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The impact of Techno stress on Work Performance and the moderating influences

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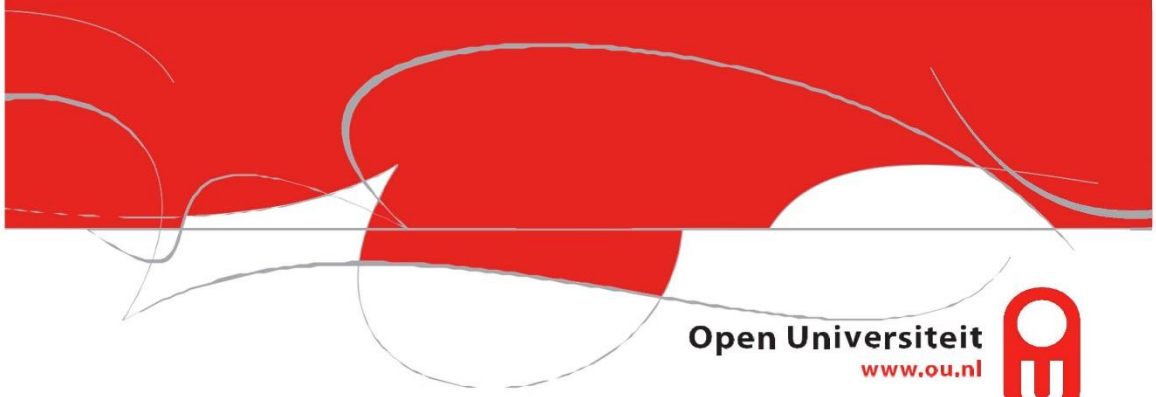

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The impact of Techno stress on Work Performance and the moderating influences

De impact van Techno stress op de werk prestatie en de modererende invloeden

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Abstract

The aim of this research is to investigate the relationship between technostress and work performance and the moderating influence on this relationship. Previous research indicates that it is not clear how technostress influences work performance exactly. This research tries to answer how technostress is related to the different levels of work performance. The study has been carried out in multiple organizations with different backgrounds. For this study 94 cases have been analysed using a pls analysis. The results show that there is a negative relationship between technostress and the different levels of work performance. This negative relationship is statistically significant. This was tested by using a bootstrap validation. The moderating constructs were divided into stress inhibitors and stress promotors. The analysis shows that the stress inhibitors had a moderated the relationship between technostress and work performance in a way that is was less negative. Stress promotors moderated the relationship between technostress and work performance in such a way that is was more negative. However the results were not significant after running a bootstrap validation.

Key terms

Technostress, work performance, stress inhibitors, stress promotors, transactional model of stress and coping.

Summary

Motivation and relevance of the study

The rise of technostress is a concern shared by the Dutch union FNV. The increase use of laptops, tablets and smartphones can give rise to technostress. This emerging problem has an effect on the society and the work place. In order to better understand how technostress influences work it is necessary to research this relationship.

Problem statement

The goal of this study was to better understand what influence technostress has on the different levels of work performance. The following research questions were proposed to answer this: *Does technostress have a significant impact on work performance. Which moderators have an effect on the relationship between technostress and work performance?*

Research method

This research focussed on the population who performs deskwork activities. The study had a cross sectional design. Data collection occurred by an online survey. The survey was sent to 118 email addresses. In total 94 participants filled in the survey, which were used for the analysis.

Technostress is a second order formative construct, consisting of five first order reflective construct. Work performance is a second order formative construct, consisting of three first order reflective constructs. These reflective constructs are task performance, contextual performance and counter productive work behaviors. The moderating effects were measured using five constructs. Support, training, autonomy, bonus are a construct consisting of one items. Overload is a first order reflective construct consisting of two items. The survey was offered both in English and in Dutch. To measure

technostress an English version was translated to Dutch. The work performance measurement had an English and Dutch version available.

Main outcomes

To answer the research questions two models were build.

The first model concentrates on the relationship between technostress and the different first order reflective constructs of work performance. The relationship between technostress and task performance had a path coefficient of -0,2975. This had a T-score of 10,718. The relationship between technostress and contextual performance had a pathway coefficient of -0,4885. The T-score for this is 4,3515. The last relationship for this model is between technostress and counter productive behaviour. This produced a pathway coefficient of -0,1502 and a T-score of 4,7289.

The second model focussed on the moderating constructs on the relationship between technostress and work performance. The moderating influence of autonomy had a pathway coefficient of 0,1987 and a T-score of 0,5078. Bonus had a moderating influence with a pathway coefficient of 0,0752 and a corresponding T-score of 0,4431. When the construct support is evaluated it produces a pathway coefficient of 0,0807 along with a T-score of 0,1359. The construct training had a pathway coefficient of -0,4464 with a T-score of 1,4859. The last moderating construct of this model is overload. This construct had a pathway coefficient of -0,4298 and a T-score of 1,0414.

Conclusions and recommendations

The relationship between technostress and the second order reflective constructs of work performance show a negative relationship. However this was not expected for the construct counter productive work behaviors. The difficulty of measuring this construct might be a cause for this outcome. The bootstrap validation shows that the results were significant. The stress inhibitors moderate the relationship between technostress and work performance less negatively. This is true except for the construct training. The difficulty to standardize the construct training might be an explanation for this unexpected result. Bootstrap validation shows that all stress inhibitors did not have a statistically significant T-score. The stress promotors moderate the relationship between technostress and work performance more negatively. However bootstrap validation shows that the results are not statistically significant. The study has several limitations. The sample size of 94 is relatively small. Because of the sample size it was not possible to check for control variables. This would decrease the sample size even more. Long term effects could not be measured because of the cross sectional design of the study. Since the moderators did not provide a statistically significant outcome it is advisable to extend the literature search for future research. Another shortcoming is that work performance was measured by the participants view of their performance. This view of performance might not be correlated with the actual work performance. Also the amount of exposure to technology was not measured in this study. The amount of hours working with technology could have an effect on work performance. From a practical point of view it is advised to monitor technostress regularly so that technostress can be avoided. This way technostress will have less influence on the work performance of employees.

Contents

1. Introduction

1.1. Background

Our working and private lives are more and more dominated by the use of Information and Communications Technologies (ICTs) (Ortt, 2018). Besides the positive effects associated with the use of these ICTs there are also negative effects. As such, people who rely on the use of ICTs intensively in their work can also experience increasing levels of stress and strain. This phenomenon is often referred to as technostress (Ayyagari, Grover, & Purvis, 2017). The term technostress was first introduced by Brod, 1984 and Wang, Shu, & Tu, 2008 where technostress was defined as: "a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner". Weil and Rosen expanded the definition of technostress to include "any negative impact on attitudes, thoughts, behaviours or psychology caused directly or indirectly by technology" (Wang et al., 2008). Technostress is also labelled by researchers with various terms like: technophobia, cyber phobia, computer phobia, computer anxiety, computer stress, negative computer attitudes, and other similar terms (Wang et al., 2008).

The current literature describes technostress as manifesting itself in several aspects, this includes overload, invasion of an individual's privacy and work-life balance, frustration due to the increasing complexity of technology and occupational crisis (Wang et al., 2008). Dimensions developed by Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007 that puts technostress in five components. The five components are:

1. Techno-overload: The ICTs pushes employees to work faster.
2. Techno invasion: The pervasive ICTs invades personal life.
3. Techno-complexity: The complexity of new ICTs makes employee feel incompetent
4. Techno-insecurity: The job security of employees threatened by fast changing ICTs
5. Techno-uncertainty: The constant changes, upgrades and bug fixes in ICT hardware and software impose stress on end users.

