authors of the questionnaire have not checked the validity of the tool by comparing its results with other recognized stress measurement tools [9]. These goals will be realized on the data obtained in the second study.

A major criterion for the usefulness of research tools used in psychology is their validity, i.e., criterion validity [23]. One of the indicators for external validity is to summarize the results obtained in a given questionnaire with those of another questionnaire measuring the given variable. In line with theoretical assumptions, the *Technostress Creators and Technostress Inhibitors Scale* is used to measure the severity of technostress creators and technostress inhibitors in the workplace. An indicator of the validity of the measure to be measured by technostress creators and technostress inhibitors should be a positive correlation with the scale used to measure the intensity of stress.

Another criterion of validity is the comparison of results obtained in a given questionnaire by different groups of respondents [22]. Measurement equivalence (functional invariance) describes the extent to which they measure a given construct in the same way in different groups [23]. Confirmation of this level of equivalence provides empirical evidence that they are the same number of latent factors in each group indicated by equivalent observable indices with an equal pattern of relationships between them [24]. The most common way for testing construct equivalence is the study of differences between women and men [23]. In the context of occupational stress, and technostress is often regarded as such, the differentiating criterion indicated often in the literature on the subject is seniority [11,18].

The third goal is to assess the stability of results by repeated testing on the same sample of people. The result obtained in a well-designed questionnaire should maintain stability during measurement across various points in time [25]. However, so far, no such analysis has been carried out for the original version [11] or its Chinese [15] or Indian [13] counterparts. The analysis of stability of results will be carried out in the third study. As recommended in the literature [23] in the case of the *Technostress Creators and Technostress Inhibitors Scale*, measurements were taken 2 weeks apart.

MATERIAL AND METHODS

Participants and procedure

The first study had 623 participants. The first researched group comprised 318 women, which represented 51% of the studied group, and 305 men making up the remaining 49%. The respondents are professionally active people who use ICT in their everyday work (computers, internet, mobile phones). The age of the respondents ranged 20–63 (M±SD 40.43±12.83). Organizations where work requires the use of ICT were asked to provide employees with a request to participate in the study. Employees interested in participation in the study filled in the online version of the measure.

The second study involved 451 people. There were 235 women, which represents 52.1% of the study group, and 216 men constituting 47.9%. The respondents are professionally active people who use ICT in their everyday work (computers, internet, mobile phones). The age of the respondents ranged 18–65 years (M±SD 40.06±13.05).

In the second study respondents were asked to provide a contact email for the second part of the study after 2 weeks. The provision of an email address was voluntary; it was understood as giving informed consent of the test subject to use this address for sending the second part of the study for scientific purposes. There were 300 people who decided to provide their email address. At the same time, it served for pairing answers from the same person from study 1 and 2.

After 2 weeks, the email was used to contact people from the first study of research and ask them to fill in the internet questionnaire once again. The task of the respondents who wanted to take part in the second stage of the study was to enter the internet address provided in the email where the questionnaire had been made available. An answer was obtained from 123 people, which gives a feedback rate of the second part of the study at the level of 41%. Analysis of the student's t-test for independent samples did not show statistically significant differences between the results collected from people who decided to take part in the second part of the study, and those who did not. Statistically significant differences also did not concern demographic data. Finally, in study 3 involved 123 people. There were

61 women, which represents 49.6% of the study group and 62 men constituting 50.4%. The age of the respondents ranged 20–65 (M±SD 38.68±12.14).

Measures

Before the first study, according to the recommendations of the scientific literature [22,26], the Polish version of the *Technostress Creators and Technostress Inhibitors Scale* was prepared. To prepare a Polish language version, the questionnaire was translated by 2 independent translators from English. Finally, together they agreed on one, correct version of the Polish translation of the questionnaire in terms of grammar, language and semantics. The common Polish version agreed by translators was subjected to back-translation into English, which showed a satisfactory correspondence with the original. The resulting Polish version of the questionnaire was used in these 3 studies.

The Polish translation of the scale, like the original version consists of 36 items. Statements are grouped into 8 scales. Depending on the scale, the number of items included in it ranges from 5 for the following scales: *Techno-overload*, *Techno-complexity*, *Techno-insecurity*, *Literacy facilitation*, 4 items for the following scales: *Techno-invasion*, *Techno-uncertainty*, *Technical support provision*, *Involvement facilitation*. The respondents are asked to indicate to what extent they agree with each of the statements on the use of technology in his workplace. Respondents are informed that the term "technology" in this study pertains to the information and communication technologies (ICT) such as internet, computers and mobile phones. The answers are given on a 5-point scale, from 1 (strongly disagree) to 5 (strongly agree). When described in item situation does not take place in their organizations respondents have sixth respondence: option 0 (not applicable). The score in each of the scales is the quotient of the sum of points obtained from answers to the questions on that scale, divided by the number of questions included in the scale. Thanks to this measure of calculating the results regardless of the number of items in the scale, it is possible to easily compare the severity of technostress creators and technostress inhibitors. The scope of possible results ranges 1–5. The higher the result, the greater the level of technostress creators and technostress inhibitors.

