Satisfaction with workplace aspects and perceived activity and productivity support in the office and at home

An in-depth look at hybrid working and task variety

van den Boogert, P.G.

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Preface

This report is the final deliverable for my graduation project, which is part of my Master's degree in Architecture Urban and Planning at the Eindhoven University of Technology. With this report, I have finalized my study at this university. After nearly seven years of hard work and joyful moments, my student career has come to an end. I am really proud of the achievements, great memories, and experiences during these years. I started my study in Eindhoven because of the broad offerings of the Bachelors. During my Bachelor's study, I mainly focused on structural engineering aspects of the Built Environment. At the end of my bachelor's, I shifted my focus to the real estate discipline. I chose to continue my Master's study in Urban Systems and Real Estate.

I am really grateful to my fellow students and friends who assisted me over the last years. The campus in Eindhoven became a home to me. I am very lucky to have such great friends around me that eased studying during the COVID-19 situation and have helped me keep up a positive spirit.

I also would like to express my gratitude towards my supervisors Rianne Appel-Meulenbroek, Lisanne Bergefurt and Astrid Kemperman. Their tutoring and expertise were essential during the execution of my study. Without their feedback and assistance, this thesis could never have been presented in this form. A special thanks to Madalina Hanc and the Leesman organization for providing me with the dataset.

All that remains is that I hope that you will enjoy reading this thesis.

Peter Friso van den Boogert
Eindhoven, March 2022

Executive summary

The COVID-19 pandemic disrupted office work and resulted in an unanticipated experiment of working from home. Many governments urgently advised working from home to minimize the spread of the COVID-19 virus. The pandemic served as a catalyst and compelled many knowledge organizations to adjust their business operations into working from home.

Due to the COVID-19 pandemic, a considerable number of knowledge workers had to work from home mandatorily. This forced employees to perform work-related activities at the home workplace that were initially considered unsuitable to be performed there. Previous studies have investigated the effective support of the workforce, either at the office- or the home-working environment (De Been & Beijer, 2014; de Croon et al., 2005; Ng, 2010). However, only a few studies simultaneously analyzed employees' perceived productivity and workplace satisfaction in both working environments (Awada et al., 2021; Moretti et al., 2020). Awada et al. (2021) concluded that workers' overall perception of productivity level did not change relative to their in-office productivity. In contrast, Moretti et al. (2020) stated that 40% of the respondents indicated to be less productive while working from home. Their findings were contrasting, so more research is preferred on this topic. It is valuable to study perceived productivity support and experienced support of activities in both environments to gain insight into the best-supported location and where to accommodate the employees to reduce organizations' operating costs. The current study aims to contribute to this knowledge gap by exploring employees' perceived productivity support in both the home and office work environment. The experienced support to perform different type of work activities is compared in both environments. This study is also distinctive because it explores the mediating role of satisfaction with physical features of the work environment and experienced support of activities on the relationship between task variety and perceived productivity support. It is valuable to have insight into this relationship to better support employees with different task profiles to enhance productivity and to reduce operating costs. Few researchers included task variety in their study and if they did, the results were insignificant or focused on different aspects of task variety. The main research question was formulated as:

How are workplace settings, personal characteristics, satisfaction with physical features of the workplace and experienced support of activities related to perceived support of productivity at home and at the office?

A dataset provided by the company Leesman is used to answer the research question. Leesman offers their service to help organizations measure and analyse employees' workplace experience by offering data and insights. They publish a yearly benchmark through their independent, evidence-based index to better understand employees' experience compared to other organizations. In March 2020, Leesman launched a new Home Working Survey to gather office occupiers' responses regarding their office and their home work environment. The data includes information on 57,286 employees from 66 different countries. The respondents answered all questions at one point in time, which provided the unique opportunity to analyse the office and home experience of the same people, measured simultaneously. This study is also unique because the respondents filled in the survey for home and office work environments. The data was analyzed in a path model for the home and office environment, which results in a better prediction regarding perceived productivity support than simpler bivariate analyses methods.

The main findings of the one-way ANOVA analyses show that telephone conversations, private conversations, and reading are better supported at home. Concentrative and interactive activities are considered better supported at home. In contrast, collaborative and facility dependent activities show

better-experienced support in the office environment. Most respondents marked a desk and chair as an important aspect for their workplace followed by accessibility to colleagues. Noise levels and people walking past your workstation had the highest dissatisfaction rating in the sample. Respondents indicated higher perceived productivity support in the home work environment than in the office settings.

Different bivariate analyses were used as input for the path analysis. The path analysis showed that satisfaction with physical features and experienced support of activities strongly relate to perceived support of productivity in the home and office work environment. Especially the support of concentrative activities and satisfaction with crowdedness aspects had a strong relationship with employees' perceived productivity support. In addition, assigned or dedicated workplaces had a stronger positive relationship with perceived productivity support than flexible workplace settings. A large part of this relationship is mediated by experienced support of activities and satisfaction with physical features. Employees who have a more diverse task profile, perceive lower productivity support in both work environments. However, experienced support of activities and satisfaction with physical features neutralize this negative effect. These variables are assumed to strongly mediate the relationship between task variety and perceived productivity support. Lastly, younger employees perceive higher productivity support in the office, while older employees scored higher when working from home. In addition, males have a slightly higher perceived productivity support in the office while women score higher at home.

This study confirmed current knowledge on the relationships between demographics and satisfaction with physical features on employees' perceived support of productivity. This study is unique because it explores different task profiles by making use of cluster analysis. Employees are divided into four clusters, each of them including concentration work. The clusters range from only concentration work, meetings, collaborative activities, and a diverse task profile. It also contributed to the relationship between task variety and perceived productivity support and the mediating role of experienced support of activities and satisfaction with physical features. The effect of workplace location, layout, and use is also included in the relationship between home and office workplace settings and perceived productivity support.

A limitation of this study was conducted during the COVID-19 pandemic lockdowns, which could be considered a turbulent period. Employees had to work from home mandatorily, which might have affected personal and societal circumstances influencing the perception of productivity support. In addition, the Leesman survey did not include the same questions regarding satisfaction with physical features of the workplace of both work environments. This made it more challenging to compare both work environments. In addition, males are overly represented in the sample, and most of the respondents come from countries in the Northern hemisphere.

The new insights and knowledge gained from this study can be used for further research. It can assist corporate real estate managers with information for optimizing the work environment and future workplace design. This study estimated two separate path models, one for the office and one for the home work environment. However, in future studies, the available data makes it possible to estimate an integrated path model analysis combining both work environments. Additionally, characteristics of the physical home and office workplaces, such as temperature, indoor air quality, network, and access to files, should be included in the questionnaire. Last, it is recommended to invest and incorporate sufficient and adequate workplaces in the office building, and offering more privacy for confidential and concentrative activities. Organizations and companies should take a supporting and facilitating role in assisting the employees to perform their activities most productively and in their preferred work setting or location.

Management samenvatting

De COVID-19 pandemie verstoorde het kantoorwerk en leidde tot een onverwacht experiment met thuiswerken. Veel overheden adviseerden dringend om thuis te werken om de verspreiding van het COVID-19 virus te minimaliseren. De pandemie werkte als een katalysator en dwong veel kennisorganisaties hun bedrijfsvoering aan te passen om thuis te werken.

Als gevolg van de COVID-19 pandemie werd een aanzienlijk aantal kenniswerkers verplicht thuis te werken. Dit dwong werknemers om werk gerelateerde activiteiten op de thuiswerkplek uit te voeren die aanvankelijk niet geschikt werden geacht om daar te worden uitgevoerd. Eerdere studies hebben de effectieve ondersteuning van het personeel onderzocht, hetzij in de kantoor-, hetzij in de thuiswerkomgeving (De Been & Beijer, 2014; de Croon et al., 2005; Ng, 2010). Echter, slechts een paar studies analyseerden tegelijkertijd de waargenomen productiviteit en werktevredenheid van werknemers in beide werkomgevingen (Awada et al., 2021; Moretti et al., 2020). Awada et al. (2021) concludeerden dat de algemene percepties van productiviteitsniveaus onder werknemers niet veranderden ten opzichte van hun kantoorproductiviteit. Moretti et al. (2020) stelden daarentegen dat 40% van de respondenten aangaf minder productief te zijn tijdens het thuiswerken. Hun bevindingen waren tegenstrijdig, dus meer onderzoek over dit onderwerp is gewenst. Het is waardevol om waargenomen productiviteitsondersteuning en waargenomen activiteit ondersteuning in beide omgevingen te bestuderen om te begrijpen wat de best ondersteunde locatie is en waar werknemers moeten worden gehuisvest om de operationele kosten van organisaties te verlagen. De huidige studie wil bijdragen aan deze kennislacune door de waargenomen productiviteitsondersteuning van werknemers in zowel thuis- als kantooromgevingen te onderzoeken. De waargenomen ondersteuning bij het uitvoeren van verschillende soorten werkactiviteiten wordt in beide omgevingen vergeleken. Deze studie onderscheidt zich ook doordat het de mediërende rol onderzoekt van tevredenheid met fysieke kenmerken van de werkomgeving en waargenomen activiteit ondersteuning op de relatie tussen taakvariatie en waargenomen productiviteitsondersteuning. Inzicht in deze relatie is waardevol om werknemers met verschillende taakprofielen beter te ondersteunen om de productiviteit te verhogen en de operationele kosten te verlagen. Weinig onderzoekers namen taakvariatie op in hun studie en als ze dat deden, waren de resultaten niet significant of gericht op verschillende aspecten van taakvariatie. De hoofd onderzoeksvraag is geformuleerd als volgt:

Hoe zijn werkpleksettings, persoonlijke kenmerken, tevredenheid met fysieke kenmerken van de werkplek, en waargenomen activiteit ondersteuning gerelateerd aan waargenomen ondersteuning voor productiviteit thuis en op kantoor?

Om de onderzoeksvraag te beantwoorden is gebruik gemaakt van een dataset van Leesman. Leesman biedt hun service aan om organisaties te helpen bij het meten en analyseren van werknemerstevredenheid op de werkplek door hen te voorzien van gegevens en inzichten. Ze publiceren jaarlijks een benchmark via hun onafhankelijke, resultaat gebaseerde index om de werknemerservaring beter te vergelijken met andere organisaties. In maart 2020 lanceerde Leesman een nieuwe Work at Home Survey om antwoorden te verzamelen van kantoorgebruikers met betrekking tot hun kantoor- en thuiswerkomgeving. De gegevens omvatten informatie van 57.286 werknemers verspreid over 66 verschillende landen. Respondenten beantwoordden alle vragen in één keer, wat de unieke mogelijkheid bood om de kantoor- en thuiservaringen van dezelfde mensen te analyseren, gelijktijdig gemeten. Deze studie is ook uniek in die zin dat respondenten de enquête invulden voor thuis- en kantoorwerkomgevingen. De gegevens werden geanalyseerd in een pad model voor thuis- en kantooromgevingen, wat resulteerde in een betere voorspelling met betrekking tot waargenomen productiviteitsondersteuning dan eenvoudigere bivariate analysemethoden.

De belangrijkste bevindingen van de eenzijdige ANOVA-analyses laten zien dat telefoongesprekken, privé gesprekken en lezen thuis beter worden ondersteund. Concentratie en interactieve activiteiten worden thuis beter ondersteund. Faciliteit afhankelijke en team activiteiten worden daarentegen beter ondersteund in de kantooromgeving. De meeste respondenten vonden een bureau en stoel belangrijk op hun werkplek, gevolgd door de toegankelijkheid tot collega's. Geluidsniveaus en mensen die langs uw werkplek lopen, kregen de hoogste ontevredenheidsbeoordeling in de steekproef. De respondenten gaven aan dat ze de productiviteitsondersteuning hoger vonden in de thuiskantooromgeving dan in de kantooromgeving.

Verschillende bivariate analyses werden gebruikt als input voor de pad analyse. De pad analyse toonde aan dat tevredenheid met fysieke kenmerken en ervaren activiteit ondersteuning sterk geassocieerd waren met waargenomen productiviteitsondersteuning in de thuis- en kantoorwerkomgeving. In het bijzonder hadden de ondersteuning van geconcentreerde activiteiten en de tevredenheid met privacy aspecten een sterke relatie met de waargenomen ondersteuning van de productiviteit van werknemers. Bovendien hadden toegewezen of toegewijde werkplekken een sterkere positieve relatie met waargenomen productiviteitsondersteuning dan flexibele werkomgevingen. Een groot deel van deze relatie wordt gemedieerd door waargenomen steun voor activiteiten en tevredenheid met fysieke kenmerken. Werknemers met meer diverse functieprofielen ervaarden een lagere productiviteitsondersteuning in beide werkomgevingen. Echter, waargenomen steun voor activiteiten en tevredenheid met fysieke kenmerken neutraliseren dit negatieve effect. De veronderstelling is dat deze variabelen de relatie tussen taakvariatie en waargenomen productiviteitsondersteuning sterk mediëren. Ten slotte ervaren jongere werknemers een hogere productiviteitsondersteuning op kantoor, terwijl oudere werknemers hoger scoren wanneer ze thuiswerken. Bovendien hebben mannen een iets hogere waargenomen productiviteitsondersteuning op kantoor, terwijl vrouwen thuis hoger scoren.

Deze studie bevestigt de huidige kennis over de relaties tussen demografische kenmerken en tevredenheid met fysieke kenmerken op de waargenomen productiviteitsondersteuning van werknemers. Deze studie is uniek in die zin dat ze verschillende taakprofielen onderzoekt door gebruik te maken van clusteranalyse. Werknemers worden ingedeeld in vier clusters, die elk concentratiewerk omvatten. De clusters variëren van alleen concentratiewerk, vergaderingen, collaboratieve activiteiten, en een gevarieerd taakprofiel. De relatie tussen taakvariatie en waargenomen productiviteitsondersteuning en de mediërende rol van waargenomen activiteit ondersteuning en tevredenheid met fysieke kenmerken werden ook onderzocht. Het effect van de locatie, indeling en gebruik van de werkplek werd ook meegenomen in de relatie tussen de thuis- en kantoorwerkplekomgeving en waargenomen productiviteitsondersteuning.

Een beperking van dit onderzoek was dat het werd uitgevoerd tijdens de COVID-19 lockdowns, wat kan worden beschouwd als een turbulente periode. Werknemers waren verplicht thuis te werken, wat een invloed kan hebben gehad op de persoonlijke en sociale omstandigheden die van invloed zijn geweest op de perceptie van productiviteitsondersteuning. Bovendien bevatte de Leesman-enquête niet dezelfde vragen over de tevredenheid met de fysieke kenmerken van de werkplek van beide werkomgevingen. Dit maakte het moeilijker om de twee werkomgevingen te vergelijken. Bovendien waren mannen oververtegenwoordigd in de steekproef en waren de respondenten afkomstig van het noordelijk halfrond.

De nieuwe inzichten en kennis die met deze studie zijn opgedaan, kunnen worden gebruikt voor verder onderzoek. Het kan bedrijfsvastgoedmanagers helpen met informatie voor het optimaliseren van de werkomgeving en het toekomstige ontwerp van de werkplek. In deze studie werden twee afzonderlijke pad modellen geschat, één voor de kantooromgeving en één voor de

thuiskantooromgeving. In toekomstige studies maken de beschikbare gegevens het echter mogelijk om een geïntegreerd pad model te schatten dat beide werkomgevingen combineert. Bovendien moeten kenmerken van de fysieke thuis- en kantoorwerkplekken, zoals temperatuur, binnenlucht kwaliteit, netwerk- en bestandstoegang, in de vragenlijst worden opgenomen. Ten slotte wordt aanbevolen te investeren in voldoende en adequate werkplekken in het kantoorgebouw, en meer privacy te bieden voor vertrouwelijke en geconcentreerde activiteiten. Organisaties en bedrijven moeten een ondersteunende en faciliterende rol spelen om werknemers te helpen hun activiteiten zo productief mogelijk uit te voeren in de werkomgeving of -locatie van hun voorkeur.

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1.0 Introduction

This chapter introduces the research subject of the current study. The structure of this chapter is as follows. First, it discusses the problem outline and the motivation by defining the scope of the study. Secondly, the aim of the thesis is discussed, followed by the scientific and societal relevance. It explains why this research is of particular interest. Additionally, the chapter introduces the research question and objectives combined with the demarcations of the research. The chapter finishes with the outline describing the structure of this study.

1.1 Problem outline

Over the past decades, different office configurations and remote working policies have been adopted by corporate real estate managers (CREM). These policies are committed to support various organizational goals, such as increasing knowledge sharing, cutting facility costs, maximizing productivity, and enhancing employee well-being (Appel-Meulenbroek et al., 2011; Van der Voordt, 2004; Van der Voordt, 1999). The workplace is one of the factors that may influence employees' perceived productivity (Batenburg & Van der Voordt, 2008). An appropriate physical environment should optimally facilitate different job activities, communication and concentration work, and informal and formal meetings. The activity profiles of office employees range from collaborative tasks, which include informal social interaction and scheduled meetings, and concentrative tasks, which include focused work and individual tasks (Vos & Van Der Voordt, 2001). Office concepts, such as Activity-based Flexible Offices (AFO) and Activity-Based Working (ABW), have a primary focus on the perceived fit of employees with the work environment and the alignment and support of activities with the workplace. The office policies provide office employees with more flexibility regarding how and where they do their work depending on the nature of the activity and their preferences (Wohlers & Hertel, 2017).

The COVID-19 pandemic disrupted office work and resulted in an unanticipated experiment of working from home. Many governments urgently advised working from home to minimize the spread of the COVID-19 virus. The pandemic served as a catalyst and compelled many knowledge organizations to adjust their business operations into working from home. Research by the European Office of Statistics indicated that the share of full-time teleworkers between 2019 and 2020 increased from 6.0% to 14.1% in the first nineteen countries of the European Union (EU-19) (Eurostat LFS, 2020). The prevalence of telework varied strongly across sectors, occupations, and countries. It was particularly high in knowledge- and ICT-intensive services and sectors, including desk-related work activities (European Commission, 2020). There are also considerable differences in the prevalence of teleworking across the EU Member States. For example, in The Netherlands, 17.8% of the employed population worked full-time from home in 2020 compared to 14.1% in 2019 (Eurostat LFS, 2020). The percentual change in Northern European countries is not that large compared to other EU-19 countries because teleworking was already more widespread than before the COVID-19 pandemic (European Commission, 2020). Figure 1 illustrates the home working trend line over the last six years.

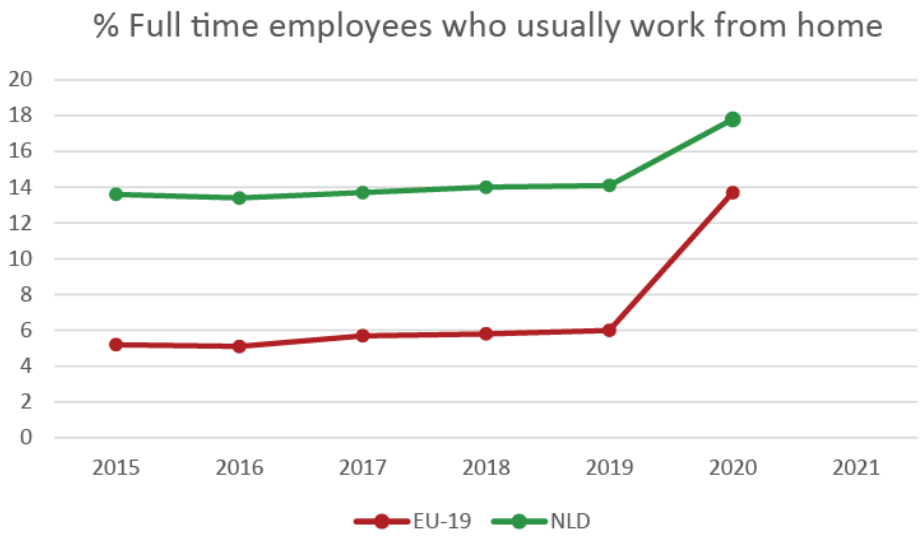


Figure 1: Employees usually working from home (Eurostat LFS, 2020)

The number of hours employees worked from home increased significantly. In 2019, the average number of hours employees worked from home was 3.8 hours per week. Expectations are that the number of teleworking hours will increase even after the pandemic. The Dutch *Centraal Bureau of Statistiek* published that approximately 30% of the labor force prefers to work remotely, 30% prefers to work in the office and 30% prefers to switch (CBS, 2021). The Dutch *Plan Bureau voor de Leefomgeving* predicts that hours worked from home will increase to at least 25% of the average workweek after the pandemic (Jongen & Verstraten, 2020).

Previous studies investigated the effective support of the workforce, either at the office- or the home-work environment (Brunia et al., 2016; Danielsson & Bodin, 2008; De Been & Beijer, 2014; de Croon et al., 2005; Fonner & Roloff, 2010; Gajendran & Harrison, 2007; Kim & de Dear, 2013; Seddigh et al., 2014; Van der Voordt, 2004). On the one hand, several studies examined the impact of the physical workplace characteristics on workplace satisfaction and self-assessed productivity support in different office settings (Brunia et al., 2016; Danielsson & Bodin, 2008; De Been & Beijer, 2014; de Croon et al., 2005; Kim & de Dear, 2013; Seddigh et al., 2014; Van der Voordt, 2004). From these studies, it can be concluded that the workplace settings and the physical aspects of the work environment affect employees' perceived productivity. Appropriate spatial conditions, like designated areas or space dividers, for concentration and communication, are of great importance (Brill & Weideman, 2001; Haynes, 2007b; Palvalin et al., 2017). On the other hand, the impact of teleworking on individual outcomes such as job satisfaction and self-assessed productivity support has also been studied (de Croon et al., 2005; Fonner & Roloff, 2010; Gajendran & Harrison, 2007; Golden & Veiga, 2005; Kieft, 2021). Teleworking might have beneficial effects on employees' perceived productivity. An explanation for this proposed advantage in productivity could be related to fewer disruptions and distractions while working from home (Bailey & Kurland, 2002). Additionally, working from home allows employees to tailor or modify the work environment to better match how and when they do their work. In general, it is assumed that employees prefer to do concentrative activities at home and collaborative activities at the office (Erlich & Bichard, 2008; Joy & Haynes, 2011; Van de Water, 2021).

However, only a few studies simultaneously analyzed employee productivity and workplace satisfaction in both work environments (Awada et al., 2021; Moretti et al., 2020). The few studies that studied both environments, analyzed productivity and work-related outcomes and did not consider the support of different activities (Awada et al., 2021; Moretti et al., 2020). Recent studies on working

from home during the COVID-19 pandemic show different results on the effect of employees' productivity (Moretti et al., 2020; Toscano & Zappalà, 2020). Awada et al. (2021) concluded that workers' overall perception of productivity level did not change relative to their in-office productivity. In contrast, Moretti et al. (2020) stated that 40% of the respondents indicated to be less productive while working from home. In conclusion, most studies focus on the office work environment since employees spend most of their time there. More studies also focused on the home work environment in the last decade. However, the combination of the office and home work environment is underexposed, leaving a research gap. This study aims to contribute to this knowledge gap by exploring employees' perceived productivity support while working from home and in the office. It is valuable to study perceived productivity support and experienced support of activities in both environments to gain insight into the best-supported location and where to accommodate the employees to reduce organizations' operating costs. Due to the COVID-19 pandemic, a considerable number of knowledge workers had to work from home mandatorily. This forced employees to perform work-related activities at home that were initially considered unsuitable. This study is also distinctive because the respondents filled in the survey for home and office work environments. The data is analyzed in an integral path model, which results in a better prediction concerning perceived productivity support. This study can provide new insights into the support of a location for certain activities assuming employees' free workplace choice. It might yield new ideas for corporate real estate strategies concerning optimizing the work environment and future workplace design.

Additionally, few researchers included task variety in their study and if they did, the results were insignificant or focused on different aspects of task variety (Bedny et al., 2012; Hoendervanger, 2021). This study is also unique because it explores the relationships between task variety, satisfaction with physical features of the workplace, experienced support of activities and the employees' perceived support of productivity in both work environments. It takes an in-depth look at different task profiles of employees and the number of performed tasks in relationship with perceived productivity support. It is valuable to have insight into this relationship to better support employees with different task profiles to enhance productivity and reduce operating costs.

For exploring the effects on perceived support of productivity in the home and office work environment, different workplace settings and physical aspects of work environments are considered. A distinction is made between different home as well as office workplace settings. Additionally, office workers are a diverse set of individuals (Haddon & Brynin, 2005). Therefore, personal characteristics can play a role in the experience of support and thus are included in the study. Knowledge workers perform a wide range of activities. The different activities might require different aspects of the work environment to support the activity in the best way. Some activities are supported better while working in the office, while others are supported best working from home. The collaborative and concentrative nature of the activity is assumed to play an important role in the preferred location choice (Erlich & Bichard, 2008; Joy & Haynes, 2011; Van de Water, 2021). In addition, different workplace settings provide different physical workplace features, while some features are the same in the office and at home. Those features might be necessary for experienced workplace support.

1.2 Scope

To narrow the scope of the study, a demarcation of the research objective is necessary. First, from the literature, it becomes apparent that several factors influence employees' perceived productivity. These factors can, for example, include work-life balance (Ipsen et al., 2021; Nakrošienė et al., 2019), colleagues, job satisfaction (Aziri, 2011; Böckerman & Ilmakunnas, 2012; Fisher, 2010; Judge et al., 2001; Olson, 2015; Wright & Cropanzano, 2007), or workplace satisfaction (Brill & Weideman, 2001; De Been & Beijer, 2014; Groen et al., 2019; Maarleveld & De Been, 2011; Vischer, 2007). The

relationship between employees' job satisfaction and job productivity has frequently been studied (Aziri, 2011; Böckerman & Ilmakunnas, 2012; Fisher, 2010; Judge et al., 2001; Olson, 2015; Wright & Cropanzano, 2007). Job satisfaction and perceived productivity might be positively correlated (Judge et al., 2001) and could be of interest for determining the employees' self-assessed productivity. Workplace satisfaction focuses more on the physical features and facilities of the workplace, it accounts for nearly 25% of overall job satisfaction (Brill & Weideman, 2001; Sundstrom et al., 1980). This study only includes the relationship between satisfaction with the physical aspects of the workplace and employees' perceived support productivity. The overall job and workplace satisfaction and work-life balance are outside the scope of this study and not included.

The physical features and facilities of the workplace are assumed to contribute to enhanced productivity and satisfaction (Batenburg & Van der Voordt, 2008; Groen et al., 2019). In general, workplace facilities imply the services that are offered, while workplace features are the tangible physical attributes to enable employees to do their job. The physical features include desk, chair, storage, and decoration, whereas the service facilities include reception, cleanliness, and security (Batenburg & Van der Voordt, 2008; Van der Voordt, 1999). In this study, only the satisfaction with physical features of the workplace is considered since the home work environment does not have access to (all) service facilities. Additionally, the effect of perceived satisfaction with the individual workspace has a much larger impact on job satisfaction than the perceived satisfaction with facilities (Olson, 2015). Thus, service facilities are excluded from this study.

The other factors that might influence employees' perceived productivity like satisfaction with the organization (Batenburg & Van der Voordt, 2008; Brill & Weideman, 2001; Groen et al., 2019) and work-life balance (Ipsen et al., 2021; Nakrošienė et al., 2019), are outside the scope of this study.

1.3 Research question

The main research question includes different aspects in relation to employees' perceived support of productivity. Previous paragraphs highlight different variables affecting perceived productivity support, including the current study's scope. The main research question for this study is formulated as follows:

Q_{main}: How are workplace settings, personal characteristics, satisfaction with physical features of the workplace and experienced support of activities related to perceived support of productivity at home and at the office?

Several sub-questions are formulated to break down the main questions to answer the main research question. The answers to the sub-questions are used as input for the conceptual model, discussed in the upcoming lines. The sub-questions are as follows:

Q1: What is the relationship between the workplace settings and experienced support of activities, satisfaction with physical features, and perceived support of productivity?

Q2: What is the relationship between personal characteristics and experienced support of activities, satisfaction with physical features, and perceived support of productivity?

Q3: What is the relationship between personal characteristics and workplace settings?

Q4: What is the relationship between employees' satisfaction with physical features and their perceived support of productivity?

Q5: What is the relationship between employees' experienced support of activities and their perceived support of productivity?

Q6: What is the relationship between employees' satisfaction with physical features and experienced support of activities?

The preliminary conceptual model is constructed based on the research question and the sub-questions presented. The preliminary conceptual model is a graphical representation of the research question and is displayed in Figure 2. It shows the relationships between the dependent variable, on the right side, and the independent variables, on the left side. The relationships are tested in the home- as well as in the office-work environment.

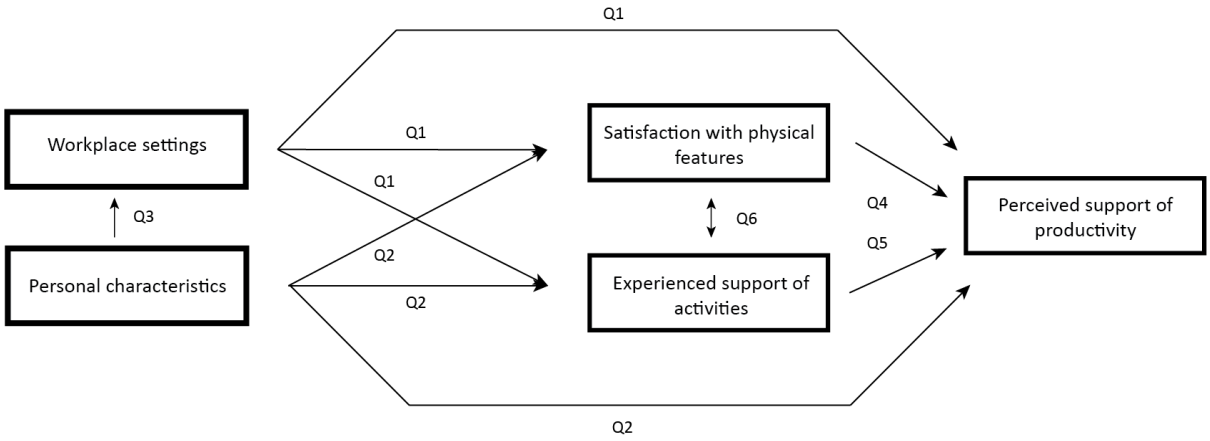


Figure 2: Preliminary conceptual model

A dataset provided by Leesman is used to answer the sub-questions. The Leesman database of office surveys is currently one of the largest databases of its kind. In March 2020, Leesman launched a new Home Working Survey to gather office occupiers' responses regarding their office and their home work environment. The home working questions are designed to pinpoint which activities are being supported, how the home work environment impacts a sense of productivity and connection and the importance of features, while also allowing the identification of demographical differences. The respondents answered both surveys at one point in time, which provides the unique opportunity to explore the office and home experience of the same people, measured simultaneously.

1.4 Relevance

The outcome of this research could be of interest for societal and scientific purposes. First, the scientific purpose of this research is to provide new insights into the effects of the office as well as home work environments on experienced support of activities and perceived productivity support impacting future workplace design. Studying the optimization of the workplace to increase employees' productivity is not new. For decades, scholars have tried to get a hand on the tangible and intangible aspects of perceived support of productivity in the built environment (Batenburg & Van der Voordt, 2008; Brill & Weideman, 2001; De Been & Beijer, 2014; Groen et al., 2019; Palvalin et al., 2017). Currently, there is a scarcity of academic literature with a focus on the support of activities in both work environments related to physical aspects of the workplace and perceived productivity (Marzban et al., 2021). Perceived productivity and experienced support of activities, in the home work environment is less explored than these aspects in the office work environment. In addition, very few studies have analyzed the home and office work environments simultaneously. Due to the COVID-19 pandemic, a unique opportunity has presented itself with employees working from home in large

numbers for an extended period. More data is now available of both work environments yielding new insights into the support of the location for certain activities. This study is distinctive because it explores the support of activities in both work environments rated by the same employee. Additionally, having insight into the physical features that influence end-user productivity at home and in the office is valuable. This research thus provides the academic community with comprehensive insights into the support of the location for certain activities, which could impact the employees' perceived support of productivity.

Secondly, the study could be of interest for Corporate Real Estate (CRE) Managers and all kinds of organizations accommodating human capital. This study yields insight into the best-supported location for certain activities. Improvements can be made with a better understanding of office worker behavior, their work environment, and the supported location. This can result in higher workplace satisfaction, lower discomfort, and increased productivity. Corporate real estate managers could have a better understanding of how to accommodate the building occupants when having insight into work settings and physical features of the workplace enabling employees to work productively. This study aims to support the decision-making process of CRE managers and organizations that consider implementing home-based teleworking practices. CRE managers and facility managers can use these new insights to enhance their organizations' policies regarding home-based teleworking. Currently, this is particularly relevant in the context of expected post-COVID-19 changes in work practices. These enhanced home-based telework policies might affect the average employee satisfaction and turnover intentions (Kröll & Nüesch, 2019). This study also provides insights into employees with different task profiles and their relationship with perceived productivity support. It is valuable to have insight into what employees with a certain task profile need to better understand and support those employees and enhance their productivity.

1.5 Outline

The study is divided into four main parts. The first chapter introduces the scope of the research and presents the research objective and question. It explains the societal and scientific value of this research. The second part includes Chapters 2 to 4. Existing literature is studied and used to formulate hypotheses for later analyses and extend the preliminary conceptual model. Chapter 2 explores the different home and office workplace settings and defines different workplace setting categories.

Additionally, the physical features of the home and office workplace are studied. The relationship is studied for both workplace settings and physical features of the workplace and perceived productivity support. Chapter 3 elaborates on the different work-related tasks employees conduct. Different activity categories are distinguished and their relationship with perceived productivity support. Additionally, the task variety characteristics, task profile and number of different tasks performed, are explored. An overview is included that highlights what work settings employees can conduct their task most productively. Chapter 4 focuses on the demographic aspects of the employees and the relationship with perceived productivity support. After each chapter, the conceptual model is updated and new hypotheses are formulated.

The third part focuses on the research approach and the results of the different conducted analyses. Chapters 5 to 8 are included in this part. Chapter 5 starts with a recap of the hypotheses formulated in the literature chapters. Subsequently, the research design and the data collection by Leesman are described. The method description consists of the description of the different statistical analyses, including different bivariate analyses and integral Path Analysis. Chapter 6 describes the general characteristics of the data set. The demographics are visualized together with the respondents'

answers on the importance and satisfaction of the different physical features of the home and office workplace questions. Additionally, the importance and experienced support of activities are divided over categories and compared. Chapter 7 explores the results of different bivariate analyses. First, the Principal Component Analyses results are discussed for the physical features of the workplace and the home and office activities. Second, correlation analyses and ANOVA tests are conducted to test the relationship between the different variables and perceived productivity support. Chapter 8 includes the results of the Integral Path Analysis. The path model is described and tested. The last part includes a summary of the findings and scientific and societal implications. In addition, the limitations of the current study and the recommendation for further research are explored.

Literature review

The following chapters provide insights into the literature review. The sub-questions posed in the previous chapter are explored and supported by scientific research. First, the work environment, including the relationship between workplace satisfaction and perceived productivity support, is discussed. Different workplace settings together with physical aspects of the workplace are explored and their relationship with perceived productivity. Second, the different activities of knowledge workers are discussed and their relationship to the preferred location of employees. Additional attention is directed to task variety characteristics, such as different task profiles and the number of tasks performed. Chapter 4.0 explores the relationship between the demographics of the employee and perceived productivity. The literature review chapter closes with an updated conceptual model.

2.0 The work environment

This chapter explores the effect of the work environment on the satisfaction and perceived productivity of the employee. To this end, the relationship between workplace satisfaction and perceived productivity is explored first. Next, various office concepts and home workspaces are studied, along with their impact on the employees' satisfaction. An overview of the most important physical workplace features that influence employees' productivity is presented. Last, a conclusion is provided in Section 2.2.4.

2.1 Workplace satisfaction and perceived productivity

In scientific literature, productivity is defined as the ratio between input and output (Antikainen & Lönnqvist, 2006; Haynes, 2007a). Output concerns the quality of work or products and the operating result. Input regards the resources (i.e. production factors such as labor, capital technology, information and facilities) (De Been et al., 2016). For the manufacturing industry, it is clear what the produced goods are and how to measure productivity (Hansika & Amarathunga, 2017). This is harder to measure for the service sector and the knowledge industry (De Been et al., 2016; Haynes, 2007b, 2007a; Mawson & Johnson, 2014). For the knowledge sector, the productivity variables are more focused on indirect variables, such as turnover, absenteeism or churn costs (Croome, 2000). These variables try to capture the intangible character of the knowledge work productivity on an organizational level. Various studies have introduced different terms to portray the employees' work-related output or job performance (Brill & Weideman, 2001; Brunia et al., 2016; Haynes, 2007a; Judge et al., 2001; Vischer, 2007). For example, job performance (Brill & Weideman, 2001; Judge et al., 2001; Vischer, 2007) or productivity (De Been et al., 2016; Haynes, 2007b; Vos & Van Der Voordt, 2001) can be used to refer to the same employee output.

According to Vos and Van der Voordt (2001), there are three ways to increase productivity or decrease the ratio between output and input.

1. Increase output with the same input (improved effectiveness);
2. Achieve the same output with less input (improved efficiency); and
3. Achieve a stronger rate of increase in output compared with the increase in input (effectiveness and efficiency improved).

There are different methods of measuring productivity on the employee level. A widely accepted approach is measuring the perceived productivity rather than the actual productivity (Batenburg & Van der Voordt, 2008; Brill & Weideman, 2001; De Been et al., 2016; Leaman & Bordass, 1999; Maarleveld et al., 2009), such as the estimated percentage of time being productive (Batenburg & Van der Voordt, 2008), the perceived increase or loss of productivity after a change (Leaman & Bordass,

1999), or the perceived support of productivity by the current work environment (Maarleveld et al., 2009). Perceived productivity support refers to the support of the workplace to enable the employee to work productively. Employees rate their perceived support of productivity primarily based on individual productivity, rather than team productivity or organizational productivity (Maarleveld & De Been, 2011). This study makes use of the term productivity.