Several studies have investigated the antecedents of technostress (Bloom, 1985). These studies found that a scarcity of computer abilities and experience are the major causes of computer related technostress. These are examples of techno-complexity and techno-uncertainty. Computer anxiety is also very common as a cause for technostress. Research done by Doronina, 1995 shows several types of computer anxiety. The fear of breaking the computer, a feeling of ignorance, anxiety for math and new technologies. These are also examples of techno-complexity and techno-uncertainty. Time panic is another form of anxiety. This is the feeling of not having enough time to finish the task at hand and getting overwhelmed by the feeling of not understanding and remembering everything to finish the task properly. This is an example of techno-overload.

Research performed by Sarabadani, Carter, & Compeau, 2018 shows that technostress has a negative impact on work performance. Based on previous research a strong case on be made that there is a direct

negative causal relationship between technostress and work performance. The question remains what influence technostress has on the different dimensions of work performance. Research performed by Sarabadani et al., 2018 clearly states that this is still unknown.

Fortunately, there are also studies that deal with coping strategies for technostress. Two major strategies arise from the existing literature: Emotion-focused strategies and problem-focused strategies (Monat, A., & Lazarus, 1991).

Emotion-focused coping refers to thoughts or actions with the aim of reducing the emotional impact of stress. Such strategies of coping do not actually alter the threatening or damaging conditions, it is aimed at making the person feel better. Examples are avoiding thinking about the trouble, denying that anything is wrong, distancing or detaching oneself as in joking about what makes one feel distressed, or taking tranquilizers as an attempt to relax.

Problem-focused coping strategies are referred to as direct approaches, while emotion-focused coping strategies are indirect approaches.

However, these two types of coping strategies also have negative impacts. For instance, although technology-based training is an effective alleviating tactic, when a company frequently trains its employees, the routine work time and leisure time of employees may be reduced. Which in turn causes higher stress. Therefore one must be careful in choosing these coping strategies.

Research performed by Ahmad, Amin, & Wan Ismail, 2014 investigates several types of coping strategies. The result this research showed that technical support had a positively inhibits techno stressors in the case of techno-overload. This coping method has the characteristics of a problem-focused strategy. Based on the literature it can be said there is little known about effective coping strategies.

What is also not addressed in previous studies is what other moderating effects there might be on the relationship between technostress and work performance.

1.2. Problem statement

In recent years, there has been an increase in the number of studies surrounding the topic of technostress. Researchers have investigated the role of technostress in influencing job satisfaction (Tarafdar, Tu, & Ragu-Nathan, 2011) (Srivastava, Chandra, & Shirish, 2015) , burnout (Tarafdar et al., 2007) (Ayyagari et al., 2017). However up to this date there has been a gap in studies investigating the relationship between technostress and individual performance (Hanaysha, 2015). Especially how technostress influences work performance (Sarabadani et al., 2018). It is also not clear which coping strategies have a positive effect on dealing with technostress, as well as other moderating effects that can influence the relationship between technostress and work performance positively or negatively. The aim of this research is to understand the relationship between and work performance and what the moderating influences are on this relationship

1.3. Research objective and questions

Based on the problem statements presented earlier the objective of this research is to better understand the factors that moderate the relationship between technostress and work performance. Another aim is to identify which dimensions of technostress have a significant impact on the relationship between technostress and work performance and which do not have a significant impact. This leads to the following research questions.

Does technostress have a significant impact on work performance?

Which moderators have an effect on the relationship between technostress and work performance?

1.4. Motivation/relevance

Technostress is increasingly featured in the public discussion. For example, the FNV, a Dutch labor union, have made their concerns about technostress public. They see the risks of ever-increasing use of mobile work with laptops, tablets and smartphone use. Their main concern lies with the psychological and physical effects of technostress. To deal with this issue Popma, 2012 performed research on how pervasive of a problem technostress is for the society. His research concludes that technostress is an emerging problem for society and the work place. Therefore, it is important to better understand the mechanisms that drive technostress and the effects it has on the workplace.

1.5. Main lines of approach

The goal of this paper is to develop and empirically validate a model of technostress. In order to achieve this goal recent literature related to technostress in combination with work performance will be reviewed. Based on this review a new theoretical model will be proposed. After this data will be collected to test this model empirically. All relationships in the model will be tested to see which components of the model are significant.

2. Theoretical framework

This section provides the theoretical framework. This section provides an overview of how the theoretical framework was developed. It starts with how literature was searched and how it was reviewed. Based on the results of the literature review a theoretical framework has been build. This section ends with the hypothesis to test the theoretical framework.

2.1. Research approach

The aim of this research paper is to investigate the moderating role of task related variables and stress inhibitors on the relationship between technostress and work performance. In order to research this topic a theoretical framework has to be build. To review the literature a search query has to be used for a search engine. This produces an output of several research articles. After determining which articles are relevant, a theoretical framework can be built. This framework is the foundation on which this research article is built upon.

To find relevant literature about technostress and work performance the search engines from Google Scholar and Ebsco Host were used. The following search queries were used (The number of hits are presented in brackets):

- Technostress AND Work performance (4120)
- Technostress AND Job performance (3120)
- Technostress AND Productivity (2760)
- Technostress AND Job productivity (2840)
- Technostress AND Tasks performance (3660)
- Technostress AND Employee performance (3250)

To reduce the number of articles the title for screened, if it contained a combination as used in the search queries. The titles were screened until saturation was achieved; this point was achieved after reviewing the first 10 results pages. To reduce the numbers further the abstracts were also reviewed. When it was clear that an article was about technostress in combination with work performance, job performance or productivity the full article was read. After reading the full articles, 20 papers were considered useful to use for this literature review. Besides the 20 research articles, 2 scientific books were also used during the literature review.

2.2. Literature review

Technostress in relation with work performance.

To better understand technostress, it is crucial to understand what causes stress in the first place. Stress is defined by Lazarus as a two-way process; it involves the production of stressors by the environment, and the response of an individual subjected to these stressors (Lazarus & Folkman, 1984).

A model which explains stress is the transactional model of stress and coping (Lazarus & Folkman, 1984). The model can be found in figure 1:

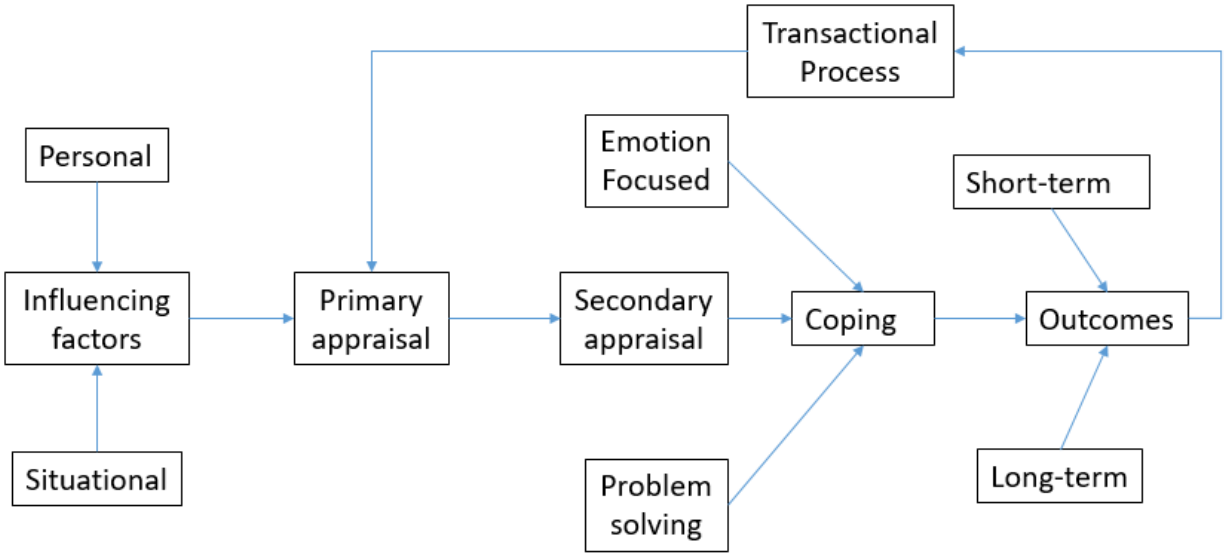

Figure 1: Transactional model of stress and coping

The model starts off with influencing factors. These influencing factors are moderated by personal and situational effects. This causes a primary appraisal. During this stage a person analyses whether a particular situation could have a personal effect. The mind will analyse if the situation is significant enough to consider it stressful. If the situation is experienced as challenging and/or threatening and/or harmful, the person will go into the next stage, secondary appraisal. This stage focuses on how a person will deal with a given situation. Coping is the behaviour an individual shows during a stressful situation. A person can use emotional focused or problem-solving strategies in order to cope with a stressful situation. This leads to a number of possible outcomes. One of them could be that the person experiences stress.