In the second study involved the use of the Polish adaptation of *Technostress Creators and Technostress Inhibitors Scale* described in the previous paragraph. The second measure used to measure the intensity of perceived stress was the *Perceived Stress Scale* – PSS-10) by Cohen et al. [20] in the Polish adaptation of Juczyński and Ogińska-Bulik [27]. The scale is used to measure the intensity of stress related to one's own life situation over the past month. The scale contains 10 questions that concern subjective feelings related to personal problems and events, behaviors and coping measures. The respondent provided his answers by entering the correct number (0 – never, 1 – almost never, 2 – sometimes, 3 – quite often, 4 – very often). The overall score of the scale is the sum of all points, the theoretical distribution of which is from 0 to 40. The higher the score, the greater the level of perceived stress. The tool is highly valid and reliable (Cronbach's α in this study is 0.84).

Statistical analyses

All analyses were performed using IBM SPSS Statistics 21.0 and IBM SPSS Amos 21. Statistical software was used to evaluate the psychometric properties of the Polish Version of the *Technostress Creators and Technostress Inhibitors Scale* [11], including factor structure, analysis of correlation between scales, validity, reliability and consistency of results. Parameters were estimated with the maximum likelihood method (MLE). In order to use all available data, the full information maximum likelihood (FIML) method was used.

Ethical considerations

The study was conducted in accordance with the guidelines of the Declaration of Helsinki, and all participants gave written informed consent. During the realization of studies, authors cared about maintaining the highest standards in the scope of scientific credibility of their design, conduct, collection, analysis and interpretation of the collected data.

RESULTS

Factor structure

Descriptive statistics (mean, standard deviation, skewness, kurtosis) of item from the Polish adaptation of *Technostress Creators and Technostress Inhibitors Scale* are presented in Table 1.

The *Technostress Creators and Technostress Inhibitors Scale* factor structure was first verified on the data obtained from the first study. To verify the factor structure of the Polish version of the questionnaire, was used CFA. With it, it was verified that the questionnaire had the following 3 model factor structure: 1-factor, 2-factor, and 8-factor models. The first model assumed

Table 1. Descriptive statistics of item from the Polish adaptation of *Technostress Creators and Technostress Inhibitors Scale* (study 1)

No.	Item	M	SD	Skewness	Kurtosis
r1	Ta technologia zmusza mnie do szybszej pracy / I am forced by this technology to work much faster	3.20	1.29	–0.57	–0.16
r2	Ta technologia zmusza mnie do wykonywania większej ilości pracy niż jestem w stanie wykonać / I am forced by this technology to do more work than I can handle	2.50	1.21	0.02	–0.64
r3	Ta technologia zmusza mnie do pracy w bardzo napiętych harmonogramach czasowych / I am forced by this technology to work with very tight time schedules	2.60	1.25	–0.02	–0.54
r4	Jestem zmuszony(a) zmienić swoje nawyki pracy, aby dostosować się do nowych technologii / I am forced to change my work habits to adapt to new technologies	2.86	1.32	–0.18	–0.68
r5	Odczuwam większe obciążenie pracą z powodu większej złożoności technologicznej / I have a higher workload because of increased technology complexity	2.49	1.28	0.22	–0.59
r6	Przez technologię spędzam mniej czasu z rodziną / I spend less time with my family due to this technology	2.59	1.32	0.26	–0.79
r7	Przez technologię muszę być w kontakcie z pracą nawet podczas wakacji / I have to be in touch with my work even during my vacation due to this technology	2.46	1.39	0.27	–0.89
r8	Muszę poświęcić wakacje i weekend, aby być na bieżąco z nowymi technologiami / I have to sacrifice my vacation and weekend time to keep current on new technologies	2.03	1.21	0.46	–0.48
r9	Wydaje mi się, że ta technologia narusza moje życie osobiste / I feel my personal life is being invaded by this technology	2.42	1.31	0.29	–0.75
r10	Nie mam wystarczającej wiedzy na temat tej technologii, aby zadowalająco poradzić sobie z moją pracą / I do not know enough about this technology to handle my job satisfactorily	2.07	1.17	0.33	–0.41
r11	Potrzebuję dużo czasu, aby zrozumieć i korzystać z nowych technologii / I need a long time to understand and use new technologies	2.19	1.22	0.38	–0.64
r12	Nie mam czasu na naukę i doskonalenie swoich umiejętności technologicznych / I do not find enough time to study and upgrade my technology skills	2.15	1.20	0.48	–0.44
r13	Poznaję nowych pracowników w tej organizacji, którzy wiedzą więcej na temat technologii komputerowej niż ja / I find new recruits to this organization know more about computer technology than I do	2.72	1.31	–0.13	–0.58
r14	Często uważam, że jest to zbyt skomplikowane, aby zrozumieć i korzystać z nowych technologii / I often find it too complex for me to understand and use new technologies	2.16	1.20	0.56	–0.48
r15	Czuję ciągłe zagrożenie dla bezpieczeństwa pracy przez nowe technologie / I feel constant threat to my job security due to new technologies	2.22	1.19	0.42	–0.51
r16	Muszę stale aktualizować swoje umiejętności, aby uniknąć zwolnienia / I have to constantly update my skills to avoid being replaced	2.50	1.36	–0.07	–0.77
r17	Jestem zagrożony(a) przez współpracowników z lepszymi umiejętnościami technologicznymi / I am threatened by coworkers with newer technology skills	2.19	1.35	0.40	–0.67
r18	Nie dzielę się wiedzą z moimi współpracownikami z obawy przed zastąpieniem mnie / I do not share my knowledge with my coworkers for fear of being replaced	1.90	1.22	0.76	0.02
r19	Uważam, że mniej jest dzielenia się wiedzą między współpracownikami z obawy przed zastąpieniem / I feel there is less sharing of knowledge among coworkers for fear of being replaced	2.38	1.34	0.25	–0.73
r20	Zawsze pojawiają się nowe osiągnięcia w technologiach, z których korzystamy w naszej organizacji / There are always new developments in the technologies we use in our organization	2.98	1.32	–0.48	–0.30