Various studies showed a relationship between workplace satisfaction and perceived productivity (Brill & Weideman, 2001; De Been & Beijer, 2014; Groen et al., 2019; Maarleveld & De Been, 2011; Vischer, 2007). Batenburg and Van der Voordt (2008) studied the relationship of satisfaction with facilities, including physical features of the workplace on self-assessed productivity support of different office tasks. The most important predictor of self-assessed support of productivity was satisfaction with the office facilities, including the physical features of the workplace. Additionally, the satisfaction with the support of the work environment to perform activities significantly influenced self-assessed productivity support. Brill & Weideman (2001) argued that the average effect of physical features directly attributable to the design of the workplace contributes 5% to individual performance and 11% to team performance. However, this percentage could differ between organizations and employees. Groen et al. (2019) conducted a repeat study, based on the study of Batenburg and Van der Voordt (2008). They confirmed that self-assessed support of productivity was significantly correlated to satisfaction with physical features of the workplace. It is also the most important predictor of self-assessed support of productivity.

2.2 Workplace settings and productivity

The following section focuses on the different workplace settings and the relationship with perceived productivity. First, the different workplace settings are explored. The conclusion yields an overview of those different settings which should be accounted for in the conceptual model. Second, the relationship between the different workplace settings and employees' perceived productivity is discussed. The section closes with an updated overview of the conceptual model.

2.2.1 Workplace settings

Office concepts can be described according to multiple dimensions. De Croon et al. (2005) distinguished three aspects or dimensions of office concepts. The first dimension is the office location, which refers to where the office worker performs his/her activities. The second dimension is the office layout. It refers to the arrangement of workplaces and types of boundaries in the office (de Croon et al., 2005). The third dimension is office use. It refers to how workplaces are assigned to office workers. These office concepts can be specified in various workplaces, which are explored below.

Workplace location

The office location refers to where an employee performs work-related activities (de Croon et al., 2005). Different locations, such as home environment, office environment, co-working space, and other third places, can be distinguished in this category. The office environment refers to the conventional office location where people conduct their daily work-related activities. The home location can be referred to as the private place where employees live. Employees do not have to commute to an office to perform their job. A co-working space offers drop-in and membership rates for remote workers seeking a place to focus or take a meeting. These office spaces are often fully serviced to work and relax. Other third places include, for example, restaurants, hotels, libraries, and coffee shops.

Workplace layout

Various studies have addressed the variety of office types and workplaces in the work environment (Danielsson & Bodin, 2008; De Been & Beijer, 2014; Duffy et al., 1997). Duffy et al. (1997) argued that workplaces should respond to the employees' workstyle and used the amount of interaction and autonomy as the main determinants. For example, the Hive and Cell workplaces support individual concentrated activities and have a high enclosure. Den and Club workplaces are more suitable for activities that require much interaction and support group processes (Duffy et al., 1997). Figure 3 illustrates the different office layouts. Danielsson & Bodin (2008) and De Been & Beijer (2014) defined them by their architectural and functional features. The most dominant architectural feature is spatial organization, referring to the placement of the workstations in the layout of the office and the physical aspects. The classification addressed by De Croon et al. (2005) is based on the level of enclosure and distance between workstations. This classification is used to define the office layout dimension.

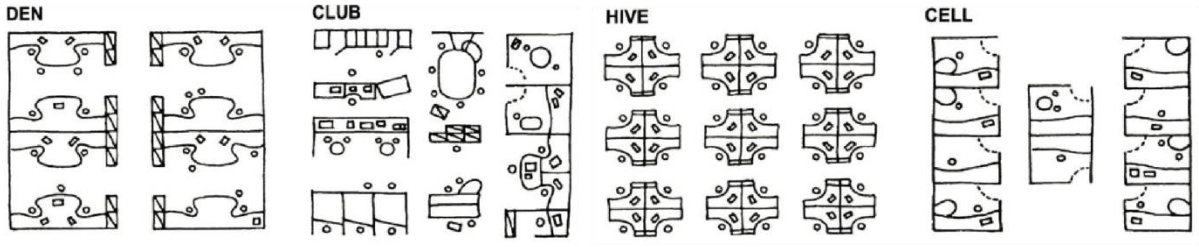


Figure 3: Duffy's layout for workplaces (Steiner, 2005)

A cellular office or cockpit is a closed, single-person workplace with four walls to the ceiling and a door (Brill & Weideman, 2001). The workplace is mainly used for independent and concentrated work (Danielsson & Bodin, 2008; De Been & Beijer, 2014). The cell office or cockpit offers visual and auditive privacy (Appel-Meulenbroek et al., 2011). Most of the time, the IT and other specialized equipment for the task are provided in the room. A cubicle is also a workplace suitable for independent and concentrated work. The difference between a cockpit and a cubicle is the level of enclosure. A cellular office or cockpit is in a dedicated room, while a cubicle is located in a semi-open environment. Another workplace in an enclosed environment is the shared room office. This is a desk in a room shared with two to three other people. The shared room office can be used for team-based work, and there are often work facilities present in the room (Bodin Danielsson & Bodin, 2009).

The open-plan office layout is defined by the absence of walls that separate workstations and by the lack of access to an individual window (Danielsson & Bodin, 2008). One of the advantages of this office type is to have a flexible shell for organizational changes (Bodin Danielsson & Bodin, 2009). Open-plan offices provide different types of workplaces. First, individual workplaces in the open office environment can be production tables or regular open workplaces. The general open workplace is an

individual working surface, including IT services and ergonomic furniture. The production table is a large table providing workplaces for multiple employees without IT equipment or adjustable furniture (Appel-Meulenbroek et al., 2011). An open-plan layout can also provide single or double lounge workplaces and touchdown areas. They consist of an active lounge chair integrated into a couch with an adjustable table. In addition, the open-plan office provides different types of meeting areas, such as meeting and team tables. These are large tables where employees can collaborate on group work. The office also provides enclosed meeting facilities and project/brainstorm rooms for private team discussion. The size of the room depends on the number of people present. The office also offers other facilities to work or sit. For example, dining tables close to canteens or pantries provide the best opportunity for spontaneous interactions and informal talks.

The home work environment uses the same layout factor defining the office concept. At home, people might have a separate office or use a shared space with a different function (e.g. kitchen, living room, bedroom) (Ng, 2010). The home work environment needs to have some spatial requirements. Not all employees' dwellings are suited for working from home. For example, the size of the dwelling (Ng, 2010) and the size of the workplace (Gurstein, 1996; Magee & Arch, 2000) are assumed to influence the choice to work from home. Availability and privacy are the main reasons the employee selects a specific location in the home for work (Magee & Arch, 2000).

Employees most commonly choose workspaces with well-defined boundaries as their home office (Magee & Arch, 2000). Examples of those workplaces at home are a spare bedroom or dedicated room. Other locations considered as workplaces are a formal living or dining room or kitchen. Formal spaces of the dining or living room or more social spaces, such as the kitchen, are considered as more visually and physically accessible locations. In contrast, a spare bedroom and dedicated room have a more enclosed nature. Typically, these workplaces are not considered intrinsically social but more private and inaccessible to outsiders.

In conclusion, open and enclosed workplaces can be distinguished in the office and home work environment. Enclosed workplaces in the office are cockpits, cellular offices, cubicles, and closed meeting/brainstorm rooms. Enclosed workplaces at home are a desk in a spare bedroom or a desk in a dedicated room. Open workplaces in the office are production tables, general workplaces, team tables, lounge workplaces or touchdown areas, and dining tables at the canteen/pantry. Open workplaces at home are a desk in the living/dining room and a work spot in the kitchen or at the couch.

Workplace use

The third dimension refers to how workplaces are assigned to office workers. The workplace can either be fixed, assigned to one office worker, or flexible and shared with multiple office workers. The workplaces discussed in the previous section can also be divided into assigned or flexible workplaces. The difference between Open-Plan Offices (OPO) and Activity-Based Work (ABW) settings is related to the use of the office. The OPO applies assigned workstations, while the ABW applies a non-territorial workplace concept with desk-sharing (Van der Voordt, 2004). Non-territorial office and desk-sharing are increasing in popularity in corporate offices, for example, to reduce costs (Van der Voordt, 2004). The cellular office or cubicle can both be assigned to a single employee or shared with other office employees. Some of the workplaces in the open-plan layout are shared with other employees. Shared workplaces are the production tables, single/double lounge workplaces, touchdown areas, team tables, and dining tables at the canteen/pantry. The closed meeting room and brainstorm/project room are also shared. It is common to make reservations for these types of workplaces.

The number of persons with which the room or workplace is shared defines the office use dimension. The same dimension can be applied to the home work environment. Some teleworkers have a designated area or corner of a room, not a separate room (Gurstein, 1996). Others share spaces with family members or other activities. Spare bedrooms or dedicated rooms are often used as designated workplaces, while the kitchen and dining/living room are more flexible.

In conclusion, the office concepts' location, layout, and use dimensions are adopted for this study. Each dimension distinguishes two extremes to emphasize the differences. Table 1 presents an overview with the office type dimensions of De Croon et al. (2005) of the different possible types of workplaces at home and the office. The last column defines the categorization of those different workplaces.

Table 1: Overview of workplaces

Workplace	**Location**		**Layout**		**Use**		**Category**
	Office	**Home**	**Open**	**Enclosed**	**Assigned**	**Shared**	
Dedicated cellular office/cockpit	x			x	x		Assigned workplace in an enclosed environment
Flex cellular office/cockpit	x			x		x	Flexible workplaces in an enclosed environment
Cubicle	x		x	x	x		Assigned workplace in an open environment
General open workplace	x		x		x		
Production table	x		x			x	Flexible workplace in an open environment
Team/meeting tables	x		x			x	
Single or double lounge workplace	x		x			x	
Touchdown areas	x		x			x	
Dining table at canteen/pantry	x		x			x	
Desk in a shared room	x		x	x	x		Shared room
Closed meeting rooms	x			x		x	Meeting facilities
Brainstorm/project room	x			x		x	
Desk in a spare bedroom		x		x	x		Dedicated workplaces in an enclosed environment
Desk in a dedicated room		x		x	x		
Desk in a dedicated room		x		x		x	Dedicated workplaces in a shared environment
Desk in living or dining room		x	x			x	Dedicated workplaces in a shared environment
Work spot in the kitchen		x	x			x	Flexible workplaces in a shared environment
Work spot on the couch		x	x			x	

In total, seventeen workplaces are distinguished. The office workplaces are categorized into six groups. They are as follows:

1. Assigned workplace in an enclosed environment

2. Flexible workplace in an enclosed environment
3. Assigned workplace in an open environment
4. Flexible workplace in an open environment
5. Shared room
6. Meeting facilities

The home workplaces are categorized into four groups:

1. Flexible workplaces in a shared environment
2. Flexible workplaces in an enclosed environment
3. Dedicated workplaces in an enclosed environment
4. Dedicated workplaces in a shared environment

2.2.2 Workplace and productivity

Various scholars studied the effects of office concepts on satisfaction with the work environment and perceived productivity support (Brill & Weideman, 2001; De Been & Beijer, 2014; de Croon et al., 2005). Workplace settings were found to have a significant effect on employees' workplace satisfaction and perceived productivity (De Been & Beijer, 2014; de Croon et al., 2005).

Office Location

Positive outcomes associated with telework, such as increased employee productivity, higher job satisfaction, and improved work-life balance, are among the most commonly cited advantages of telework (Fonner & Roloff, 2010). The main argument is that teleworkers might be more productive because they can work during their most productive time and be less distracted by co-workers (Golden & Veiga, 2008; Martínez-Sánchez et al., 2008). However, the relationship between working from home and increased perceived productivity support is subject to contradictory findings. On the one hand, teleworking is associated with improved perceived productivity support (Baker et al., 2006; Butler et al., 2007; Gajendran & Harrison, 2007; Guler et al., 2021; Hoornweg et al., 2016; Martin & MacDonnell, 2012; Martínez-Sánchez et al., 2008) due to fewer interruptions and distractions, longer working hours, better use of high productivity moments, and increased enjoyment due to flexibility (Tavares, 2017). Despite this potential for increased productivity, home-based employees can lack technical support and may have inadequate IT equipment, which prevents them from achieving the desired productivity (Tavares, 2017). On the other hand, other studies are more nuanced and did not find significant evidence to conclude that the home location is related to perceived support of productivity (Aguilera et al., 2016; Bailey & Kurland, 2002; de Croon et al., 2005). A comparison study concluded that employees' overall perception of productivity level did not change relative to their in-office productivity (Awada et al., 2021).

A specific element of teleworking is the teleworking intensity. Telework intensity can be expressed as the percentage of the number of hours working from home compared to the total number of hours worked (Hoornweg et al., 2016). Hoornweg et al. (2016) found that the direct relationship between telework intensity and individual productivity appeared to be moderated by the number of hours. When the number of teleworking hours becomes too high, it might decrease productivity. A negative relationship is found between telework intensity and productivity (Hoornweg et al., 2016). Knowledge workers have been obliged to work from home full-time during the COVID-19 pandemic. This increases the number of teleworking hours and intensity, resulting in a decrease in productivity. In conclusion, the literature is not conclusive on the difference in the relationship between location and perceived support of productivity. However, the home location is expected to better support employees' perceived productivity support. So, the hypothesis stated is as follows:

H_{1A}: The home location better supports employees' perceived productivity compared to the office location

Office layout

Some authors argued that employees who are more satisfied and supported by their workplace and physical environment are more likely to have higher perceived productivity (Kamarulzaman et al., 2011). Higher self-reported productivity is related to the suitability of a working place at home (Nakrošienė et al., 2019) and at the office (De Been & Beijer, 2014; de Croon et al., 2005). Although many claims have been made about improvements in productivity with open office designs, research findings have been mixed. Some studies concluded that employees in individual and shared room workplaces rate their perceived productivity support higher than employees working in more open layout settings (De Been & Beijer, 2014). A higher extent of enclosure can explain this in individual workplaces, which was a significant factor for productivity in earlier studies (Brill & Weideman, 2001; Sundstrom et al., 1980). Other studies indicated no clear and inconsistent evidence for a relationship between office openness and layout on employees' perceived support of productivity (Ahmad et al., 2020; Brennan et al., 2002; de Croon et al., 2005; Haynes, 2008b).

An open office layout is associated with complaints regarding noise and distractions, which office employees judge as a primary resource of discomfort and reduced productivity (Kamarulzaman et al., 2011; Oldham, 1988; Sundstrom et al., 1982). Too much noise in open work environments might increase the workload (de Croon et al., 2005), linked to a decrease in productivity support. In contrast, other studies claim that the open office design facilitates communication and increases interaction between employees and, as a result, improves employees' satisfaction and productivity (De Been & Beijer, 2014; Erlich & Bichard, 2008; Joy & Haynes, 2011; Kim & de Dear, 2013). Workplaces in enclosed environments, such as cockpits and cellular workplaces, support concentrative tasks well but do not support more socially related tasks such as brainstorm meetings. In conclusion, a direct relationship between office layout and perceived support of productivity is not established. Satisfaction with the work environment, including the physical features is assumed to have a mediating role between work settings and perceived productivity support. When the overall satisfaction increases, it may also raise employees' perceived productivity support. The hypothesis is formulated that office layout relates to employees' perceived productivity support since a direct relationship could not be established.

As discussed in the previous section, home-working employees select a spare bedroom and a dedicated room as the most commonly used workplace location (Magee & Arch, 2000). The common denominator of these locations is privacy and well-defined boundaries. These workplaces have strictly defined spaces that help teleworkers to differentiate between home and work. Spaces that are public and hold other household functions, such as formal living and dining rooms, are less likely to be used (Magee & Arch, 2000). Employees working in a dedicated separate room at home reported higher perceived productivity than employees working in different rooms (Awada et al., 2021; Kieft, 2021). The desk in the dedicated room at home is assumed to have the largest positive relation with employees' perceived productivity. The living room supports the employee's productivity the least (Kieft, 2021). Working in the bedroom is more preferred than working in the living room. Higher productivity levels are achieved by workers who have a dedicated home workspace compared to those who have not (Awada et al., 2021). In addition, the size of the home work environment influences productivity (Kieft, 2021; Magee & Arch, 2000). A large size workplace has a larger positive influence on productivity compared to a small size workplace.

In conclusion, the hypothesis is stated as follows:

H_{1B}: The home and office workplace layout relate to perceived support of productivity

Office use

Activity-Based Working aims to provide a diversity of settings that may improve the adverse effects of reduced productivity. Dissatisfaction regarding auditory privacy may be reduced by switching to a more quiet workplace. It is assumed that there are fewer distractions in activity-based offices compared to Open Plan Offices (Seddigh et al., 2014). The variety of workplaces is claimed to enhance privacy, autonomy and communication between employees (Van der Voordt, 2004). In an ABW environment, it is assumed that the activity influences the choice of the workplace (Appel-Meulenbroek et al., 2015). However, several studies found that the office type is not always used as intended (Appel-Meulenbroek et al., 2011; Been & Beijer, 2015; Gorgievski et al., 2010). The studies indicate that employees do not frequently switch (Rolfö et al., 2018) from a workstation, thus using workplaces not suited for the performed activity. This might result in dissatisfaction with the workplace and decreased productivity (Appel-Meulenbroek et al., 2011).

Other salient complaints that can result in dissatisfaction among office employees are non-territorial workplaces searching for co-workers and not knowing their placement in the office. Productivity decreases because of insufficient desk and storage space (Kim et al., 2016). The workplace's personalization possibilities and time to sit down and to install are also not conducive to productivity (Kim et al., 2016; Rolfö et al., 2018). Rolfö et al. (2018) found no significant change in individual and group productivity after relocation to ABW. In contrast, Öhrn et al. (2021) did find a significant decrease in employees' productivity after relocation to an ABW environment. Major arguments were the lack of privacy and increased noise disturbance, and reduced satisfaction with furniture comfort. Employees based in ABW settings with activities requiring a high degree of concentration experienced lower productivity, while those with a large part of collaborative tasks rated productivity to be continually high (Öhrn et al., 2021). It can be assumed that experienced support of activities mediates the relationship between workplace settings and perceived productivity support.

De Croon et al. (2005) did not find a significant relationship between desk-sharing and perceived productivity. So, a direct relationship between unassigned workplace concepts and various settings and individual and group productivity is questionable. Few studies have examined the relationship, and the different studies show inconsistent results (De Been & Beijer, 2014; Gorgievski et al., 2010; Nijp et al., 2016). Kim et al. (2016) argued that the relationship between office use and perceived productivity support is mediated by satisfaction with workplace aspects. Occupants in flexible arrangements are more likely to negatively evaluate their workplace productivity when satisfaction decreases for workplace aspects such as personalization possibilities, comfort of office furniture, amount of work space and storage available, and office layout.

A positive relationship was found for the workplace use and perceived productivity in the home environment. Employees prefer to work privately compared to working in a shared environment. Employees who did not have to share their workplace with relatives reported higher productivity than those who did (Kieft, 2021; Ng, 2010). The rooms that are shared mostly are the living room and kitchen. A work room or bedroom are most used as a private or dedicated office. In conclusion, the hypothesis is stated as follows:

H_{1C}: The home and office workplace use relate to perceived support of productivity

2.2.3 Conclusion

This section explored different workplace settings. Office concepts can vary between location, layout, and use. Workplaces can be assigned to employees, like in conventional offices, or be flexible, like in activity-based offices. Additionally, the work environment can be open or enclosed, like the open-plan or cell offices. Both office concepts are supported by concentrative and interactive environments, like

meeting rooms and coffee corners. These differences in office workplaces form the basis of the identified workplaces, which are listed below:

1. Flexible workplaces in an enclosed environment
2. Flexible workplace in an open environment
3. Assigned workplace in an open environment
4. Assigned workplace in an enclosed environment
5. Assigned workplace in a shared room
6. Meeting or project rooms
7. Flexible workplaces in a shared environment at home
8. Dedicated workplaces in an enclosed environment at home
9. Dedicated workplaces in a shared environment at home
10. Flexible workplaces in an enclosed environment at home

Next, the relationship between the different workplace settings and employees' perceived productivity support is elaborated. This section formulated three hypotheses regarding the location, layout and use. The literature revealed inconsistent results to conclude that the home location is related to perceived support of productivity. Higher self-reported productivity is related to the suitability of a working place at home and at the office. However, literature theories reveal a relationship with teleworking intensity. This results in the following hypothesis:

H_{1A}: The home location better supports employees' perceived productivity compared to the office location

There is also inconsistent evidence for a relationship between office openness and layout on employees' perceived support of productivity. So, no direct relationship between office layout and perceived support of productivity could be established. However, the openness of the workplace can be indirectly linked to perceived productivity support by noise and distraction, which is judged by office employees as a primary resource of discomfort and reduced productivity. Resulting in the following hypothesis:

H_{1B}: The home and office workplace layout relate to perceived support of productivity

Studies showed inconsistent results for desk-sharing in relationship to perceived support of productivity. Regarding the home work environment, employees that did not have to share their workplace with relatives reported higher productivity compared to those who did. Resulting in the following hypothesis:

H_{1C}: The home and office workplace use relate to perceived support of productivity

In conclusion, the home and office workplace settings relate to perceived productivity support. However, the literature revealed inconsistent results concerning a direct relationship. It is expected that satisfaction with physical aspects of the workplace mediates between workplace settings and perceived productivity support. The definite hypothesis is stated below.

H_1: Workplace settings relate to perceived support of productivity

The conceptual model is updated based on the different workplace settings described above and the hypothesis. Figure 4 illustrates the updated.

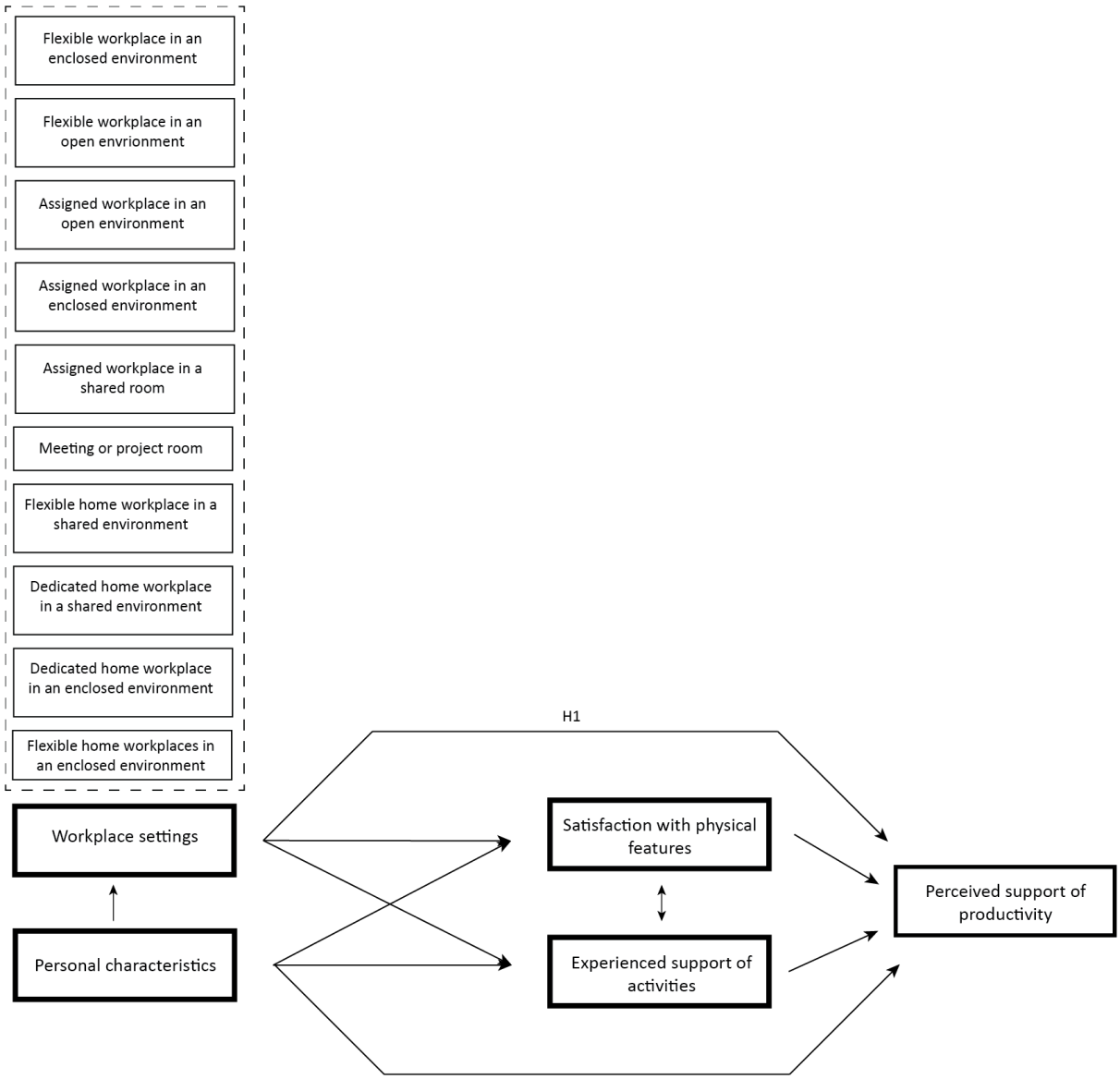


Figure 4: Conceptual model including workplace settings

2.3 Physical workplace features

This chapter explores the satisfaction with different physical workplace features that might affect employees' perceived productivity. First, the different physical features of the office and home work environment are summarized. Second, the relationship between satisfaction with physical features at home and in the office and perceived productivity support is explored. The chapter closes with an overview of different workplace characteristics assumed to impact employees' self-assessed productivity support.

2.3.1 Physical features of the office work environment

Various studies explored employees' satisfaction with one or multiple workplace- and building-characteristics (Awada et al., 2021; Batenburg & Van der Voordt, 2008; Brill & Weideman, 2001; Maarleveld & De Been, 2011; Ng, 2010). Batenburg & Van der Voordt (2008) and Maarleveld et al. (2009) studied the satisfaction with different office facilities and services. They used the WODI work environment diagnostic tool. Satisfaction with features and facilities was operationalized by the employees' level of satisfaction with multiple aspects of the work environment. Satisfaction or dissatisfaction with physical characteristics implies indirectly that the physical feature is important for

employees. These aspects were divided into different categories based on the study of Maarleveld et al. (2009). Not all categories are included since some focus on organizational and service characteristics. In total, six categories are distinguished, including different physical features of the workplace. Table 2 displays the different categories and characteristics. The functionality category includes variables related to supportive spaces and rooms in the office for meetings. Also, this category includes a room booking system. The second category focuses on the ergonomics of the workplace. Aspects related to the workplace are included, such as dimensions and adaptability of the furniture and the possibility of personalizing the workplace. Esthetics is related to the general office décor. The ambience and how the space feels is included in these features. Archive includes central or personal archive or storage space. IT focuses on fixed and mobile equipment such as desktops and laptops. The last category focuses on the indoor climate. Indoor environmental qualities such as temperature, ventilation, and air quality are included in this category. The characteristics are marked if they are applicable for the office and the home work environment. The complete overview is presented in Table 2.

Table 2: Overview physical features of the work environment

Category	Characteristics	Office	Home
Functionality	Space for official meetings	X[1,2,3]	
	Space for informal meetings	X[1,2,3]	
	Activity-based workplace use	X[3]	
	Layout of the office	X[1]	
	Orientation of workplaces relative to each other	X[1,3]	
	Reservation systems	X[1]	
Ergonomics	Dimensions of the workplace	X[1,2,3]	X[5,6]
	Dimensions of the furniture	X[1,2,3]	X[5,6]
	Comfort of the furniture	X[1,2,3]	X[5,6]
	Adaptability of the desk chair	X[1,3]	X[4,6]
	Adaptability of the desk	X[1,3]	X[4,6]
	Monitor and keypad	X[1]	X[4]
	Space for personal attributes	X[2,3]	
Esthetics	Use of materials	X[1,3]	
	Use of color	X[1,3]	X[5]
	Furnishing	X[1,3]	X
	Art	X	X[5]
	Plants	X	X[5]
	Outside view	X[1]	X[5,6]
	Architecture of the building	X[1,3]	
Archive	Central archive	X[1,3]	
	Personal archive	X[2,3]	X[6]
	Amount of storage space	X[2]	X[6]
IT	Computers	X[3]	X[4]
	Laptop		X[4]
	Network	X[3]	X[6]
	Copier/scanner	X[3]	X[5]
	Software	X[3]	X[6]
Indoor climate	Temperature	X[1,2,3]	X[4,5]
	Ventilation	X[1,2,3]	X[4,5]
	Air quality	X[1,3]	X[4]

	Acoustics	X[1,2,3]	X[4,6]
	Artificial lighting	X[1,2,3]	X[4,5,6]
	Day light	X[1,2,3]	X[4,5,6]
	Personal control over IEQ	X[1,2,3]	X[4,5]
	Noise of climate installations	X[1,3]	

1: Batenburg & Van der Voordt (2008); 2: Kim et al. (2016); 3: Maarleveld et al. (2009); 4: Awada et al. (2021); 5. Kieft (2021); 6. Ng (2010)

The comparison studies suggest that teleworkers desire characteristics in their home offices similar to conventional offices (Ng, 2010). Each workplace setting includes a different set of physical features that are either fixed or flexible. Space for personal attributes and personalization possibilities are more likely to be part of an assigned or dedicated workplace. It is assumed that different home and workplace settings relate to satisfaction with the physical features of the workplace.

2.4 Satisfaction with physical features and productivity

Satisfaction with the physical features of the workplace is argued to be the most important predictor of self-assessed support of productivity (Batenburg & Van der Voordt, 2008; Groen et al., 2019). The relation between satisfaction with the physical features of the work environments and the perceived support of productivity is explored.

2.4.1 Functionality

Satisfaction with functionality does have a significant influence on perceived productivity (Batenburg & Van der Voordt, 2008; De Been & Beijer, 2014; Groen et al., 2019; Lou & Ou, 2019). Satisfaction with functionality seems to have a larger effect than the other variables. Satisfaction with the functionality category showed the second highest correlation with perceived productivity compared with the other categories (Batenburg & Van der Voordt, 2008). The office layout and orientation of the workplaces relative to each other determine mainly the possibility to do communication- and concentration work. Spatial arrangement is about the overall layout and position of different working zones. Satisfaction with the spatial arrangement, number and variety of workplaces is significantly positively related to perceived office satisfaction (Brill & Weideman, 2001; Göçer et al., 2018; Haapakangas et al., 2018; Kim et al., 2016)

The presence of dedicated meeting rooms in the office environment stimulate communicative and collaborative activities (Oseland et al., 2011; Peponis et al., 2007). Formal meeting areas are better suited for conversations or consultations than informal meeting places. Various authors recognize the formal meeting area (Brill & Weideman, 2001; Haynes, 2007b; Palvalin et al., 2017) as a possible productivity enhancer. Office spatial requirements include meeting areas (including conference rooms, meeting rooms and project tables, and break-out areas (such as lounge cafeteria, soft seating, and kitchen). Lower satisfaction ratings for space for breaks and space to collaborate increased the likelihood of negative votes on perceived productivity (Kim et al., 2016).

2.4.2 Ergonomics

Satisfaction with comfort and furnishing and the size of the workspace is most important for flexible workplaces. The physical design of workplaces and office furniture has great importance for ergonomics. Studies showed that implementing ergonomic furniture, like sit-stand workstations and adjustable furniture, in an office environment are likely to accomplish higher levels of productivity (Brill & Weideman, 2001; De Been et al., 2016; Karakolis & Callaghan, 2014). Having adequate and suitable furniture and equipment might be even more critical for teleworkers (Hill et al., 1998). Home office ergonomics are positively related to employees' productivity (Moretti et al., 2020; Ralph et al., 2020)

Limited possibilities for workplace personalization are associated with decreased workplace satisfaction (Haapakangas et al., 2018; Wells, 2000). In contrast, personalization appears to have a limited relationship with productivity support (Haapakangas et al., 2018) but might have an indirect relationship via general satisfaction with the work environment. This variable is expected to contribute to general satisfaction with the work environment, which is also assumed to positively influence the employees' support of productivity.

2.4.3 Esthetics

Bringing the natural environment or greenery inside an office is expected to be positively related to the occupiers' satisfaction and productivity (Gray & Birrell, 2014). Chang & Chen (2005) and Nieuwenhuis et al. (2014) reported that views of nature and plants from windows help increase occupants' productivity. Employees with plants in the home work environment and an outside view reported higher individual productivity than employees with no plants and without an outside view (Kieft, 2021; Magee & Arch, 2000).

2.4.4 Archiving

Various studies looked into the relationship between satisfaction with archive and storage facilities and the support of individual productivity (Batenburg & Van der Voordt, 2008; Gorgievski et al., 2010; Gurstein, 1996; Haapakangas et al., 2018; Haynes, 2007b; Maarleveld & De Been, 2011). The workplace should facilitate sufficient storage (Magee & Arch, 2000). Insufficient storage space at home is reported to be a problem in nearly half of the cases (Gurstein, 1996; Kieft, 2021). Haapakangas et al. (2018) reported a significant positive relationship between satisfaction with storage possibilities. However, the relationship was limited.

2.4.5 ICT

Employers should ensure that the computer and software are suited for the task and that technical assistance can be accessed easily (Montreuil & Lippel, 2003). The information, communication, and technology services should be up-to-date, and access to information should be guaranteed (Magee & Arch, 2000). It is essential that the used IT and equipment is high-quality and trouble-free to enhance perceived productivity support (Maarleveld et al., 2009).

IT facilities can be a source of dissatisfaction but appears to have limited influence on productivity support. The relationship between satisfaction with IT functions is significant but limited (Haapakangas et al., 2018). The variable of access to facilities and ICT is likely to contribute to general workplace satisfaction which is related to productivity. The availability of ICT facilities at home has the second-highest positive influence on employee productivity (Kieft, 2021).

2.4.6 Indoor climate

The satisfaction with the overall comfort of the work environment is mentioned as a characteristic that affects the perceived productivity (Batenburg & Van der Voordt, 2008; Brill & Weideman, 2001; Brunia et al., 2016; Groen et al., 2019; Haynes, 2007b; Palvalin et al., 2017; Van den Berg, 2017). The comfort conditions of the work environment include multiple variables. The comfort component covers indoor air quality, temperature, natural daylight, artificial light, thermal comfort, and noise & acoustics. Early research by Leaman (1995) states that people unhappy with temperature, air quality, lighting, and noise conditions in their offices are more likely to rate their productivity at work poorly. The indoor environmental qualities (IEQ) have significant interactions and crossovers. For example, daylight directly relates to the thermal comfort state in the office. The sunlight radiates into the indoor environment by heating the windows (Huizenga, Zhang, et al., 2006). A decrease in temperature may improve occupant perception of the indoor air quality (De Dear & Brager, 2002).

Relative to the office, the specific physical features that scored higher at home were better air quality, more silence, and control over the temperature (Montreuil & Lippel, 2003; Umishio et al., 2021). Compared to the office, the satisfaction rate was lower for lighting, spatial environments, and information technology (Umishio et al., 2021). Kieft (2021) reported a limited influence of indoor climate variables on employees' productivity at home, while the indoor climate factors have a more determinant role in the office environment.

Thermal comfort

Thermal comfort is a subjective state which varies between employees. Comfort is dependent on dynamic factors such as clothing, altering activity, window location, and mood. Multiple studies (Akimoto et al., 2010; Awada et al., 2021; Geng et al., 2017; Lou & Ou, 2019) found a relationship between thermal satisfaction and office workers' productivity. Occupant productivity increases when an environment moves from an acceptable thermal state to a preferred thermal state. When the thermal environment was unsatisfactory, it also weakened the comfort expectations of other indoor climate factors and may result in productivity loss (Akimoto et al., 2010). A quantitative relationship between productivity and the thermal environment was established. The optimal productivity was obtained when people felt neutral or slightly cool and the increase of thermal satisfaction positively affected productivity (Geng et al., 2017). Satisfaction with IEQ parameters in the home environment, especially the thermal environment, were positively associated with perceived productivity (Awada et al., 2021).

Indoor air quality

The indoor air quality (IAQ) is the degree of quality of the indoor air of a building (Al Horr et al., 2016). Numerous studies demonstrate that a workplace with acceptable air quality enhances employees' productivity in performing office tasks such as writing, reading, and mathematical tasks (Al Horr et al., 2016; Fanger, 2000). Lou & Ou (2019) concluded that satisfaction with indoor air quality is also related to perceived office productivity. Unpleasant odors can cause various adverse effects on office performance, such as harming occupants' mood and perceived health.

Noise & acoustics

Noise and acoustics play an important role in office design as most office tasks require a degree of noise control to enable the occupant to work productively. Lousy acoustics and noise can result in dissatisfaction with the office environment and negatively affect office workers' productivity (Al Horr et al., 2016; Balazova et al., 2008; Frontczak et al., 2012; Toftum et al., 2012). Other studies concluded that satisfaction with acoustics is significantly related to employees' perception of productivity (Batenburg & Van der Voordt, 2008; Lou & Ou, 2019). Open plan office noise can have a negative impact on the performance of employees (Field, 2008). Internal office noise affects tasks associated with word processing and numbers calculation. Open plan office employees are more prone to privacy issues and disturbances due to the various office sounds (Balazova et al., 2008; Toftum et al., 2012). Noise and distractions can be better controlled in the home work environment than at the office (Golden & Veiga, 2008; Martínez-Sánchez et al., 2008). Agreements should be made when working from home with family members or roommates to reduce the noise. The noise is also dependent on the room's original function, for example, kitchen or bedroom. Noise is assumed to be a highly relevant feature of the home workplace related to perceived productivity (Ng, 2010).

Lighting

Satisfaction with lighting, daylight and artificial light is related to perceived productivity, dependent on the task employees perform (Brill & Weideman, 2001; Groen et al., 2019; Lou & Ou, 2019; Palvalin et al., 2017). Lou & Ou (2019) concluded that satisfaction with lighting is mainly related to respondents' perception of productivity. A desk that is situated near a window enhances the view and

natural daylight, which are important factors for the office and home workplace. Building occupants prefer natural light over artificial light (Boyce et al., 2003; Reinhart, 2002).

Personal control

Various researchers revealed that the ability to personally control environmental factors, like temperature, air quality, light and noise levels, has a positive impact on perceived productivity (Batenburg & Van der Voordt, 2008; Boerstra et al., 2014; De Been et al., 2016; Leaman, 1995; Palvalin et al., 2017; Van den Berg, 2017). Results predicted a 6%-10% higher perceived productivity when complete personal control is experienced than no control (Boerstra et al., 2014). Individual control over indoor climate may result in conflicts between office employees (De Been et al., 2016), especially in shared workplaces.