Technostress is a consequence that arises from the use of technology. A definition of technostress is the following: Technostress is stress caused by an inability to cope with the demands of organizational computer usage (Tarafdar et al., 2011). Technostress can be categorized into five dimensions

Stressor	Description
Techno-invasion	This describes being 'always exposed' so that people can potentially be reached anywhere and anytime and feel the need to be constantly connected. The regular workday is extended, office work is done at all sorts of hours, and it is almost impossible to 'cut away'
Techno-overload	This describes situations where use of new technologies forces people to work more and faster.
Techno-insecurity	This is associated with situations where people feel threatened about losing their jobs to other people who have a better understanding of new gadgets and computing devices.

Techno-complexity	This describes situations where the complex computer systems used at work force people to spend time and effort learning and understanding how to use new applications and updating their skills. People find the variety of applications, functions and jargon intimidating and consequently feel stressed.
Techno-uncertainty	This relates to the short life cycles of computer systems. Continuous changes and upgrades do not give people the chance to experience a particular system. People find this unsettling because their knowledge becomes rapidly outdated, and they are required to re-learn things very rapidly and often.

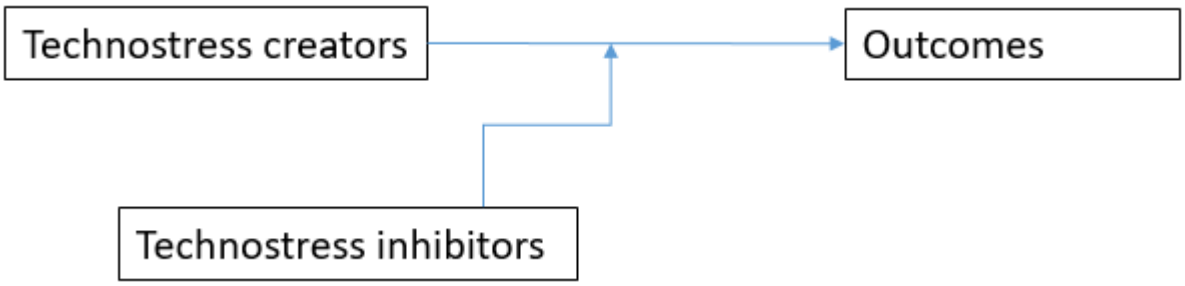

Figure 2: Adapted conceptual model of stress according to (Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008)

Figure 2 outlines a generic conceptual model of technostress. The model starts with (techno) stressors. These stressors create stress in individuals such as events or demands in the context of work. This influences a certain outcome like work performance or job satisfaction. Technostress inhibitors have a moderating effect on the relationship, which can be seen in the conceptual model. Several control variables also have an influence, which can explain individual differences.

The outcome variable of this research, work performance, was defined as: "*Behaviours or actions of an employee that are relevant for the targets of an organization*". Work performance is divided into three categories:

- The performance according to the employee in the last three months.
- The contextual performance, which is related to pro-active behaviours.
- Contra productive work behaviour, which is about the negative behaviour from employees.

Research performed by Sarabadani et al., 2018 shows that there is a negative causal relationship between technostress and work performance. This means when a person experiences technostress work performance will decrease. Since technostress consists of five dimensions all of these elements were considered relevant to explain the causal relationship and are incorporated in the model. It is therefore justified to draw a direct link between technostress and work performance as shows in figure 3. This leads to the first hypotheses of this research:

- **H1:** Techno stressors have a negative relationship with work performance.

Since work performance is measured into three categories, these sub-hypotheses are proposed:

- **H1.1:** Techno stressors have a negative relationship with task performance (in the last 3 months).
- **H1.2:** Techno stressors have a negative relationship with contextual performance.
- **H1.3:** Techno stressors have a positive relationship with contra productive work behavior.

Stress moderators

The model in figure 2 does not specify the technostress inhibitors. Other research goes into more detail about the aspects of technostress inhibitors. According to the articles of Ansah, Azasoo, & Adu, 2016, Sarabadani et al., 2018, Hung, Chang, & Lin, 2011 and Jena et al., 2017 there are several stress inhibitors described. If the employees have been through stress management training the stressors have less effects in comparison to an employee who has not received stress management training. This is because an employee who has effective coping strategies can handle stressful situations better. These coping strategies will have a moderating effect.

The more job control/autonomy the employee experiences the more likely it is that stressors can be regulated more effectively (Ahmad et al., 2014). This gives the person more freedom to perform their job as they see fit, so this will also have a moderating effect on the relationship between technostress and work performance.

Giving individual rewards can also be a positive incentive to handle stressful situations better (Ahmad et al., 2014). It gives a person. When a stressful situation arises a person can think about the reward more than the stressful situation. A reward in this case can give a positive thought and can therefore be a moderating effect.

The last moderating inhibitor in the research model is receiving support during stressful situations (Ahmad et al., 2014). It can help when an employee knows that they will receive support during a stressful situation. The person can rely on the help of colleagues and this in turn can moderate stressful situations positively.

Research performed by Ayyagari et al., 2017 shows that task related variables can negatively impact the relationship between technostress and work performance. This research identified workload and work hours as potential moderators for the technostress – performance relationship. Workload relates to the number of tasks an employee is expected to perform. The higher the amount of tasks is the more likely it is an employee will face difficulties to handle all the tasks and perform them well. This situation can moderate the effect between technostress and work performance negatively.
Another task related moderator is work hours (Ayyagari et al., 2017).

The same reasoning can be applied for work hours as it is for work load. If the work hours increase an employee can be overworked which can moderate the work performance in a negative way.

Based on these findings the following hypothesis are proposed:

H2: Stress inhibitors moderate the relationship between technostress and performance in such a way that the relationship is less negative if stress inhibitors are present:

H3: Stress promotors moderate the relationship between technostress and performance in such a way that the relationship is more negative if stress promotors moderators are present.

Based on the synthesis of the literature the following research model is proposed. Also included in the conceptual model are the hypotheses in whether there is a positive relationship/effect or a negative one. It also shows the variables that are part of a larger concept These variables are all relevant for this research.