Table 1. Descriptive statistics of item from the Polish adaptation of *Technostress Creators and Technostress Inhibitors Scale* (study 1) – cont.

No.	Item	M	SD	Skewness	Kurtosis
r21	W naszej organizacji ciągle zmieniają się oprogramowania komputerowe / There are constant changes in computer software in our organization	2.44	1.36	–0.07	–0.63
r22	W naszej organizacji zachodzą ciągłe zmiany w sprzęcie komputerowym / There are constant changes in computer hardware in our organization	2.46	1.27	–0.01	–0.46
r23	W naszej organizacji są częste aktualizacje sieci komputerowych / There are frequent upgrades in computer networks in our organization	2.75	1.35	–0.21	–0.58
r24	Nasza organizacja zachęca do dzielenia się wiedzą, aby pomóc w radzeniu sobie z nowymi technologiami / Our organization encourages knowledge sharing to help deal with new technology	2.89	1.39	–0.42	–0.44
r25	Nasza organizacja kładzie nacisk na pracę zespołową w rozwiązywaniu problemów związanych z nowymi technologiami / Our organization emphasizes teamwork in dealing with new technology-related problems	2.86	1.39	–0.35	–0.45
r26	Nasza organizacja zapewnia szkolenie dla użytkowników przed wprowadzeniem nowej technologii / Our organization provides end user training before the introduction of new technology	2.91	1.49	–0.45	–0.71
r27	Nasza organizacja zapewnia dobre relacje między działem IT a użytkownikami technologii / Our organization fosters a good relationship between IT department and end users	2.77	1.48	–0.39	–0.62
r28	Nasza organizacja zapewnia użytkownikom technologii przejrzystą dokumentację na temat korzystania z nowych technologii / Our organization provides clear documentation to end users on using new technologies	2.79	1.42	–0.36	–0.49
r29	Nasz dział wsparcia technicznego dobrze sobie radzi z udzielaniem odpowiedzi na pytania dotyczące technologii / Our end user help desk does a good job of answering questions about technology	2.78	1.48	–0.43	–0.54
r30	Nasz dział wsparcia technicznego jest dobrze obsadzone przez osoby kompetentne / Our end user help desk is well staffed by knowledgeable individuals	2.87	1.49	–0.47	–0.58
r31	Nasz dział wsparcia technicznego jest łatwo dostępny / Our end user help desk is easily accessible	2.82	1.52	–0.43	–0.65
r32	Nasz dział wsparcia technicznego reaguje na prośby użytkowników / Our end user help desk is responsive to end user requests	2.87	1.48	–0.51	–0.47
r33	Zachęcamy naszych pracowników do wypróbowania nowych technologii / Our end users are encouraged to try out new technologies	3.01	1.45	–0.64	–0.29
r34	Nasi pracownicy są nagradzani za korzystanie z nowych technologii / Our end users are rewarded for using new technologies	2.34	1.47	–0.04	–0.96
r35	Nasi pracownicy są informowani przed wprowadzeniem nowej technologii / Our end users are consulted before introduction of new technology	3.00	1.42	–0.61	–0.23
r36	Nasi pracownicy są zaangażowani w zmianę i/lub wdrażanie technologii / Our end users are involved in technology change and/or implementation	2.77	1.39	–0.40	–0.40

Study 1 consisted in completing online questionnaires. They were carried out in March–May 2020 among 632 employees from all over Poland who use information and communication technologies (ICT) in their everyday work. English version by [11].

the existence of 1 general stress factor [20]. The second one took into account the presence of 2 factors: technostress creators and technostress inhibitors [17]. The last of the tested models in line with the original language version suggested an 8-factor solution [11]. The verified models were drawn from approaches to stress most frequent in the subject literature. The fit indices for the proposed models are presented in Table 2.