2.5 Conclusion

In this section, the studies of Al Horr et al. (2016) and Batenburg & Van der Voordt (2008) among others are explored which focus on characteristics of the office environment, while others studied the characteristics of the home work environment (Moretti et al., 2020; Nakrošienė et al., 2019; Ng, 2010; Ralph et al., 2020). Some of the physical characteristics are equivalent in the home and office work environment. Access to ICT facilities, workplace ergonomics, and storage can be interpreted similar for both environments. Layout features are less applicable to the home environment. All six categories, functionality, ergonomics, esthetics, archive, ICT, and indoor climate are assumed to be significantly related to productivity support. Satisfaction with functionality and indoor climate are assumed to have the highest and second-highest correlation with perceived productivity support. Archive and esthetical aspects are assumed to have a limited impact on perceived productivity support. Different workplace settings include a different set of physical workplace features. Some physical features determine the workplace while others are flexible such as personalization possibilities. It is assumed that different workplace settings relate to satisfaction with those features. In conclusion, the following hypotheses are posed:

H_2: Satisfaction with physical features relates to perceived support of productivity in the home and office work environment

H_3: Workplace settings relate to satisfaction with physical features

In Section 2.2 is concluded that the home and office workplace settings relate to perceived support of productivity. However, the literature revealed inconsistent results concerning a direct relationship. The hypothesis above states a direct relationship between satisfaction with physical features of the workplace and perceived productivity support. It is expected that satisfaction with physical aspects of the workplace mediates between workplace settings and perceived productivity support. The hypothesis formulated is stated below:

H_4: Satisfaction with physical features mediates the relationship between workplace settings and perceived support of productivity

Different physical features of the home and office environment are explored in the previous section. Figure 5 shows the updated conceptual model.

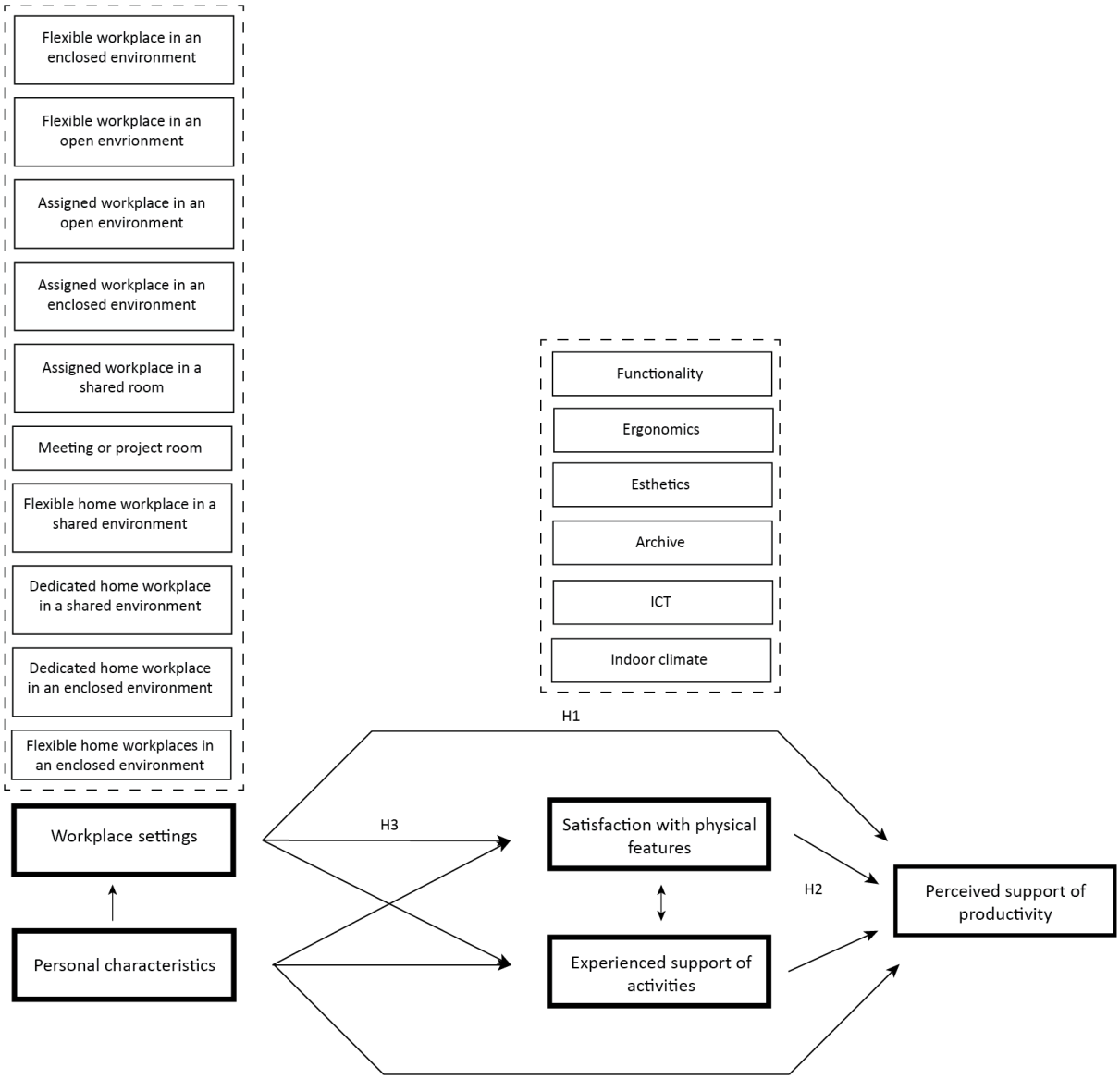


Figure 5: Conceptual model including physical features

3.0 Activities

This chapter elaborates on the relationship between the experienced support of activities to perceived productivity. Firstly, the different activities employees perform are discussed. Different studies are examined to get insight into employees' different tasks and activities. Secondly, task variety is explored. Both task variety and the number of different tasks are elaborated and their relationship to perceived productivity. Third, the location for different types of activities is discussed. The chapter closes with an overview of the preferred workplace linked to a work-related activity and an updated conceptual model.

3.1 Activity types

Activities can differ in attributes like duration, frequency and importance (Tabak, 2009). This depends on the nature of the activity and personal aspects. The number of times an activity is performed varies per activity and can range from just once to multiple times a day. Activities like a coffee break or telephone conversations happen multiple times a day, while other activities, like audio conferences and presenting, are performed less often. The same applies to the duration of an activity. This can also range from a couple of minutes to a couple of hours. Different activity categories can be defined to capture the work behavior of employees.

The three main activities identified by De Been et al. (2016) are focused concentrated work, knowledge sharing and social interaction. Vos and Van Der Voordt (2001) defined seven categories of work activities: computer-related activities, reading, archiving, phoning, informal consultation, formal consultation and a category of other activities. Brill and Weideman (2001) also explored how people spend their time at work. They used eight task categories to understand where and how people spend their time. They took the time-at-tasks as averages for four functional job types. The activities studied by Vos and Van Der Voordt (2001) and Brill and Weideman (2001) show overlap with the categorization of three by De Been et al. (2016) and Maarleveld et al. (2009). Behind the computer, quiet work, and desk work show similarities with focused concentrated work. Formal communication, telephoning, and meeting in a workspace can be related to knowledge sharing, while break and informal interaction can be referred to as informal interactions. De Been et al. (2016) identified the three activity categories, which could be seen as more broad. The difference between the percentage of informal interaction of Maarleveld et al. (2009) and Vos & Van Der Voordt (2001) and Brill and Weideman (2001) is remarkable. Maarleveld et al. (2009) reported that 30% of an employee's working time is spent on informal interaction compared to 14% in the other studies (Brill & Weideman, 2001; Vos & Van Der Voordt, 2001). A possible explanation could be that a larger part of the respondents of Maarleveld et al. (2009) worked in open workplace settings. Figure 6 illustrates the average time spent on these activities. An office worker is on average engaged in 60% concentrated desk-based working. Office workers spend approximately 20% of their time on meetings, dialogues, and telephoning.

Liebregts (2013) conducted a factor analysis to determine whether the set of work-related activities could be reduced to a smaller number. She grouped activities based on their experienced support. The analysis yielded four categories: concentrative activities, interaction-based work activities, facility dependent work activities, and collaborative work activities. Her classification shows similarities with other activity grouping results (Tabak, 2009; Van der Voordt, 1999). Table 3 presents an overview of the different activities including the classification. Figure 6 shows the percentage of time spend on those activities.

Table 3: Categorization of the activities

Categories	Brill and Weideman (2001)	Vos and Van Der Voordt (2001)	Maarleveld et al. (2009)
Focused concentrated work	Computer, Quiet work	Desk work	Computer work
		Filing	Read/wright
			Paper work
Formal meetings	In meeting rooms	Formal communication	Formal meeting
Informal interaction	Meet in workspace	Informal communication	Informal meeting
	Informal interactions		
Telephoning	Phone	Telephoning	Telephone
Other	Break		Break
	Other	Other activities	Other

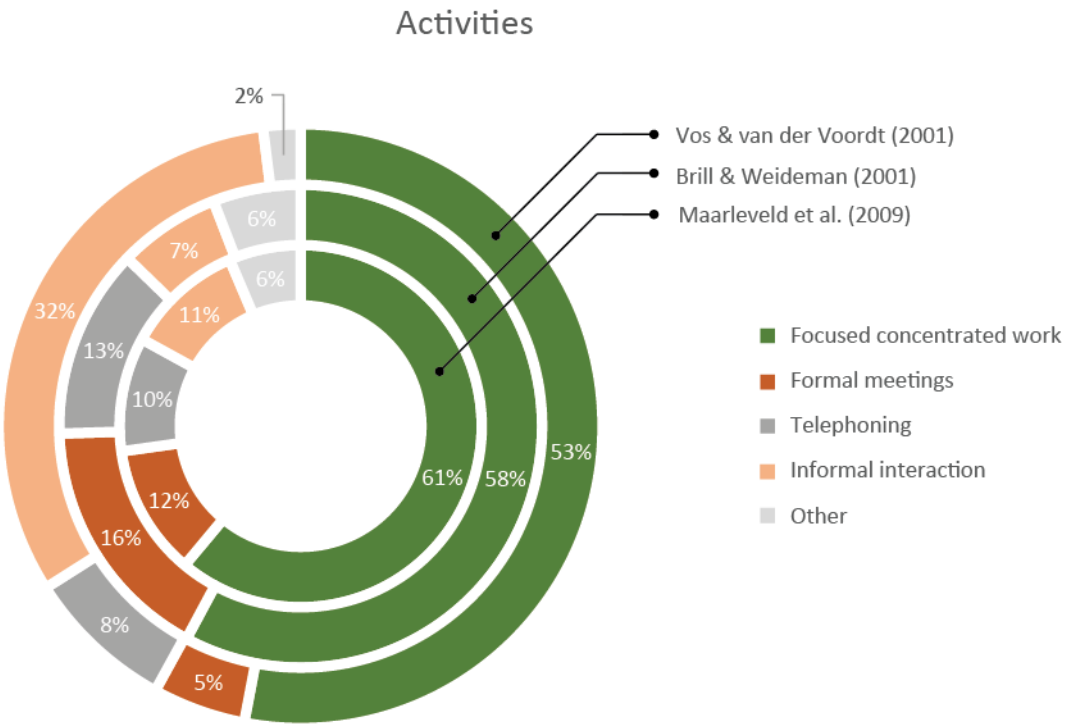


Figure 6: Percentage of time spend on activities

Leesman (2021) asked respondents to fill in an office survey identifying the importance of activities. Table 4 shows the overview of important activities by employees. Respondents were asked to indicate if an activity is important for their line of work. Individual focused, desk-based work is rated as important by most of the respondents. Second, planned meetings (i.e. formal communication) are rated important by nearly 75% of the respondents. This corresponds to the high percentage of time spent on focused concentrated work and formal communication activities.

Table 4: Importance per activity (Leesman, 2021)

Activity	Importance (%)
Individual focused work, desk-based	91.3
Planned meetings	74.1
Telephone conversations	67.7

Informal, unplanned meetings	56.7
Collaborating on focused work	56.0
Relaxing/taking a break	50.4
Audio conferences	47.2
Reading	45.2
Individual routine tasks	45.2

In conclusion, the four most dominant activities prevailing in the literature are concentrative work (individual focus work, reading and computer work), informal social interactions (relaxing), collaborative work (planned meetings or collaborating), and facility dependent activities.

It seems important to users of an office building that the facilities support their current activities. The support and satisfaction with concentrative tasks are considered most important for employees' productivity followed by the support of communicative tasks (De Been et al., 2016). Spatial arrangements favoring spontaneous interaction (Brill & Weideman, 2001) and collaboration (Strubler & York, 2007) are established to be important to enable productivity. The presence of dedicated meeting spaces stimulates the amount of communication (Oseland et al., 2011; Peponis et al., 2007) and the perceived support of collaboration.

Employees who perceive their workplace as not suitable for the task they have to perform usually report lower productivity outcomes (Soriano et al., 2021; Vischer, 2007). Maarleveld et al. (2009) found that satisfaction with the facilities substantially influences perceived productivity when asking for the support of the work environment. Optimizing the employees' fit of the workplace and experienced support of activities is positively related to enhanced productivity (Kristof-brown et al., 2005), while a misfit may negatively affect the performance of the employee (Edwards, 2008). In conclusion, it is assumed that experienced support of activities relates perceived productivity support. The following hypothesis is formulated:

H_5: Experienced support of activities relates to perceived support of productivity

3.2 Task variety

Tasks are defined as activities that employees could conduct in the work environment to perform and execute their job. Due to the rise of information and communication technology taking over the traditional office tasks, more employees perform work-related activities in the knowledge category. Knowledge work typically involves a high degree of job autonomy (Davenport, 2005). Multiple task characteristics are concerned with the work-related activities office employees perform. A task can be described by its characteristic, such as complexity or variety. Task characteristics are primarily concerned with how the work itself is accomplished and the range and nature of tasks associated with a particular job (Morgeson & Humphrey, 2006). Bedny et al. (2012) and Liu & Li (2012) studied different aspects of task characteristics to determine the complexity of the job. The degree of unpredictability and associated uncertainty are other important factors of complexity. Time restrictions and the risk factor in case of erroneous action also increase task complexity.

Task variety depends on the number of static and dynamic components of the task and the interaction of these components. The nature of the task determines the task profile an employee is occupied with. For example, when the share of concentrative work for an employee is important or more time consuming, he/she then has a concentrative task profile. In contrast, if the share of communication work is larger or more important, the employee has a more collaborative task profile. The task profiles are based on the categorization of the activities as discussed above. Another aspect of task variety is the number of different tasks performed, which is determined by the number of activities employees

deem important. Task variety refers to the extent to which a job requires employees to perform a wide range of tasks. The combination of different activities implies that employees' tasks are characterized by a high degree of task variety (Morgeson & Humphrey, 2006).

Task variety is a motivational work characteristic. The basic principle of the motivational approach is that jobs are enriched, made more motivating and satisfying if high levels of these characteristics are present (Morgeson & Humphrey, 2006). Jobs that involve the performance of several different work activities are likely to be more exciting and enjoyable to perform (Sims et al., 1976). So, it is assumed that employees with a high task variety perceive higher productivity support compared to employees who perform fewer tasks.

According to Maher & von Hippel (2005), the relation between task profiles and productivity support is not evident. In addition, Wohlers & Hertel (2017) concluded that employees who always work on the same kind of task could not take advantage of the flexibility of the various office settings, as they do not need different working locations for their tasks. On the other hand, employees with a high task variety might switch workstations several times a day. Higher levels of strain might be experienced by employees when working in assigned workplaces or by switching too often (Wohlers & Hertel, 2017). This could result in reduced perceived productivity. Too few studies established a direct effect between task variety and perceived productivity support. If an employee with a concentrative task profile experiences focused activities as well supported, the employee likely perceives higher productivity support. So, it is assumed that satisfaction with physical features and experienced support of activities mediate the relationship between task variety and perceived productivity support.

In conclusion, current studies show different findings to conclude a direct relationship between task variety and perceived productivity support. On the one hand, Morgeson & Humphrey (2006) claim that task variety will enrich jobs and make them more motivating. On the other hand, Wohlers & Hertel (2017) argued that higher levels of strain might be experienced by employees when switching too often which reduced perceived productivity. It is assumed that experienced support of activities and satisfaction with physical features mediate this relationship. Kaarlela-Tuomaala et al. (2009) argued that more research is necessary to find scientific evidence between the influence of task variety and satisfaction and productivity. Task variety is seen as a personal characteristic of the employee. The following hypotheses can be formulated in which it is assumed that task variety relates to perceived productivity support:

H_6: Task variety relates to perceived support of productivity

H_7: Task variety relates to experienced support of activities and satisfaction with physical features which mediate the relationship with perceived support of productivity

3.3 Workplace settings and activity support

An activity occurs at a certain location in the building. Dependent on the nature of the activity, a particular type of location is preferred. Employees' decision-making is based on individual preferences between home and office locations. It is proposed that the activity patterns adopted by the large and increasing number of employees with a choice about the moments and places for carrying out work activities result from individual decision-making in response to individual constraints and opportunities (Fawcett & Song, 2009).

3.3.1 Interactive activities and workplace settings

Interactive activities can be divided into two types of interaction at work, namely work-related interactions (e.g. formal meetings) and social interactions (e.g. chatting during coffee breaks) (Marouf, 2007; Weijs-Perrée et al., 2020). Several studies suggest that more informal interactive activities, such as chatting and casual conversations, take place more often at individual workstations, kitchen or coffee areas, in the canteen or hallways (Davenport & Bruce, 2002; Hua et al., 2011; Tschan et al., 2004). On the other hand, formal interactive activities, like formal planned meetings, are likely to occur in meeting rooms or at employees' workplaces. The same applies to collaborative activities, such as discussions and brainstorming (Tschan et al., 2004). Furthermore, Peponis et al. (2007) and Toker & Gray (2008) explored that the layout and design of the physical work environment mainly facilitate unplanned social activities. Working in open settings is favourable for stimulating interaction. However, it often leads to distraction resulting in lower support of perceived productivity than enclosed environments (Brill & Weideman, 2001; De Been & Beijer, 2014; Erlich & Bichard, 2008; Haynes, 2008b; Seddigh et al., 2014). Wohlers & Hertel (2017) suggested that the openness of the work environment could increase relationships and new collaborative activities between team colleagues and other employees. An open workplace is characterized by low-walled and high-visibility work settings (Stryker et al., 2012). Several important locations are identified (Appel-Meulenbroek et al., 2017; Boutellier et al., 2008; Hua et al., 2011) where interactive activities might take place in office buildings. Workstations, coffee areas, and open/closed meeting areas are important locations for interactive activities (Hua et al., 2011), while a café/restaurant is an important location for sharing personal information (Rashid et al., 2006; Rothe et al., 2012).

3.3.2 Concentrative activities and workplace settings

Concentrative tasks are essential for knowledge work, as desk work represents approximately 60% of the time spent working on it (Brill & Weideman, 2001; Vos & Van Der Voordt, 2001). Additionally, the physical features rated most important by office employees are related to distraction and interaction (Brill & Weideman, 2001; De Been et al., 2016; Palvalin et al., 2017; Van den Berg, 2017). So, there is high importance for workplaces supporting concentrative tasks (Maarleveld et al., 2009). Employees who get distracted or interrupted acquire a productivity penalty for their current task because they need time to focus on their current task to get back in the workflow (Haynes et al., 2017). An appropriate spatial layout to work distraction-free is relevant for various activity profiles. Erlich & Bichard (2008) presented an overview, illustrated in Figure 7, of the workspaces with the axes representing the perceived support for collaborative and concentrative activities. Employees prefer mostly the home work environment for performing concentrative activities (Erlich & Bichard, 2008; Joy & Haynes, 2011). The home work environment seems suitable for low collaborative and high concentrative task profiles. The locations preferred in the office work environment are quiet rooms and team-based areas (Joy & Haynes, 2011). Activities, like planning, analyzing, processing, and writing, require uninterrupted and longer attention spans, a state of mind deemed difficult within the open-plan office (Erlich & Bichard, 2008). The location preferred for scheduled meetings, either one-on-one as well as team meetings, is a meeting room or an open plan design where additional spaces such as public seating areas, closed meeting rooms, cafeterias and breakout areas are provided (Erlich & Bichard, 2008; Joy & Haynes, 2011). These alternative spaces were also used mostly for collaborative work and reflect the importance of communication. Office employees also favor the team-based area or social spaces for collaborative activities (Erlich & Bichard, 2008; Joy & Haynes, 2011).

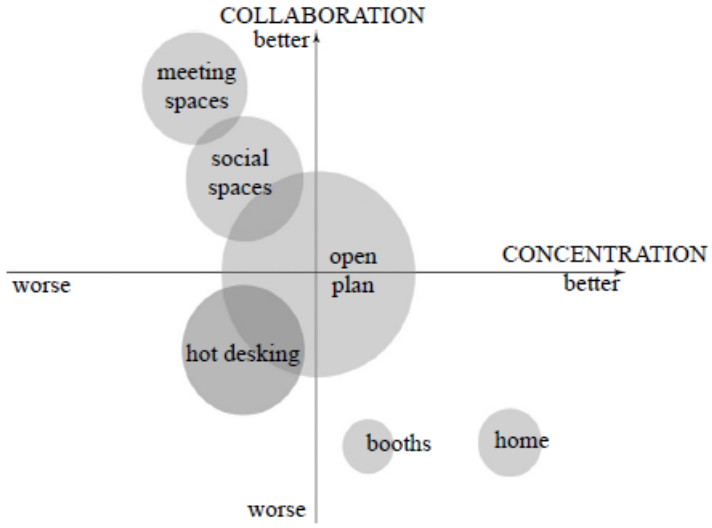


Figure 7: User perception of workspace design and performance (Erlich & Bichard, 2008)

Unfortunately, the support for collaborative tasks might contradict the support of concentrative tasks. Figure 7 illustrates that the workspaces are beneficial for either concentrative or communicative tasks. De Been et al. (2016) argue that creating an environment that supports both activities is a challenge. In conclusion, based on the literature study, the following hypothesis can be formulated:

H_8: Workplace settings relate to experienced support of activities

In Section 2.2, it was concluded that the home and office workplace settings relate to perceived productivity support. However, the literature revealed inconsistent results concerning a direct relationship. The hypothesis above states a direct relationship between experienced support of activities and perceived productivity support. It is expected that experienced support of activities also mediates between workplace settings and perceived productivity support. If the employee experiences an activity better supported at the workplace, this is likely to have a positive effect on employees' perceived productivity support. The hypothesis formulated is stated below:

H_9: Experienced support of activities mediates the relationship between workplace settings and perceived support of productivity

3.3.3 Task variety and workplace settings

Different task profiles can have specific environmental requirements, such as workplace settings. It is assumed that workplace settings affect task variety (De Been et al., 2016; Hoendervanger, 2021). Hoendervanger (2021) found that the perceived environment fit was positively correlated with satisfaction with the work environment and task performance. The perceived fit between highly concentrative tasks and open-office work settings is particularly low. Employees working on concentrative tasks were more satisfied and productive in a private office than those performing simple tasks, who appeared to perform better in a non-private setting (Haynes, 2008a). Numerous studies suggest a better fit with closed rather than open-work settings for individual high-concentration work (De Been & Beijer, 2014; Haynes, 2008a; Hoendervanger, 2021; Kaarlela-Tuomaala et al., 2009; Kim & de Dear, 2013). Workers who perceive their job as requiring high concentration experienced lower levels of environmental distraction and stress in cell offices compared to open-plan offices (Seddigh et al., 2014). Regarding individual low-concentration work, a better fit is assumed with non-private open-work settings (Hoendervanger et al., 2019; Sundstrom et

al., 1980). It might provide two advantages. First, some distractions help to prevent repetitive activities from becoming too dull and increase the employees' performance for individual low concentrative tasks (Sundstrom et al., 1980). Second, the evidence for social facilitation of the performance of routine tasks suggests a better performance of routine tasks in non-private areas (Sundstrom et al., 1980). By this reasoning, employees with routine tasks might feel most satisfied and work most productive in areas accessible to co-workers (Sundstrom et al., 1980).

The desired amount of social contact may decrease as the concentrative nature of a job increases. Employees with complicated and concentrative tasks may require greater freedom from distraction and consequently, may require more physical privacy to enhance workplace satisfaction and productivity (Sundstrom et al., 1980). Erlich & Bichard (2008) predicted that concentrative tasks will be performed in the home working settings, since office environments offer mostly open office work settings, that are not suitable for highly concentrative tasks. Consequently, a higher number of different tasks requires more frequent setting-switching to sustain the perceived fit. Employees with a high number of different tasks are more satisfied in an ABW environment (Hoendervanger et al., 2016). Hence, it is assumed that employees with a high number of different tasks prefer the office settings more compared to the home working settings. This can be explained by the availability of multiple workspaces in the office environment compared to the home environment. In conclusion, the following hypothesis is formulated based on the previous paragraph:

H_{10}: Task variety relates to workplace settings

3.4 Overview location type and activities

Table 5 presents an overview of activity support per location type. The location types explored in Section 2.2 are included and differentiation is made between the home and office work environment. The list of activities is composed based on the taxonomy matrices presented by Appel-Meulenbroek et al. (2011) and Tabak (2009). The locations supporting the activities best are marked with a '++'. When the location does not support the designated activity, it is indicated with a '- -'. The location support is based on literature findings explored in section 3.3.

Table 5: Overview location type and activities

Location type		Activities														
		Focused concentrated work						Collaborative work			Interactive activities					
		Behind the computer	Individual focused work, desk-based	Writing	Reading	Archiving	Individual routine tasks	Collaborating on focused work	Coffee break	Lunch	Telephone conversation	Planned meetings	Informal unplanned meetings	Informal talk	Presenting	Audio conferences
Office environment	Flexible workplace in an enclosed environment	++	++	++	++	-	++	-	-	-	+	--	-	-	--	+
	Flexible workplace in an open environment	-	--	-	-	-	+	+	-	-	-	+	++	++	+	--
	Assigned workplace in an open environment	-	-	-	-	+	+	--	-	-	-	--	+	+	--	-
	Assigned workplace in an enclosed environment	++	++	++	++	++	++	-	-	--	++	--	-	+	-	++
	Assigned workplace in a shared room	++	++	++	-	-	+	+	--	--	-	--	-	-	+	-
	Meeting or project rooms	-	-	-	+	+	--	++	--	--	-	++	+	-	++	++
	Other	-	-	+	+	--	-	--	++	++	+	-	++	++	--	--
Home environment	Dedicated workplace in a shared environment	++	+	+	+	-	++	--	+	+	+	-	-	-	--	-
	Flexible workplace in an open environment	-	--	+	+	--	+	--	+	+	+	--	+	+	--	--
	Dedicated workplace in an enclosed environment	++	++	++	++	+	++	+	-	-	++	+	-	-	+	++
	Other	--	--	--	+	--	-	--	++	++	+	--	-	+	--	--

The location of the workplace influences the concentrative and interactive nature of the activity. The home work environment supports better individual concentrative activities, while interactive and collaborative tasks are less preferred to do at home. The layout and the level of enclosure of workplaces influence the level of communication and concentration required for a task. Enclosed environments facilitate better individual concentrated activities. In contrast, open workplaces facilitate better collaborative and communicative tasks. Meeting or project rooms better support the collaborative and communicative activities. The use, flexible or assigned, seems to be related to the level of planning for an activity. If an activity happens spontaneously, it is most likely to occur at a flexible workstation. Planned activities are most likely to take place at assigned workstations.

It is assumed that employees prefer working in the office when more communicative work is on the agenda. However, when more concentration is required, employees prefer to work from home or in an enclosed office environment (Van de Water, 2021). The physical office is essential for facilitating interactive and collaborative activities (Greene & Myerson, 2011; O'Kane et al., 2007), while the home work environment is more suitable for individual concentrative activities (Erlich & Bichard, 2008; Van de Water, 2021). It could be beneficial for organizations to make arrangements and support

employees to work from home. This allows employees to benefit from the positive effects of working from home, such as increased productivity.

3.5 Physical features and activity support

The importance of the physical features differs per activity mode (Van den Berg, 2017). According to Van den Berg, the three most important attributes are noise, level of enclosure, and lighting for all work modes. The characteristics of an ideal workspace differ per activity mode. For individual concentration work and formal interactions, the ideal workspace is an enclosed environment with low noise levels and pleasant lighting. In contrast, a noise-neutral, semi-enclosed environment with a pleasant lighting situation should be facilitated for informal interactions. For individual concentration work, the workspace characteristic noise is most important, followed by the level of enclosure, lighting, temperature, ergonomics, and personal control (Van den Berg, 2017). In general, employees whose work requires much concentration, functionality, and comfort of the workplace plus the opportunity to concentrate contribute the most to perceived productivity support (Maarleveld & De Been, 2011). For the employees who spend a large proportion of their time deliberating with colleagues, the most important factor is the number, variety and functionality of workspaces (Maarleveld & De Been, 2011). Van den Berg (2017) found that the order of importance of features for informal interaction is level of enclosure, lighting, noise temperature, ergonomics of the workspace, and personal control. For formal interactions, one should consider the noise level of enclosure, lighting, temperature, ergonomics of the workspace and personal control in decreasing order of importance. Also, a relationship between office tasks, temperature and productivity is found (Huizenga, Abbaszadeh, et al., 2006; Tanabe et al., 2007). Thermal comfort depends on the type of activities the office employee is engaged in. Complex or creative work has different optimum temperatures to improve productivity (Tanabe et al., 2007).

Certain activities require different features and facilities. For example, focused work requires a desk and cell office preferably to conduct the work without being distracted or disturbed. In contrast, social interaction and informal meetings can occur at the lounge or coffee machine. In conclusion, the importance of the physical features differs concerning the nature of the activity. It is assumed that satisfaction with physical features of the workplace and experienced support of activities relate to each other. Based on the literature study the following hypothesis can be formulated:

H_{11}: Satisfaction with physical features and experienced support of activities relate to each other

3.6 Conclusion

This section explored the activities studied by Brill & Weideman (2001), Maarleveld et al. (2009) and Vos & Van Der Voordt (2001) that were performed by knowledge. The activities are categorized with help of the factor analysis results by Liebregts (2013). Employees who perceive their workplace as unsuitable for the task, meaning low experienced support of the workplace, usually report lower productivity outcomes. The hypothesis is as follows:

H_5: Experienced support of activities relates to perceived support of productivity

Two different aspects of task variety, task profiles and numbers of different tasks, are explored. Task variety is also added to the updated conceptual model, depicted in Figure 8. The literature reveals inconsistent results to positively relate task variety to productivity. The hypotheses posed for the relationship between task variety and workplace settings and perceived productivity support are as follows:

H_6: Task variety relates to perceived support of productivity

H_7: Task variety relates to experienced support of activities and satisfaction with physical features which mediates the relationship with perceived support of productivity

The physical office is essential for facilitating interactive and collaborative activities. In contrast, the home work environment is more suitable for individual concentrative activities. Employees with a high number of different tasks prefer the office settings more compared to the home working settings, due to the larger offering of different workplace settings in the office. So, task variety does relate to workplace settings. In addition, a mediating effect is expected between workplace settings and productivity by experienced support of activities. The hypotheses posed for the relationship between task variety and workplace settings, and perceived productivity support are as follows:

H_8: Workplace settings relate to experienced support of activities

H_9: Experienced support of activities mediates the relationship between workplace settings and perceived support of productivity

H_{10}: Task variety relates to workplace settings

The characteristics of an ideal workspace differ per activity mode. For all work modes, the three most important attributes are noise, level of enclosure and lighting. It is assumed that satisfaction with the physical features relates to experienced support of activities.

H_{11}: Satisfaction with physical features and experienced support of activities relate to each other

The activity categories are added to the updated conceptual model depicted in Figure 8.

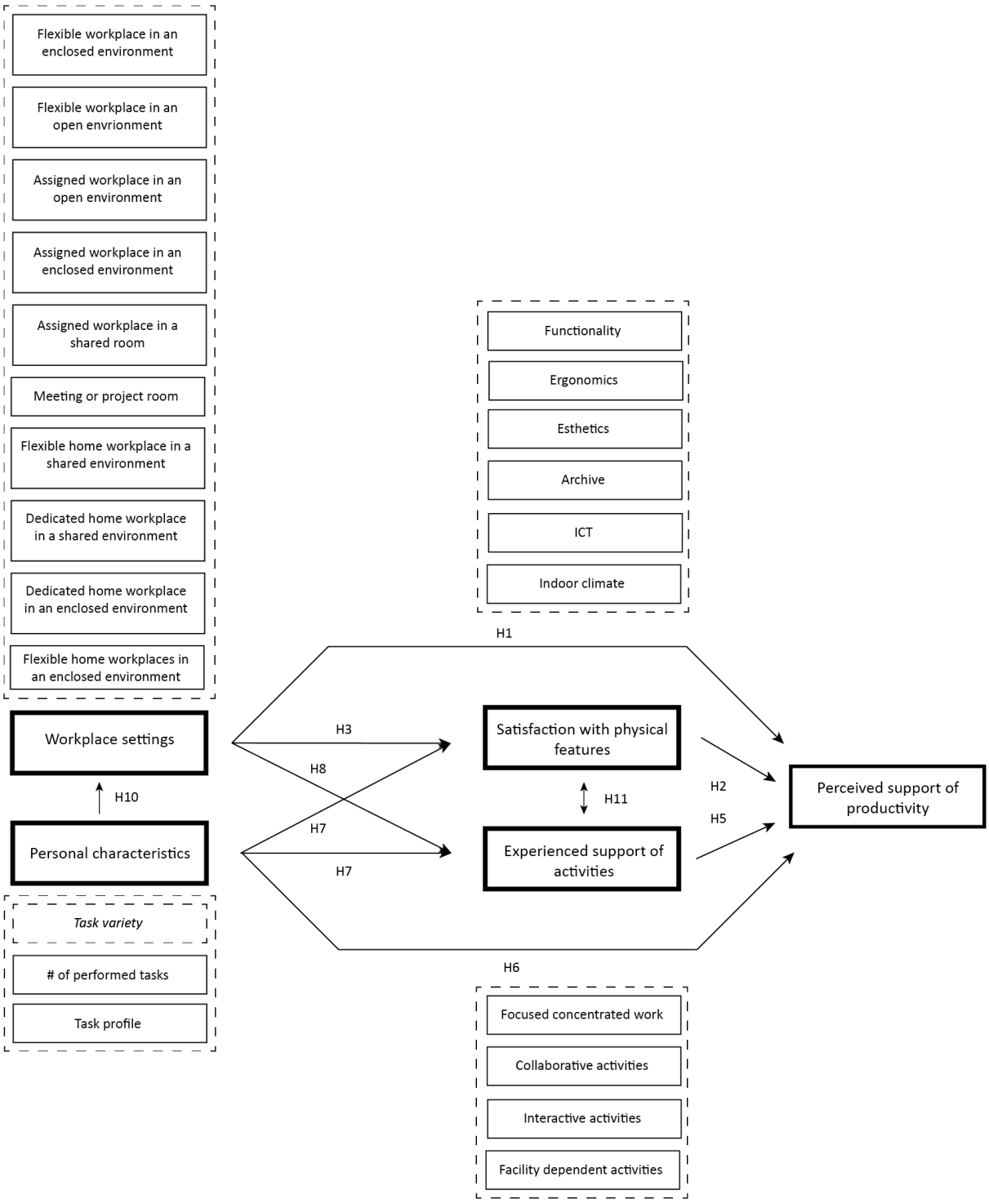


Figure 8: Updated conceptual model with activities

4.0 Demographics

Not only do differences exist between the activities that office employees perform, but also the employees performing the tasks are different from each other. Personal characteristics might influence the desired conditions for conducting the work. Demographics should thus be considered when analyzing the support of activities and perceived productivity in both the home and the office work environment. First, the relationship between gender and perceived support of productivity is explored. Subsequently, the relationship is explored for employees' age and time with the organization. The chapter finishes with a conclusion and states the hypotheses.

4.1 Gender

The literature assumes that gender differences have only a minor insignificant influence on the need for privacy, concentration, and collaboration (Rothe et al., 2012). The differences between men and women concern mainly climate comfort, personalization, and status expression (Rothe et al., 2011). A significant relationship is found between gender and satisfaction with indoor climate, with female employees being less satisfied. Women are generally more dissatisfied with indoor climate and thermal comfort, indicating that indoor climate is more important for female employees (Karjalainen, 2007, 2012; Rothe et al., 2011). As Kieft (2021) and Voulon (2021) indicated, the female category yielded a higher mean in perceived productivity compared to the male category for the home work environment. A possible explanation could be a better work-life balance to take care of their household. These findings assume a relationship between gender and perceived support of productivity. In conclusion, gender does not relate to perceived support of productivity. However, it does relate to the satisfaction with different physical features of the workplace.

4.2 Age

Different generations have been working alongside one another. The multi-generational workforce can be classified in several ways. For example, the employees can be divided into age groups based on their birth year. Another classification is a sub-division in distinct generational categories, the Baby Boomers, born between 1946 and 1964, Generation X, born between 1965 and 1978, and Generation Y, born between 1979 and 2000. Various scholars studied the relationship between generational differences and work environment preferences (Earle, 2003; Joy & Haynes, 2011; Rothe et al., 2011, 2012). Pullen (2014) concluded that there are large differences in assessing cellular and flexible office types between different age groups. Employees who are below 30 are more optimistic about flexible office workplaces compared to cellular workplaces. The flexible workplace types score high in all age groups on aspects related to layout components. However, privacy is a negative aspect in the flexible workplace according to all age groups (Pullen, 2014). Rothe et al. (2012) stated that privacy and concentration preferences might be more related to the tasks the employees are completing rather than their age. Based on the results of her study, the privacy and concentration preferences are very similar for all age groups. All employees value their privacy to the same extent, although it can be noted that the respondents born in the 1950s value privacy a bit more than the others. However, other studies addressed that the Baby Boomer generation prefers quiet work environments and cell offices for concentration more, while the later generations prefer more open work environments (Earle, 2003; Joy & Haynes, 2011). Baby Boomers generally prefer a private office (Joy & Haynes, 2011), which is complimentary for the privacy need. The collaboration and networking preferences differ considerable more over the age groups. The group from the 80s valued work environments that support collaborative work and socializing within the team much higher compared to other age groups. On the other hand, the people from the 40s and 50s value the possibility to network with others in the building more (Rothe et al., 2012). Joy & Haynes (2011) studied the relationship between different generations and knowledge working preferences for formal and informal meeting spaces.

The result indicates that Baby Boomers and Generation X value privacy more regarding formal communication, and therefore choose meeting rooms for this activity. In contrast, Generation Y prefers informal areas for formal communication more. Concluding, privacy is more important for older employees.