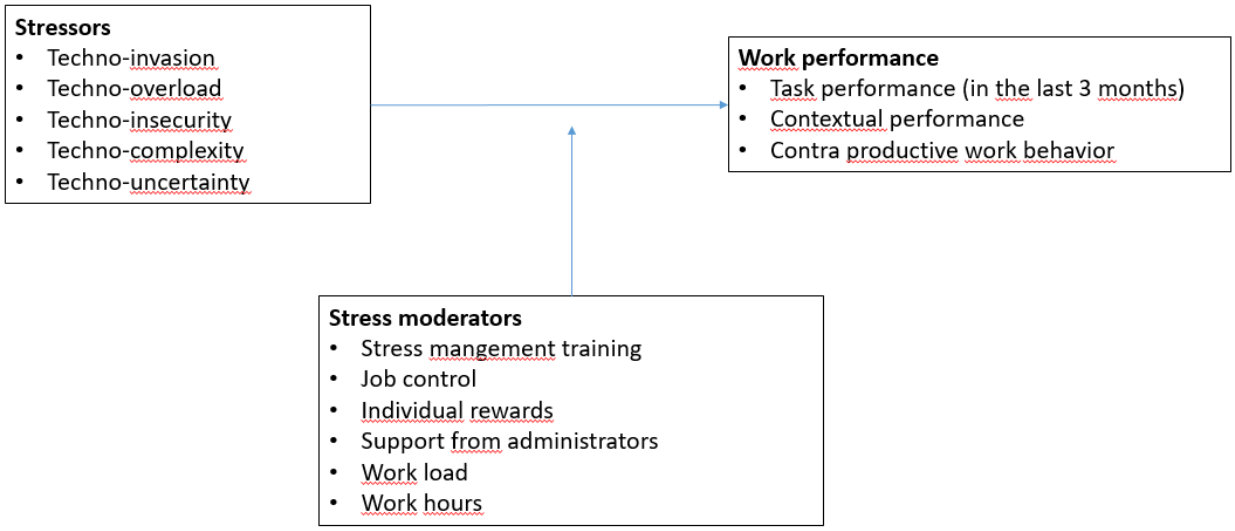

Figure 3: Research model based on synthesis

2.3. Objective of the follow-up research

The objective of this research is to better understand the influence moderating variables have on the relation between techno-stressors and work performance. With this better understanding, managers have more insight in how to prevent stressors having an impact on the work performance of their employees. In addition, employees have a better understanding how to cope more effectively with stressful situations.

3. Methodology

In this section, you provide substantiation for the empirical research you have conducted.

3.1. Conceptual design: select the research method(s)

In order to test the research model data needs to be gathered to see if the hypotheses can be confirmed. To do this there are some options. First it is important to determine to gather data in a quantitative way or a qualitative way. This research is about developing a predictive model. Gathering quantitative data makes it possible to develop such a predictive model. It is also important to determine which method will be used to gather the data. Because of the many items that need to be measured it is almost not very practical to gather the data with an experiment. This would be very time-consuming and therefore very costly. A survey seems more practical to gather the data. Respondents will be asked to fill in a questionnaire about their experiences related to technostress. The other questionnaire will be used to measure work performance. Questions about stress moderators are formed on the basis of literature findings. Lastly there are questions asked about general background information of the participants.

The target population of this research are people who perform desk job activities with a computer. Because this population is quite large it is necessary to draw a representative sample. To get a representative sample the data will be gathered at a company with a diverse staff regarding age, gender, educational background and working area. This should give more variety to the sample and will make it easier to generalize the outcomes of this research.

3.2. Technical design: elaboration of the method

The survey was built with the tool Lime Survey. With this tool, it is possible to distribute the survey through email. This makes the data collection easier and less prone to errors. Another benefit is that the data is stored on the servers of the Open Universiteit, this way the data is stored safely and in compliance with the GDRP.

The survey consists out of two questionnaires. The questionnaire used to measure work performance is the Individual Work Performance Questionnaire (IWPQ). It consists of three reflective constructs: Task performance, contextual performance and counterproductive work behaviour. The constructs are reflective because it is expected that the items within a construct are highly correlated with each other. An overview of the constructs and items can be found in table 1 This scale was evaluated for its validity and reliability in Koopmans, Bernaards, Hildebrandt, de Vet, & van der Beek, 2014. This scale is also available in Dutch and English. This ensures that no translation errors can occur.

Individual Work Performance Questionnaire (Koopmans, 2014)	
Likert scale from 1 to 5	
Task performance scale	
TP1	I managed to plan my work so that it was done on time.
TP2	My planning was optimal.
TP3	I kept in mind the results that I had to achieve in my work.
TP4	I was able to separate main issues from side issues at work.
TP5	I knew how to set the right priorities
TP6	I was able to perform my work well with minimal time and effort
TP7	Collaboration with others was very productive
Contextual performance	
CP1	I took on extra responsibilities.
CP2	I started new tasks on myself, when my old ones were finished.
CP3	I took on challenging work tasks, when available.
CP4	I worked at keeping my job knowledge up-to-date.
CP5	I worked at keeping my job skills up-to-date.
CP6	I came up with creative solutions to new problems.
CP7	I kept looking for new challenges in my job.
CP8	I did more than was expected of me.
CP9	I actively participated in work meetings.
CP10	I actively looked for ways to improve my performance at work.
CP11	I grasped opportunities when they presented themselves.
CP12	I knew how to solve difficult situations and setbacks quickly.
Counterproductive work Behaviour	
CWB1	I complained about unimportant matters at work.
CWB2	I made problems greater than they were at work.
CWB3	I focused on the negative aspects of a work situation, instead of on the positive aspects.
CWB4	I spoke with colleagues about the negative aspects of my work.
CWB5	I spoke with people from outside the organization about the negative aspects of my work.
CWB6	I did less than was expected of me.
CWB7	I managed to get off from work task easily.
CWB8	I sometimes did nothing, while I should have been working.

Table 1

In order to measure technostress a scale developed by Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008 was used. In contains all the five dimensions of technostress. This questionnaire covers all the five dimensions of technostress, to capture all the five dimensions makes it possible to identify which dimensions have a significant impact on work performance. For this research an English and Dutch version of the questionnaire will be used. The English is the original language of the questionnaire the Dutch version has been translated. The translated version has been used in previous research, to ensure as little translation errors as possible. An overview of the constructs and items can be found in table 2.

Technostress (Ragu-Nathan et all, 2008)	
Likert scale from 1 to 5	
Techno-overload	
TOV01	I am forced by this technology to work much faster.
TOV02	I am forced by this technology to do more work than I can handle.
TOV03	I am forced by this technology to work with very tight time schedules.
TOV04	I am forced to change my work habits to adapt to new technologies.
TOV05	I have a higher workload because of increased technology complexity.
Techno-invasion	
TIV01	I spend less time with family due to this technology.
TIV02	I have to be in touch with my work even during my vacation due to this technology.
TIV03	I have to sacrifice my vacation and weekend time to keep current on new technologies.
TIV04	I feel my personal life is being invaded by this technology.
Techno-complexity	
TCO01	I do not know enough about this technology to handle my job satisfactorily.
TCO02	I need a long time to understand and use new technologies.
TCO03	I do not find enough time to study and upgrade my technology skills.
TCO04	I find that new recruits to this organization know more about computer technology than I do.
TCO05	I often find it too complex for me to understand and use new technologies.
Techno-insecurity	
TIS01	I feel constant threat to my job security due to new technologies.
TIS02	I have to constantly update my skills to avoid being replaced.
TIS03	I am threated by co-workers with newer technology skills.
TIS04	I do not share my knowledge with co-workers for fear of being replaced.
TIS05	I feel there is less sharing of knowledge among co-workers for fear of being replaced.
Techno-uncertainty	
TUC01	There are always new developments in the technologies we use in our organization.
TUC02	There are constant changes in computer software in our organization.
TUC03	There are constant changes in computer hardware in our organization.
TUC04	There are frequent upgrades in computer networks in our organization.

Table 2

In order to use moderators during the analysis all relevant moderating items were also be measured with the questionnaire. In addition control items are asked in the survey. Both the moderating and control items can be found in table 3.