The first model assuming the existence of 1 general factor turned out to be poorly fitted: the value of χ^2 was high and the value of RMSEA and SRMS exceeded the recommended cut off < 0.08) [28]. A high value of χ^2 implies high values of the fit indices that are based on it, such as CFI [29], which means the 1-factor model must be rejected. Similarly, the model distinguishing 2 factors: technostress creators and technostress inhibitors, was characterized by poor fit indices [28], which makes it necessary to reject this model as well.

The third model assuming the occurrence of 8 intercorrelated factors. *Techno-overload*, *Techno-invasion*, *Techno-uncertainty*, *Techno-complexity*, *Techno-insecurity*, *Literacy facilitation*, *Technical support* provision, *Involvement facilitation* met the criteria set for well-suited models. The system of factors proposed in the original version of the tool [11], after calculating the confirmatory factor analysis, turned out to be well fit to the data in the light of statistical criteria: $\chi^2 = 2485.35$, $p < 0.001$; $\chi^2/df = 4.47$ (appropriate values for χ^2/degrees of freedom should exceed 1 and should be <5) and RMSEA = 0.07 (desired level <0.08) and SRMR = 0.06 (desired level <0.08) [28] to and fitted the data sufficiently in terms of the goodness-of-fit indices: CFI = 0.91 and Tucker-Lewis index: TLI = 0.90 [29]. The obtained values of fit indices are acceptable as they are close to those obtained in the validation of other measures for measuring psychological variables [28].

As a result of this survey, the 8-factor structure of the *Technostress Creators and Technostress Inhibitors Scale* was confirmed. In the assumed model, confirmed was not just the 8-factor structure, but also the relations between those factors. Each factor loading is significant at the $p < 0.01$ level. The factor loading of all items in the questionnaire are at a satisfactory level, ranging 0.60–0.76 (Table 3). Assuming a correlations between the observable variables (average scores in factors) which is in the range of 0.20–0.67 (Table 4).

The values of the Pearson r correlation coefficient between individual scales of the questionnaire (Table 4) are at high, moderate and low levels [24]. The analysis of correlation between the scales making up the questionnaire reveals that the highest correlation was obtained between the *Technical support provision* and *Involvement facilitation* scales ($r = 0.67$, $p < 0.001$), and the lowest between the *Techno-complexity* and *Technical support provision* scales ($r = 0.20$, $p < 0.001$). High and moderate correlations were obtained between the scales falling under the categories of technostress creators and technostress inhibitors. In turn, low correlation values connect the scales between technostress creators and technostress inhibitors.

Table 2. Confirmatory factor analyses of the *Technostress Creators and Technostress Inhibitors Scale* (study 1)

Model	χ^2	df	CFI	TLI	SRMR	RMSEA
1-factor	9648.36	595	0.48	0.45	0.18	0.16
2-factor	5717.74	593	0.71	0.69	0.22	0.11
8-factor	2485.35	566	0.91	0.90	0.06	0.07

CFI – comparative fit index, RMSEA – room-mean-square error, SRMR – standardized room-mean-square residual, TLI – Tucker-Lewis Index. Study 1 consisted in completing on-line questionnaires. They were carried out in March–May 2020 among employees from all over Poland who use information and communication technologies (ICT) in their everyday work.

Description and reliability

After determining the factor structure, descriptive statistics and reliability were calculated for the obtained Polish version of the scale. Table 5 demonstrates descriptive statistics and Cronbach's α coefficients for each of the 8 scales making up the questionnaire: *Techno-overload*, *Techno-invasion*, *Techno-complexity*, *Techno-insecurity*, *Techno-uncertainty*, *Literacy facilitation*, *Technical support provision*, *Involvement facilitation*. The values of responses on the scales making up the questionnaire are within the range 1–5. The highest value was obtained for the *Literacy facilitation* scale M±SD = 2.85±1.24, while the lowest value was obtained for the *Techno-insecurity* scale M±SD = 2.23±1.02.