In the study by Joy & Haynes (2011), respondents were asked about their preferred location for performing work that requires concentration. The results show that all three generations favor working from home when performing concentrative tasks. All three generations selected the team-based area as the second most preferred location. Scheduled meetings include both team meetings as well as one-on-one meetings. The results show a clear difference between Generation X, Baby Boomers, and Generation Y. Generation Y prefers to hold scheduled meetings in openwork settings compared to Generation X and Baby Boomers who prefer bookable meeting rooms (Joy & Haynes, 2011). Generation Y prefers the flexibility of informal meeting spaces which are not confined to time frames and booking procedures. Regarding high collaborative activities, all the generations favored the team-based area. The open-plan office was rated second most popular, including the lounge area. All generations prefer the same location for sharing information with colleagues. However, Baby Boomers also prefer bookable meeting rooms for this activity (Joy & Haynes, 2011).

In conclusion, age does relate to perceived support of productivity, experienced support of activities, and the workplace settings.

4.3 Time with organization

Tenure or time with organization is studied by various scholars (Budie, 2016; Houben, 2015; Maher & von Hippel, 2005; Oldham et al., 1991; Van Susante, 2015). The conclusions of the scholars are not all in line with each other. Some researchers did not find a significant correlation between tenure and productivity and job satisfaction (Maher & von Hippel, 2005; Oldham et al., 1991). Consequently, the characteristic was not included in further analyses. However, other researchers found significant results for the relationship of tenure and characteristics of the physical work environment (Budie, 2016; Houben, 2015). Employees with a tenure of over eight years find privacy and storage more important than employees with a shorter tenure. Additionally, the desk and chair are less important for employees with more time at the organization compared to employees with a shorter tenure (Houben, 2015). Assumed is that tenure has a negative effect on satisfaction with the regulations of social interaction (Budie, 2016).

In conclusion, no direct relationship can be concluded between time with the organization and perceived support of productivity. However, there seems to be a relationship between time with organization and satisfaction with the physical features of the workplace.

4.4 Other

Numerous other demographic characteristics might also influence workplace satisfaction and employee productivity. The influence on the physical work environment has not been studied for all demographic characteristics. Gender and age are generally included in studies including satisfaction because of their assumed direct effects (Danielsson & Bodin, 2008; De Been & Beijer, 2014; Kim & de Dear, 2013; Maher & von Hippel, 2005; Oldham et al., 1991; Van Susante, 2015). Other characteristics included in employees' satisfaction studies are, for example, the level of education and teleworking might be positively related to each other (Batenburg & Van der Voordt, 2008; Davenport, 2005; De Been & Beijer, 2014; Giovanis, 2018; Maher & von Hippel, 2005; Oldham et al., 1991). The higher the level of education, the more likely the employee will participate in teleworking arrangements. Besides, a high education level might also relate to higher productivity (Giovanis, 2018). In addition, personality

traits are assumed to impact workplace and location preferences (Bozionelos, 2004; Hartog, 2015; Oseland, 2009). The difference between introverts and extroverts might influence social interaction and privacy in the office (Oseland, 2009). Third, respondents with children rated the benefits of teleworking higher than those who have no children at home (Hoornweg et al., 2016). Additionally, job type or department (Danielsson & Bodin, 2008; Houben, 2015; Kim & de Dear, 2013; Oldham et al., 1991; Van Susante, 2015) and job rank (Houben, 2015; Maher & von Hippel, 2005; Oldham et al., 1991; Van Susante, 2015) might influence employees' satisfaction and productivity.

4.5 Conclusion

In conclusion, it may be assumed that office users' work environment preferences vary depending on different demographic characteristics such as age and gender and how they do their work. It would be wrong to assume that employees who perform similar work prefer the same things or that all female or male employees have the same preference.

Demographics relate to satisfaction with physical features, experienced support of activities, and workplace settings. Age relates to perceived productivity support. However, no direct relationship could be established between gender and time with the organization and perceived productivity support. It is assumed that satisfaction with the physical features and experienced support of activities mediates the relationship with perceived productivity support. The hypotheses that followed from the literature study are as follows:

H_{12}: Demographics relate to experienced support of activities

H_{13}: Demographics relate to satisfaction with physical features

H_{14}: Demographics relate to perceived support of productivity

H_{15}: Demographics relate to workplace settings

Figure 9 illustrates the updated conceptual model.

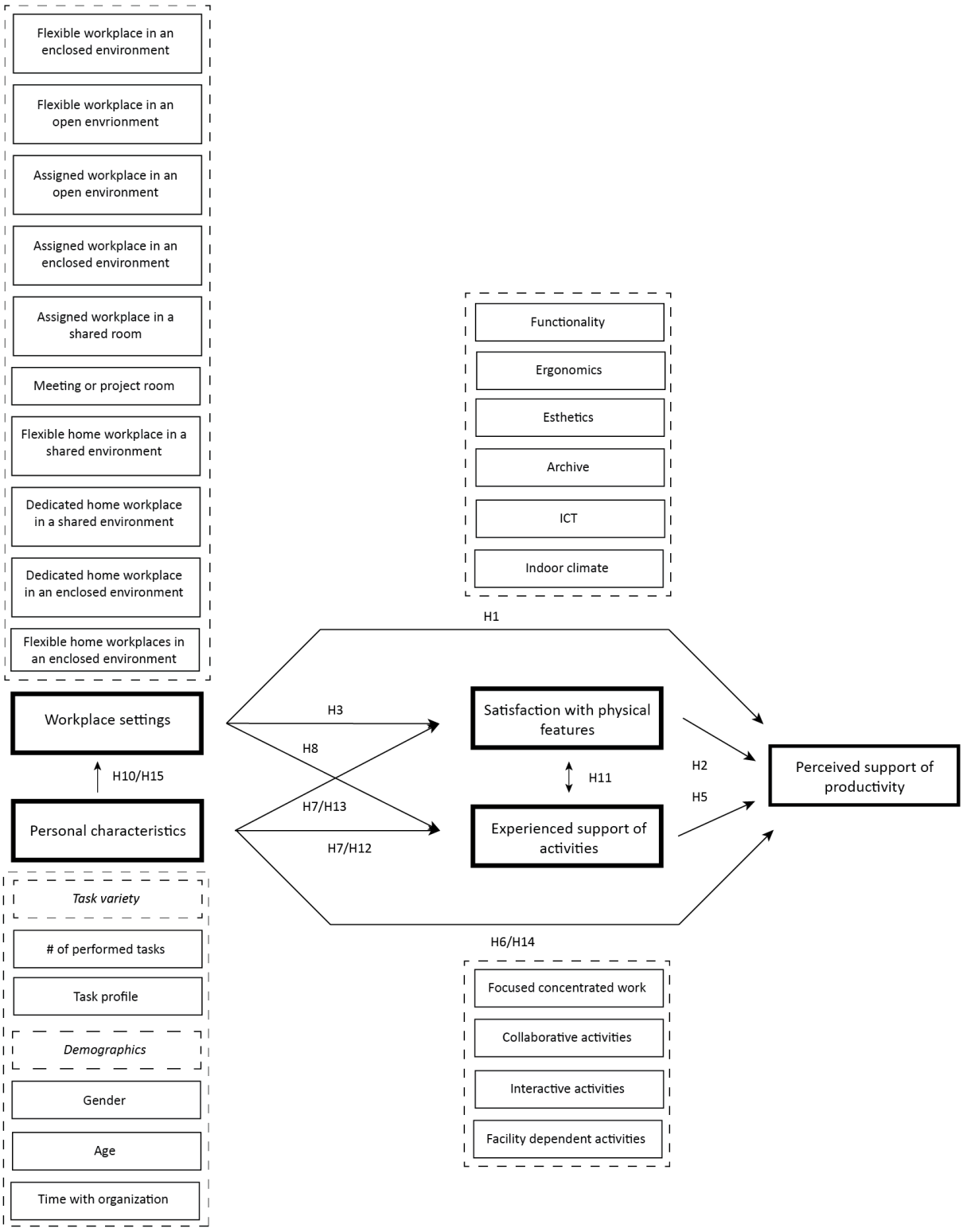


Figure 9: Updated conceptual model demographics

5.0 Research approach

The second chapter explored the existing literature studies regarding the relationship between different workplace settings and various physical features of the workplace with employees' perceived productivity. The third chapter elaborated on the different activities and the preferred location by employees. The relationship concerning employees' demographics and perceived productivity support was discussed in the fourth chapter. This chapter recaps the hypotheses posed in the literature review. Subsequently, the data collection is elaborated in Chapter 5.2, including the survey design and included variables. Chapter 5.3 discusses the reliability and validity of the data. Lastly, the method description is explored discussing the different statistical analysis methods.

5.1 Conceptual model

The conceptual model presented in the introduction has been elaborated with the new insights yielded in the literature review chapters. The structure of the model has not changed, but relevant workplace settings and demographics have been added to the model. A hypothesis is formulated for each relationship in the conceptual model, depicted with an arrow. The hypotheses are formulated to elucidate the conceptual model.

Section 2.2 explored the relationship between different workplace settings and perceived productivity support. The literature revealed inconsistent results concerning a direct relationship between the home and office workplace settings and perceived productivity support. The physical features of the workplace are related to the workplace settings. Satisfaction with the physical aspects of the workplace is assumed to have a positive relationship with perceived productivity support. The expectation is that when satisfaction with the physical features increases, the perceived support of productivity increases. It is expected that satisfaction with physical aspects of the workplace mediates between workplace settings and perceived productivity support.

Employees who perceive their workplace as unsuitable for the task, meaning low experienced support of the workplace, usually report lower productivity outcomes. It is assumed that experienced support of activities relates perceived productivity support.

The findings in the literature are not evident to conclude a positive relationship between task variety, task profiles and the number of performed tasks, and perceived productivity support. On the one hand, task variety will enrich jobs and make them more motivating. On the other hand, higher levels of strain might be experienced by employees when switching too often which reduced perceived productivity. The physical office is essential for facilitating interactive and collaborative activities. In contrast, the home work environment is more suitable for individual concentrative activities. Employees with a high number of different tasks prefer the office settings compared to the home working settings, due to the larger offering of different workplace settings in the office. So, task variety does relate to workplace settings. In addition, a mediating effect is expected between workplace settings and productivity by experienced support of activities.

The characteristics of an ideal workspace differ per activity mode. For all work modes, the three most important attributes are noise, level of enclosure and lighting. It is assumed that satisfaction with the physical features relates to the experienced support of activities.

Demographics relate to satisfaction with physical features, experienced support of activities, and workplace settings. Age does relate to perceived productivity support. However, no direct relationship could be established between gender and time with the organization and perceived productivity support.

The hypotheses are added in the definitive conceptual model illustrated in Figure 10.

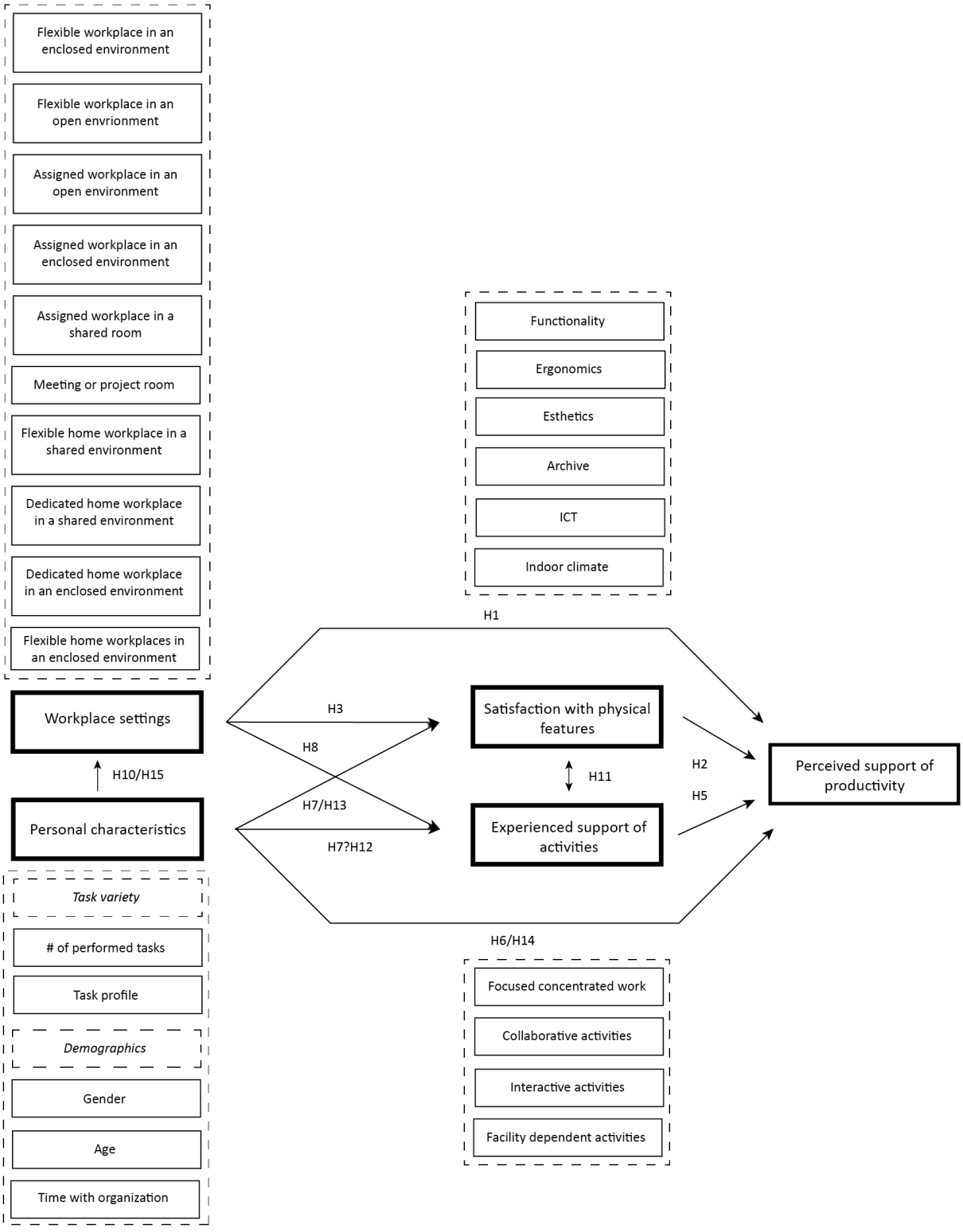


Figure 10: Definite conceptual model

5.2 Data collection

The data used for this study is gathered and provided by Leesman. Leesman collects their data by taking online surveys amongst employees worldwide, questioning various aspects of their work environment. The standardized surveys are commissioned and purchased by the employer or

organization. The employer can send the link of the surveys to all or some of their employees. Some organizations only want to target employees working in specific buildings or countries. The link to the survey is only sent out to those employees. The survey is open for ten to fourteen days, during which the employer can send reminders.

Since the start of the COVID-19 pandemic, Leesman also extensively gathered data concerning the home work environment. The same respondent is asked to fill in their experience with the office and the home work environment in a single questionnaire. Leesman publishes their own index, a benchmark to rate different aspects of the work environment. The index is based on the large dataset gathered throughout the years. Leesman started their home working survey in March 2020. The data used for this research stems from the start of the pandemic lockdown, March 2020, till May 2021 and comprises 57,286 respondents.

5.2.1 Survey design

The Leesman Home Working Experience survey explores the importance of activities and physical features of the home and the office work environment. In addition, the questionnaire includes questions concerning the satisfaction with physical features and the support of activities, if those features/activities are deemed important by the respondent. First, the characteristics and general data of the respondent were asked. The characteristics include time with the organization, gender, and age group. Also, questions are asked regarding the type of workplace used most in the home and office work environment. Second, the survey includes activity-related questions. The importance of work activities is asked, combined with the perceived support of that specific activity when deemed important. If the activity is checked as important, a scale appears asking the respondent to rate the support of activities when working from home. The scale used is a 6-point scale ranging from -3 to 3. In total, the survey recognizes 21 different activities.

Third, questions elaborate on the importance and satisfaction of the physical features of the home and office workplace. The respondent should check features that are important to him/her for an effective workplace. If a feature is considered important, the respondent is asked to rate his/her satisfaction with the specific features on a 5-point scale ranging from highly satisfied to a highly dissatisfied score [-2;2]. There is also an option “not provided” available, indicating that the feature is important to the employee for an effective workplace but absent. Maarleveld et al. (2009) and De Been & Beijer (2014) also used a five-point Likert scale that indicated the satisfaction or dissatisfaction of employees with the aspects of the office environment. The way Leesman asks their workplace satisfaction questions to their respondents is in line with scientific studies. Eleven features of the home work environment are included and 25 office workplace features. Last, the question is whether the home and office workplace enable the employee to work productively. The scale used is a 7-point scale ranging from strongly agree to disagree strongly. Figure 11 shows the survey design, including the measurement scale per question.

Question	Measurement scale
Gender	☐ ☑ ☐ ☐
Age group	☐ ☑ ☐ ☐
Time with the organization	☐ ☑ ☐ ☐
Type of home/office workplace	☐ ☑ ☐ ☐
Mark important activities	☑ 1- 21 activities
Experienced support of ...	-3 ——— 3 Not supported at all — Very well supported
Mark important physical features	☑ 1- 25 physical features
Satisfaction with ...	-2 — 0 — 2 ☑ Not available Highly dissatisfied — Highly satisfied
My working environment enables me to work productively	-3 — 0 — 3 Strongly disagree — Strongly agree

Figure 11: Survey design

5.2.2 Productive work environment

There are different methods of measuring productivity on the employee level. A widely accepted approach is measuring the perceived productivity rather than the actual productivity. An objective method would be if a respondent physically works in two different work environments and the work output is measured and compared for both work environments. The work environment which stimulates the highest output can be appointed as the most productive work environment. However, it is not easy to scale up the sample size for this method, and it is expensive and time-consuming. Perceived productivity is different from employees' actual productivity, as perceived or self-assessed productivity is subjective, limiting the validity of the perceived productivity measure (Jensen & van der Voordt, 2021). Although the actual productivity is not measured, the perceived productivity is also valuable (Van der Voordt, 2004). Perceived productivity can be used as a reliable indicator of employee performance (De Been et al., 2016). Employee productivity is measured by self-assessment in the dataset provided by Leesman too, but slightly different. The respondents are asked if their workplace enables them to work productively. So, perceived productivity support refers to the support of the workplace to enable the employee to work productively. Using such methods is more subjective since respondents self-assess their support of productivity.

Perceived productivity is mostly measured by subjective questionnaires, asking employees directly about the effects of the work environment on productivity. The statements posted in the questionnaire are presented in Table 6. The respondent is asked if he/she agrees or disagrees with the statements. A seven-point scale is used ranging from strongly agree to disagree strongly, to which a neutral option is added. De Been et al. (2016) and Maarleveld et al. (2009) proposed several statements to assess the support of productivity of the work environment and facilities for certain activities. The statements were scored using a 5-point Likert scale, for example, 1 = "very

unsupportive" to 5 = "very supportive". In conclusion, the way Leesman asked the support of productivity questions to their respondents is slightly different compared to previous approaches.

Table 6: Perceived support of productivity

Perceived support of productivity	
Office	**Home**
My office environment enables me to work productively	My home environment enables me to work productively

5.2.3 Workplace settings

In the literature review, the dimensions of De Croon et al. (2005) were used to categorize the different workplace settings. The Leesman questionnaire distinguishes eleven office workplace settings and four home workplace settings. Table 7 presents the explored office and home workplace settings and compares them with the Leesman workplace settings.

Table 7: Workplace settings

Literature	Leesman
Office workplace settings	
Assigned workplace in an enclosed environment	A cubicle assigned solely to you
	A private office assigned solely to you
Assigned workplace in an open environment	A workstation, assigned solely to you, in an open plan office area
Flexible workplace in an enclosed environment	A quiet room/private office (available for flexible use)
Flexible workplace in an open environment	A flexible/non-allocated workstation
	A shared team table
A meeting or project room	A meeting room
Assigned workplace in a shared room	A workstation, assigned solely to you, in a shared office (enclosed room or space)
Other	An informal work setting such as a break-out zone
	A specialist practical or technical setting
	Other
Home workplace settings	
Dedicated home workplace in a shared environment	A dedicated work area (but not a separate room)
Dedicated home workplace in an enclosed environment	A dedicated workroom or office
Flexible home workplace in a shared environment	A non-work specific home location (such as a dining table)
Flexible home workplace in an enclosed environment	
Other	Other

In total, seven office workplace settings are distinguished in the literature review, while the Leesman questionnaire uses eleven different settings. Some Leesman workplace settings are combined into one office workplace setting from the literature. For example, 'a cubicle assigned solely to you' and 'a

private office assigned solely to you' are combined into 'the assigned workplace in an enclosed environment'. Most of the home workplace settings can be translated one on one with the literature workplace settings. However, flexible home workplaces in an enclosed environment are not included in the answer option in the Leesman survey. In conclusion, all workplaces described by Leesman can be subdivided into literature categories.

5.2.4 Physical features

The Leesman questionnaire includes 25 physical features of the office workplace and 11 of the home workplace. In total, 35 physical features of the workplace divided over six categories are explored in literature studies. Table 8 compares the findings of the literature and the features used in the Leesman survey.

Table 8: Physical features of the workplace

	Physical features of the workplace		
	Literature	**Leesman office**	**Leesman home**
Functionality	Space for official meetings	Meeting room large	
		Meeting room small	
	Reservation system	Desk room booking system	
	Space for informal meetings	Informal work areas breakout zones	
	Activity-based workplace use	Variety of different types of workspace	
		Quiet room for working alone or in pairs	
	Layout of the office	Space between work settings	
Ergonomics	Dimensions of the workplace	Desk	Desk or table
	Dimensions of the furniture	Chair	Chair
	Comfort of the furniture		
	Adaptability of the desk		
	Adaptability of the chair		
	Monitor and keypad		Monitor
	Space for personal attributes	Ability to personalize my workspace	
Crowdedness		Accessibility of colleagues	
		Dividers between desk areas	
		People walking past your workstation	
Archive	Personal archive	Personal storage	
	Central archive	Shared storage	
	Amount of storage space	Archive storage	
Esthetics	Use of materials	General décor	
	Use of color		
	Furnishing		
	Plants	Plants greenery	
	Art	Art photography	
		Atriums communal areas	
	Outside view		

	Architecture of the building		
IT	Computers		Computing equipment fixed desktop
	Laptop		Computing equipment mobile e.g. laptop/tables
	Network		WiFi network connectivity
			Wired network connectivity
	Copier/scanner		Printing copying scanning equipment
	Software		
			Remote access to work files or network
			Telephone equipment
			Audio headset
Indoor climate	Air quality	Air quality	
	Ventilation		
	Temperature	Temperature control	
	Acoustics	Noise levels	
	Noise of climate installations		
	Daylight	Natural light	
	Artificial lighting	Office lighting	
	Personal control over IEQ		

The physical office features of the literature and the Leesman questionnaire show many similarities. The Leesman questionnaire matches nearly all features in the functionality, archive, esthetics, and indoor climate categories. The Leesman survey does not include a question concerning the adaptability of the furniture and physical IT features. Additionally, in the Leesman survey, three physical features are included that do not correspond to one of the literature findings. These features are related to the crowdedness in the office.

The functionality category is excluded in the Leesman home questionnaire since these features do not apply to the home work environment. Also, no physical features are included in the categories archive, esthetics, and indoor climate. The Leesman home survey focuses mainly on the importance and satisfaction with IT features. Eight of the eleven physical features belong to the IT category.

In conclusion, the physical features of the office match largely the features described in the literature. The largest difference is the exclusion of IT facilities in the Leesman dataset. The home features are mainly include characteristics of the IT category and do not entirely correspond to the physical features of the office work environment.

5.2.5 Activities

In the Leesman survey, the experienced support of 21 activities is asked where the respondent indicates that the activity is important for his/her line of work. The experienced support is asked for both work environments. Table 9 compares the activities from the literature (Brill & Weideman, 2001; Maarleveld et al., 2009; Van der Voordt, 2004) and the Leesman survey.

Table 9: Activities

Activities

Literature	Leesman
Focused concentrated work	Individual focused work desk-based
	Individual focused work, away from your desk
	Individual routine tasks
	Reading
	Thinking creative thinking
Collaborative activities	Collaborating on creative work
	Learning from others
	Collaborating on focused work
	Informal unplanned meetings
	Relaxing taking a break
	Informal social interaction
Interactive interaction	Telephone conversations
	Video conferences
	Planned meetings
	Audio conferences
	Larger group meetings or audiences
	Private conversations
	Business confidential discussions
Facility dependent activities	Hosting visitors, clients or customers
	Spreading out paper or materials
	Using technical specialist equipment or materials

The number of activities included in the Leesman survey exceeds the activities listed in the literature. The activities in the Leesman survey are more specific compared to the literature. The questionnaire covers all the activities explored in the literature review.

5.3 Reliability and validity of the data

The reliability and validity of the data and research are essential. Those factors determine the quality and the usefulness of the results to a large extent. Reliability concerns the presence of random error. Validity is sub-divided into two categories, external and internal validity. Internal validity means what you intend to measure is actually measured. External validity concerns the representativeness and generalizability of the study.

5.3.1 Reliability of the data

The reliability aspect concerns the presence of random error. The respondents of the questionnaire might be influenced by different factors, such as the mood at a certain time and their concentration. The first part of the survey is more objective. It includes questions regarding the age, gender and type of workplace. It is less likely that mood and concentration of the employee have a large influence on the outcome of these questions. However, the latter part of the questionnaire is more subjective. The support and satisfaction are asked using a five-point Likert scale. The outcome is likely to be more influenced by the employee's mood. Because the number of respondents is large, it is assumed that it covers all sorts of circumstances and has little influence on the outcome in general. If a feature of the work environment is not provided, the respondent can still indicate if the feature is important. So, the reliability of the responses does not seem to be influenced by the moment of measurement.

5.3.2 Validity of the data

The survey results can provide helpful insight into how well the office and home environment supports the employees with their work. The respondents indicate which physical characteristics they regard as important. This reflects the preferences of the employees well.

External validity concerns the representativeness and generalizability of the study. The data includes information concerning the preferences of the workplace of office employees who were instructed by their company/organization to fill in the survey. Only the respondents who filled in that they work partially from home (at least 10%) are included in this data set. The respondents who work full-time in the office did not get any home working questions in their survey. The threshold for a company to conduct such a survey is considerable. There should be an incentive and funds to conduct the survey and to implement innovations at the workplace based on the outcome. The organizations that instruct Leesman to conduct an office survey amongst their employees might have considerable interest in the satisfaction and productivity of their employees.

Most of the organizations and companies were located in the Northern continents. The respondents from the Southern continents are only represented by less than 5% in the sample. This study can be generalized for only the countries in the Northern hemisphere. The external validity is good because of the large number of respondents in the dataset. Many different employees are represented well in the data because of this large number.

5.3.3 Data preparation in SPSS

Some alterations to the data should be done to guarantee proper use. Labels were added to the variables to prevent misinterpretation. The system missing values should be recoded into new variables to get a proper insight into the importance of the physical features and activities. Some respondents are removed from the data set because of missing values.

5.3.4 Missing values

SPSS uses two different missing values, system missing values and normal missing values. System missing values are represented with a dot in the data cell, indicating that the activity or physical feature is regarded as not important. The normal missing value is represented with a -99. This means that the respondent has failed to provide his/her opinion on the question.

5.3.5 Recoding

The dataset only used one variable for the importance of the activity and how well it is supported. Also, one variable is used for the importance of the physical features and the satisfaction with it. When the feature or activity is marked as important, the cell has a value. When the feature or activity is marked as unimportant, the cell is empty or represented as a dot in SPSS. Table 10 explains the different meanings of the values.

Table 10: Recoding

Initial code in the dataset	Meaning	New code in the dataset
.	Perceived as not important	0
-99	Perceived as important, but the respondent has not provided an answer to the satisfaction question	Removed from data
NP	Perceived as important, but the feature is not provided	1
[-3;3]	Perceived as important, the number indicates the level of support or satisfaction with the facility or activity	1

New variables are added to distinguish between the importance of an activity or a feature and the satisfaction or support. A new variable has been added for each activity and physical feature variable to differentiate the importance and satisfaction. The newly created variables have a nominal measurement level. Either the physical feature or activity is important or considered unimportant. This allows for an even more robust factor analysis because there are no missing values of the variables regarding importance.

It is necessary to convert string variables to numeric values to conduct bivariate analysis. The string variables of home workplace settings, office workplace settings, age, gender, and time with the organization are recoded. The table with the recoding to numeric values for each string category is presented in Appendix I – Recoding variables. The gender variable includes four categories. The respondents indicated that they prefer not to say their gender are combined with the male category. There is no specific reason to combine "prefer not to say" concerning gender with males. It only is merged because of the low response rate. In total, 61 respondents indicated that they preferred not to say their gender.

5.3.6 Case removals

In total, 154 cases have been removed from the dataset because the respondents did not fill in all the questions in the survey (-99). Also, 39 cases have been excluded from the data because of the low response rate in the gender non-binary category. These respondents could not be added to the male or female group since their preference is non-binary. After the case removals, the data set included the answers of 57051 respondents

5.4 Method description

The data that the Leesman organization provided is analyzed through quantitative research methods, such as bivariate analyses and path analysis.

5.4.1 Principal component analyses

The goal of the Principal Component Analysis (PCA) is to replicate the correlation matrix using a set of components that are fewer in number and linear combinations with respect to the original set of items. PCA is applied to determine if the responses group regarding satisfaction with physical features and experienced support of activities and if there are underlying dimensions of the variables. The reduction of variables into the newly constructed factors is used as input for the path analysis. Factor rotation is applied to approach a simple structure to improve interpretability. Orthogonal rotation is selected because the factors are assumed to be independent and uncorrelated with each other. The benefit of using an orthogonal rotation is that loadings are simple correlations of items with factors, and the standardized solutions can estimate the unique contribution of each factor. The assumption to apply a rotation method is that there should be several items for which entries approach zero in one column but have large loadings on the other (Pedhazur & Schmelkin, 1991). Varimax rotation is the most common type of orthogonal rotation method and is also used in this study. Varimax rotation maximizes the variances of the loadings within the factors while maximizing differences between high and low loading on a particular factor. Varimax distributes the variances evenly across factors (Lawley & Maxwell, 1973; Pett et al., 2003).

Kaiser Normalization is used to obtain stability of solution across samples. It is preferred when commonalities are high across all factors. The KMO measurement indicates if the sample is suitable for the analysis (Field, 2013). In the end, new factors are created using the regression method. It maximizes the correlation and validity between the factor scores and the underlying.

The satisfaction with 25 physical features in the office environment was asked on a 5-point Likert scale, ranging from highly dissatisfied to highly satisfied. The first question asked in the survey concerns the importance of physical features for employees in their line of work. If the respondent marked the physical feature of the workplace as important, the second question about the satisfaction with that feature is asked. Not all respondents marked the physical features as important, resulting in many missing values in the data set. When conducting a PCA, these missing values are not included in the PCA leaving only a few usable cases. All missing values are beforehand recoded to "0", adding them to the neutral category to ensure a complete PCA. This increases the number of respondents considered in the PCA due to missing values. Only a small number of respondents indicated that certain features are not provided. Respondents that indicated the physical feature as important, however, not available are also recoded into the neutral category.

The respondents were asked to indicate important activities and their experienced support for these activities. In total, the respondents could select 21 different activities. A 6-point Likert scale is applied, ranging from not supported at all to very well supported. PCA is applied to determine groups of the different activities and to reduce the number of variables for further analyses. Not all respondents marked the activities as important. Again, this results in many missing values which are not included in the PCA, leaving few useable cases. A new neutral category is created between the under-supported and supported classification to ensure a complete PCA. This results in a 7-point Likert scale. All missing values are recoded to "0", the neutral category.

5.4.2 Cluster analysis

Cluster analysis is a type of data classification used to classify cases that are relatively homogeneous within themselves and heterogeneous between each other, based on a defined set of variables. The different groups are so-called clusters. A non-hierarchical procedure is selected because it is suitable for quickly clustering large data sets. The number of clusters needs to be predefined before running the analysis, which is somewhat arbitrary. In hierarchical clustering, no decision about the number of clusters needs to be made. However, this method is not suitable for large datasets. A K-Means cluster analysis is applied to identify relatively homogeneous groups of cases on the activities the respondents rated as important (Shukla, 2014).

5.4.3 Bivariate analyses

The research question introduced in Section 1.3 investigates the correlation between satisfaction with physical features, experienced support of activities, and perceived productivity support. The previous section explored the underlying dimensions between the different physical features and experienced support of activities, and the number of included variables is reduced. These analyses explore the strength and direction of the relationship between the variables and perceived productivity support. A bivariate Pearson Correlation analysis is executed to measure the strength and direction of linear relationships between pairs of continuous variables. Certain assumptions should be met to execute a Pearson Correlation analysis. Otherwise, a Spearman Correlation analysis has to be executed.

The first assumption concerns the measurement scale of the variables. The inserted variables should be at interval or ratio level. Perceived support of productivity at home and in the office is measured using a 7-point Likert scale that can be considered an interval scale. The satisfaction with physical features and experienced support of activities is an output factor of the PCA and can also be regarded as an interval variable. So, the first assumption is met. Another assumption of a Pearson Correlation analysis that must be met, is that the variables should be approximately normally distributed. A histogram yields valuable insight regarding the normal distribution of variables. The Skewness is a measure of the lack of symmetry. When a variable is normally distributed, the Skewness is equal is 0.

Kurtosis is a measure that indicates if the data is tailed relative to the normal distribution. The data is normally distributed if Kurtosis is 0. When the Skewness and Kurtosis values differ too much from zero, the variable is assumed not to be normally distributed (Ryu, 2011). The results of the descriptives are presented in Table 11.

Table 11: Descriptives perceived productivity support (N=57051)

	Perceived productivity support office		**Perceived productivity support home**	
Descriptives	Statistic	Std. Error	Statistic	Std. Error
Mean	1.13	0.006	1.83	0.006
Std. Deviation	1.502		1.338	
Skewness	**-0.845**	0.010	**-1.372**	0.010
Kurtosis	**-0.009**	0.021	**1.569**	0.021

The skewness of perceived productivity support in the office environment is -0.845 and is for the home environment is -1.372. This indicates that the office and home work environment data is skewed left. The home environment has an even longer tail on the left compared to the office environment. The Kurtosis value (-0.009) of the office environment indicates that the data distribution is slightly tailed compared to the normal distribution. The home environment shows a Kurtosis of 1.569, meaning that the data is heavy-tailed (Ryu, 2011). The histograms of the perceived productivity support of the office and home environment are displayed in Appendix II – Histogram perceived productivity support.

In conclusion, the perceived support of productivity is assumed to be approximately normally distributed. So, a Pearson correlation analysis can be executed for this variable and the other PCA factors. In contrast, home perceived support of productivity shows a highly skewed and tailed curve and is assumed not to be normally distributed, resulting in a Spearman correlation analysis between perceived productivity support and the other PCA factors. The last two assumptions concern the linearity of the relationship and the absence of outliers. Scatterplots can be created in SPSS to determine the relationship between the input variables and to check if there are outliers.

5.4.4 One-way ANOVA analyses

A one-way ANOVA test is executed to compare the means of perceived productivity support of different independent variables. The one-way ANOVA test explores if there is a significant mean difference in respondents' perceived support of productivity for different categories of a variable. The respondents were asked to agree or disagree on a 7-point Likert scale with the statements if their office and/or home workplace enables them to work productively. The perceived productivity score ranges from strongly disagree [-3] to strongly agree [3]. The mean value reflects the average score of the respondents in that category. A negative score indicates that respondents deem their workplace not supportive of their productivity. A positive score indicates the opposite.

The null hypothesis is accepted when the results are insignificant ($p > 0.01$). The null hypothesis states that there is no significant difference in perceived support of productivity between the different categories of the variables. The null hypothesis is rejected and the alternative hypothesis is accepted when there is a significant difference in perceived productivity support between the different categories of a variable.

Three assumptions have to be met before the execution of one-way ANOVA tests in SPSS. First, the observations have to be independent. This means that each row in SPSS represents a different respondent. Second, the variables should be normally distributed. This assumption does not hold for

the Leesman sample. The variable “my home working settings enable me to work productively” is not normally distributed. A Kruskal Wallis-H test is applied for testing perceived productivity support at home with other variables. Third, the sample has to meet the requirements of homogeneity. This means that the variances in all groups have to be equal. This can be confirmed by Levene’s test when running the ANOVA tests. The null hypothesis should be rejected when sig > 0.01. The null hypothesis had to be rejected for all variables because of sig < 0.01. A post hoc Games-Howell test is applied because not equal variance is assumed. A Games-Howell test compares all possible combinations of group differences when the assumption of homogeneity of variance is violated. This post hoc test provides confidence intervals for the differences between group means and shows whether the differences are statistically significant.

5.4.5 Path analysis

Path Analysis (PA) is a series of multiple regressions, one for each variable, and is used to examine the comparative strength of direct and indirect relationships among variables. The result of a PA can be displayed in graphical diagrams showing the different relationships between the variables.

The statistical package LISREL, version 8.54, is used to estimate the relationships of the path models. The SPSS Leesman data is used and uploaded in the LISREL plugin to perform the analyses. For the operationalization of the model, categorical variables are recoded into dummy variables. The variables age, workplace settings, and task profiles are recoded into different dummies. Continuous variables, experienced support of activities, satisfaction with physical workplace aspects, and perceived productivity support, do not need alteration. According to the bivariate analyses, only the variables that have significant predicting power are included in the causal diagram. The results from the path model are used to answer the hypotheses and the sub- and the main questions stated in the introduction.

Goodness of fit statistics

The significance of the Chi-Squared statistic is generally recognized as the fit index for assessing the overall model fit. The statistic tests the null hypothesis of having no difference between the proposed model and the data. The goodness of fit measure is acceptable when p > 0.05, meaning that the difference between the observed and expected variance is not due to variation in the sample. The Chi-Squared value should not be significant (Smith & McMillan, 2001). Over the years, several researchers criticized the use of this statistic because of its shortcomings primarily impacted by the sample size, making retention of the null hypothesis for large samples almost impossible (Bollen and Long, 1993; Smith & McMillan, 2001). The larger the sample size, the higher the chance of obtaining a statistically significant Chi-Squared statistic. As a result of this criticism, different fit indices have been developed to tackle the negative aspects of the Chi-Square statistic.

The Root Mean Square Error of Approximation (RMSEA) is an index of the differences between the observed covariance matrix per degree of freedom (Chen, 2007). RMSEA’s greatest strength is its ability to outline a confidence interval around its calculated value. The RMSEA index has more predictive value than the other alternative fit indices because it is less affected by the sample size than for example the Chi-Squared value (Smith & McMillan, 2001). The interpretation of the RMSEA values is commonly considered according to the following guidelines: < 0.05 good fit; values ranging from 0.05 < 0.08 fair fit; values ranging from 0.08 < 0.1 a mediocre fit; and values larger than 0.1 a poor fit (Byrne, 1998).