Moderators (Ayyagari et al., 2017)		**Control items by (Sarabadani et al., 2018)**	
MTASK1	I have to do more tasks than I can handle. (Likert scale from 1 to 5)	**CONTVAGE**	What is your age (20-29, 30-39, 40-49, 50-59, 60+)
MTASK2	I have to work more hours than I can handle(Likert scale from 1 to 5)	**CONTVEDU**	What is your educational background (High school, Vocational education, Bachelor, Master, PhD)
MINHIB1	I received stress management training (Yes/No)	**CONTVGEN**	What is your gender (Male, Female)
MINHIB2	I have influence on how I do my work (Likert scale from 1 to 5)	**CONTVSEC**	In what sector do you work? (Behavior & Society, Economics, Education, Healthcare, Engineering, Language & Culture, Law)
MINHIB3	I receive individual rewards for the work that I do ,salary excluded (Likert scale from 1 to 5)		
MINHIB4	I receive support from colleagues when needed (Likert scale from 1 to 5)		

Table 3

Another benefit of collecting the data digitally is that the data can be exported into a file that can be read by multiple statistical programmes. To offer flexibility to the participants the survey can be taken in either Dutch or English. This offers more flexibility to the participants

3.3. Data analysis

Once the data is gathered some descriptive statistics will be made the get a better understanding of the sample characteristics. These characteristics will be plotted in multiple bar charts so that the results will be clearly visible.

Once the data is gathered it is important to determine which constructs have a significant contribution to the research model. To determine this a PLS-SEM analysis will be performed. First, it will measure which items contribute significantly within a construct. This way only items that contribute significantly will remain. Because this research tries to test a research model a confirmatory factor analysis is the best approach (Hair, Hult, Ringle, & Sarstedt, 2014).

PLS-SEM is utilized for complex models with many associations and contains both observed and unobserved variables. It combines features of factor analysis and regression, it supports both reflective and formative constructs. PLS-SEM focuses on the prediction of a specific set of hypothesized relationships that maximizes the explained variance of the dependent variable. PLS-SEM minimizes the error terms and maximizing the R^2 values of the endogenous constructs (Hair et al., 2014).

In order to evaluate if a control items have a significant influence on the relationship between technostress and work performance, the analysis will be performed with the control variables incorporated in the multiple regression analysis.

The software SmartPLS version 2 has been used to perform the analysis.

3.4. Reflection w.r.t. validity, reliability and ethical aspects

To comply with ethical issues all the participants who volunteer to participate in this study will be asked to sign an informed consent. This ensures that all participants joined the study voluntarily. The data that will be collected will be stored on the servers of the Open Universiteit Nederland. This way the data is stored safely and only accessible for authorised researchers.

To ensure anonymity the participants will get an anonymous link their email address. No personal information will be asked which can link the data to the participants. Because the link is anonymous the email address of the participants cannot be linked to the data. This way the email addresses of the participants will not be part of the collected data.

To further promote reliability and validity this research draws on measurements that were tested by previous research. To check for reliability of the data an additional Cronbach alpha analysis will be performed.

A limitation of this study is that the data is collected at one moment in time. This cross-sectional design makes it impossible to track long-term effects of technostress on work performance. Another limitation is that there is no control group available. Without a control group in might be possible that unobserved items/variables might influence the results of the data analysis. To limit the effects of confounders a set of predefined control variables will be incorporated in the analyses.

Another limitation is that the data was collected during one point in time. This makes it difficult to make conclusions of the long-term effects.

4. Results

In this chapter the results of the analysis will be discussed. In addition, information about the sample will be discussed. The process of data collection will also be described in this chapter.

4.1. Data collection & sample

The data was collected using LimeSurvey. All participants received an email with an link which guided them to the online survey. The survey was sent to 118 email addresses. These were personal/work email addresses and addresses were on an organizational level. Multiple persons could use the survey link if the email address was from an organization. To ensure anonymity was the participants no timestamps were recorded of when the questionnaire was filled in. Participants had 21 days to fill in the survey.

When the survey closed 94 participants filled in the questionnaire. Looking at the age of the sample there seems to be an even distribution among the different age groups. Only the group 60 + shows a strong deviation.

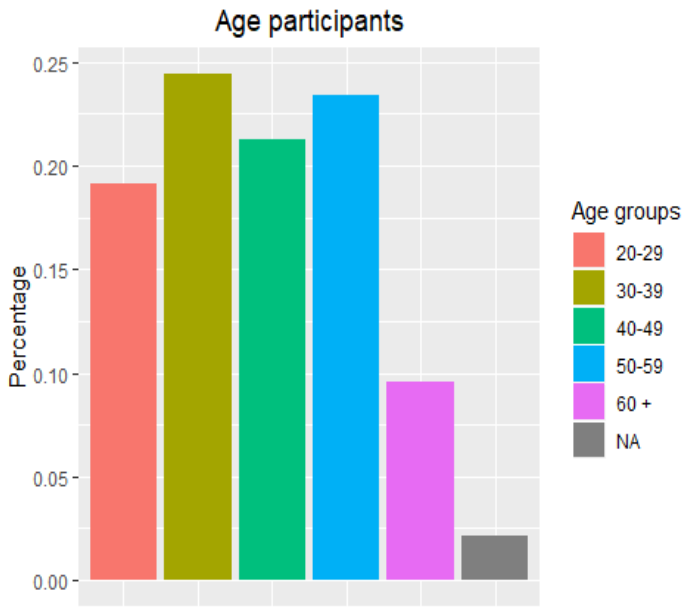

Figure 4

Looking at figure 5 shows that the survey was filled in more by men than women by 15 percent.

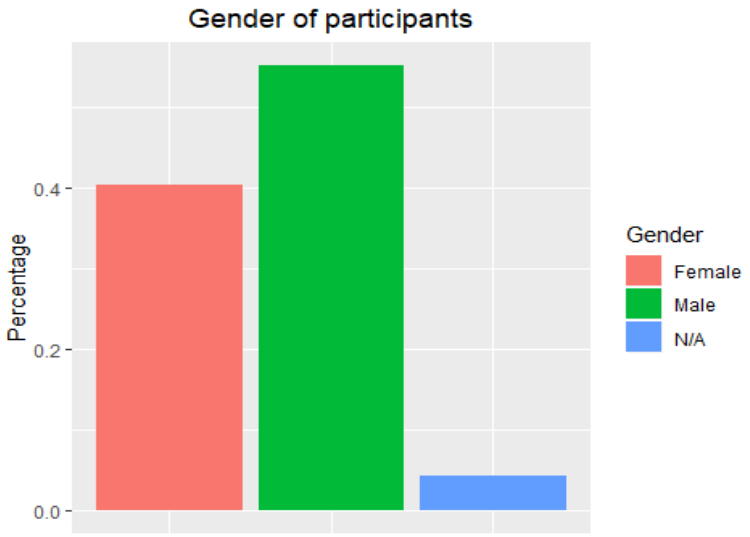

Figure 5

The educational background of the participants was also a question in the survey. Looking at figure 6 it is clear that the majority of the participants had a Bachelor or Master degree.