The reliability of the questionnaire defined as the consistency of results in individual scales was measured with Cronbach's α coefficient [23]. The results presented in Table 5 show that the consistency of individual scales is at a satisfactory level and is in the range of 0.82–0.95 [24]. Also estimated was the impact of removing the item on the coefficient of internal consistency of the subscale to which the item belongs. Removing any of the test items does not increase the reliability factor in any of the scales. The values of Cronbach's α reliability obtained for the Polish version of the questionnaire are at a higher level than in the original version of the tool [11]. The exception is the *Techno-overload* scale,

Table 3. Factor loadings (study 1)

Item	Factor loading							
	Techno-overload	*Techno-invasion*	*Techno-complexity*	*Techno-insecurity*	*Techno-uncertainty*	*Literacy facilitation*	*Technical support provision*	*Involvement facilitation*
r1	0.601							
r2	0.634							
r3	0.761							
r4	0.702							
r5	0.710							
r6		0.662						
r7		0.623						
r8		0.601						
r9		0.621						
r10			0.676					
r11			0.674					
r12			0.661					
r13			0.680					
r14			0.713					
r15				0.646				
r16				0.621				
r17				0.612				
r18				0.691				
r19				0.746				
r20					0.766			
r21					0.760			
r22					0.724			
r23					0.755			
r24						0.729		
r25						0.722		
r26						0.749		
r27						0.759		
r28						0.760		
r29							0.708	
r30							0.744	
r31							0.733	
r32							0.659	
r33								0.725
r34								0.759
r35								0.628
r36								0.625

Study 1 consisted in completing online questionnaires. They were carried out in March–May 2020 among 632 employees from all over Poland who use information and communication technologies (ICT) in their everyday work.
All factor loadings are significant at $p < 0.001$.

Table 4. Correlations between factors (study 1)

Variable	Study 1 correlation							
	1	2	3	4	5	6	7	8
1. *Techno-overload*	1							
2. *Techno-invasion*	0.59	1						
3. *Techno-complexity*	0.57	0.62	1					
4. *Techno-insecurity*	0.57	0.58	0.68	1				
5. *Techno-uncertainty*	0.41	0.39	0.31	0.46	1			
6. *Literacy facilitation*	0.34	0.36	0.22	0.26	0.56	1		
7. *Technical support provision*	0.23	0.23	0.20	0.21	0.56	0.60	1	
8. *Involvement facilitation*	0.27	0.22	0.23	0.27	0.57	0.64	0.67	1

Study 1 consisted in completing online questionnaires. They were carried out in March–May 2020 among 632 employees from all over Poland who use information and communication technologies (ICT) in their everyday work.
All correlation coefficients are significant at $p < 0.001$.

which can boast a slightly higher reliability in the original language version.

External validity – study 2

To assess the external validity of the *Technostress Creators and Technostress Inhibitors Scale*, the results in individual subscales were correlated with those obtained using the *Perceived Stress Scale*. The descriptive statistics for results obtained in both questionnaires and the Pearson's correlation coefficients (r) between them are presented in Table 6. The values of correlation coefficients between the results in the *Technostress Creators and Technostress Inhibitors Scale* and the *Perceived Stress Scale* are at a moderate level. At the same time, the scales included in technostress creators (*Techno-overload*, *Techno-invasion*, *Techno-complexity*, *Techno-insecurity*, *Techno-uncertainty*) correlate positively, and the scales measuring the intensity of technostress inhibitors (*Literacy facilitation*, *Technical support provision*, *Involvement facilitation*) correlate negatively.

In addition to checking the factor structure of the questionnaire using CFA also checked as its measurement invariance (MI) across professional experience of using the technology. In order to testing of the configural, metric and scalar measurement invariance across groups is the multigroup confirmatory factor analysis (MGCFA).

Checking configural invariance was done by verifying the unconstrained model, which was assumed to that item intercepts, factor loadings, and error variances can vary groups distinguished due to professional experience. Metric invariance was testing using the model in which factor loadings were marked as equal in all separated groups. In the third model for testing scalar invariance additionally assumed intercepts were constrained to be equal in all separated groups. For the purpose of analyses, 4 groups were distinguished due the professional experience: the first group were people with a professional experience with ICT of under a year, the second group consisted of people working for 1–5 years, the third group had been working for 6–10 years, and the fourth group included people with >10 years of experience in a position using technologies.

The results of analyses demonstrated that the model has satisfactory parameters of adjustment to data in all groups of employees distinguished according to

Table 5. Descriptive statistics and test reliability (study 1)

Variable	Study 1				
	min.	max	M	SD	α
Technostress creator					
Techno-overload	1	5	2.73	1.02	0.86
Techno-invasion	1	5	2.37	1.05	0.82
Techno-complexity	1	5	2.26	0.96	0.84
Techno-insecurity	1	5	2.23	1.02	0.85
Techno-uncertainty	1	5	2.65	1.09	0.85
Technostress inhibitor					
Literacy facilitation	1	5	2.85	1.24	0.89
Technical support provision	1	5	2.83	1.41	0.95
Involvement facilitation	1	5	2.78	1.25	0.90

Study 1 consisted in completing online questionnaires. They were carried out in March–May 2020 among 623 employees from all over Poland who use information and communication technologies (ICT) in their everyday work.