The Comparative Fit Index (CFI) is an additional goodness of fit statistic based on the Normed Fit Index (NFI). The NFI index assesses the fit by comparing the tested model with a more restricted null model

in which all observed variables are assumed to be uncorrelated (Bentler & Bonett, 1980). The NFI is an underestimate when small samples are used. So, the CFI was developed. NFI and CFI values greater than 0.90 are generally considered acceptable model fit levels.

The Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Index (AGFI) are more specific indices than the Chi-Squared statistic and take the degrees of freedom into account (Smith & McMillan, 2001). The indices range from 0 (poor fit) to 1 (perfect fit). The GFI should be larger than 0.90 to assume an acceptable model (Browne & Cudeck, 1993).

Mediation analysis

The total direct and indirect effects yielded by the path model are also used to determine the mediation effect between the variables in the conceptual model. In this study, various satisfaction with physical features and experienced support of activity variables are assumed to mediate the effect between the office and home workplace settings and perceived support of productivity. To analyze to what extent these relationships are mediated by the dependent variables the total, direct, and indirect effects are investigated. The mediation analysis is based on the theory by Kenny et al. (1998).

Figure 12 describes the concept of mediation by one other variable. In the model, the effect of the independent variable X on the dependent variable Y may be mediated by the variable M.

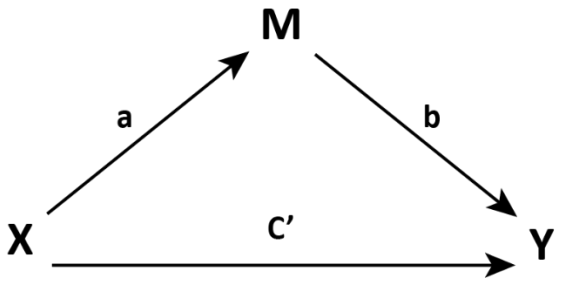


Figure 12: Path model with mediation variable M

Path C' is the direct effect of the dependent (X) on the independent (Y) variable. Paths a and b are also direct effects between the variables. *a* is the direct effect of variable X on the mediation variable M. *b* is the direct effect of M on Y. The mediational effect, in which X leads to Y through M, is called the indirect effect. The indirect effect represents the portion of the relationship between X and Y that is mediated by M. Complete mediation is achieved when the direct path (C') between the dependent and independent variable is zero. Partial mediation is the case when both the direct and indirect effects contribute to the total effect of X on Y. The coefficients of the paths can be estimated by different analysis methods, such as multiple regression and integral Path Analysis (Baron & Kenny, 1986; Kenny et al., 1998).

In the current study, different hypotheses are posed in the literature review stating a mediation effect by the independent variables of satisfaction with physical workplace features and experienced support of activities on perceived support of productivity. In some cases, multiple mediators influence the relationship with perceived productivity.

Baron & Kenny (1986) proposed a four-step approach in which several regression analyses are conducted and the significance of the coefficients is examined at each step.

1. Perform a simple regression analysis with X predicting Y to test for path C' alone
2. Conduct a simple regression analysis with X predicting M to test for path a

3. Conduct a simple regression analysis with M predicting Y to test the significance of path b alone
4. Perform a multiple regression analysis with X and M predicting Y

Steps one to three try to establish the zero-order relationship among the variables. In the fourth step, some form of mediation is supported if the effect of M (path *b*) remains significant after controlling for X. If X is no longer significant when M is controlled, the finding supports full mediation. If X is still significant (i.e., both X and M significantly predict Y), the finding supports partial mediation (Kenny et al., 1998).

The total effect is composed of the direct and indirect effects. The percentage of mediation is calculated by taking the product of paths *a* and *b* and dividing it by the total effect of the relationship (Kenny et al., 1998).

5.5 Conclusion

This chapter described the survey design and explained how Leesman gathered the data. The activity and physical features of the workplace categories explored in the literature are compared with the Leesman data. In addition, the representativeness and validity of the data are elaborated. The reliability of the responses did not seem to be influenced by the moment of measurement. The internal and external validity is acceptable. Also, the method description is discussed in previous sections. A Principal Component Analysis is performed to determine if the responses on satisfaction with physical workplace features and experienced support of activities cluster. Cluster analysis is applied to identify relatively homogeneous groups of cases on the activities the respondents rated as important. Different bivariate analyses are performed to determine significant correlations between the dependent variables and perceived productivity support at home and in the office. The outcomes are used as input for the Path Analysis. Last, the Path Analysis is explored. Different goodness of fit statistics are discussed and the mediation analysis.

6.0 Data description

This chapter starts by describing the general characteristics of the data set. First, the demographics of the Leesman sample are explored. Second, the importance and support of the different office activities are elaborated. The experienced support of activities is compared for the home and office work environment. Additionally, the importance and satisfaction with the office and home features are elaborated. The section finishes with comparing the perceived support of productivity for both work environments.

6.1 Demographics

The variables gender, age groups, and time with the organization are explored. Figure 13 shows the percentage of the respondents distributed over the continents. Half of the respondents originate from Europe. Asia and America are represented in the sample by nearly 25% each. The Southern continents are represented by less than 5% of the respondents.

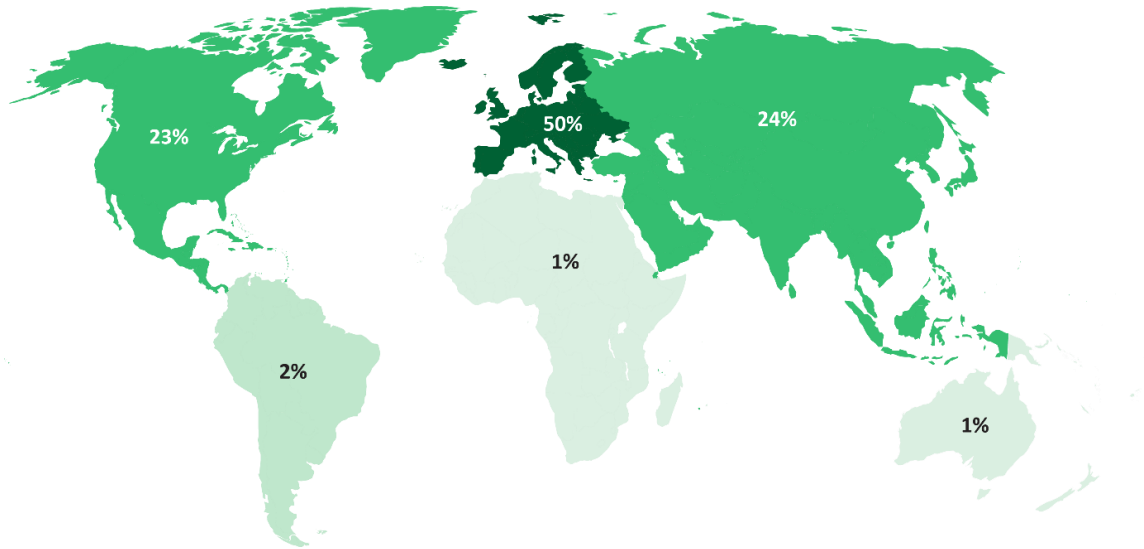


Figure 13: Percentage respondents over the continents (N=56,274)

6.1.1 Gender

Figure 14 displays the comparison between the male-female ratio of the respondents. The respondents that chose the option "prefer not to say" are included in the male category. The number of respondents who indicated this preference is minimal (<1.0). The males are, with 64%, better represented in the Leesman sample compared to the women.

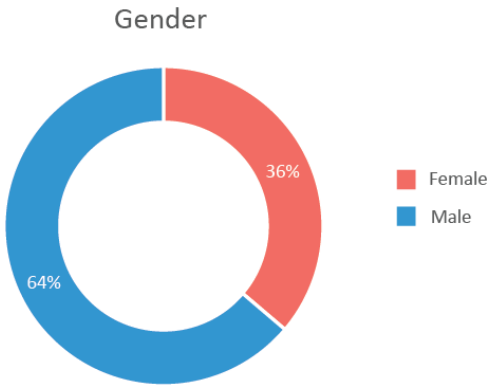


Figure 14: Demographics gender (N=57051)

6.1.2 Age group

The age of the respondents is divided into six categories ranging from under 25 years to over 65 years. The largest group of respondents (32.6%) is between 35 and 44 years old. The group of 65 years or over is represented by 0.6% of the respondents. A logical explanation for the low percentage in this age group could be the retirement age of employees. Figure 15 shows the distribution in percentages over de different age categories.

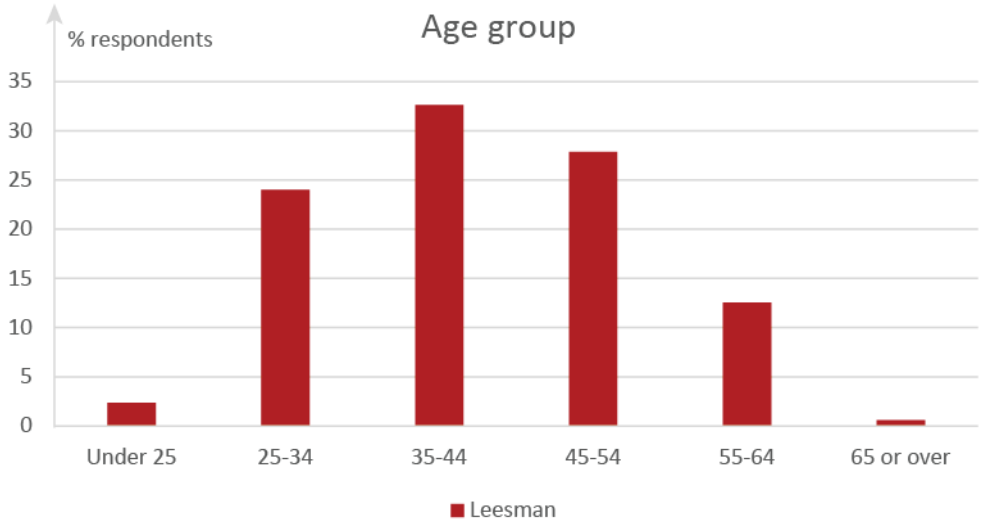


Figure 15: Demographics age group (N=57051)

6.1.3 Time with organization

The last demographic variable is the tenure of the employee. The time with the organization is divided into six categories ranging from under six months to over twelve years, see Figure 16. Not all categories have the same range making it more difficult to compare. The largest category, consisting of nearly one-third of the sample, is over twelve years with the organization. The tenure group with 8 till 12 years is less represented. The group between 6 and 18 months is also better represented in the sample compared to the other categories. In conclusion, the spread of employees' time with the organization is not divided equally over the categories.

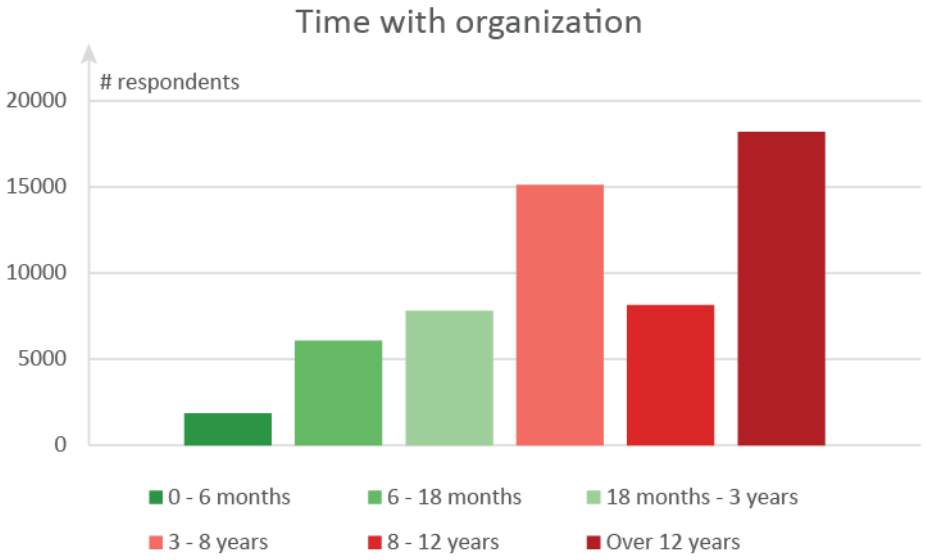


Figure 16: Demographics time with the organization (N=57051)

6.2 Workplace

Section 6.2 explores the different workplaces at home and in the office that employees use most often. First, the work settings in the office are discussed followed by the work settings at home.

6.2.1 Office workplace settings

Seven different workplace settings are distinguished. The largest two categories cover over 70% of the work locations at the office. Those are flexible and assigned workplaces in an open environment. The enclosed workplace categories cover approximately 20% of the most used workplaces. Figure 17 visualizes the division over the working settings in the office.

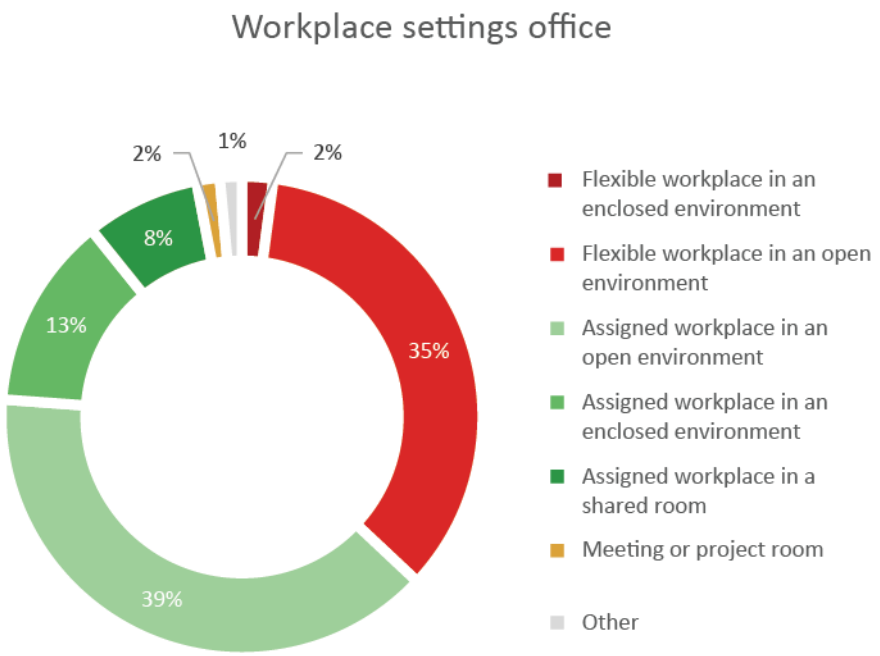


Figure 17: Workplace settings office

6.2.2 Home workplace settings

The home working settings comprise four categories. Figure 18 displays the different categories with their percentage. The largest part of the respondents (75%) uses a dedicated home workplace. The other 25% of the respondents use a flexible home workplace in a shared environment or another workplace.

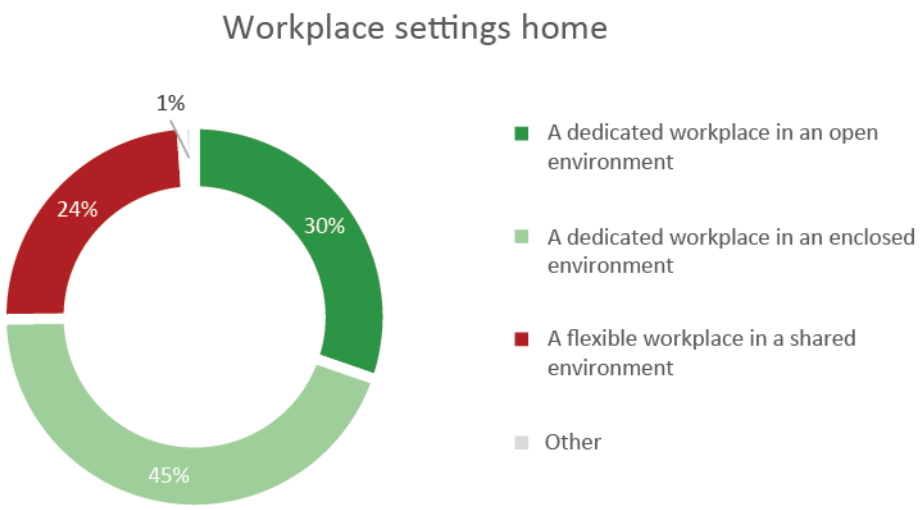


Figure 18: Workplace settings home

6.3 Importance and support of activities

The importance and support of activities are presented in the sections below. The respondents rated the activity as important for their line of work. The follow-up question was regarding the support of the activity by the office and home environment. First, the importance and support of activities conducted in the office environment are explored and second in the home environment. Section 6.3.3 compares the results of both environments.

6.3.1 Support of important activities in the office

Figure 19 displays the importance and support of the questioned activities in the office environment. The activities are categorized based on the activity's concentrative, collaborative, facility dependent, and informal nature. Additionally, the activities are ordered based on the percentage of respondents indicating them as important. Individual focused work, desk-based is most considered by employees as an important activity for their line of work. More than 70% of the respondents mentioned that it is well supported. Over 80% of the office employees consider planned meetings important for their line of work. Again, approximately 70% of the respondents mentioned that it is well supported. Using technical specialist equipment or materials is least important. The least supported activity is telephone conversations with 18% of the employees mentioning an under-support of the activity.

Figure 19: Experienced support of important activities in the office

6.3.2 Support of important activities at home

For the home work environment, individual focused work, desk-based is most rated as important by the home-working employees. Approximately 10% considers the activity as under-supported, while the majority (80%) considered it well supported. The respondents considered hosting visitors, clients, or customers and informal social interaction the least supported activity at home. Over 75% of the respondents rated the activity of hosting visitors, clients, or customers under-supported to not supported at all. More than half of the employees rated informal social interaction under-supported. Figure 20 visualizes the importance and support of activities at home.

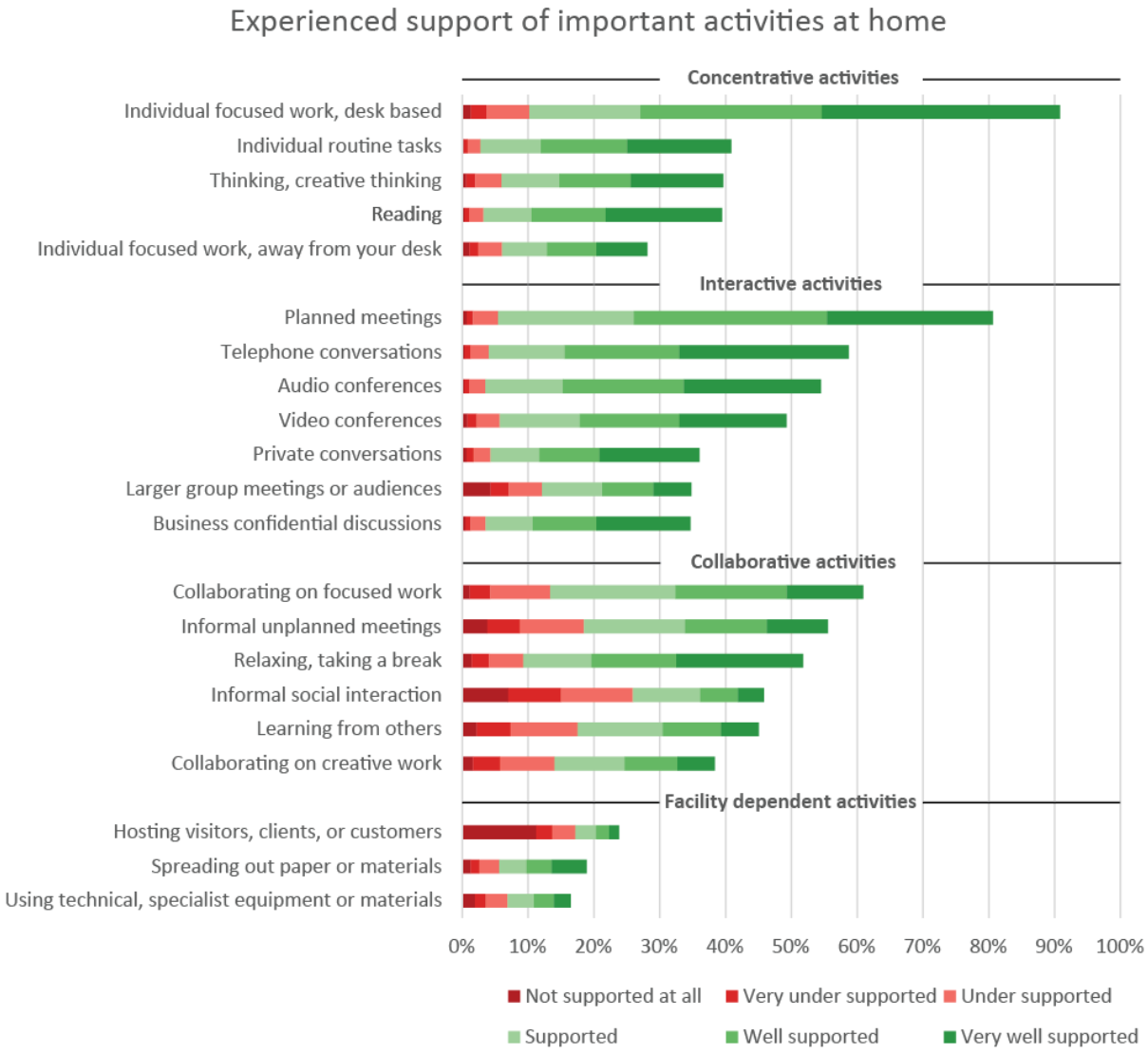


Figure 20: Experienced support of important activities at home

6.3.3 Comparison support of activities

When the respondents indicated an activity as important, the survey included questions concerning the experienced support for both the home and office work environment. This logically results in the same percentage of respondents indicating an activity as important for both work environments. The experienced support of the activity can differ in both work environments. The category division as used in previous figures is also used to compare the experienced support in both work environments.

Concentrative activities

Figure 21 compares concentrative activities in the home and office work environment. The experienced support of activities in the home environment is displayed first, followed by the office environment.

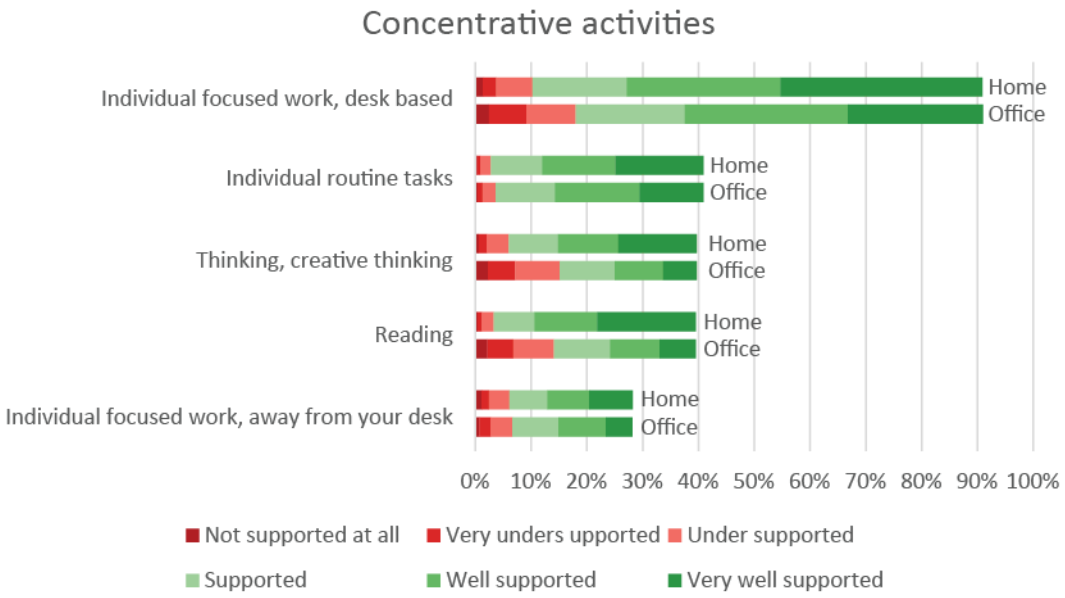


Figure 21: Experienced support of concentrative activities

The differences between the experienced support of concentrative activities in the home and office environment are small. Nevertheless, the respondents indicated that the home work environment supports individual-focused desk-based activities better. Additionally, reading and creative thinking are also better supported in the home environment. There is only a very slight difference in experienced support for individual routine tasks and individual focused work away from the desk. In general, concentrative activities are better supported in the home work environment.

Interactive activities

Figure 22 compares interactive activities in the home and office work environment. The experienced support of activities in the home environment is displayed first, followed by the office environment.

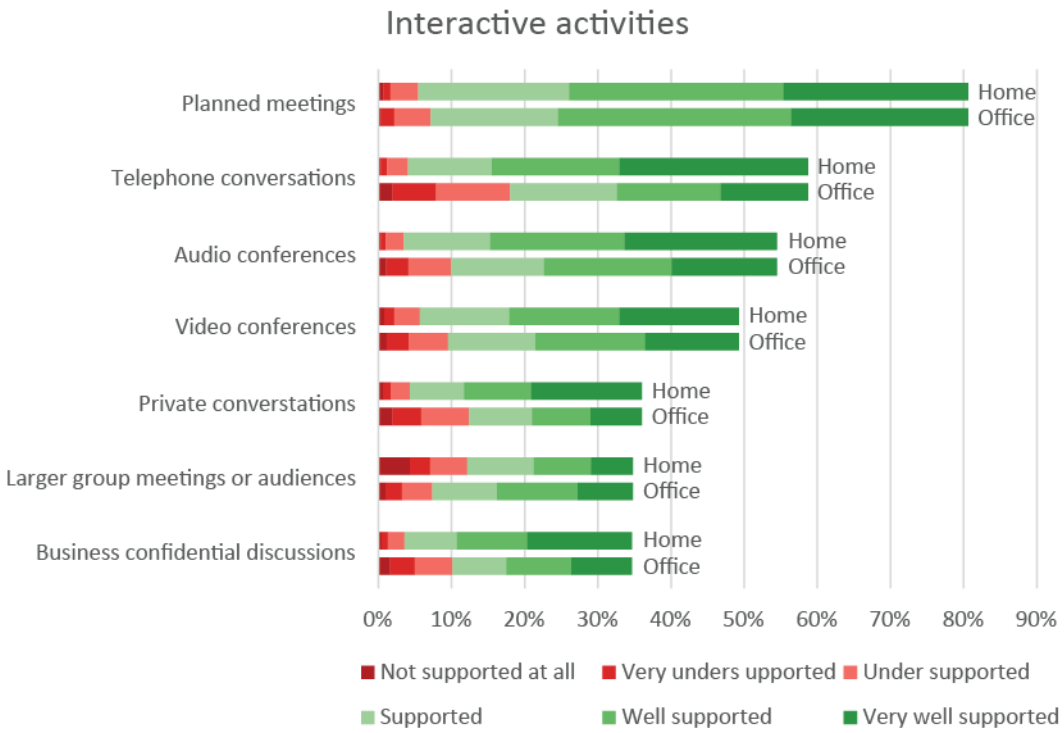


Figure 22: Experienced support of interactive activities

Telephone conversations, private conversations, and business confidential discussions are better supported at home. For these activities, more privacy is preferred which is better supported in the home environment. Respondents also reported better support for audio and video conferencing. In contrast, larger group meetings or audiences are better supported in the office environment. In general, most interactive activities are better supported at home. The home environment offers more visual and auditory privacy, making it a better-supported place for private and confidential meetings.

Collaborative activities

Figure 23 compares collaborative activities in the home and office work environment. The experienced support of activities in the home environment is displayed first, followed by the office environment.

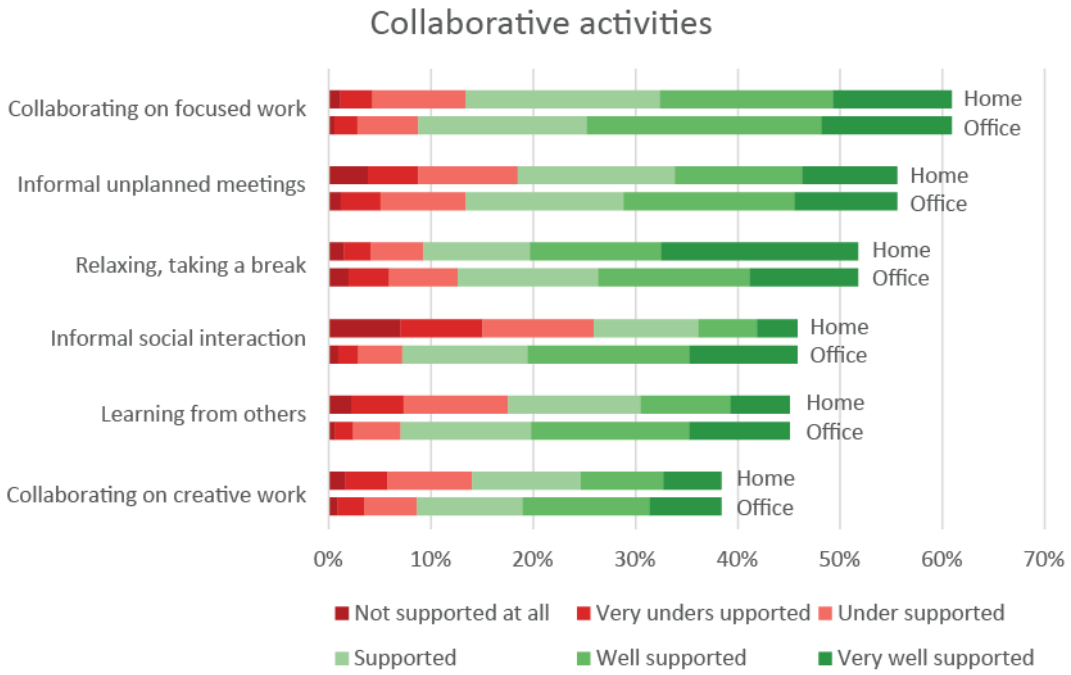


Figure 23: Experienced support of collaborative activities

Informal social interaction and informal unplanned meetings are better supported in the office. Especially social interactions and hosting visitors are rated under-supported in the home environment. Learning from others and collaborative activities are better supported in the office. Only relaxing and taking a break show higher experienced support in the home environment. In general, collaborative activities are better supported in the office work environment.

Facility dependent activities

Figure 24 displays the comparison of the facility dependent activities in both environments.

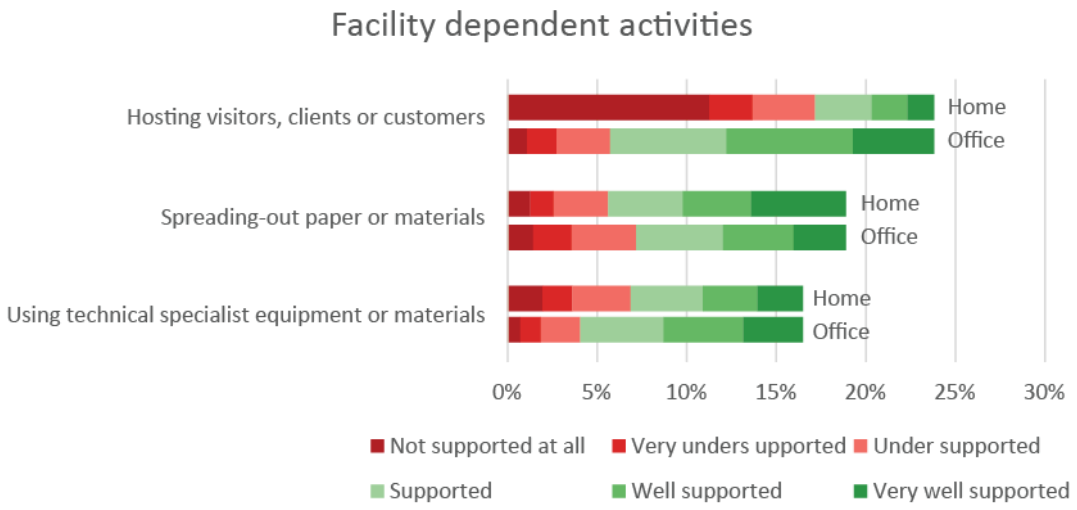


Figure 24: Experienced support of facility dependent activities

Hosting visitors, clients, or customers is better supported in the office environment and using technical specialist equipment. In general, facility dependent activities are better supported in the office work environment.

In conclusion, concentrative and interactive activities are considered better supported at home. When there is a need for controlling distractions and noise, the home work environment supports the activities better. In contrast, collaborative and facility dependent activities show better-experienced support in the office environment.

6.3.4 ANOVA comparison activities

A one-way ANOVA test is conducted to test if there is a significant difference between the experienced support of activities in the home and office work environment. There is a significant difference in experienced support of activities between the home and office work environment if the test results are significant ($p < 0.01$). Table 12 presents the results of the analysis.

Table 12: ANOVA results comparison experienced support of activities home and office

	Mean office	Mean home	Mean difference	F-Value	Significance	
Informal social interaction[3]	0.65	-0.14	0.79	5075.893	0.000	Better supported in the office work environment
Hosting visitors, clients or customers[4]	0.25	-0.31	0.56	3015.862	0.000	
Audio conferences[2]	0.76	1.06	0.30	3780.69	0.000	
Collaborating on creative work[3]	0.73	0.22	0.51	4228.308	0.000	
Learning from others[3]	0.63	0.21	0.42	6784.218	0.000	
Informal unplanned meetings[3]	0.65	0.37	0.28	2193.323	0.000	
Larger group meetings or audiences[2]	0.42	0.18	0.24	4338.356	0.000	
Collaborating on focused work[3]	0.88	0.69	0.19	5093.582	0.000	
Using technical specialist equipment or materials[4]	0.17	0.05	0.12	3590.447	0.000	
Planned meetings[2]	1.44	1.47	0.03	4645.895	0.000	
Individual focused work, desk-based[1]	0.30	0.36	0.06	616.731	0.000	Better supported in the home work environment
Individual routine tasks[1]	0.70	0.79	0.09	11240.23	0.000	
Spreading-out paper or materials[4]	0.09	0.18	0.09	608.183	0.000	
Video conferences[2]	0.66	0.83	0.17	4040.48	0.000	
Relaxing, taking a break[3]	0.55	0.79	0.24	2057.107	0.000	
Business confidential discussions[2]	0.33	0.64	0.31	1845.558	0.000	
Private conversations[2]	0.26	0.65	0.39	977.801	0.000	
Thinking, creative thinking[1]	0.21	0.64	0.43	690.199	0.000	
Individual focused work, away from your desk[1]	1.13	1.66	0.53	3116.771	0.000	
Reading[1]	0.24	0.78	0.54	800.808	0.000	
Telephone conversations[2]	0.51	1.18	0.67	1089.422	0.000	

1: Concentrative activities; 2. Interactive activities; 3. Collaborative activities; 4. Facility dependent activities
Sample size (N = 57051), Degrees of Freedom (DoF = 6)

The results indicate a significant difference between the experienced support in the home and office work environment for all activities. The null hypothesis is rejected, indicating a significant difference between the environments. The respondents experienced informal social interaction better supported in the office environment compared to the home environment. In contrast, telephone conversations are experienced as better supported at home. Individual focused work, desk-based and planned meetings show the slightest difference in experienced support.

6.4 Task variety

One of the aspects of task variety can be defined as the number of tasks per employee. Figure 25 shows the number of activities per respondent. Respondents indicated in the survey which activities are important for their line of work. In total, 21 activities are included in the questionnaire. The mode (most selected) is six different activities. The number of important activities seems normally distributed, however, tailed to the left (M = 9.45, SD = 4.99). Remarkable is the increase in respondents who indicated all 21 activities as important. A possible explanation could be the respondents' interpretation of the question, which resulted in marking all the activities as important.

In total, 985 respondents marked only one activity as important. Individual focused work, desk-based (N = 686) is selected most by the respondents who marked only one activity as important. In total, 84% (N = 782) of the respondents marked a concentrative activity as important when selecting only one activity, including individual focused work, desk-based. Planned meetings are more often selected by the respondents who selected two activities as important. Also, more than half of the activities that were marked important by the respondents, who indicated two activities as important, have a concentrative nature.

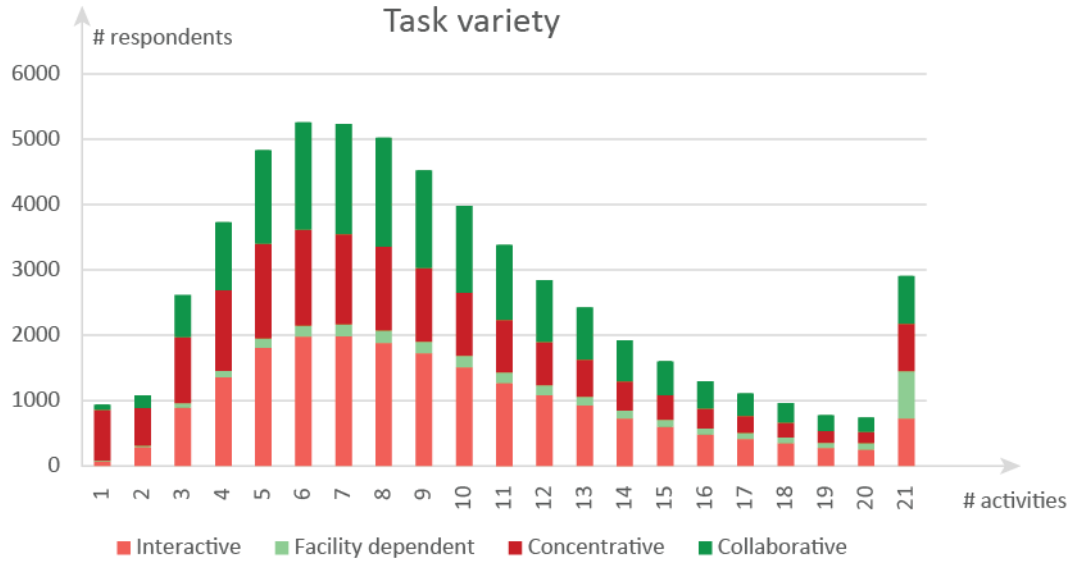


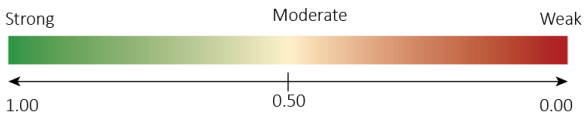
Figure 25: Number of important activities

6.4.1 Cluster analysis

Another aspect of task variety is the nature of the performed tasks. K-Means cluster analysis is applied to identify relatively homogeneous groups of cases on the activities the respondents rated as important. The data on the experienced support of the activity is not accounted for in this analysis method but only if an activity is regarded as important. Multiple K-means analyses are performed with different numbers of clusters. In total, four cluster groups are selected to find contrasting activity clusters. These four clusters show the most diverse activity clustering without overlapping of activities within the clusters. The results of the final cluster centers are presented in Table 13. A red cell indicates a low score on the cluster while a green cell indicates a high score for that cluster. A large score indicates that an activity strongly influences this cluster. The values range from 0 to 1. For an in-depth explanation of the selection of this analysis method, see Chapter 5.4.2.