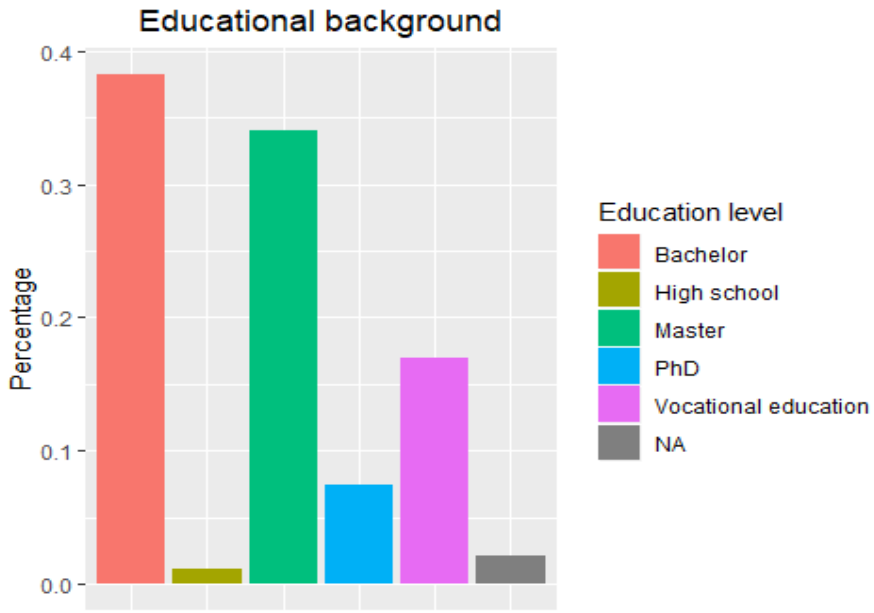

Figure 6

The last sample characteristic is the working area of the participants. These are based on the sectors used in the higher educational system of the Netherlands. The majority of the participants worked in education/

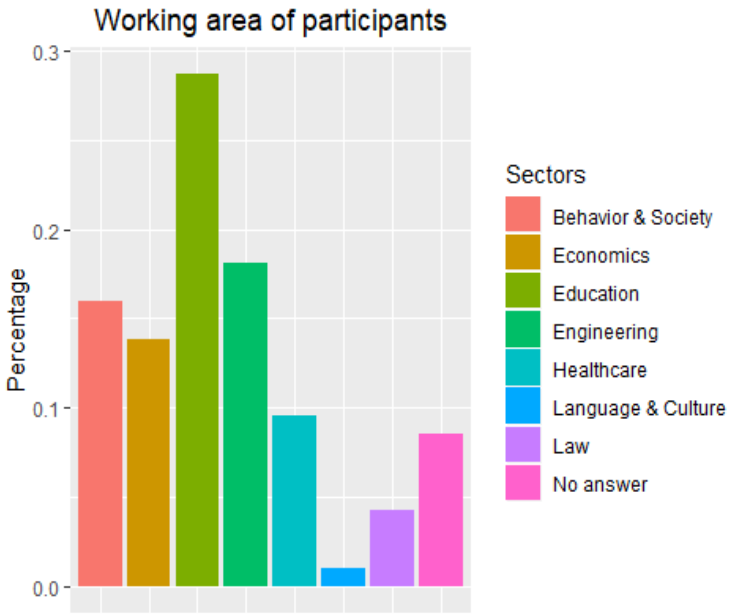

Figure 7

4.2. Analysis model 1: Relationship between Technostress and Work performance

Model 1 uses the five first order reflective constructs belonging to technostress. It also includes the three separate constructs belonging to work performance. These constructs are task performance, contextual performance and contra productive work behaviour.

4.2.1. Loadings and AVE values model 1

The first step is to look at how well the items load on the constructs. The values of the outer loadings should be above be 0.708 to ensure indicator reliability. However if outer loadings are between 0.40 and 0.708 the indicator should be removed from the data set, if the removal increases the composite reliability or average variance extracted (AVE) above their threshold of 0.7 respectively 0.5. The AVE value for the construct WP_CONTEXT initially was lower than 0.5. To resolve this issue the items CP1, CP3 and CP4 were removed because they had the lowest loading value. As table 4 shows all AVE values are above 0.5.

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
Autonomy	1	1	0	1	1	0
Bonus	1	1	0	1	1	0
Overload	0,8168	0,8991	0	0,7765	0,8168	0
Support	1	1	0	1	1	0
TS	0,3423	0,9087	0,9979	0,8978	0,3423	0,187
TS_Com	0,7411	0,9344	0	0,911	0,7411	0
TS_INV	0,5157	0,8088	0	0,6929	0,5157	0
TS_InSec	0,5181	0,8418	0	0,7664	0,5181	0
TS_Over	0,546	0,8738	0	0,8217	0,546	0
TS_Uncert	0,5137	0,7997	0	0,7696	0,5137	0
Training	1	1	0	1	1	0
WP_Context	0,5023	0,8332	0,4517	0,7488	0,5023	0,0892
WP_Counter	0,5113	0,8369	0,2056	0,7603	0,5113	-0,0129
WP_Task	0,4977	0,8262	0,4556	0,7344	0,4977	-0,0348

Table 4

4.2.2. Cross loadings model 1

Now that the AVE values have been validated it is important to see if the items do not cross load with other constructs. This means the items should have the highest value within their own construct. Looking at the table the green values give the highest scores, the other values are coloured red. The table shows that all items within a construct are coloured green. So there is no cross loading of an item within another construct.

	TS	TS_Com	TS_INV	TS_InSec	TS_Over	TS_Uncert	WP_Context	WP_Counter	WP_Task
CP2	-0,3922	-0,3252	-0,1743	-0,4118	-0,3324	0,0188	0,8171	0,015	0,2714
CP4	-0,4589	-0,4287	-0,3594	-0,4002	-0,294	0,0287	0,6199	0,1551	0,3173
CP5	-0,2767	-0,22	-0,0025	-0,2852	-0,2863	-0,0982	0,7469	0,1801	0,3509

CP6	-0,3907	-0,3294	-0,151	-0,5209	-0,2231	-0,0346	0,6947	0,0466	0,2427
CP8	-0,3474	-0,3775	-0,0655	-0,2672	-0,2934	-0,0834	0,6475	-0,0205	0,1869
CWB1	-0,1411	-0,15	-0,1988	-0,0954	-0,0528	0,1393	0,2115	0,6579	0,3559
CWB2	-0,2638	-0,2306	-0,1431	-0,2509	-0,2264	0,1352	0,1545	0,5346	0,2665
CWB3	-0,3203	-0,2431	-0,3705	-0,1385	-0,36	-0,026	0,1842	0,7834	0,3416
CWB4	-0,0666	-0,0413	-0,2211	0,0088	-0,0658	0,1361	-0,0854	0,7731	0,3407
CWB5	-0,1038	-0,0416	-0,2986	-0,0075	-0,1042	0,052	-0,0934	0,7915	0,2703
TCO01	0,775	0,8927	0,3808	0,5152	0,5844	0,1005	-0,3343	-0,1662	-0,3815
TCO01	0,775	0,8927	0,3808	0,5152	0,5844	0,1005	-0,3343	-0,1662	-0,3815
TCO02	0,8226	0,9156	0,4156	0,5891	0,5973	0,034	-0,4963	-0,2112	-0,3566
TCO02	0,8226	0,9156	0,4156	0,5891	0,5973	0,034	-0,4963	-0,2112	-0,3566
TCO03	0,6895	0,8026	0,3203	0,3724	0,5618	0,0949	-0,3656	-0,2133	-0,3739
TCO03	0,6895	0,8026	0,3203	0,3724	0,5618	0,0949	-0,3656	-0,2133	-0,3739
TCO04	0,6453	0,7618	0,3107	0,4272	0,4892	0,0835	-0,3262	-0,022	-0,1833
TCO04	0,6453	0,7618	0,3107	0,4272	0,4892	0,0835	-0,3262	-0,022	-0,1833
TCO05	0,7949	0,9198	0,3252	0,5864	0,5789	0,0566	-0,4603	-0,1771	-0,3604
TIS01	0,7013	0,6281	0,2772	0,8045	0,5128	-0,0098	-0,48	-0,114	-0,3072
TIS01	0,7013	0,6281	0,2772	0,8045	0,5128	-0,0098	-0,48	-0,114	-0,3072
TIS02	0,4254	0,2531	0,2813	0,5982	0,3382	0,2417	-0,2691	-0,1667	-0,1838
TIS02	0,4254	0,2531	0,2813	0,5982	0,3382	0,2417	-0,2691	-0,1667	-0,1838
TIS03	0,6524	0,4858	0,4272	0,7714	0,4728	0,0996	-0,4334	-0,1802	-0,3781
TIS03	0,6524	0,4858	0,4272	0,7714	0,4728	0,0996	-0,4334	-0,1802	-0,3781
TIS04	0,5483	0,3508	0,3569	0,7338	0,4361	0,0531	-0,3736	-0,066	-0,1593
TIS04	0,5483	0,3508	0,3569	0,7338	0,4361	0,0531	-0,3736	-0,066	-0,1593
TIS05	0,4682	0,2868	0,2374	0,6724	0,3925	0,3519	-0,2917	0,1457	-0,0492
TIV01	0,5397	0,3881	0,7313	0,3339	0,4699	0,0543	-0,2345	-0,2207	-0,4191
TIV02	0,3305	0,1182	0,6459	0,1686	0,3835	-0,0361	-0,0395	-0,3892	-0,2168
TIV02	0,3305	0,1182	0,6459	0,1686	0,3835	-0,0361	-0,0395	-0,3892	-0,2168
TIV03	0,598	0,3391	0,8048	0,4145	0,6124	0,2338	-0,2027	-0,2033	-0,3044
TIV03	0,598	0,3391	0,8048	0,4145	0,6124	0,2338	-0,2027	-0,2033	-0,3044
TIV04	0,4076	0,2637	0,6807	0,2925	0,4129	0,1463	-0,028	-0,3012	-0,2008
TIV04	0,4076	0,2637	0,6807	0,2925	0,4129	0,1463	-0,028	-0,3012	-0,2008
TIV04	0,4076	0,2637	0,6807	0,2925	0,4129	0,1463	-0,028	-0,3012	-0,2008
TOV01	0,6468	0,4473	0,4881	0,4023	0,7664	0,1895	-0,2382	-0,2007	-0,2575
TOV01	0,6468	0,4473	0,4881	0,4023	0,7664	0,1895	-0,2382	-0,2007	-0,2575