Table 6. Descriptive statistics and correlation coefficients for the *Technostress Creators and Technostress Inhibitors Scale* and *Perceived Stress Scale* 10-item questionnaire (PSS-10) (study 2)

Variable	Study 2						
	Technostress Creators and Technostress Inhibitors Scale					PSS-10	
	min.	max	M	SD	α	Pearson's r	p
Technostress creator							
Techno-overload	1	5	2.69	0.96	0.88	0.42	<0.001
Techno-invasion	1	5	2.38	1.01	0.84	0.45	<0.001
Techno-complexity	1	5	2.33	0.91	0.86	0.44	<0.001
Techno-insecurity	1	5	2.26	0.95	0.87	0.44	<0.001
Techno-uncertainty	1	5	2.57	1.03	0.88	0.30	<0.001
Technostress inhibitor							
Literacy facilitation	1	5	2.70	1.20	0.92	–0.41	<0.001
Technical support provision	1	5	2.68	1.40	0.96	–0.47	<0.001
Involvement facilitation	1	5	2.66	1.29	0.91	–0.42	<0.001
PSS-10	0	40	16.01	8.28	0.84		

Study 2 consisted of online completion of questionnaires. It was conducted in January–March 2021 among 451 employees across Poland who use information and communication technologies (ICT) in their everyday work.

professional experience and displays the same structure and comparable patterns of factor loadings of statements with latent factors of the scale. The assumed 8-factor measurement model accurately describes the structure of the construct in each group. No statistically significant differences were found between the groups of employees distinguished according to professional experience in the fit level of the model $\chi^2 = 106.31$, $p = 0.09$. In each of the distinguished groups, the model was well fit. In next steps done MGCFA. The fit of the configural model to the data in all 4 groups was acceptable, indicating that configural invariance was achieved. In next analysis, factor loadings were marked as equal in all groups. The model comparison confirmed good metric invariance. In next analysis, equality constraints were imposed on all item intercepts to test scalar invariance. Model comparison supported scalar invariance of the *Technostress Creators and Technostress Inhibitors Scale* regardless of professional experience of using the technology.

Measurement stability – study 3

The use of the test-retest measure was verified by applying the measurement measure 2 weeks apart [23]. The correlation coefficients of the second measurement with the initial measurement are presented in Table 7.

In all *Technostress Creators and Technostress Inhibitors Scales*, a satisfactory measurement stability was achieved [25]. Pearson's r correlation coefficients between the baseline and 2 weeks later are high and very high [24]. The mean results of the 2 measurements are similar. The t tests for the repeated measurement did not indicate statistically significant differences.

DISCUSSION

Confirmatory factor analysis (CFA) demonstrated that the best adjustment to data characterizes the model assuming the occurrence of 8 correlated factors: *Techno-overload*, *Techno-invasion*, *Techno-uncertainty*, *Techno-complexity*, *Techno-insecurity*, *Literacy facilitation*, *Technical support provision*, *Involvement facilitation*. This model follows the primary concept of the authors of the original *Technostress Creators and Technostress Inhibitors Scale* [11]. The 8-factor solution was also confirmed in other adaptations of the measure [13,15,18].

As in the original version, intercorrelations between the factors were obtained [11]. High and moderate correlations were achieved between the scales falling into the category of technostress creator (*Techno-overload*, *Techno-invasion*, *Techno-uncertainty*, *Techno-complexity*, *Techno-insecurity*) and technostress inhibitors (*Literacy facilitation*, *Technical support provision*, *Involvement facilitation*). Various sources of stress often coexist, and their accumulation may intensify symptoms of stress [17].

Table 7. Pearson's r correlations and t-tests for 2 measures (study 3)

Variable	Study 3					
	M	SD	Pearson's r	p	t	p
Techno-overload			0.72	>0.001	–0.55	0.59
1	2.84	0.93				
2	2.90	0.89				
Techno-invasion			0.65	>0.001	–0.96	0.31
1	2.47	1.06				
2	2.59	1.08				
Techno-complexity			0.79	>0.001	–0.22	0.82
1	2.38	0.93				
2	2.40	0.95				
Techno-insecurity			0.63	>0.001	–1.33	0.19
1	2.31	0.92				
2	2.43	1.01				
Techno-uncertainty			0.77	>0.001	–0.59	0.55
1	2.89	0.87				
2	2.93	0.86				
Literacy facilitation			0.68	>0.001	1.33	0.19
1	3.19	0.93				
2	3.05	1.09				
Technical support provision			0.66	>0.001	1.55	0.13
1	3.23	1.02				
2	3.05	1.26				
Involvement facilitation			0.69	>0.001	0.61	0.54
1	3.09	0.98				
2	3.03	1.05				

Study 3 involved the completion of online questionnaires. It was conducted in February–April 2021 among 123 employees across the country who use information and communication technologies (ICT) in their everyday work.