Table 13: Results K-means cluster analysis (N = 57051)

	Cluster			
Activities	Concentration	Concentration and meetings	Concentration and collaborative work	Various activities
Individual focused work desk-based	0.86	0.91	0.93	0.98
Individual focused work away from your desk	0.13	0.24	0.24	0.71
Individual routine tasks	0.25	0.32	0.46	0.80
Reading	0.17	0.33	0.47	0.85
Collaborating on focused work	0.34	0.61	0.78	0.94
Collaborating on creative work	0.15	0.27	0.53	0.84
Informal unplanned meetings	0.22	0.66	0.68	0.94
Planned meetings	0.60	0.91	0.88	0.98
Informal social interaction	0.15	0.40	0.66	0.91
Business confidential discussions	0.10	0.50	0.17	0.87
Private conversations	0.11	0.42	0.29	0.89
Telephone conversations	0.31	0.81	0.50	0.96
Thinking/creative thinking	0.16	0.25	0.54	0.90
Learning from others	0.21	0.19	0.77	0.90
Audio conferences	0.28	0.76	0.44	0.92
Spreading out paper or materials	0.06	0.12	0.12	0.66
Using technical specialist equipment	0.07	0.08	0.12	0.55
Relaxing/taking a break	0.24	0.44	0.73	0.92
Larger group meetings or audiences	0.08	0.42	0.27	0.90
Hosting visitors, client or customers	0.06	0.28	0.10	0.74
Video conferences	0.19	0.76	0.35	0.92
Respondents (N)	20256	13967	13073	9755
Percentage (%)	**36%**	**24%**	**23%**	**17%**



The first cluster includes mainly concentration-related activities. Individual focused work desk-based shows the highest score (0.86), followed by planned meetings (0.60). The second cluster includes concentration work and meetings. In this cluster, planned meetings scores high (0.91) together with telephone conversations and audio and video conferences. The third group contains concentration and collaborative work and meetings. Learning from others (0.77) and informal social interaction (0.66) score high in this cluster compared to the first and second clusters. The audio and video conferences scores are lower than the second cluster. The second cluster differs from the third by focusing more on online activities while the third cluster focuses on collaborating with colleagues. The fourth cluster includes a diverse set of activities. All activities score high on this cluster.

The results of the K-means ANOVA test, presented in Appendix III – K-means ANOVA task profiles, show that learning from others (F = 12280.854) has the greatest influence in forming the clusters. In total, 45% of the respondents marked this activity as important. Learning from others scored significantly higher in the third cluster compared to the first and second clusters. This distinguishes the collaborative nature of the third cluster. Business confidential discussion (F = 10770.656) and larger group meetings or audiences (F = 10367.575) yield the second and third highest F-values. Those activities score moderate in the second cluster which focuses more on meetings. Respectively, 35% of the respondents marked both activities as important. Individual focused work, desk-based (F = 452.062) has the lowest F-value, so the least influence in the formation of the clusters. This activity scores highest in all clusters. A possible explanation could be the high percentage of respondents (91%) indicating the activity as important for their line of work. Planned meetings (F = 3457.336) has the second-lowest F-value compared to the other activities. This activity scores second-highest in all clusters.

6.4.2 Relationship between task profiles and number of performed tasks

A descriptive analysis is conducted to have a first indication of the differences between the number of activities regarded as important and the nature of the tasks. Table 14 presents the mean differences in the number of important activities per task profile. In total, the respondents could mark 21 activities as important for their line of work.

Table 14: Descriptives task profiles and number of performed tasks (N = 57051)

Task profiles	N	Mean	Std. Deviation	Minimum	Maximum
Concentration	20256	4.7526	1.67808	1.00	10.00
Concentration and meetings	13967	9.6952	2.15073	5.00	15.00
Concentration and collaborative work	13073	10.0356	2.19772	5.00	15.00
Various activities	9755	18.0615	2.45703	12.00	21.00

The lowest mean of number of important activities is reported for the concentration activity cluster (M = 4.75, SD = 1.68). Additionally, the answers of the respondents range between one and ten important activities. The highest mean of number of important activities is reported for the various activity clusters (M = 18.06, SD = 2.46). The respondents within this cluster marked at least twelve activities as important. The other two clusters show similar means and ranges of the selected number of important activities. A strong correlation between task profiles and the number of different tasks performed is found (r = 0.861, p = 0.000). Therefore, only task profiles are included in the path model analyses.

6.5 Importance of physical features

The importance and satisfaction with the physical features of both environments are explored in this section. The respondents are asked to indicate if the activity is important for their line of work and how satisfied they are with the feature. In total, 25 different physical features are rated.

6.5.1 Importance of physical office features

Desk and chair are most often indicated as important for conducting work-related activities in the office. Approximately 85% of the respondents rated those features as important. Meeting rooms and personal storage were also indicated as important by the respondents. Over 65% of the respondents rated the comfort condition, lighting, noise, temperature, and air quality as important features for their workplace. Figure 26 displays the results.

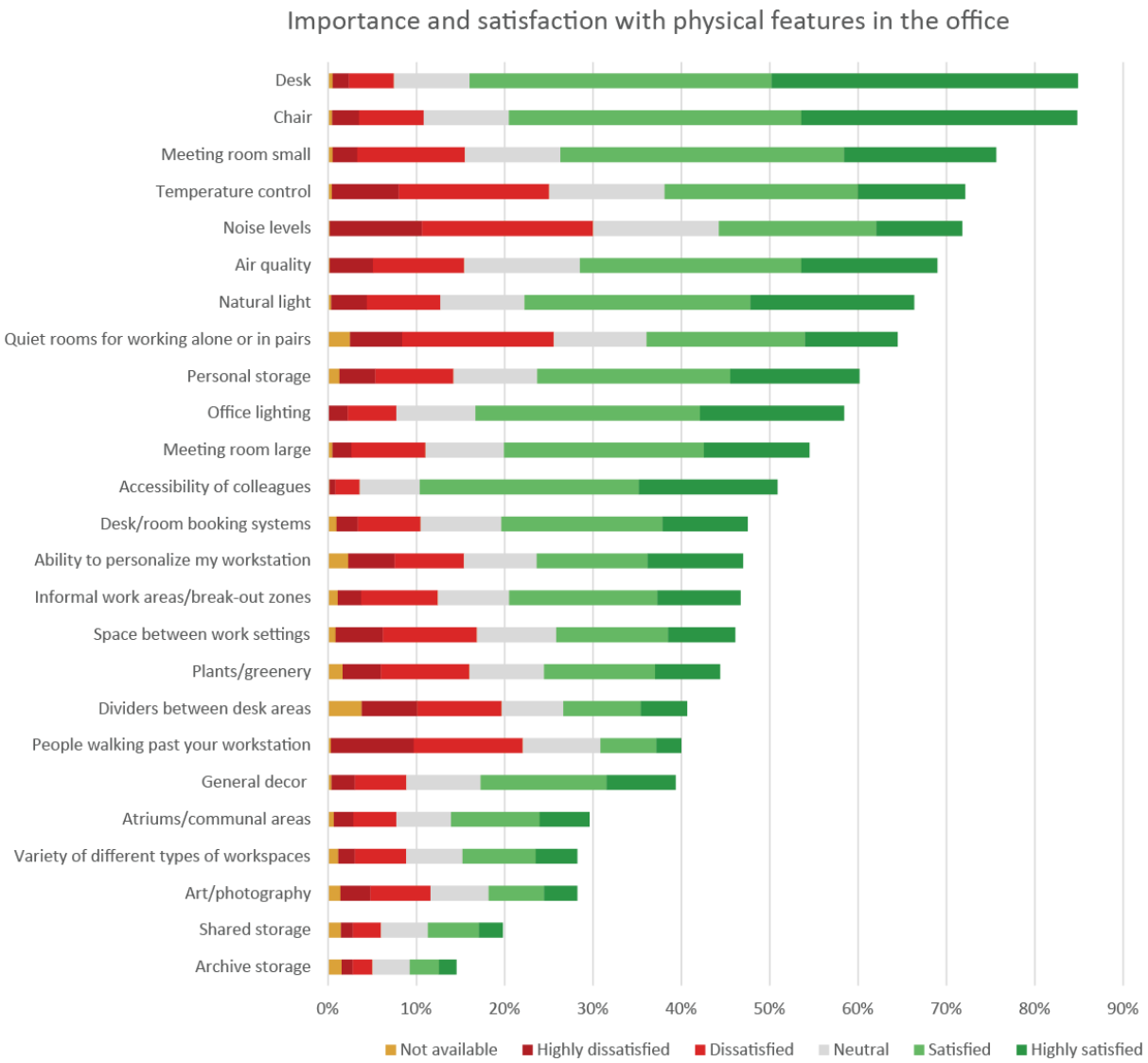


Figure 26: Importance and satisfaction with physical features in the office

6.5.2 Importance of physical home features

Nearly all the physical features of the survey are considered important for employees' line of work. Computing equipment, fixed desktop and wired network connection score significantly lower than WiFi and mobile equipment. Most likely, the organization provided laptops and telephones for their personnel to be able to work from home. The respondents indicated that printing, copying, and scanning equipment is most marked as not available. The largest dissatisfactory feature is chair. Figure 27 shows the importance and satisfaction with the physical features of the home environment.

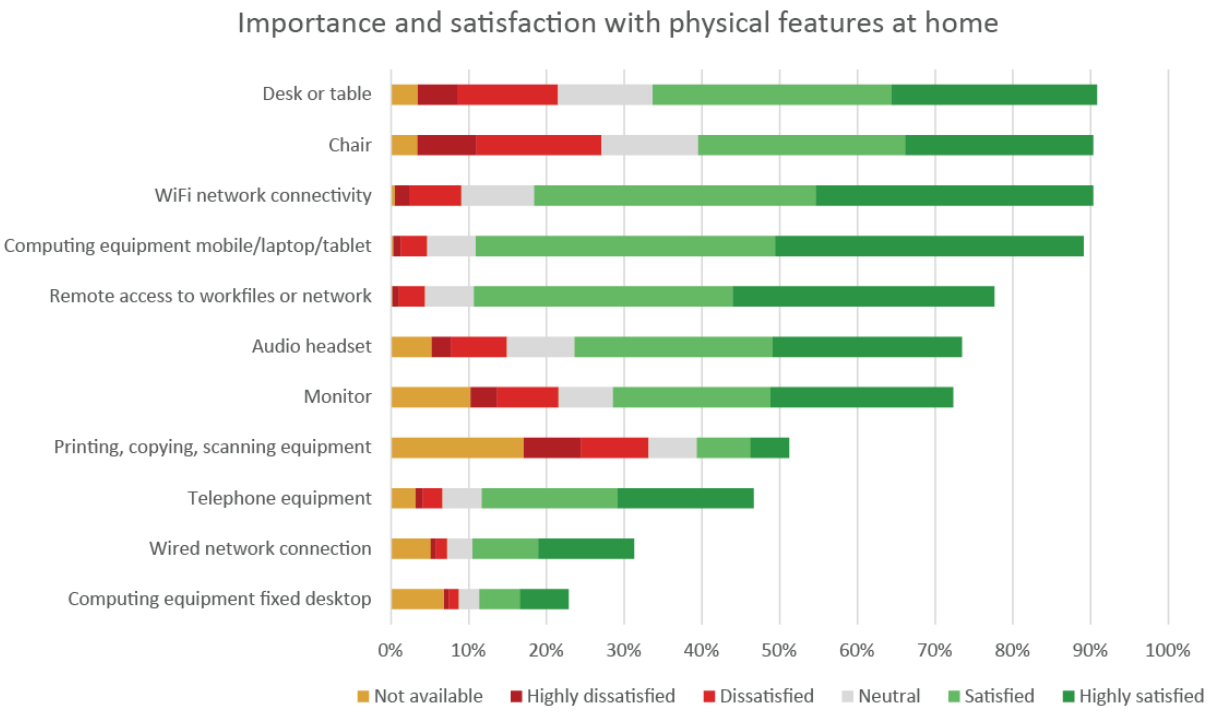


Figure 27: Importance and satisfaction of physical features at home

6.5.3 Comparison of home and office physical features

Unfortunately, only two physical features of the home and office environment can be compared. The survey made use of different physical features applicable to the different environments. The physical features at home did not include comfort conditions, storage, nor aesthetics. The IT equipment, such as desktop, monitor, headset, and internet connections, was mainly asked. However, the desk and chair can be compared with the office (Figure 28).

The chair and desk at home have a higher percentage of employees being dissatisfied with the features. There is no desk or chair available in the home working settings in some cases. Fewer office employees rate the desk and chair as important. This can be explained by offering other workplaces, like a single or double lounge workplace, in the office environment.

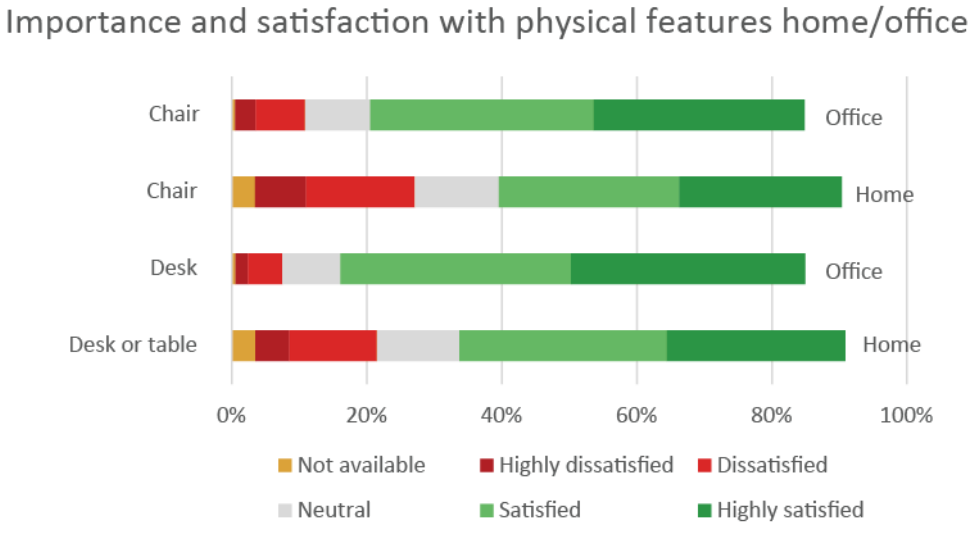


Figure 28: Comparison of home and office physical features

A one-way ANOVA test is conducted to test if there is a significant difference between satisfaction with physical features in the home and office work environment. The null hypothesis states that there is no significant difference in satisfaction with physical features between the home and office work environment. Section 5.4.4 elaborated on the method description. Table 15 presents the results of the analysis.

Table 15: Results ANOVA analysis comparison of satisfaction with physical features at home and in the office

	Mean office	Mean home	Mean difference	F-Value	Significance
Desk or table	0.95	0.44	0.51	297.877	0.000
Chair	0.82	0.60	0.22	459.027	0.000

Sample size (N = 57051), Degrees of Freedom (DoF = 4)

The results indicate that there is a significant difference between satisfaction with physical features of the home and office work environment. The respondents indicated that they are more satisfied with the desk and chair in the office work environment.

6.6 Perceived support of productivity

The perceived support of productivity is asked for both work settings. Figure 29 shows the results of the respondents. There are clear differences between the enablement of the work environment to support the employee to work productively. On average, the home work environment better enables employees to work productively. Over 85% of the respondents share this statement. Additionally, more workers disagree with the statement that the office work environment enables employees to work productively compared to the home environment.

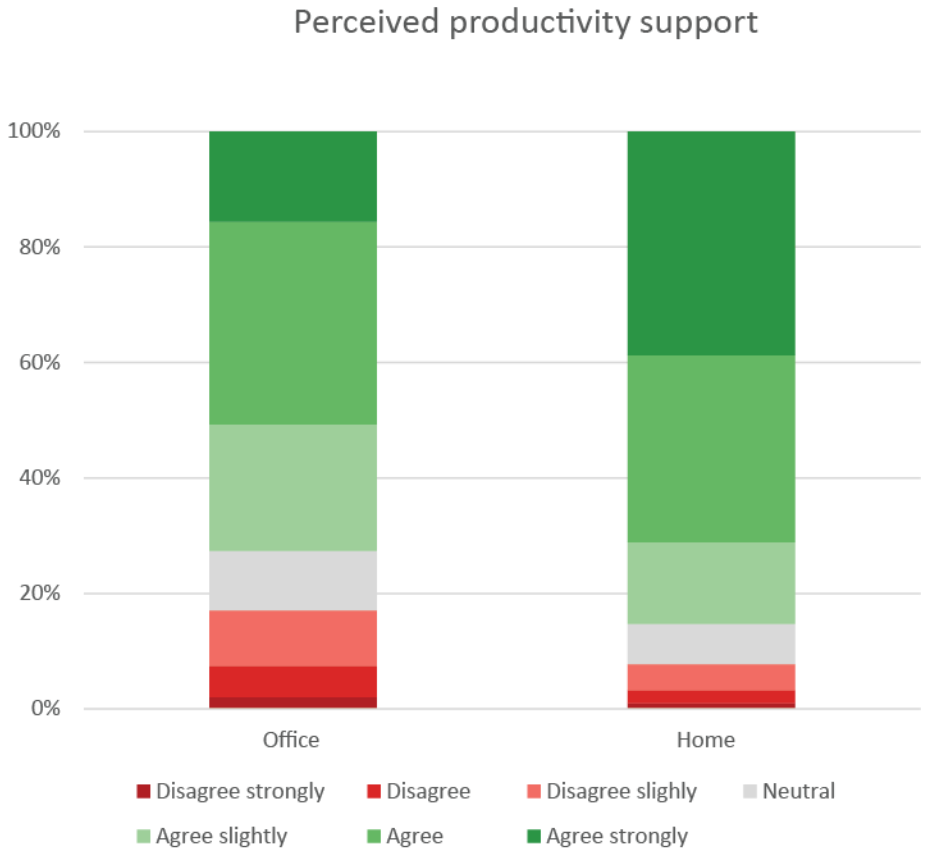


Figure 29: Perceived support of productivity in both work environments

A one-way ANOVA test is conducted to test a significant difference between the perceived productivity support in the home and office work environment. There is a significant difference ($p < 0.01$). in perceived support of productivity between the home and office work environment. The results indicate a significant difference between the productivity support in the home and office work environment, $F(6, 57044)= 89.827$, $p = 0.000$.

6.7 Conclusion

The conclusion recaps the results of the descriptives, which were elaborated in previous sections, and compares them with literature findings. The males are better represented in the Leesman sample. Additionally, the middle-aged group is better represented in the Leesman sample compared to the older aged categories. The employees working for over twelve years at the organization and between 6 and 18 months are over-represented.

Most employees work in a dedicated workplace in an enclosed environment at home and in an assigned workplace in an open environment at the office. The percentual division of workplaces cannot be validated by Kieft (2021) and Maarleveld et al. (2009) because they made use of a different categorization of workplaces. In their studies, the workplaces are differentiated by the number of people, while in this study the three office dimensions by de Croon et al. (2005) are used.

Telephone conversations, private conversations, and reading discussions are better supported at home. Other studies concluded a lack of space in the office offering sufficient visual and auditory privacy to support confidential (telephone) conversations (Gorgievski et al., 2010). More privacy is preferred for private and confidential conversations, which the home environment better supports. In conclusion, concentrative and interactive activities are considered better supported at home. When there is a need for controlling distractions and noise, the home work environment better supports the activities. In contrast, collaborative and facility dependent activities show better-experienced support in the office environment. These findings confirm studies by Erlich & Bichard (2008) and Van de Water (2021).

Task variety is subdivided into the number of important activities and the nature of the activities. Most respondents marked a concentrative activity as important when only selecting one activity as important. The number of important activities is normally distributed. However, tailed to the left and the respondents that marked all activities as important are higher. K-Means cluster analysis is applied to identify relatively homogeneous groups of cases on the activities the respondents rated as important. Four clusters are formed based on the nature of the activities. Learning from others has the greatest influence in forming the clusters. A high correlation between task profiles and the number of different tasks was found, resulting in the exclusion of the number of performed tasks in the path model.

Most respondents, approximately 90%, marked desk and chair as important for their workplace. Accessibility to colleagues and desk had the respondents' highest percentages of satisfaction rating. Noise levels and people walking past your workstation had the highest dissatisfaction rating in the Leesman sample. Maarleveld et al. (2009) showed that privacy and concentration can be large dissatisfactory aspects of the work environment

Respondents indicated higher perceived productivity support in the home work environment than the office settings. Groen et al. (2019) used WODI data to analyze the perceived productivity support in the office environment. The average mark assigned to self-assessed productivity support was 6.4 on a ten-point scale. The average mark assigned by the respondents for the Leesman data is 6.9 when

translated to a ten-point scale. The perceived productivity measured for the Leesman sample is 0.5 points higher.

7.0 Bivariate analysis

This chapter elaborates on different analyses to explore relationships between the different variables and perceived productivity support as stated in the conceptual model. The goal of these analyses is to explore the mutual relationships between the different variables which are used in the path model. First, a Principal Component Analysis (PCA) is conducted to determine the underlying dimensions of the variables based on the responses of the employees. New factors are constructed based on the outcome of the PCA, which also helps to limit the number of different variables in the analyses. Second, these new factors are used for correlation analyses to determine the strength and direction of experienced support of activities, satisfaction with physical features and perceived productivity support. Third, one-way ANOVA tests are conducted to compare the means of different independent variables. For an in-depth explanation of the selection of these analyses methods, see Chapter 5.4. This chapter finishes with a conclusion.

7.1 Principal component analysis

Principal Component Analysis is applied to determine if the responses group and whether underlying dimensions of the variables can be identified. It helps to reduce the number of variables that are used in the path analysis. The PCA is applied on the variables of satisfaction with physical features and experienced support of activities at home and in the office. For an in-depth explanation of the selection of this analysis method, see Chapter 5.4.1.

7.1.1 Satisfaction with physical features in the office

Respondents were asked to indicate important physical features and their satisfaction with the important features. In total, they rated 25 physical features of the office environment. A PCA is applied to determine if there are underlying dimensions of the variables. The missing values for features not indicated as important are recoded to the neutral category as described in the method section. The dataset meets the assumptions that variables are independent and uncorrelated. It is assumed that there is no unique variance since the total variance is equal to the common variance. The Kaiser-Meyer-Olkin measurement shows that the sample is suitable for the analysis (KMO = 0.901). According to Field (2013), a minimum KMO statistic of 0.5 is necessary to conclude the suitability of the sample to conduct a PCA. The results are presented in Table 16.

Table 16: Results of principal component analysis in the office (N = 57051)

Rotated Component Matrix satisfaction with physical features in the office

	Component					
Satisfaction with physical features in the office	Availability supportive spaces	Indoor comfort	Office décor	Crowdedness	Workstation	Storage
Meeting room small	0.741	0.152	0.022	0.065	0.118	0.023
Meeting room large	0.674	0.122	0.050	0.007	0.065	0.076
Quiet rooms for working alone or in pairs	0.590	0.164	0.088	0.294	0.044	-0.006
Desk/room booking systems	0.568	0.088	0.057	0.080	0.143	0.097
Informal work areas/break-out zones	0.533	0.122	0.355	0.077	0.038	0.019
Variety of different types of workspaces	0.455	0.032	0.370	0.164	-0.022	0.068
Accessibility of colleagues	0.429	0.129	0.129	0.042	0.214	0.086
Air quality	0.163	0.752	0.188	0.151	0.104	0.019
Temperature control	0.152	0.747	0.132	0.170	0.053	0.006
Office lighting	0.189	0.665	0.160	0.016	0.184	0.101

Natural light	0.126	0.643	0.168	0.061	0.150	0.091
Noise levels	0.197	0.527	0.051	0.520	0.049	0.024
Art/photography	0.058	0.099	0.761	0.121	0.045	0.061
Plants/greenery	0.073	0.210	0.727	0.108	0.099	0.044
General décor	0.163	0.207	0.708	0.038	0.114	0.080
Atriums/communal areas	0.173	0.099	0.704	0.025	0.053	0.062
Dividers between desk areas	0.085	0.061	0.105	0.750	0.157	0.074
People walking past your workstation	0.108	0.113	0.052	0.738	0.007	0.085
Space between work settings	0.144	0.155	0.111	0.690	0.213	0.098
Desk	0.204	0.178	0.077	0.143	0.809	0.036
Chair	0.176	0.203	0.091	0.083	0.802	0.009
Ability to personalize my workstation	0.085	0.044	0.123	0.414	0.483	0.115
Shared storage	0.106	0.056	0.091	0.077	0.044	0.814
Archive storage	0.077	0.054	0.083	0.100	0.023	0.807
Personal storage	0.141	0.145	0.089	0.259	0.373	0.405
Eigenvalue	**2.713**	**2.612**	**2.585**	**2.352**	**1.929**	**1.578**
% of Explained Variance	**10.850**	**10.448**	**10.340**	**9.408**	**7.715**	**6.313**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 6 iterations.

In total, six factors are extracted in the rotated PCA which have an eigenvalue larger than one. Together these components explain 55% of the variance. Six new factors are constructed based on the mean of all physical features in this new variable. These factors are used for other analyses in the next sections.

The first component includes satisfaction with the availability of supportive spaces. A variety of spaces in the office is included in this variable as well as accessibility to colleagues. The second component is satisfaction with different indoor climate features, such as temperature, air quality, lighting, and noise. The third component includes satisfaction with office décor; multiple features are included regarding plants and art in the office environment. The fourth component covers satisfaction with crowdedness; it includes space between workplaces and dividers between desk areas. The fifth component is satisfaction with the furniture. Desk and chair yield the highest values in this category. The last component covers the different storage possibilities.

7.1.2 Satisfaction with physical features at home

Respondents were asked to indicate important physical features and their satisfaction with the important features. In total, they rated eleven physical features in the home environment. PCA is executed to look for underlying dimensions of the variables and to reduce the number of variables for further analyses. The same recoding is applied as described in the method section. The missing values and the 'not available' category are recoded into the neutral category to ensure larger input for the PCA. The Kaiser-Meyer-Olkin measurement shows that the sample is suitable for the analysis (KMO = 0.852). The results of the rotated PCA are displayed in Table 17.

Table 17: Results of principal component analysis of the physical features at home (N = 57051)

Rotated Component Matrix satisfaction with physical features at home

	Component		
Satisfaction with physical features at home	Workstation + office equipment	Collaborative tools	Fixed computer and landline

Chair	0.850	0.171	0.039
Desk or table	0.841	0.200	0.054
Monitor	0.560	0.169	0.342
Printing, copying, scanning equipment	0.401	0.138	0.262
Remote access to work files or network	0.087	0.758	0.077
Computing equipment mobile/ laptop/tablet	0.225	0.685	-0.011
WiFi network connectivity	0.309	0.618	0.060
Telephone equipment	-0.062	0.580	0.384
Audio headset	0.283	0.511	0.169
Computing equipment fixed desktop	0.212	-0.008	0.757
Wired network connectivity	0.091	0.198	0.679
Eigenvalue	**2.196**	**1.179**	**1.409**
% of Explained Variance	**19.962**	**19.814**	**12.813**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 5 iterations.

Three new factors are created which explain 53% of the variance. The first component includes satisfaction with the workstation and office equipment. Desk and chair are grouped into the same component as well as in the office. Monitor and printing equipment score also high for this factor. Remote access, flexible computing and telephone equipment group into the collaborative tools component. Third, the fixed computer and landline factor includes wired connectivity and a fixed desktop. Three new factors are constructed based on the mean of all physical features in this new variable. These three variables are used for other analyses in the next sections.

7.1.3 Experienced support of activities in the office

The respondents were asked to indicate important activities and their experienced support for the important activities. In total, the respondents rated 21 different activities. The same recoding is applied as described in the method section. The missing values are recoded into the neutral category to ensure larger input for the PCA. The Kaiser-Meyer-Olkin measurement shows that the sample is suitable for the analysis (KMO = 0.919). The results are presented in Table 18.

Table 18: Results Principal component analysis office activities (N = 57051)

Rotated Component Matrix experienced support of activities in the office

	Component			
Experience support of activities in the office	Meetings	Collaborative and informal work	Concentrative work	Away from desk activities
Audio conferences	0.651	0.105	0.274	0.006
Video conferences	0.645	0.157	0.076	0.127
Business confidential discussions	0.589	0.103	0.237	0.202
Planned meetings	0.577	0.347	0.125	-0.096
Telephone conversations	0.559	0.027	0.482	0.058
Private conversations	0.530	0.122	0.296	0.172
Larger group meetings or audiences	0.506	0.351	-0.128	0.289
Informal social interaction	0.101	0.654	-0.075	0.162
Collaborating on creative work	0.104	0.642	0.204	0.073
Learning from others	0.041	0.620	0.231	0.158
Collaborating on focused work	0.249	0.579	0.310	-0.058
Informal unplanned meetings	0.342	0.546	0.103	0.002
Relaxing, taking a break	0.164	0.473	0.177	0.192

Individual focused work, desk-based	0.216	0.090	0.692	0.004
Reading	0.145	0.126	0.687	0.152
Thinking, creative thinking	0.137	0.364	0.561	0.156
Individual routine tasks	0.117	0.199	0.504	0.122
Using technical specialist equipment or materials	0.056	0.160	0.128	0.696
Spreading-out paper or materials	0.081	0.025	0.292	0.659
Hosting visitors, clients or customers	0.410	0.203	-0.204	0.506
Individual focused work, away from your desk	0.143	0.239	0.262	0.289
Eigenvalue	**2.897**	**2.708**	**2.458**	**1.600**
% of Explained Variance	**13.794**	**12.896**	**11.705**	**7.617**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Rotation converged in 7 iterations.

In total, four new variables are constructed explaining 46% of the variance. For larger sample sizes more factors are needed to explain the same amount of variance because smaller leading eigenvalues tend to be overestimated and trailing eigenvalue underestimated (Jolliffe, 2002). This could explain the lower total explained variance. The meeting factor includes planned meetings, conferences, and conversations. The second component concerns collaborative and informal activities which focus on group work and cooperating between employees. The concentrative work category includes individual-focused tasks. Using specialist equipment and hosting visitors group together in away from desk activities factor. Four new factors are constructed based on the mean of all physical features in this new variable. These four variables are used for other analyses in the following sections.

7.1.4 Experienced support of activities at home

The same activities rated by the respondents as important were questioned on their experienced support at home. The survey assumes the job description does not change when working from home so, the same activities indicated as important are asked for their experienced support. The same recoding is applied as described in the method section. A neutral category is added resulting in a 7-point Likert scale. The Kaiser-Meyer-Olkin measurement shows that the sample is suitable for the analysis (KMO = 0.904). The results of the PCA are presented in Table 19.

Table 19: Results principal component analysis activities at home (N = 57051)

Rotated Component Matrix experienced support of activities at home

	Component			
Experienced support of activities at home	Collaborative and informal work	Individual and concentrative work	Meetings	Facility dependent
Informal social interaction	0.662	0.088	-0.050	0.168
Learning from others	0.654	0.196	0.050	0.133
Informal unplanned meetings	0,611	0.183	0.215	-0.048
Collaborating on focused work	0,610	0.363	0.187	-0.110
Collaborating on creative work	0,609	0.362	0.049	0.041
Larger group meetings or audiences	0.535	-0.145	0.338	0.195
Hosting visitors or client or customers	0.532	-0.244	-0.089	0.299
Reading	-0.070	0.663	0.190	0.103

Thinking/creative thinking	0.135	0.615	0.152	0.139
Individual focused work, desk based	0.174	0.545	0.251	-0.115
Individual routine tasks	0.164	0.544	0.159	0.029
Relaxing/taking a break	0.144	0.457	0.167	0.134
Individual focused work, away from your desk	0.170	0.414	0.117	0.286
Audio conferences	0.118	0.179	0.666	-0.025
Videoconferences	0.159	0.073	0.663	0.064
Telephone conversations	-0.055	0.335	0.617	0.077
Business confidential discussions	-0.007	0.240	0.577	0.232
Planned meetings	0.370	0.201	0.548	-0.206
Private conversations	-0.009	0.304	0.508	0.266
Spreading out paper or materials	0.032	0.315	0.136	0.643
Using technical/specialist equipment or materials	0.316	0.051	0.093	0.641
Eigenvalue	**2.960**	**2.656**	**2.582**	**1.335**
% of Explained Variance	**14.094**	**12.646**	**12.294**	**6.365**

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

Rotation converged in 7 iterations.

The total variance explained by the new factors is 45%. Four new factors are constructed based on the mean of all physical features in this new variable. These four variables are used for other analyses in the next sections. The grouping and the underlying dimensions of the activities performed at home are different compared to the office environment. Hosting visitors or clients is moved from the facility dependent to the collaborative and informal activity component. A possible explanation could be the shift to an online meeting instead of needed facilities. The fourth factor includes facility dependent activities. This component includes activities that require facility support to perform the task. Also, relaxing/taking a break is in the group of collaborative activities in the office, while it is in the group of individual activities at home.

7.2 Bivariate analyses

This section explores the results of the strength and direction of the relationship between the variables and perceived productivity support. Pearson correlation analyses are executed for perceived support of productivity in the office and the PCA factors. Home perceived support of productivity shows a highly skewed and tailed curve and is assumed not to be normally distributed, leading to a Spearman correlation analysis between perceived productivity support and the other PCA factors. The relations that are tested are highlighted in red in the conceptual model displayed in Figure 30. For an in-depth explanation of the selection of this analysis method, see Chapter 5.4.3.

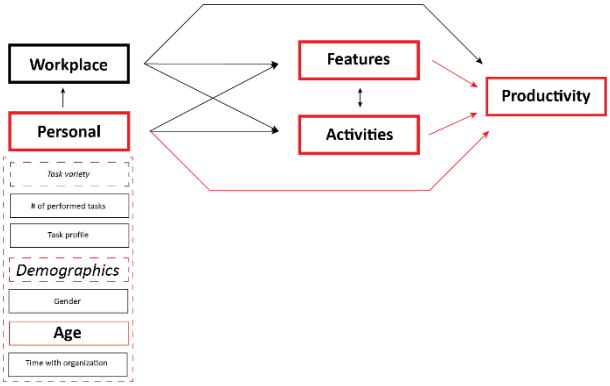


Figure 30: Conceptual model relationships highlighted

7.2.1 Results perceived productivity support in the office

A Pearson correlation is run to determine the strength and direction of the relationship between perceived productivity support in the office and the PCA factors, which are discussed in Section 7.1. The null hypothesis states that there is no association between the input variables. The null hypothesis has to be rejected when $p < 0.01$. A more conservative higher level of significance is selected because of the large sample size to reduce the significance of the error. The alternative hypothesis states that a correlation between the variables could exist. The correlation coefficient (r) yields insight into the strength and direction of the relationship. The sign (+/-) of the coefficient indicates the direction of the relationship, while the magnitude (close to 1 or -1) provides information on the strength of the relationship. The strength can be assessed by the general guidelines. An r-value of $r > 0.5$ indicates a strong correlation, $0.3 < r < 0.5$ indicates a moderate correlation, and $r < 0.3$ indicates a weak correlation (Cohen, 1988). These simplified guidelines should be interpreted as an indication of the strength of the relationship in the context of the research subject rather than a hard range (Schober & Schwarte, 2018). Sundstrup et al. (2018) and Kabir et al. (2019) also made use of this interpretation of the range of correlation values. The variables with a very weak correlation ($r < 0.1$) are excluded from the path model. The effect size is added in the last column to be able to compare the correlation coefficients with the ANOVA results. The results of the Pearson correlation analysis are illustrated in Table 20.

Table 20: Results Pearson Correlation Analysis with perceived support of productivity in the office (N=57051)

	Perceived support of productivity office		
Pearson Correlation Analysis	Correlation Coefficient	Significance	Effect size (r^2)
Experienced support of concentrative work	0.484**	0.000	0.234
Experienced support of meetings	0.256**	0.000	0.066
Experienced support of collaborative and informal work	0.207**	0.000	0.043
Experienced support of away from desk activities	0.058**	0.000	0.003
Satisfaction with crowdedness	0.372**	0.000	0.138
Satisfaction with availability supportive spaces	0.326**	0.000	0.106
Satisfaction with indoor comfort	0.272**	0.000	0.074
Satisfaction with workstation	0.203**	0.000	0.041
Satisfaction with office décor	0.090**	0.000	0.008
Satisfaction with storage	0.054**	0.000	0.003
Age	-0.116**	0.000	0.013
Perceived support of productivity at home	0.005	0.248	0.000

*** Correlation is significant at the 0.01 level (2-tailed)*

Table 20 shows a moderate, positive correlation between experienced support of concentrative work and productivity ($r = 0.484$, $p = 0.000$). The other activity categories show a significant positive weak correlation with perceived productivity support in the office. The results indicate that productivity support is higher perceived when the concentrated work activities of an office employee are experienced as well supported.

Looking at satisfaction with the physical features, satisfaction with crowdedness correlates strongest with perceived productivity support ($r = 0.372$). This indicates that perceived productivity support is higher when employees are more satisfied with the crowdedness in the office and the ability to work concentrative. A significant positive moderate correlation is shown with satisfaction with the availability of supportive spaces ($r = 0.326$, $p = 0.000$). Significant positive weak correlations are found between the other satisfaction factors and productivity ($r < 0.3$).

Age and perceived support of productivity in the home environment show a significant weak correlation with perceived support of productivity in the office. Additionally, the correlation between the office and home perceived productivity support is not significant (r = 0.005, p = 0.248). The variables that are excluded from the path model (r < 0.1) are satisfaction with office décor and storage and experienced support with away from desk activities.