TOV02	0,7019	0,5136	0,5361	0,4578	0,7869	0,1539	-0,2439	-0,1512	-0,2647
TOV02	0,7019	0,5136	0,5361	0,4578	0,7869	0,1539	-0,2439	-0,1512	-0,2647
TOV03	0,6867	0,4765	0,4549	0,5215	0,7542	0,2149	-0,4568	-0,0546	-0,2339
TOV03	0,6867	0,4765	0,4549	0,5215	0,7542	0,2149	-0,4568	-0,0546	-0,2339
TOV04	0,627	0,4674	0,4143	0,396	0,7336	0,411	-0,3058	-0,0714	-0,2556
TOV04	0,627	0,4674	0,4143	0,396	0,7336	0,411	-0,3058	-0,0714	-0,2556
TOV05	0,8259	0,6524	0,5075	0,565	0,8897	0,2489	-0,4101	-0,2432	-0,3538
TOV05	0,8259	0,6524	0,5075	0,565	0,8897	0,2489	-0,4101	-0,2432	-0,3538
TP1	-0,2933	-0,2762	-0,3049	-0,1703	-0,2368	0,0468	0,174	0,401	0,8318
TP2	-0,3462	-0,3094	-0,1994	-0,3762	-0,2333	-0,0399	0,4723	0,1624	0,5628
TP3	-0,2941	-0,2932	-0,0998	-0,2847	-0,222	0,1414	0,2514	0,2598	0,4878
TP4	-0,3671	-0,2812	-0,4035	-0,1661	-0,3659	0,0585	0,2431	0,3149	0,734
TP5	-0,3087	-0,258	-0,372	-0,2296	-0,2176	0,1716	0,317	0,3623	0,8385
TUC01	0,1324	0,0386	0,1077	0,1206	0,1906	0,7184	-0,0187	0,2001	0,1761
TUC01	0,1324	0,0386	0,1077	0,1206	0,1906	0,7184	-0,0187	0,2001	0,1761
TUC02	-0,0638	-0,0854	-0,0519	-0,0349	0,0218	0,4188	0,1897	0,085	0,2138
TUC02	-0,0638	-0,0854	-0,0519	-0,0349	0,0218	0,4188	0,1897	0,085	0,2138
TUC03	0,1613	0,0464	0,0651	0,1552	0,2537	0,8564	-0,084	0,102	0,1547
TUC03	0,1613	0,0464	0,0651	0,1552	0,2537	0,8564	-0,084	0,102	0,1547
TUC04	0,156	0,062	0,1561	0,0913	0,2362	0,7936	0,0749	-0,0128	0,0115
TUC04	0,156	0,062	0,1561	0,0913	0,2362	0,7936	0,0749	-0,0128	0,0115

Table 5

4.2.3. Pathway coefficients model 1

Now that the model is free from cross loading influences the analysis comes to its next phase. Table 6 shows the pathway coefficients. For this model the interesting coefficients focus around the constructs of WP_Context, WP_Counter and WP_TASK.

	TS	WP_Context	WP_Counter	WP_Task
TS	0	-0,4885	-0,1502	-0,2975
TS_Com	0,416	0	0	0
TS_INV	0,1436	0	0	0
TS_InSec	0,2648	0	0	0
TS_Over	0,3668	0	0	0
TS_Uncert	0,0012	0	0	0
WP_Context	0	0	0	0
WP_Counter	0	0	0	0
WP_Task	0	0	0	0

Table 6

4.2.4. Bootstrap validation model 1

Now that the pathway coefficients have been calculated the model has to be validated. To validate the model the bootstrap method was used. This is a resampling technique used to estimate statistics on a population by sampling a dataset with replacement. The results in table 7 are the product of a bootstrap validation which resampled the data 2000 times. The column T-Statistics show the T value. This indicates if the model show significant pathway coefficients. If the value is greater than 1.96 it is considered statistically significant.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STERR|)
TS_Com -> TS	0,4117	0,4061	0,0316	13,0435
TS_INV -> TS	0,1479	0,1483	0,0228	6,4953
TS_InSec -> TS	0,2584	0,2565	0,0288	8,9623
TS_Over -> TS	0,3713	0,3627	0,0261	14,2452
TS_Uncert -> TS	0,0119	0,0354	0,0354	0,3366
WP_Context -> WP	0,3953	0,3938	0,0909	4,3515
WP_Counter -> WP	0,4218	0,4107	0,0892	4,7289
WP_Task -> WP	0,5114	0,4962	0,0477	10,718

Table 7

4.3. Analysis model 2: Moderating influences

The second model will test the moderating influences of the relationship between technostress and work performance. Model 2 uses the five first order reflective constructs belonging to technostress. It also includes the three first order reflective constructs belonging to work performance. Model 2 will also include the interaction between the five first order reflective constructs of technostress and the constructs MINHIB1, MINHIB2, MINHIB3 and MINHIB4. The items MTASK1 and MTASK2 are part of the reflective construct Overload.

4.3.1. Loadings and AVE values model 2

Table 8 shows the results of how well an item loads within a construct. Not surprisingly all constructs except for overload have a AVE score of 1. This is because all the constructs except for overload only have 1 item. The construct overload has a value of 0,985. This is higher than 0,5. This means that the items load well within the construct.