In a situation which involves an excessive overload of an individual with ICT technology, and the requirements of the work environment in terms of its use beyond the capabilities of the employee, technostress appears [9]. The pace of technology development has never been faster in history than it is today [2]. The emerging devices are becoming more and more complex, which requires employees to constantly learn and improve their qualifications [6]. In extreme cases, despite the use of the latest ICT solutions, employees have much more work, because the pace and the number of duties increases. Therefore, they are forced to take their work home, and their family system suffers [4]. At the same time, due to the progressive automation and the emergence of better educated employees in terms of handling technology, job security is reduced, which can be a strong source of stress for employees [11].

As in the case of technostress creators, high and moderate correlations were obtained between the scales included in the technostress inhibitors category. Distinguished by Tarafdar et al. [14] factors counteracting technostress regard the support of employee resources to cope with the increasing demands of the work environment in terms of ICT application. Those include mainly the supplement of knowledge, skills and competencies in the scope of ICT handling and providing consultancy support from professionals. It is also helpful to properly prepare for the use of ICT and build involvement among employees in the implementation of new technologies [11].

Weak negative relationships have been revealed between the scales measuring technostress creators and technostress inhibitors. Protection factors constitute a kind of buffer reducing the impact of risk factors, modifying their potential negative impact, and thus increasing the individual's resistance to difficult life situations so that he can better cope with them [21]. Analogically, with minor resources protecting even the small effect of technostressors, it can be received as a serious threat exceeding the capabilities of an individual [17]. The appearance of technostress creators in the workplace of an individual is not synonymous with the inevitability of difficulties or the development of technostress, but it significantly increases the risk [11]. A better understanding of the protective factors gives new possibilities to counter technostress. Traditional stress prophylaxis focusing mainly on threats and reducing the impact of risk factors, e.g., by limiting access to ICT, with today's omnipresence of new technologies, may prove insufficient in preventive measures [2]. Therefore, pro-preventive activities should focus on developing employee resources and increasing adaptability to new technologies [7,15,18].

Cronbach's α-coefficients obtained for all scales are at a high level, which indicates a satisfactory consistency of the measure [23,24,29]. The obtained reliability indicators were even higher than those observed in the original study [11], which encourages the use of this measure in research and screening in the population of Polish workers who have contact with modern technologies in their work.

The *Technostress Creators and Technostress Inhibitors Scale* correlates with the intensity of stress assessed on the basis of the *Perceived Stress Scale*. Whereby, the scales belonging to technostress creators (*Techno-overload*, *Techno-invasion*, *Techno-complexity*, *Techno-insecurity*, *Techno-uncertainty*) correlate positively, and the scales measuring the intensity of technostress inhibitors (*Literacy facilitation*, *Technical support provision*, *Involvement facilitation*) correlate negatively. The obtained coefficients exceeded the level of statistical significance, which justifies the claim that the adapted measure used to measure technostress creators and technostress inhibitors is theoretically valid. The level of correlation does not go beyond moderate [24], which indicates that the measured constructs are similar, but they are relatively independent of each other.

The PSS-10 scale serves to measure subjectively felt general stress associated with various issues and personal events regarding different spheres of human life [20]. In turn, the *Technostress Creators and Technostress Inhibitors Scale* is used to determine the severity of stress creators and stress inhibitors in more specific conditions, such as the impact of new technologies in the workplace [11]. The overall measurement of stress informs us about a certain nonspecific reaction of the body to any requirement made from the outside [17]. However, the use of the most specific forms of measuring sources and protection factors reflects their importance for the life and development of a given person [1,4]. This allows for a more relevant reaction and modification of the environment in which a human is functioning to remove or minimize the ailments of the causes of perceived stress [12]. The *Technostress Creators and Technostress Inhibitors Scale* is more accurate for diagnosing the severity of stress related to the functioning of employees in an ICT environment.

The developed Polish version of the *Technostress Creators and Technostress Inhibitors Scale* is an equivalent measure. The 8-factor model of sources of stress and protection factors underlying the construction of the scale has found confirmation in groups that differ due to their professional experience in using ITC in their workplace. The theoretically adopted measurement model provides a good description of the scale structure in the analyzed groups. The multigroup confirmatory factor analysis supported measurement invariance of the *Technostress Creators and Technostress Inhibitors Scale* regardless of professional experience of using the technology.