7.2.2 Overview Pearson correlations

Table 21 presents the overview of the results of the Pearson correlation analyses between productivity, satisfaction with physical features, experienced support of activities, demographics, and task variety variables. The lower part of the matrix presents the correlation coefficients. The higher the correlation coefficient, the darker the color of the cell.

Table 21: Overview Pearson correlation analyses between all variables of the office environment (N = 57051)

Pearson correlation	Perceived productivity support in the office	Age group	Meetings	Collaborative and informal activities	Concentrative work	Availability supportive spaces	Indoor comfort	Crowdedness	Workstation
Perceived productivity support in the office									
Age group	-.116**								
Meetings	.256**	.016**							
Collaborative and informal activities	.207**	-.054**	0,000						
Concentrative work	.484**	-.105**	0,000	0,000					
Availability supportive spaces	.326**	-.078**	.343**	.346**	.151**				
Indoor comfort	.272**	-.070**	.147**	.119**	.149**	0,000			
Crowdedness	.372**	-.076**	.085**	-0,004	.348**	0,000	0,000		
Workstation	.203**	.020**	.082**	.125**	.139**	0,000	0,000	0,000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

r > 0,3 | 0,2 < r > 0,3 | 0,1 < r > 0,2 | r < 0,1

Availability of supportive spaces has a strong correlation with both experienced support of meetings (r = 0.343, p = 0.000) and collaborative and informal activities (r = 0.346, p = 0.000). Additionally, crowdedness correlates strongly with experienced support of concentrative work (r = 0.348, p = 0.000). The different satisfaction-with-physical-feature variables, except the availability of supportive spaces, do not significantly correlate with each other. All the non-significant relationships between the variables are excluded in the path analysis.

7.3.3 Results perceived productivity support at home

Spearman correlation analyses were run to determine the strength and direction of the relationships with perceived productivity support at home. The same guidelines apply to this analysis as discussed in Section 7.3.1. The results of the Spearman correlation analysis are shown in Table 22.

Table 22: Results Spearman Correlation Analysis with perceived support of productivity at home (N=57051)

Spearman Correlation Analysis	Perceived support of productivity home		
	Correlation Coefficient	Significance	Effect size (r^2)
Experienced support of individual and concentrative work	0.363**	0.000	0.132
Experienced support of collaborative and informal work	0.313**	0.000	0.098
Experienced support of meeting	0.232**	0.000	0.054
Experienced support of facility dependent activities	-0.114**	0.000	0.013
Satisfaction with workstation + office equipment	0.414**	0.000	0.171
Satisfaction with collaborative tools	0.313**	0.000	0.098
Satisfaction with fixed computer and landline	-0.010*	0.020	0.000
Age	0.047**	0.000	0.002
Perceived support of productivity in the office	0.035**	0.000	0.001

*** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed)*

Again, the strongest correlation is with experienced support of individual and concentrative work (r = 0.363). This correlation is positive and statistically significant (p = 0.000). Employees who experienced concentrative activities as well supported indicated higher perceived support of productivity. This is in line with the findings of the office work environment. Experienced support of collaborative and informal activities shows also a positive significant moderate correlation (r = 0.313, p = 0.000). Experienced support with facility dependent activities shows a weak negative correlation with perceived productivity support at home. This indicates that it is negatively related to the support of productivity.

Looking at satisfaction with physical features of the workplace, satisfaction with workstation and office equipment and collaborative tools both show moderate positive correlations, which are statistically significant (r > 0.3, p = 0.000). Satisfaction with furniture shows the strongest correlation (r = 0.414). This indicates that perceived productivity support is higher perceived when employees are more satisfied with their furniture.

Age and perceived support of productivity in the home environment show a significant weak correlation with perceived support of productivity at home. Also, satisfaction with fixed computer and landline shows a very weak correlation with perceived productivity support. This variable is excluded from the path model.

7.2.4 Overview Spearman correlations

Table 23 presents the overview of the results of the Spearman correlation analyses between productivity, satisfaction with physical features, experienced support of activities, demographics, and task variety variables. The lower part of the matrix shows the correlation coefficients. The higher the correlation coefficient the darker the color of the cell.

Table 23: Overview results spearman correlation analysis for all variables at home (N = 57051)

Spearman correlation	Perceived productivity support at home	Age	Collaborative and informal activities	Concentrative work	Meetings	Facility dependent activities	workstation + office equipment	Collaborative tools

Perceived productivity support at home								
Age	.047**							
Collaborative and informal activities	.314**	-.119**						
Individual and concentrative work	.363**	.058**	.034**					
Meetings	.232**	.114**	0,006	0,001				
Facility dependent activities	-.114**	.011**	-.156**	-.099**	-.086**			
Workstation + office equipment	.414**	-.043**	.252**	.209**	.077**	-.051**		
Collaborative tools	.331**	.083**	.163**	.217**	.292**	-.101**	.036**	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

R > 0,3

0,2 < r > 0,3

0,1 < r > 0,2

R < 0,1

In total, there are two non-significant correlations between the variables (p > 0.000). All the non-significant relationships between the variables are excluded from the path model.

7.3 Results one-way ANOVA test

A one-way ANOVA test is performed to compare the means of perceived productivity support in the office of different independent variables. The one-way ANOVA test explores if there is a significant mean difference in respondents' perceived support of productivity for different categories of a variable. The mean value reflects the average score of the respondents in that category. A negative score indicates that respondents deem their workplace not supportive for their productivity. A positive score indicates the opposite. Kruskal-Wallis H tests are conducted for perceived productivity support in the home environment because the dependent variable is not normally distributed. Additionally, Games-Howell post hoc tests are performed to compare all possible combinations of group differences. For an in-depth explanation of the selection of this analysis method, see Chapter 5.4.4.

7.3.1 Results office workplace settings and productivity

The respondents are asked to agree or disagree on a 7-point Likert scale with the statement whether their office workplace settings enable them to work productively. A one-way ANOVA test is executed to compare the different means of the respondents' perceived productivity support per workplace category. The null hypothesis is accepted when the results are insignificant (p > 0.01). The null hypothesis states that there is no significant difference in perceived support of productivity between the different workplaces in the office. The relationship is highlighted in red in Figure 31. The null hypothesis is rejected when there is a significant difference in perceived productivity support between the workplaces. Additionally, a Games-Howell post hoc test is used because the assumption of homogeneity of variances is violated. The post hoc test compares all possible combinations of group differences. The descriptives are presented in Table 24. The SPSS output tables and multiple comparison tables are added in Appendix IV – ANOVA office workplace settings.

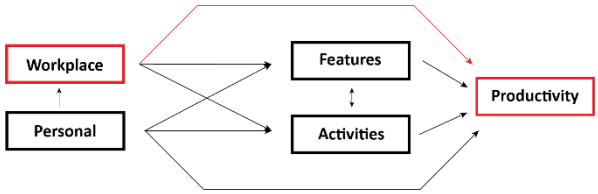


Figure 31: Workplace settings relationship highlighted in red

Table 24: Descriptives of workplace settings and office perceived productivity support

Office work settings	Number of respondents (N)	Mean (M)	Standard Deviation (SD)
Assigned workplace in an enclosed environment	7450	1.52	1.348
Assigned workplace in a shared room	4411	1.40	1.361
Assigned workplace in an open environment	22335	1.09	1.510
Flexible workplace in an open environment	19924	1.01	1.515
Other	843	0.96	1.626
Flexible workplace in an enclosed environment	1195	0.82	1.725
Meeting or project room	893	0.52	1.636

The main effect between workplace settings and perceived productivity support in the office is significant, $F(6, 57044)= 170.357$, $p = 0.000$. The null hypothesis is rejected, indicating a significant difference between the different office workplace settings. A Games-Howell post hoc test is applied to determine the differences between the group means. All workplace settings showed significant differences in the mean of perceived productivity support except for the other category. The highest mean of productivity support is reported for an assigned workplace in an enclosed environment ($M = 1.52$, $SD = 1.348$). So, the productivity support in these workplaces is significantly different from other workplaces ($p = 0.000$) and the respondents agreed most with the productivity statement. The lowest mean is reported for the meeting rooms ($M = 0.52$, $SD = 1.626$). Employees report less productivity support when working in meeting rooms. In conclusion, respondents perceive an assigned workplace in an enclosed environment as the best-supported location for productivity followed by assigned workplaces in a shared room.

7.3.2 Results home workplace settings and productivity

A non-parametric Kruskal-Wallis H test is executed to compare the different means of the respondents' rating of perceived productivity support. There is a significant difference in perceived support of productivity between the different workplaces at home if the results are significant ($p < 0.01$). The SPSS output tables are added in Appendix V – Kruskal-Wallis H test home workplace settings. The Kruskal-Wallis H test demonstrates a significant difference between the groups, $H(3) = 5903.3$, $p = 0.000$. The null hypothesis is rejected, indicating a significant difference between the different home workplace settings. Table 25 summarizes the descriptives.

Table 25: Descriptives home workplace settings and perceived productivity support

Home working settings	Number of respondents (N)	Mean (M)	Standard Deviation (SD)
Dedicated home workplace in an enclosed environment	25381	2.24	1.029
Dedicated home workplace in a shared environment	17292	1.82	1.264
Other	608	1.19	1.654
Flexible home workplace in a shared environment	13770	1.13	1.589

The highest mean of productivity support is reported for a dedicated home workplace in an enclosed environment ($M = 2.24$, $SD = 1.029$). So, the productivity support in these workplaces is significantly different from other workplaces ($p = 0.000$) and the respondents agreed most with the productivity statement. Also, a dedicated home workplace in a shared environment scored high. The lowest mean

is reported for flexible workplaces in a shared environment (M = 1.13, SD = 1.589). The employees working at home locations rate their perceived productivity support higher than office settings.

7.3.3 Results task profiles and productivity

The task profiles are divided into four different clusters. The respondents can mark any activity that is important for their line of work. A one-way ANOVA test is performed to test if there are differences between the different task profiles and perceived support of productivity in the office. The tested relationship is highlighted in red in Figure 32. For the home work environment, a non-parametric test is used, because the variable is not normally distributed. When the mean difference is significant ($p > 0.01$), which implies that there is a significant difference in perceived productivity support between respondents' task profiles. The descriptives are displayed in Table 26.

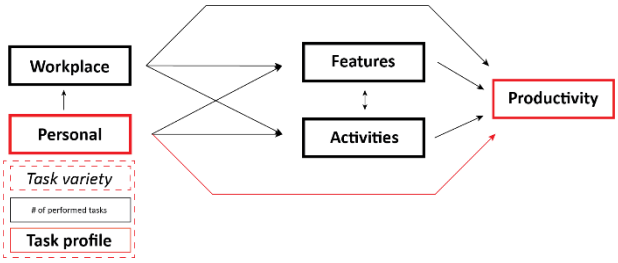


Figure 32: Task variety highlighted in red

Table 26: Descriptives task profiles and perceived productivity support

		Office		Home	
Task profiles	N	Mean	Std. Deviation	Mean	Std. Deviation
Concentration and collaborative work	13073	1.21	1.48	1.79	1.366
Concentration	20256	1.15	1.46	1.85	1.322
Concentration and meetings	13967	1.06	1.51	1.86	1.298
Various activities	9755	1.05	1.60	1.82	1.385

The main effect between task profiles and perceived productivity support in the office is significant, $F(3, 57047) = 34.977$, $p = 0.000$. The null hypothesis is rejected, indicating a significant difference between the respondents with different task profiles. Concentration work and meetings score the highest mean productivity in the office environment (M = 1.21, SD = 1.48).

The Kruskal-Wallis H test demonstrates a significant difference between the clusters, $H(3) = 13.085$, $p = 0.004$. The null hypothesis is rejected, indicating a significant difference in home perceived productivity support and task profiles. The highest mean of perceived productivity support at home is reported in the concentration and meetings cluster (M = 1.86, SD = 1.298). This cluster included audio and video conferences which is better supported at home.

7.3.4 Results gender and productivity

An independent t-test is executed to compare the means for perceived productivity support for males and females in the office. Only two categories, men and women, are included in this variable, making it possible to conduct an independent t-test instead of a one-way ANOVA test. Figure 33 highlights the tested relationship in red. The SPSS output tables are presented in Appendix VI – Independent t-test gender.

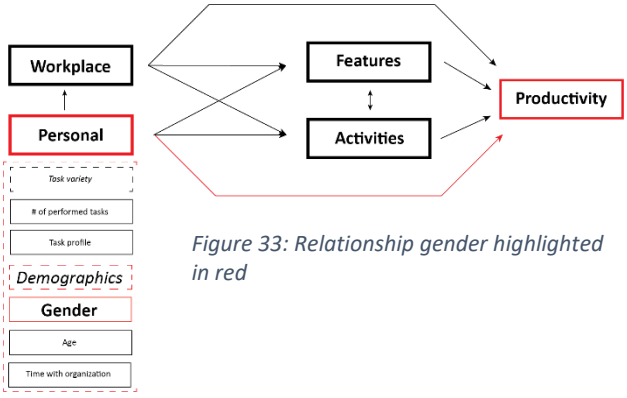


Figure 33: Relationship gender highlighted in red

The results indicate that males (M = 1.16, SD = 1.495) have significantly higher perceived support of productivity in the office compared to females (M = 1.06, SD = 1.514), t(57049)= -7.551, p = 0.000).

A Wilcoxon Sign-Rank test is applied to look for significant mean differences between males and females in perceived productivity support in the home environment. The results indicate a statistically significant mean difference between the two categories (Z= -147.716, p = 0.000). Considering the home environment, the female category shows a higher mean (M = 1.92). When the means of perceived productivity in both environments are compared both males and females show higher means when working from home (Males: 1.16 relative to 1.86; Females: 1.06 relative to 1.92).

7.3.5 Results time with organization and productivity

The last demographic variable is time with the organization. For this variable, the mean of perceived productivity support is compared with the different categories in employees' tenure. Time with the organization includes six categories ranging from 0-6 months with the organization to over 12 years. Figure 34 highlights the tested relationship in red.

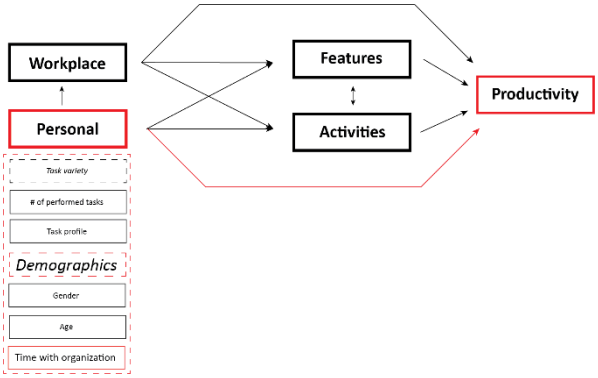


Figure 34: Relationship time with organization highlighted in red

The results of the one-way ANOVA test for the office environment are displayed in Table 27. The SPSS output tables are presented in

Appendix VII – ANOVA time with organization

Table 27: Descriptives time with organization and perceived productivity support (N = 57051)

		Office		Home	
Time with organization	N	Mean	Std. Deviation	Mean	Std. Deviation
0 - 6 months	1856	1.38	1.391	1.76	1.367
6 - 18 months	6059	1.30	1.438	1.83	1.363
3 - 8 years	15064	1.19	1.489	1.84	1.350
8 - 12 years	8122	1.18	1.486	1.78	1.354
18 months - 3 years	7784	1.16	1.470	1.78	1.382
Over 12 years	18166	0.95	1.549	1.88	1.286

The main effect between time with the organization and perceived productivity support in the office is significant, $F(5, 57045)= 85.606$, $p = 0.000$. The null hypothesis is rejected, indicating a significant difference in perceived productivity support between the different time with organization groups. The Kruskal-Wallis H test demonstrates a significant difference between the tenure groups, $H(5) = 40.501$, $p = 0.000$. The null hypothesis is rejected, indicating a significant difference between home perceived productivity support and the different time with the organization categories.

A Games-Howell post hoc test is applied to determine the differences between the group means. Most of the groups showed significant differences in the mean of perceived productivity support in the office. The highest mean is reported for the employees that are the shortest with the organization ($M = 1.38$, $SD = 1.391$). The means gradually decrease the longer the employees' tenure. The category over 12 years with the organization yields the lowest mean ($M = 0.95$, $SD = 1.549$). The shorter the tenure the higher the reported perceived support of productivity in the office environment. A possible explanation could be that respondents who have worked longer at their organization are also older, affecting their productivity.

7.3.6 Overview bivariate analyses

Table 28 presents an overview of the bivariate analyses exploring significant relationships between the workplace settings and personal characteristics in the office environment. Table 29 present the results for the home work environment. The analyses are performed to determine which variables to include in the path model. The null hypothesis states that there is no significant difference between the variables when $p > 0.01$. All the non-significant relationships between the variables are excluded from the path model.

Table 28: Overview bivariate analyses workplace settings and personal characteristics in the office (N = 57,051)

	Demographics		Experienced support of						Satisfaction with							
	Age group		Meetings		Collaborative and informal activities		Concentrative work		Availability supportive spaces		Indoor comfort		Crowdedness		Workstation	
One-way ANOVA	F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.
Office workplace	57.804	0.000	53.662	0.000	52.148	0.000	357.594	0.000	27.763	0.000	26.629	0.000	300.081	0,000	281.337	0.000
Task profile	414.318	0.000	1796.084	0.000	3152.190	0.000	161.249	0.000	274.717	0.000	61.520	0.000	88.959	0,000	180.127	0.000
Time with organization	4269.526	0.000	11.728	0.000	24.757	0.000	64.832	0.000	44.111	0.000	62.016	0.000	47.859	0,000	25.594	0.000
Independent t-test	t	Sig.	t	Sig.	t	Sig.	t	Sig.	t	Sig.	t	Sig.	t	Sig.	t	Sig.
Gender	-5.722	0.000	-11.422	0.000	-1.493	0.135	-3.650	0.000	-14.147	0.000	-31.889	0.000	5.562	0,000	10.913	0.000

Table 29: Overview bivariate analyses workplace settings and personal characteristics at home (N = 57,051)

	Demographics		Experienced support of								Satisfaction with			
	Age group		Collaborative and informal activities		Concentrative work		Meetings		Facility dependent activities		workstation + office equipment		Collaborative tools	
Kruskal-Wallis H test	H	Sig.	H	Sig.	H	Sig.	H	Sig.	H	Sig.	H	Sig.	H	Sig.
Home workplace settings	1218.342	0.000	871.079	0.000	1680.658	0.000	745.512	0.000	247.554	0.000	8125.087	0.000	211.438	0.000
Task profile	125.,587	0.000	636.132	0.000	7868.960	0.000	15608.2	0.000	1162.789	0.000	145.973	0.000	1165.490	0.000
Time with organization	16109.7	0.000	539.930	0.000	56.639	0.000	228.104	0.000	26.897	0.000	115.391	0.000	111.377	0.000
Wilcoxon Sign-Rank test	Z	Sig.	Z	Sig.	Z	Sig.	Z	Sig.	Z	Sig.	Z	Sig.	Z	Sig.
Gender	-5.178	0.000	-1.140	0.254	-2.600	0.009	-13.657	0.000	-2.182	0.029	-2.529	0.011	-7.502	0.000

Four relationships are not significant at $p < 0.01$. The results of the independent t-test and Wilcoxon Signed-Rank test concluded that the relationship between gender and experienced support of collaborative and informal activities in the office environment ($t(57049)= -1.493$, $p = 0.135$) and home environment ($Z = -1.140$, $p = 0.254$) are not significant. In addition, the relationship between gender and experienced support of facility dependent activities is not significant ($Z = -2.182$, $p = 0.029$). The outcomes showed that the relationship between gender and satisfaction with workstation + office equipment in the home environment ($Z = -2.529$, $p = 0.011$) is not significant. These relationships are not included in Path Analysis. In addition, strong correlation between the age of the employees and their time with the organization is found ($r = 0.485$, $p = 0.000$). Therefore, only the age of the employees is included in the path model analyses.

7.4 Effect size

The bivariate analysis conducted in the previous sections provided insights concerning the statistical significance of the relationships between the variables and perceived support of productivity. Each bivariate analysis method yields its respective factors indicating the strength and direction of the relationship, making it difficult to interpret the magnitudes of the outcomes. Therefore, the results of the different analyses are compared using effect size estimates.

The overview of the effect sizes is presented to indicate which variables relate strongly to each other and employees' perceived productivity support. The effect size results are used as input for the path analysis. The experienced support of concentrative work for the office environment shows the largest positive effect on employees' perceived productivity support. In contrast, satisfaction with the workstation and equipment at home shows the largest positive effect on perceived support of productivity in the home work environment. In addition, task profiles yield a large positive effect on experienced support of collaborative and informal activities in the office environment, while, the experienced support of meetings and concentrative task show the largest effects at home. Last, workplace settings show a larger positive effect on satisfaction with physical workplace features and experienced support of activities in the home environment compared to the office environment.

The effect size overview presents various relationships between the variables including magnitude and direction. The darkness of the color of the cell represents the strength of the relationship. The effect size matrix of the office work environment is presented in Table 30 and of the home work environment in Table 31.

Table 30: Overview effect sizes office work environment

				Characteristics				Experienced support of			Satisfaction with			
		Office environment	1	2	3	4	5	6	7	8	9	10	11	12
	1	Perceived productivity office												
Characteristics	2	Gender	0.001**											
	3	Age group	0.013**	0.001**										
	4	Task profile	0.002**	0.000**	0.021**									
	5	Office working settings	0.018**	0000*	0.006**	0.000**								
Experienced support of	6	Meetings	0.066**	0.002**	0.000**	0.086**	0.006**							
	7	Collaborative and informal activities	0.043**	0.000	0.003**	0.142**	0.005**	0.000						
	8	Concentrative work	0.234**	0.000**	0.011**	0.008**	0.036**	0.000	0.000					
Satisfaction with	9	Availability supportive spaces	0.106**	0.004**	0.006**	0.014**	0.003**	0.118**	0.120**	0.023**				
	10	Indoor comfort	0.074**	0.018**	0.005**	0.003**	0.003**	0.022**	0.014**	0.022**	0.000			
	11	Crowdedness	0.138**	0.001**	0.006**	0.005**	0.031**	0.007**	0.000	0.121**	0.000	0.000		
	12	Workstation	0.041**	0.002**	0.000**	0.009**	0.029**	0.007**	0.016**	0.019**	0.000	0.000	0.000	

Table 31: Overview effect sizes home work environment

				Characteristics				Experienced support of				Satisfaction with	
		Home environment	1	2	3	4	5	6	7	8	9	10	11
	1	Perceived productivity home											
Characteristics	2	Gender	0.002**										
	3	Age	0.002**	0.001**									
	4	Task profile	0.000**	0.000**	0.000**								
	5	Home working settings	0.109**	0.001**	0.000**	0.000**							
Experienced support of	6	Collaborative and informal work	0.099**	0.000	0.014**	0.016**	0.014**						
	7	Individual and concentrative work	0.132**	0.000	0.004**	0.146**	0.029**	0.001**					
	8	Meetings	0.054**	0.004**	0.013**	0.251**	0.013**	0.000	0.000				
	9	Facility dependent activities	0.013**	0.000*	0.000**	0.028**	0.001**	0.024**	0.010**	0.007**			
Satisfaction with	10	Workstation + office equipment	0.171**	0.000	0.002**	0.040**	0.143**	0.064**	0.044**	0.006**	0.003**		
	11	Collaborative tools	0.110**	0.001**	0.007**	0.018**	0.003**	0.027**	0.047**	0.085**	0.010**	0.001**	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

	r > 0.3	0.1 < r > 0.2
	0.2 < r > 0.3	r < 0.1

7.5 Conclusion

In the previous sections, a Principal Component Analysis is conducted for satisfaction with the physical features and experienced support of activities for the home and office work environment. In total, six new physical feature categories (availability of supportive spaces, indoor comfort, office décor, crowdedness, workstation, and storage) are created for the office environment. The PCA categories for the office environment are in line with the factors presented by Maarleveld et al. (2009). The PCA on experienced support of activities yielded four new categories for the office and the home work environment. No other studies were found to compare the latter factor analysis results.

Different bivariate analyses were performed to test the assumed relationships illustrated in the conceptual model. First, correlation analyses are run to determine the strength and direction of the factor variables with perceived support of productivity. Experienced support of concentrative activities showed the strongest correlation with perceived support of productivity at home and in the office. The results indicate that productivity support is mostly perceived when the concentrated activities of an office employee are experienced as well supported. Satisfaction with crowdedness had the strongest correlation with productivity of the office physical features. For the home environment, the results indicate that employees who are satisfied with their furniture and experience concentrative work as well supported perceive higher support of productivity.

The effect size matrices showed strong relationships between experienced support of activities, satisfaction with physical features, and perceived productivity support. In addition, strong relationships were explored between experienced support of activities and task profiles. Gender shows weak and negligible relationships with the other variables except for indoor comfort in the office. All significant weak correlations are removed from the path model. For this reason, satisfaction with office décor and storage in the office and experienced support of away from desk activities are removed. Satisfaction with fixed computer and landline is removed from the analysis at home. Figure 35 shows an overview of the bivariate relationships for the office work environment. Figure 36 shows the model for the home work environment. The variables and relationships marked red are removed from the model to achieve an acceptable model fit.

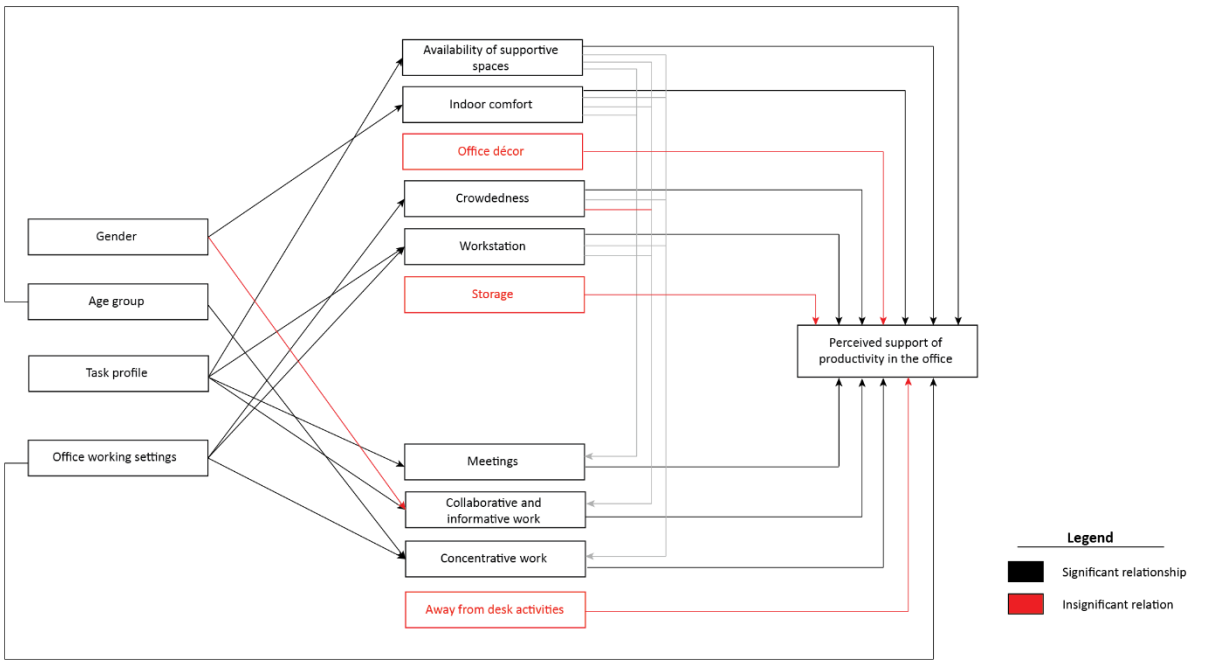


Figure 35: Overview relationships bivariate analyses office environment

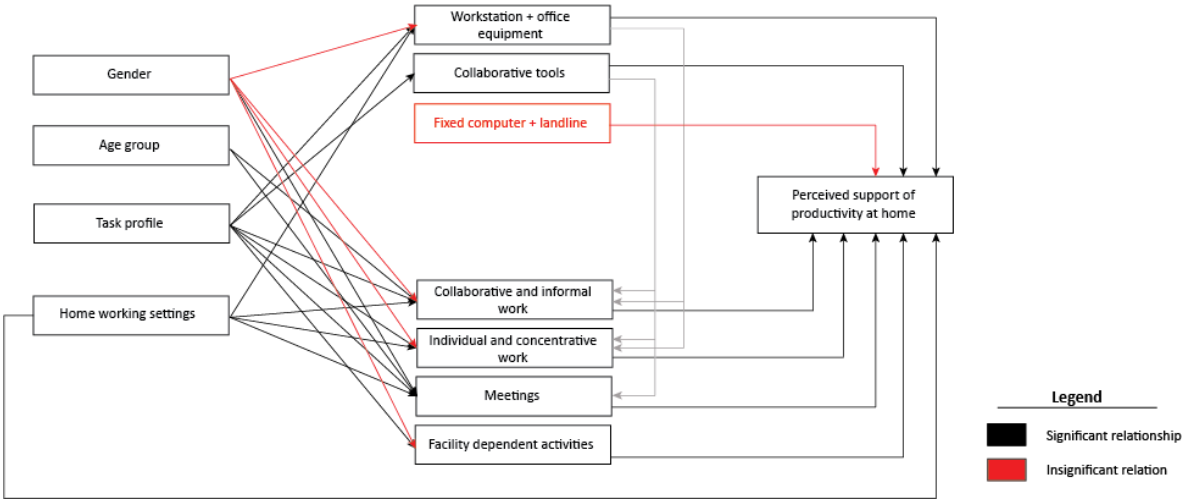


Figure 36: Overview relationships bivariate analyses home environment

8.0 Path analysis

According to the bivariate analyses, only the variables that have significant predicting power are included in the path model. All significant relationships that were observed in the previous chapter by performing different bivariate analyses are added to the path model. The results from the path model are used to answer the hypotheses summarized in Section 5.1.

8.1 Operationalization

Two different path models for perceived support of productivity in the home and office work environment are constructed to reduce the number of included variables. Variables with an insignificant influence on perceived productivity support are removed from the path model. In Sections 6.4 and 7.3, it was concluded that there was a strong correlation between time with the organization and age as well as between the number of tasks performed and task profile. Therefore, time with the organization and the number of tasks performed were removed from the path model. The age variables are recoded into one dummy variable distinguishing between younger and older employees. The category of young employees includes office employees who are aged below 35 years. The category old employees represent the respondents who are aged above 35 years. In addition, the workplace settings variables are also recoded into dummy variables.

First, different bivariate analyses are performed to determine the correlation between the variables and perceived support of productivity which are presented in Chapter 7. The variables with an insignificant or significant but weak relationship are removed from the path model. Also, the variables with high correlations were removed from the model. The observed strong correlations were used as a start for the path model. The model is optimized based on the significance of the relationships. The risk of overfitting the model is diminished by reducing the number of variables and relationships in the models. Insignificant relationships ($t \leq 1.96$) are removed from the path model to enhance the goodness of fit. In addition, the variable 'other workplace settings' in the home and office work environment and satisfaction with availability of supportive spaces are removed from the models. A back-ward step-by-step approach was used until a best fitting and acceptable model fit was achieved within the thresholds posed in the literature. The following variables are removed from the office and home work environment models:

Office environment

1. Workplace settings other
2. Availability of supportive spaces

Home environment

1. Workplace settings other

8.2 Goodness of fit statistics

The LISREL output yields information on the goodness of fit statistics. Different model fit measures are discussed in Section 5.4.5 to describe the goodness of fit of the path model. Section 5.4.5 also discusses the thresholds for these goodness of fit statistics. Table 32 indicates the required and achieved values for the different model fit measures. Two columns for achieved goodness of fit statistics are inserted, one for the office work environment model and one for the home work environment model.

Table 32: Model fit information

Requirements	Required value	Achieved (office)	Achieved (home)
Degrees of freedom		41	17
Goodness-of-Fit Index	GFI ≥ 0.90	1.00	0.99
Adjusted Goodness of Fit Index	AGFI ≥ 0.90	0.98	0.97
Comparative Fit Index	CFI ≥ 0.90	0.98	0.98

Normed Fit Index	NFI ≥ 0.90	0.98	0.98
Root Mean Square Error of Approximation	RMSEA < 0.08	0.030	0.046
Chi-Square value significance	p > 0.05	2213.09, p = 0.0	2086.58, p = 0.0

Table 32 shows that all the goodness of fit statistics are met for the home and office work environment models except for the significance of the Chi-Square value. In both models the Chi-Squared value is significant (p = 0.0). However, this was expected due to the large sample size. The larger the sample size, the higher the chance of obtaining a statistically significant Chi-Square statistic (Bollen and Long, 1993; Smith & McMillan, 2001). In conclusion, the goodness of fit statistics indicate that the model fit is acceptable. For a complete overview of the LISREL output concerning the goodness of fit statistics, see Appendix VIII – Goodness of fit statistics.

8.3 Results path model office work environment

The section aims to answer the hypotheses posed in the literature chapters, summarized in Section 5.1. The full path model and results for the office work environment are discussed followed by the path model of the home work environment. For clarity reasons, the full path model for the office work environment is divided into two parts. First, the relationships between the dependent and independent variables with perceived support of productivity are illustrated in Figure 37. Second, Figure 38 shows the relationships between the independent and dependent variables excluding perceived productivity support. Larger positive relationships are illustrated with thick green arrows, while larger negative relationships are illustrated with thick red arrows. The line weight indicates the strength of the relationship. Table 33 presents the unstandardized (B) and standardized coefficients (ß) of the relationships inserted in the model. All the relationships are significant at the 0.01 level (2-tailed). The results are discussed in the order of the hypotheses. The office work environment is discussed first.