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
Autonomy	1	1	0	1	1	0
Bonus	1	1	0	1	1	0
Overload	0,8163	0,8988	0	0,7765	0,8163	0
Support	1	1	0	1	1	0
TS	1	1	0	1	1	0
TS * Autonomy	1	1	0	1	1	0
TS * Bonus	1	1	0	1	1	0
TS * Overload	0,985	0,9924	0	0,9848	0,985	0
TS * Support	1	1	0	1	1	0
TS * Training	1	1	0	1	1	0
Training	1	1	0	1	1	0
WP	1	1	0,5137	1	1	-0,0054

Table 8

4.3.2. Cross loadings model 2

Since the constructs consist only of one item cross loading should not take place. The only construct which has two items is the construct overload consisting of MTASK1 and MTASK2. Since a construct needs to have at least two items according to (Hair et al., 2014) it is not necessary to check for cross loadings for this model.

4.3.3. Pathway coefficients model 2

Table 8 shows the path coefficients for the second model. This shows the moderating influence of the constructs on the relationship between technostress and work performance. The coefficients scores of interest are in the column WP.

	TS * Autonomy	TS * Bonus	TS * Overload	TS * Support	TS * Training	Training	WP
TS * Autonomy	0	0	0	0	0	0	0,1987
TS * Bonus	0	0	0	0	0	0	0,0752
TS * Overload	0	0	0	0	0	0	-0,4298
TS * Support	0	0	0	0	0	0	0,0807
TS * Training	0	0	0	0	0	0	-0,4465
Training	0	0	0	0	0	0	0,0872
WP	0	0	0	0	0	0	0

Table 9

4.3.4. Bootstrap validation model 2

To validate the model the bootstrap method was used. The results in table 7 are the product of a bootstrap validation which resampled the data 2000 times. The column T-Statistics show the T value. This indicates if the model show significant pathway coefficients. If the value is greater than 1.96 it is considered statistically significant.

As the result of the bootstrap validation shows none of the moderating constructs have a significant impact on the relationship between technostress and work performance.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STERR|)
TS * Autonomy -> WP	0,1987	0,2004	0,3912	0,5078
TS * Bonus -> WP	0,0752	0,0675	0,1697	0,4431
TS * Overload -> WP	-0,4298	-0,4312	0,4127	1,0414
TS * Support -> WP	0,0807	0,1817	0,5937	0,1359
TS * Training -> WP	-0,4465	-0,4551	0,3005	1,4859

Table 10

5. Discussion

This section will be about the interpretation of the results. What do the results conclude, what are the implications of the results and how can they be applied in practice.
The findings are compared to the existing literature. The limitations of the research are written down
Recommendations for future research are discussed.

5.1. Discussion – reflection

The objective of this research was to evaluate the relationship between technostress and work performance and what the moderating influences are on this relationship. In order to answer the objective it is best to go back to the hypotheses of this research and its sub hypotheses.

H1: Techno stressors have a negative relationship with work performance:

- **H1.1:** Techno stressors have a negative relationship with task performance (in the last 3 months).
- **H1.2:** Techno stressors have a negative relationship with contextual performance.
- **H1.3:** Techno stressors have a positive relationship with contra productive work behavior.

According to the analysis there a negative relationship between technostress and work performance has been confirmed for the majority of the work performance constructs. These results are in consistent with the existing literature Sarabadani, Carter, & Compeau, 2018. What was unknown before was how it affected work performance exactly. Since work performance was measured as three individual constructs it is clearer how technostress influences the different aspects of work performance.

To give a more detailed conclusion it is necessary to look at the sub hypotheses. Hypotheses H1.1 and H1.2 both have a negative relationship with technostress. Based on the existing research this is the expected result. What is a surprising outcome is that hypothesis H1.3 also has a negative relationship with technostress. Koopmans, Bernaards, Hildebrandt, de Vet & van der Beek recognize that counter productive work behavior is a difficult construct to measure. So this unexpected result might be explained due to an error in the scale for this specific construct. It also might be the case that the sample characteristics play a role. The majority of the sample has a Bachelor degree or higher. Participants with a higher educational background have to solve complex issues at a daily basis, since they frequently face difficult challenges it might the case that counterproductive behavior is not a common trait among this part of the sample.

Another possibility might be that the majority of the sample works in the field of education. According to previous research this is one of the most stressful fields to work in (Hummel, 2019). This group might have to deal with stress in such a way that they do not show counter productive work behavior.

Another hypothesis of this research was the moderating to look at the moderating effects between technostress and work performance.

H2: Stress inhibitors moderate the relationship between technostress and performance in such a way that the relationship is less negative if stress inhibitors are present:

Based in the result of the analysis there are a number of items which moderate the relationship between technostress and work performance in such a way that it is less negative. This is true for the items: Bonus, autonomy and support. Based on the existing literature this was an expected outcome. The bootstrap validation shows that the stress inhibitors do not have a significant moderating influence.

A surprising outcome is that training (stress management training) moderates the relationship between technostress and work performance negatively. This might because of the fact that stress management training is difficult to standardize. There are many stress management training available with different materials. This unstandardized concept might cause confusion among the participants who filled in the survey.

It is also not clear if there are stress management training courses followed by the participants were focussed on technostress. Best practices on how to handle stress might not be sufficient for people who experience technostress, which could explain the negative moderating influence.

The last hypothesis of this study focusses on the stress promoting moderators.

H3: Stress promotors moderate the relationship between technostress and performance in such a way that the relationship is more negative if stress promotors moderators are present.

The construct overload moderates the relationship between technostress and work performance in such a way that it is more negative. This outcome corresponds well with the existing literature. However after running a bootstrap validation shows that the construct overload does not have a significant moderating influence. This might be explained by the way overload was measured. The items which consists of overload were measured with a 5 point likert scale. This is not a standardized way of measuring overload. So it could be possible that some items were missing which could contribute to the construct of overload.

5.2. Conclusions

The results of this study provide new insight how technostress influences work performance. It showed that there is a significant negative relationship between all the constructs of work performance. This was not expected for counterproductive work behaviors. Several mechanisms might cause this unexpected result. These mechanisms have to be researched further to give a more detailed conclusion.

The model also looked at the moderating influences between technostress and work performance.

5.3. Recommendations for practice

After reviewing the evidence some recommendations can be made for practice. Because of the negative relationship between technostress and work performance for desk employees it is important for employers to monitor for signs of technostress among staff. If mistakes are being made due to technostress errors can occur. These errors can have an effect on business processes, end products and might even result in dropping revenue. Even though that the moderating constructs did not show a statistically significant impact it might have a practical benefit on the work floor. Giving support to colleagues who experience technostress could in some cases reduce the impact of technostress.

It would also be advisable to involve staff more when it comes to acquiring new technologies for an organization. This can give the employees a feeling of autonomy which is also an indicator to reduce technostress. Although this is not proven with a statistically significant number during this research, other research has confirmed that more autonomy reduces the amount of experienced stress (Rousseau, Salek, Aubé, & Morin, 2009).

5.4. Recommendations for further research

Because of the relatively low sample size of 94 it is difficult to check the model for control variables. The subsets of different groups would result in low numbers. This makes it difficult to generalize the results for the population. It is recommended to have a follow-up study with a larger sample size. With this larger sample size it is more meaningful to check the model for control variables. When such a follow up study takes place it is also vital to look at other potential moderating influences on the relationship between technostress and work performance. The literature search has to be extended to get another set of potentially influencing moderators. This is due the fact that the current moderators have not shown a statistically significant result. This might be because of the lower sample size. But it also might be the case that the hypothesized model needed to have more theoretical support for the current moderators.

What also needs to be researched is the effect of hours exposed to technology has influence on experienced technostress. Now it is not clear if a person who has high exposure to technology has a higher risk of experiencing technostress. It also is not clear which kind of technology usage leads to technostress and whether all technologies have the same effect.

These findings are based on the reported work performance of the participants. These experiences might not fully reflect the actual performance of the participants. Actual performance metrics would be preferred for a follow up study.

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