High correlations between the results of studies collected over a period of time and the lack of statistically significant differences between them indicate a high stability of results [24,25] obtained using the *Technostress Creators and Technostress Inhibitors Scale*. Such a result in the context of perceived stressors and protection factors points to their stability and the maintenance of an unchanged level for a longer period of time. Working conditions and how work is organized are relatively constant in most workplaces. The external and internal setting of an organization can impact stressors in various ways, increasing or weakening their effect on employees [30]. If the intensity of stressors is low, it does not constitute a heavy burden for working people, however, long-term work in conditions of high intensity of technological stressors may have negative consequences for the health and quality of life of employees [9]. The situation is quite opposite for protectors. In this case, desirable is their long-term high level, and quick changes are necessary in a situation when their level does not

provide employees with effective and efficient protection against stress [17].

Practical implications and limitations

The demonstrated research comes with certain limitations. Because the phenomena of technostress are complex and multidimensional, limiting ourselves to questionnaire surveys may be a kind of simplification of the studied subject [12,21]. Future studies on technostress could include the measurement of physiological indicators by using mixed research designs, and more objective empirical data could be obtained. At the same time, it reduces the susceptibility to the variable of social approval, which may affect questionnaire research based on self-report, especially when conducted within an organization. The adapted scale serves to study people working with ITC; hence the scope of its use is limited. Owing to the fact that technological changes are constantly progressing, it is also worth consider preparing a version of the scale addressed not only to employees who are dealing with ITC on a daily basis, but also to ordinary people who, due to the continuous technological development in their environment, are exposed to the presence of numerous sources technostress. Pursuing the latest trends in the construction of measures encouraging the use of the shortest possible measures, a desired procedure would also be to prepare a shortened version of the measure. Another limitation is that the results of the *Technostress Creators and Technostress Inhibitors Scale* were not compared with another technostress measure to assess its validity, as this is the first measure in Poland used to examine technostress. Instead, it was used the *Perceived Stress Scale* which is a more general measure. It should be noted that the Polish version of the *Technostress Creators and Technostress Inhibitors Scale* requires further research. The relationships between the results and various individual and organizational variables that may be predictors of technostress should be determined, e.g., industry, organizational climate, personality variables.

CONCLUSIONS

Looking at the past dynamics of development of ITC, it should be assumed that technological solutions will contribute even more greatly to introducing ICT into everyday life, work or entertainment [2]. This process will intensify even more, and thus negative feelings of technostress will become more and more common among ITC users [1,2,7] hence the need to produce a useful measure for the diagnosis of technostress. For this purpose, 3 studies were conducted to determine the psychometric properties of the Polish adaptation of the *Technostress Creators and Technostress Inhibitors Scale*.

The first study confirmed compliance of the factor structure of the Polish version of the *Technostress Creators and Technostress Inhibitors Scale* with the original version. The RMSEA index <0.07 proves a good fit of the data collected on the Polish sample to the 8-factor theoretical model of technostress proposed by Ragu-Nathan et al. [11]. On top of that, the factor structure is maintained taking into account different subgroups distinguished by gender and experience of using ITC, which proves the equivalence of the translated questionnaire (study 2). Correlations between scales belonging to the category of technostress creators and technostress inhibitors are at a low level. Nevertheless, it confirms the dependence, known in psychology for a long time, that the stronger the resources and factors protecting against stress, the less it affects the functioning of people, whether in everyday or professional life [17,21,30]. This is evidenced also by the correlation of the *Technostress Creators and Technostress Inhibitors Scale* with the Polish adaptation of the *Perceived Stress Scale* [20]. The overall score in the *Perceived Stress Scale* is positively related to stress factors and negatively to conservation factors. The mentioned correlations with another recognized measure for measuring stress confirm the external validity of the Polish version of the *Technostress Creators and Technostress Inhibitors Scale*.

High test reliability rates (even higher than in the original version) and high stability over time of the measurement results should be considered consistent with the requirements for psychological questionnaires [23–25]. This allows to conclude that the scale may be used in scientific research as well as in the prevention of technostress in work environments where employees are dealing with ITC. Beside good psychometric properties, the scale offers the possibility of easy calculation of results and their quite simple interpretation, which makes it a useful organizational measure. Accurate diagnosis of the factors causing technostress in the workplace, based on a reliable measure, can provide the management staff in the organization with information that will contribute to taking actions reducing the significance of technostress creators [15]. Effective counteraction of technostress is primarily related to becoming familiarized with it, and

in particular to identifying the factors that cause its appearance in the organization [9,12]. Excessive exposure to stressors associated with new technologies translates into the need for interventions at an organizational level (the aim of which should be to eliminate or reduce the intensity of unfavorable technostress creators in the work environment) and at the individual level (aimed at strengthening the resources of employees, i.e., properties that condition good coping with technostressors) [3,8,21]. Moreover, information obtained thanks to the *Technostress Creators and Technostress Inhibitors Scale* can serve as the basis of actions strengthening technostress inhibitors as an effective protection against technostress [11]. Employee involvement in the introduction of technological changes, properly selected employee training and support of IT departments are protective factors that should be monitored and developed in every organization that remains in contact with ITC [14].

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