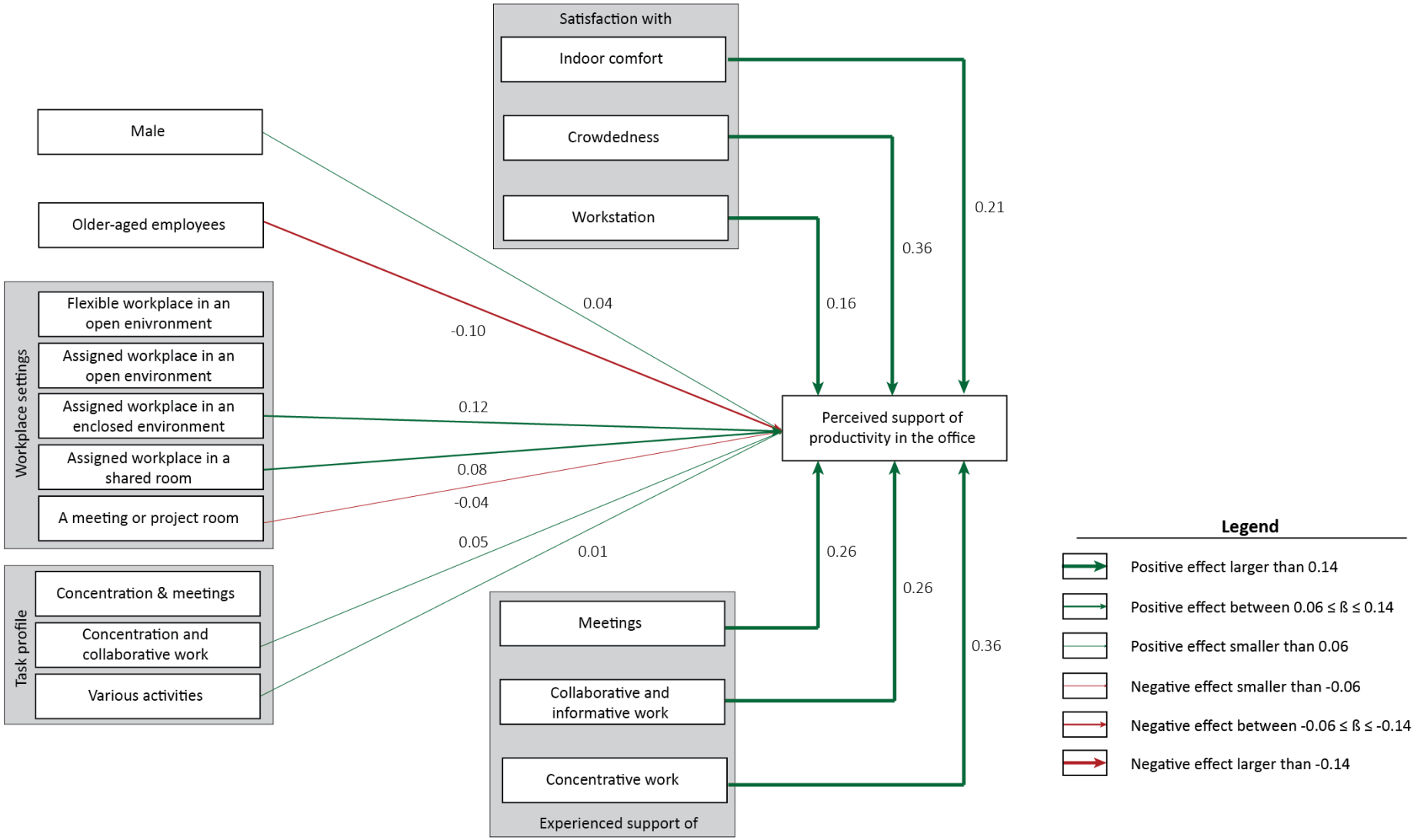


Figure 37: Relationships path model with perceived support of productivity in the office (standardized effects)

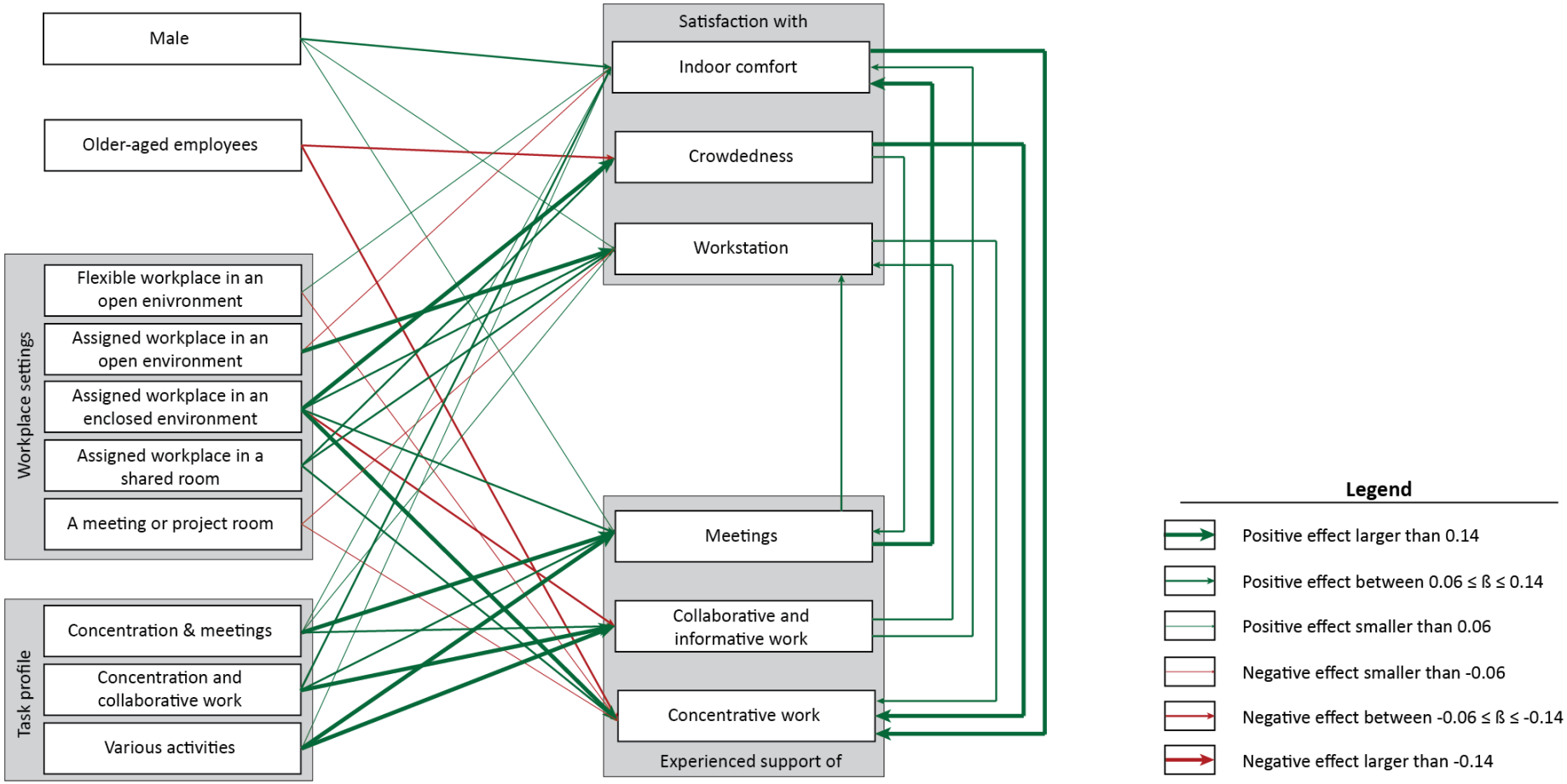


Figure 38: Results path model independent dependent variables in the office (Standardized effects)

Table 33: Results path model unstandardized and standardized effects

			Experienced support of			Satisfaction with				Experienced support of			Satisfaction with		
		Perceived support of productivity	Meetings	Collaborative and informal activities	Concentrative work	Indoor comfort	Crowdedness	Workstation	Perceived support of productivity	Meetings	Collaborative and informal activities	Concentrative work	Indoor comfort	Crowdedness	Workstation
Variable	**Category**	**Unstandardized coefficients (B)**							**Standardized coefficients (β)**						
Gender	Female														
	Male	0.11 (10.14)	0.11 (13.76)			0.28 (32.54)		-0.10 (-11.85)	0.04	0.05			0.13		-0.05
Age	Young														
	Old	-0.35 (-26.90)			-0.22 (-24.14)		-0.15 (-15.60)		-0.10			-0.10		-0.06	
Office workplace settings	Flexible workplace in an enclosed environment														
	Flexible workplace in an open environment				-0.02 (-2.42)	0.07 (6.81)						-0.01	0.03		
	Assigned workplace in an open environment					-0.06 (-5.90)		0.33 (35.13)					-0.03		0.16
	Assigned workplace in an enclosed environment	0.53 (28.79)	0.18 (15.51)	-0.17 (-15.21)	0.53 (41.32)		0.48 (38.89)	0.35 (26.67)	0.12	0.06	-0.06	0.18		0.16	0.12
	Assigned workplace in a shared room	0.43 (19.81)			0.28 (17.76)		0.32 (20.85)	0.29 (17.83)	0.08			0.07		0.09	0.08
	A meeting or project room	-0.44 (-10.41)			-0.37 (-11.75)			-0.16 (-4.91)	-0.04			-0.05			-0.02
Task profiles	Concentration														
	Concentration and meetings		0.64 (61.72)	0.18 (17.35)		0.11 (9.65)		0.13 (13.01)		0.28	0.08		0.05		0.05
	Concentration and collaborative work	0.16 (12.11)	0.13 (12.32)	0.83 (80.19)		0.16 (13.98)			0.05	0.06	0.35		0.07		
	Various activities	0.04 (2.61)	0.66 (56.16)	0.83 (72.57)		0.11 (8.82)			0.01	0.25	0.31		0.04		
Experienced support of	Meetings	0.40 (77.03)				0.15 (35.02)		0.07 (17.85)	0.26				0.15		0.07
	Collaborative and informal activities	0.39 (72.47)				0.12 (28.03)		0.13 (30.54)	0.26				0.12		0.13
	Concentrative work	0.55 (105.62)							0.36						
Satisfaction with	Indoor comfort	0.32 (60.98)			0.15 (38.67)				0.21			0.15			
	Crowdedness	0.54 (98.41)	0.10 (24.04)		0.33 (84.41)				0.36	0.10		0.32			
	Workstation	0.24 (45.86)			0.13 (33.34)				0.16			0.13			

	Positive effect larger than 0.14		Negative effect larger than 0.14
	Positive effect between 0.06 ≤ 0.14		Negative effect between 0.06 ≤ 0.14
	Positive effect smaller than 0.06		Negative effect smaller than 0.06

8.3.1 Office workplace settings

The results for the office workplace settings are discussed in this section. The path model results are discussed first, followed by bivariate analysis to formulate a complete answer to the hypotheses. The significant effects of workplace settings on perceived support of productivity are presented in order of relative strength indicated by the standardized coefficients (ß). The first hypothesis focused on the relationship between different workplace settings and perceived productivity support. Three sub-hypotheses are formulated for location, layout, and use. The results of the path model indicate that for the office environment, assigned workplaces in an enclosed environment yield the largest positive significant effect on perceived support of productivity (ß = 0.12, $p < 0.01$) followed by assigned workplaces in a shared room (ß = 0.08, $p < 0.01$). The other office workplace settings show either small or negligible effects on perceived support of productivity. This indicates that employees who work in assigned workplaces in a more enclosed environment perceive higher productivity support than those in flexible workplaces in more open environments. Hypotheses 1B (The home and office workplace layout relate to perceived support of productivity) and 1C (the home and office workplace use relate to perceived support of productivity) focus on the relationship between workplace layout and use on employees' perceived support of productivity. In order to accept or reject these hypotheses, an additional bivariate analysis should be performed to check for significant mean differences between open and enclosed workplace layouts and assigned or flexible workplace use.

Hypotheses 1B focuses on the relationship between office openness and layout on employees' perceived support of productivity. The workplace settings variable is recoded into a variable, making only a difference between open or enclosed workplace settings. The respondents are asked to agree or disagree on a 7-point Likert scale [-3 ; 3] with the statement whether their office workplace settings enable them to work productively. An independent t-test is performed to test for significant mean differences between the workplace settings. The results indicate that employees in enclosed workplaces (M = 1.36, SD = 1.438) rate perceived support of productivity in the office significantly higher than in open work environments (M = 1.05, SD = 1.515), $t(57049)= 32.734$, $p = 0.000$.

Hypotheses 1C highlights the relationship between office workplace use and employees' perceived support of productivity. The variable workplace settings is recoded into a variable distinguishing three categories: assigned, flexible, and other. A one-way ANOVA test is executed to compare the different means of the respondents' perceived productivity support per workplace category. There is a significant difference in perceived support of productivity between the different workplace uses in the office, if the results are significant ($p < 0.01$). The results show that employees in assigned workplaces (M = 1.23, SD = 1.469) have significantly higher perceived support of productivity in the office compared to those in flexible work settings (M = 1.00. SD = 1.529), $F(2, 57048)= 218.172$, $p = 0.000$.

The last sub-hypothesis (1A) states that the home location better supports employees' perceived support of productivity compared to the office location. Section 6.5 already showed a significant mean difference in perceived productivity support between both locations. The mean for perceived productivity support for the home work environment is higher than the office environment. Employees who work at home perceive higher productivity support compared to those working in the office.

In conclusion, employees who work at home perceive higher support of productivity. In addition, employees who work in assigned workplaces in an enclosed environment perceive higher productivity support than those in flexible and open workplaces. The first hypothesis, including the three sub-hypotheses, can be accepted for the office work environment.

$H_{1\text{-office}}$: Workplace settings relate to perceived support of productivity

8.3.2 Satisfaction with physical features in the office

The second hypothesis states that satisfaction with physical features is related to perceived support of productivity. Satisfaction with crowdedness has the largest significant positive effect on perceived productivity (ß = 0.36, p < 0.01). This indicates that office employees who are satisfied with crowdedness aspects of the workplace perceive higher productivity support. Satisfaction with indoor comfort is also positively related to perceived productivity support (ß = 0.21, p < 0.01). Office employees who are satisfied with indoor comfort aspects perceive higher productivity support. In general, the results show that satisfaction with all three physical workplace aspects relates positively to perceived support of productivity. So, employees who are satisfied with physical workplace aspects perceive higher productivity in the office work environment. The second hypothesis is confirmed.

$H_{2\text{-office}}$: Satisfaction with physical features relates to perceived support of productivity in the home and office work environment

The third and fourth hypotheses focus on the relationship between workplace settings and satisfaction with physical features, which mediate the relationship with perceived productivity support. First, the direct total effect of workplace settings on satisfaction with physical features is discussed followed by the mediation effect. Assigned workplaces in an open environment show a positive effect on satisfaction with the workstation (ß = 0.16, p < 0.01). In addition, an assigned workplace in an enclosed environment and a shared room yields moderate positive relationships with satisfaction with the workstation. The results indicate that office employees who work in assigned workplaces are more satisfied with workstation aspects than employees in flexible settings. Assigned workplaces in an enclosed environment positively affect satisfaction with crowdedness (ß = 0.16, p < 0.01). Additionally, assigned workplaces in a shared room show a moderate positive effect on satisfaction with crowdedness (ß = 0.09, p < 0.01). The results indicate that employees who work in assigned workplaces are more satisfied with crowdedness aspects than employees who work in flexible workplaces. In conclusion, office workplace settings relate to satisfaction with physical features, which means that the third hypothesis can be accepted.

$H_{3\text{-office}}$: Workplace settings relate to satisfaction with physical features

8.3.3 Experienced support of activities in the office

The fifth hypothesis states that experienced support of activities is related to perceived productivity support. In the office environment path model, experienced support of concentrative work shows the largest positive significant effect on perceived productivity support (ß = 0.36, p < 0.01). Employees who experience concentrative work as well supported perceive higher support of productivity. In addition, experienced support of concentrative work has a larger positive relationship with perceived productivity support than the other activity categories. Nonetheless, both experienced support of meetings as well as collaborative and informal activities also show a large positive effect on productivity (ß = 0.26, p < 0.01). In conclusion, experienced support of activities positively affects employees' perceived support of productivity. So, the fifth hypothesis can be confirmed for the office work environment.

$H_{5\text{-office}}$: Experienced support of activities relates to perceived support of productivity

Four different task profiles were created based on the cluster analysis results. The sixth hypothesis states that task variety relates to perceived support of productivity in the office environment. The task profile cluster labeled 'concentration and collaborative work' has a small positive effect on perceived productivity support in the office (ß = 0.05, p < 0.01). This indicates that employees in this cluster perceive higher productivity support than employees in the task profile cluster 'concentration' where

employees mostly found concentrative work important. The different task profiles have a relatively small effect on employees' perceived support of productivity. In conclusion, task profiles have a very small significant effect on perceived support of productivity. The model included not all relationships with the task profiles and perceived productivity support. Employees in the cluster 'concentration and meetings' did not significantly affect perceived productivity support; therefore, it was excluded from the path model. The other task profile variables were included in the analysis. So, the sixth hypothesis is partly accepted for the office work environment. It is not a strong relationship however, it is a significant one.

$H_{6\text{-office}}$: Task variety relates to perceived support of productivity

The seventh hypothesis posed in Section 3 states that task variety relates to experienced support of activities and satisfaction with physical features of the workplace, which mediate the relationship with perceived productivity support. The hypothesis consists of two parts. The first part explores the effects of task profiles on experienced support of activity and satisfaction with physical features based on the path model results. For the latter part, mediation analysis is performed.

The employees in the task profile cluster 'concentration and collaborative work' experience the largest positive effect on support of collaborative and informal activities (ß = 0.35, $p < 0.01$). Employees who have such a task profile experience collaborative and informal activities as better supported compared to employees in the task profile cluster 'concentration'. Employees in the task profile cluster labeled 'various activities' experience both meetings (ß = 0.25, $p < 0.01$) and collaborative and informal activities (ß = 0.31. $p < 0.01$) better supported compared to employees in the task profile cluster labeled 'concentration'. The relationship between the different task profiles and experienced support of concentrative activities seemed insignificant and, thus, was not included in the path model to get an acceptable model fit. So, the path model did not yield results of the relationship between the different task profiles and experienced support of concentrative activities. In general, task profiles positively relate to experienced support of activities in the office environment.

Office employees in the task profile cluster labeled 'concentration and collaborative work' experience a moderate effect on satisfaction with indoor climate (ß = 0.07, $p < 0.01$). The results indicate that those employees are more satisfied with indoor climate aspects than employees in the task profile labeled 'concentration'. The employees in the other task profiles experienced weak effects on satisfaction with indoor climate aspects. In conclusion, weak effects between employees in the different task profiles and satisfaction with physical features of the office workspace are found. In conclusion, the first part of the hypothesis can be partly accepted for the office environment based on the included relationships with experienced support of meetings and collaborative and informal activities.

Part of the hypothesis includes the mediation effect of experienced support of activities and satisfaction with physical features on the relationship between task profiles and perceived productivity support. Table 34 presents the direct, indirect, and total effects of the different significant effects in the path model. The calculations are based on the literature discussed in Chapter 5.4.

Table 34: Results mediation analysis task profiles and perceived productivity support in the office

Task profiles – Perceived support of productivity	Direct effect	Indirect effect	Total effect
Concentration and meetings	-0.08	0.09	0.01
Concentration and collaborative work	-0.06	0.11	0.05
Various activities	-0.13	0.14	0.01

The results in Table 34 show that the relationship between the different task profiles and perceived support of productivity in the office environment all have a negative direct effect. This indicates that employees who have these task profiles perceive lower productivity support than those in the task profile 'concentration'. This is in contrast with the total standardized coefficients discussed in previous paragraphs. A large indirect effect results in a positive total effect for these task profiles. This means that experienced support of activities and satisfaction with physical features positively affect the relationship between the task profiles and perceived support of productivity. The employees in the task profile labeled 'various activities' show the largest negative direct effect on perceived productivity support (ß = -0.13, $p < 0.01$). This indicates that employees with a very diverse task profile perceive lower productivity support in the office than those in the task profile labeled 'concentration'. In conclusion, the seventh hypothesis is accepted.

$H_{7\text{-office}}$: Task variety relates to experienced support of activities and satisfaction with physical features which mediate the relationship with perceived support of productivity

Assigned workplaces in an enclosed environment show the largest positive effect on experienced support of concentrative work (ß = 0.18, $p < 0.01$). This indicates that employees who work in assigned workplaces in an enclosed environment experience the support of concentrative work more positively compared to those who work in flexible workplace settings. In addition, assigned workplaces in a shared room yield a moderate positive effect on experienced support of concentrative work (ß = 0.07, $p < 0.01$). In contrast, employees who work in assigned workplaces in enclosed settings experience collaborative and informal activities as under-supported (ß = -0.06, $p < 0.01$). The path model generally shows both positive and negative effects between different workplace settings and experienced support of activities. However, not all relationships are included in the path model. So, the eighth hypothesis is partly confirmed only based on the tested relationships in the model.

$H_{8\text{-office}}$: Workplace settings relate to experienced support of activities

The fourth and the ninth hypotheses include the mediating effect of satisfaction with physical features and experienced support of activities on the relation between the actual workplace settings and perceived support of productivity. Table 35 presents the direct, indirect, and total effects of the different significant effects in the path model. First, the proportions of total mediation of satisfaction with physical workplace features are calculated followed by the percentage of mediation by experienced support of activities. The calculations are based on the literature discussed in Chapter 5.4.

Table 35: Results mediation analysis office work environment

Workplace settings – Perceived support of productivity	Direct effect	Indirect effect	Total effect	Proportion of total mediation (%)	Total mediation by satisfaction with wp features (%)	Total mediation by experienced support of activities (%)
Flexible workplace in an open environment	-	0.00	0.00	0%	0%	0%
Assigned workplace in an open environment	-	0.02	0.02	100%	100%	0%
Assigned workplace in an enclosed environment	0.01	0.11	0.12	92%	40%	51%
Assigned workplace in a shared room	0.02	0.06	0.08	75%	62%	14%
A meeting or project room	-0.02	-0.02	-0.04	50%	6%	44%

The results in Table 35 show that the relationship between assigned workplaces in an enclosed environment with perceived support of productivity in the office is mediated for 92% by other independent variables. The mediation effect includes 40% satisfaction with physical features of the workplace and 51% experienced support of activities. Employees who work in assigned workplaces in an enclosed environment perceive higher productivity support compared to those who work in flexible offices in an enclosed environment. However, more than 90% of this effect is mediated by experienced support of activities and satisfaction with physical features of the workplace. Similarly, satisfaction with physical features of the workplace also mediates the relationship between assigned workplaces in a shared room and perceived productivity support, even for 62%. Employees who work in assigned workplace settings perceive higher productivity support compared to those who work in flexible workplaces in an enclosed environment. However, this relationship is primarily mediated by satisfaction with physical features of the workplace. In conclusion, the fourth and ninth hypotheses can be confirmed.

$H_{4\text{-office}}$: Satisfaction with physical features mediates the relationship between workplace settings and perceived support of productivity

$H_{9\text{-office}}$: Experienced support of activities mediates the relationship between workplace settings and perceived support of productivity

The tenth hypothesis describes the relationship between task variety and workplace settings. Both variables were recoded into dummy variables which made it impossible to determine an effect between these variables in the path analysis. The effect size matrix presented in Section 7.4 concludes a very weak relationship between task variety and office workplace settings ($r = 0.000$, $p = 0.000$). Based on this analysis the tenth hypothesis is rejected

$H_{10\text{-office}}$: Task variety relates to office workplace settings

Hypothesis eleven elaborates on the relationship between satisfaction with physical features and experienced support of activities in both directions. Experienced support of meetings has the largest effect on satisfaction with indoor comfort (ß = 0.15, $p < 0.01$). This indicates that office employees who experience meetings as well supported are more satisfied with indoor comfort aspects of the workplace. Experienced support of collaborative and informal activities shows positive moderate relationships with satisfaction with indoor comfort (ß = 0.12, $p < 0.01$) and satisfaction with workstation (ß = 0.13, $p < 0.01$). So, experienced support of activities relates positively to satisfaction with physical features of the workplace.

Satisfaction with crowdedness shows the largest positive effect on experienced support of concentrative work (ß = 0.32, $p < 0.01$). This indicates that office employees who are satisfied with crowdedness aspects of the workplace experience concentrative work as better supported. In addition, the model shows positive relationships between satisfaction with indoor comfort (ß = 0.15, $p < 0.01$) and workstation (ß = 0.13, $p < 0.01$) and experienced support of concentrative work. So, satisfaction with physical features of the workplace relates positively to experienced support of activities.

In conclusion, satisfaction with physical features and experienced support of activities positively relate to each other in both directions. The hypothesis is accepted based on the included relationships that were tested in the path model. So, the sixth hypothesis is partly accepted for the office work environment.

$H_{11\text{-}office}$: Satisfaction with physical features and experienced support of activities relate to each other

8.3.4 Demographics

A hypothesis is composed for the relationship between demographics and experienced support of activities. The demographic variable is divided into gender and age. First, gender is discussed followed by the age of the respondents. The path model results yield a positive relationship between gender and experienced support of meetings (ß = 0.05, p < 0.01). This indicates that males experience the support of meetings better than females in the office work environment. The age variable is divided into a category including young employees [<25 ; 34] and older employees [35 ; 65<]. Older age has a moderate negative effect on experienced support of concentrative work (ß = -0.10, p < 0.01). The results indicate that younger employees experience concentrative work as better supported compared to the older age category. In general, the path model shows both positive and negative effects between the demographic variables and experienced support of activities. However, not all relationships are included in the path model. So, the hypothesis can be partially confirmed.

$H_{12\text{-}office}$: Demographics relate to experienced support of activities

Gender also positively affects satisfaction with indoor comfort in the office (ß = 0.13, p < 0.01). This indicates that males tend to be more satisfied with indoor comfort aspects compared to women. In addition, gender shows a rather small negative effect on satisfaction with the workstation (ß = -0.05, p < 0.01). The age variable shows a moderate negative relationship with satisfaction with crowdedness aspects of the workplace (ß = -0.06, p < 0.01). Older employees are less satisfied with crowdedness aspects of the workplace than younger aged office employees. Not all relationships between the age variables and satisfaction with physical feature variables are tested. Both positive and negative effects exist between those variables, so the hypothesis is partly accepted.

$H_{13\text{-}office}$: Demographics relate to satisfaction with physical features

The hypothesis states that there is a relationship between demographics and perceived productivity support. The path model shows a small positive effect of gender on perceived productivity support in the office environment (ß = 0.04, p < 0.01). This means that males perceive slightly higher productivity support in the office environment than females. The age variable shows a moderate negative effect on perceived support of productivity (ß = -0.10, p < 0.01). These results indicate that younger aged office employees perceive higher support of productivity in the office compared to the older aged employees. In conclusion, the hypothesis is accepted for the office work environment.

$H_{14\text{-}office}$: Demographics relate to perceived support of productivity

The last hypothesis describes the relationship between demographics and workplace settings. Both demographic variables and workplace settings were recoded into dummy variables, making it impossible to determine an effect between these variables in the path analysis. The effect size matrix presented in Section 7.4 concludes a very weak relationship between demographics and office workplace settings (r = 0.000, p = 0.000). Based on this analysis this hypothesis is rejected

$H_{15\text{-}office}$: Demographics relate to home workplace settings

8.4 Results path model home work environment

The full path model and results for the home work environment are elaborated. The path model for the home work environment is illustrated in Figure 39 and Figure 40. Larger positive relationships are illustrated with thick green arrows, while larger negative relationships are illustrated with thick red

arrows. The line weights indicate the strength of the relationship. Table 36 presents the unstandardized (B) and standardized coefficients (ß) of the relationships inserted in the model. All the relationships are significant at the 0.01 level (2-tailed).

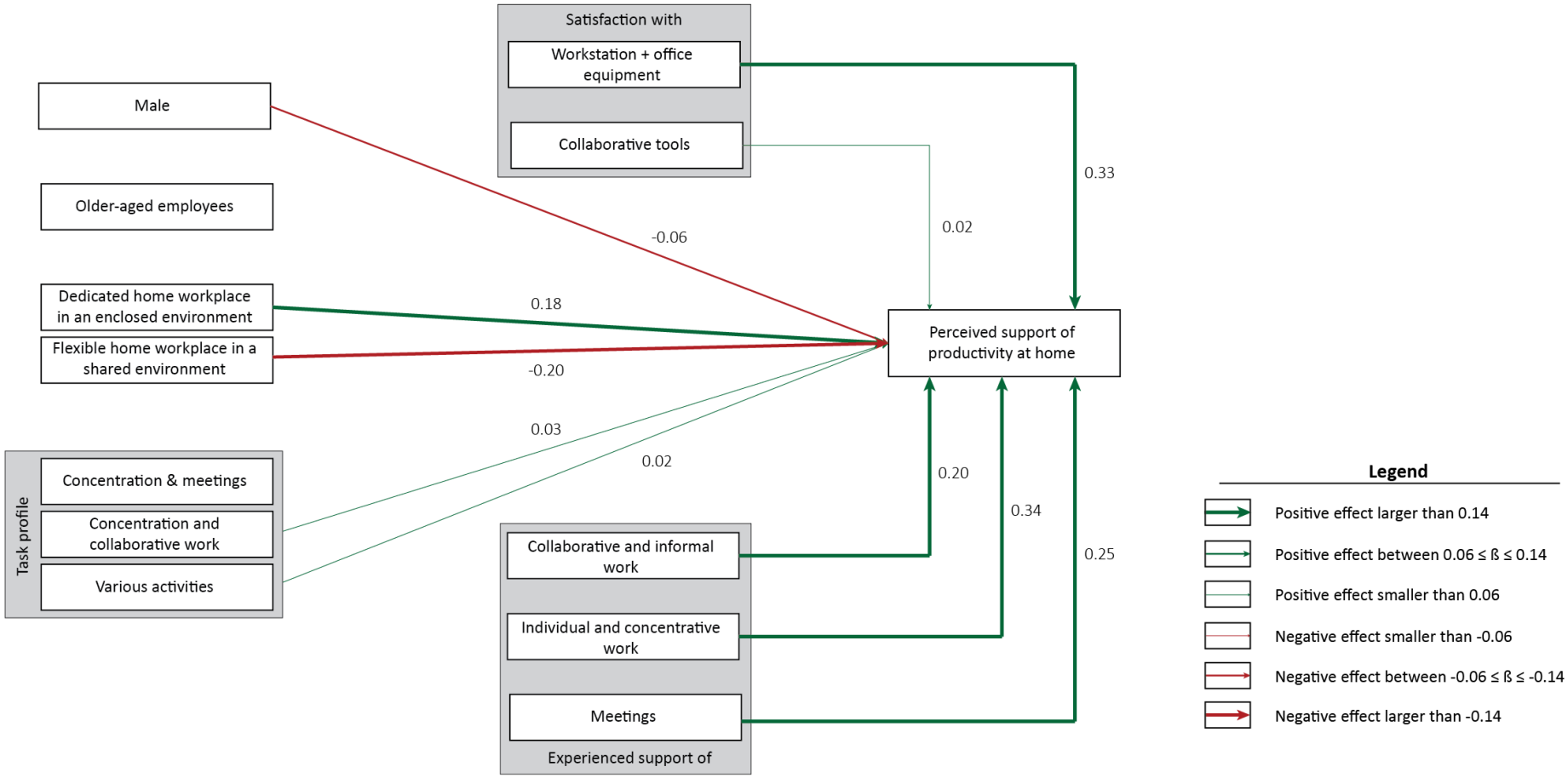


Figure 39: Results path model home work environment (standardized effects)

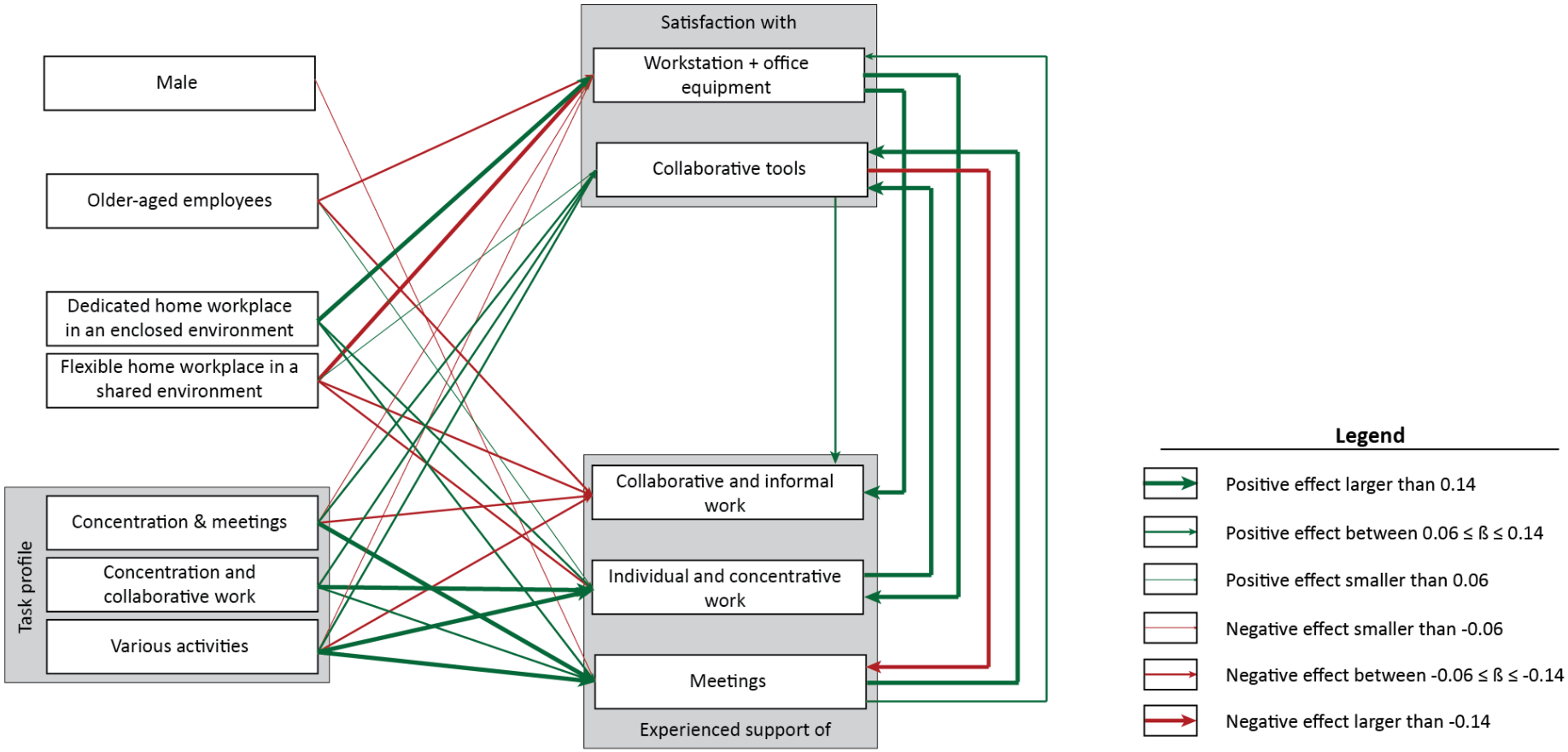


Figure 40: Results path model dependent and independent variables at home (standardized effects)

Table 36: Results path model home work environment unstandardized and standardized effects

			Experienced support of			Satisfaction with			Experienced support of			Satisfaction with	
		Perceived support of productivity	Collaborative and informal work	Individual and concentrative work	Meetings	Workstation + office equipment	Collaborative tools	Perceived support of productivity	Collaborative and informal work	Individual and concentrative work	Meetings	Workstation + office equipment	Collaborative tools
Variable	**Category**	**Unstandardized coefficients (B)**						**Standardized coefficients (β)**					
Gender	Female												
	Male	-0.17 (-17.90)			-0.10 (-15.62)			-0.06			-0.05		
Age	Young												
	Old		-0.22 (-23.46)	0.09 (10.23)		-0.13 (-14.15)			-0.10	0.04		-0.06	
Home workplace settings	Dedicated home workplace in a shared environment												
	Dedicated home workplace in an enclosed environment	0.48 (39.52)		0.16 (18.31)	0.14 (21.45)	0.29 (31.36)		0.18		0.08	0.07	0.14	
	Flexible home workplace in a shared environment	-0.62 (-45.76)	-0.21 (-21.30)	-0.26 (-24.94)		-0.66 (-63.16)	0.08 (11.88)	-0.20	-0.09	-0.11		-0.28	0.03
Task profiles	Concentration												
	Concentration and meetings		-0.16 (-15.66)		1.08 (11576)	-0.07 (-7.89)	0.24 (22.68)		-0.07		0.47	-0.03	0.10
	Concentration and collaborative work	0.09 (7.37)		0.50 (54.47)	0.27 (27.80)		0.25 (22.33)	0.03		0.21	0.11		0.10
	Various activities	0.06 (4.18)	-0.30 (-26.64)	1.01 (96.29)	1.12 (105.75)	-0.13 (-12.21)	0.31 (25.70)	0.02	-0.11	0.38	0.42	-0.05	0.12
Experienced support of	Collaborative and informal work	0.27 (59.31)						0.20					
	Individual and concentrative work	0.46 (89.46)					0.20 (46.57)	0.34					0.20
	Meetings	0.34 (58.27)				0.07 (24.02)	0.60 (221.22)	0.25				0.07	0.60
Satisfaction with	Workstation + office equipment	0.45 (88.11)	0.24 (57.11)	0.19 (47.58)				0.33	0.24	0.19			
	Collaborative tools	0.03 (4.44)	0.10 (26.05)		-0.40 (-59.97)			0.02	0.10		-0.40		

	Positive effect larger than 0.14		Negative effect larger than 0.14
	Positive effect between 0.06 ≤ 0.14		Negative effect between 0.06 ≤ 0.14
	Positive effect smaller than 0.06		Negative effect smaller than 0.06

8.4.1 Home workplace settings

The results for the office workplace settings are discussed in this section. The path model results are discussed first followed by bivariate analysis to formulate a complete answer to the hypotheses. The significant effects of workplace settings on perceived support of productivity are presented in order of relative strength indicated by the standardized coefficients (ß). The first hypothesis focused on the relationship between different workplace settings and perceived productivity support. Three sub-hypotheses are formulated for location, layout, and use. The path model results show for the home work environment that a dedicated home workplace in an enclosed environment has the largest positive effect (ß = 0.18, $p < 0.01$) on perceived productivity support. The results indicate that employees who work in an enclosed environment perceive higher productivity support than employees who work in a shared environment. Flexible home workplaces in a shared environment show the largest negative effect (ß = -0.20, $p < 0.01$) on perceived productivity support. The results indicate that employees who work in dedicated workplaces perceive higher productivity support than those who work in flexible workplaces. Hypotheses 1B and 1C focus on the relationship between workplace layout and use and employees' perceived productivity support. In order to accept or reject these hypotheses, an additional bivariate analysis is performed to check for significant mean differences between open and enclosed workplace layouts and assigned or flexible workplace use.

Hypotheses 1B focuses on the relationship between workplace openness and layout on employees' perceived support of productivity. The workplace settings variable is recoded into a variable, making only a difference between open or enclosed workplace settings. The respondents are asked to agree or disagree on a 7-point Likert scale [-3 ; 3] with the statement whether their office workplace settings enable them to work productively. A Wilcoxon Sign-Rank test is performed to test for significant mean differences between the workplace settings. The results indicate that enclosed workplaces (M = 2.24, SD = 1.029) have significantly higher perceived support of productivity at home compared to open work environments (M = 1.83, SD = 1.338), Z = -66.199, p = 0.000.

Hypotheses 1C highlights the relationship between workplace use and employees' perceived support of productivity. The variable workplace settings is recoded into a variable distinguishing between dedicated and flexible workplaces. A Wilcoxon Sign-Rank test is performed to test for significant mean differences between the workplace settings. The results show that dedicated workplaces (M = 2.07, SD = 1.149) have significantly higher perceived support of productivity in the office compared to flexible work settings (M = 1.14. SD = 1.592), Z = -67.689, p = 0.000. The first sub-hypothesis (1A) is already confirmed in Section 8.3.1.

In conclusion, employees who work in dedicated workplaces in an enclosed environment perceive higher productivity support compared to those in flexible and open workplaces. The first hypothesis, including the three sub-hypotheses, can be accepted for the home work environment.

$H_{1\text{-home}}$: Workplace settings relate to perceived support of productivity

8.4.2 Satisfaction with physical features at home

The second hypothesis states that satisfaction with physical features of the workplace is positively related to employees' perceived support of productivity in the home environment. Satisfaction with workstation + office equipment is positively related to perceived productivity support (ß = 0.33, $p > 0.01$). This means that employees who are satisfied with aspects of their workstation and equipment perceive higher productivity support. Satisfaction with collaborative tools shows a very small positive effect on productivity. In general, the results show that satisfaction with physical workplace aspects relates positively to perceived support of productivity. So, employees who are satisfied with physical

workplace aspects perceive higher productivity support in the home work environment. The second hypothesis is confirmed.

$H_{2\text{-}home}$: Satisfaction with physical features relates to perceived support of productivity

The third and fourth hypotheses focus on the relationship between workplace settings and satisfaction with physical features which mediates the relationship with perceived productivity support. First, the direct total effect of workplace settings on satisfaction with physical features is discussed followed by the mediation effect. A dedicated home workplace in an enclosed environment positively affects satisfaction with workstation and office equipment (ß = 0.14, $p < 0.01$). This indicates that employees who work in enclosed settings are more satisfied with their workstation + office equipment compared to those in a shared environment. In addition, flexible workplaces in a shared environment show a large negative effect on satisfaction with workstation and office equipment (ß = -0.28, $p < 0.01$). This indicates that employees working in flexible settings are less satisfied with these workplace aspects compared to those working in dedicated work settings. Also, a small positive relationship exists between flexible home workplaces and satisfaction with collaborative tools (ß = 0.03, $p < 0.01$). In conclusion, home workplace settings relate to satisfaction with physical features. The third hypothesis can be accepted.

$H_{3\text{-}home}$: Workplace settings relate to satisfaction with physical features

8.4.3 Experienced support of activities at home

The fifth hypothesis states that experienced support of activities is related to perceived productivity support. Experienced support of individual and concentrative work shows the largest positive effect on productivity support (ß = 0.34, $p < 0.01$). Employees who experience individual and concentrative work as well supported perceive higher productivity support in the home environment. Both experienced support of meetings as well as collaborative and informal work show a large positive effect on productivity support. In general, employees who experience activities as well supported perceive higher productivity support. In conclusion, the fifth hypothesis is accepted for the home work environment.

H_5: Experienced support of activities relates to perceived support of productivity

Employees in the task profile cluster labeled ‘concentration and collaborative work’ show the largest positive effect on perceived productivity support in the office (ß = 0.03, $p < 0.01$). This indicates that employees in this cluster perceive higher productivity support than employees in the task profile cluster ‘concentration’. The different task profiles have a relatively small effect on employees’ perceived support of productivity. In conclusion, task variety has a very small effect on perceived support of productivity. The relationship of the employees in the task profile cluster labeled ‘concentration and meetings’ and productivity is not included in the path model. So, the sixth hypothesis is partly accepted for the home work environment. It is not a strong relationship however, it is a significant one.

$H_{6\text{-}home}$: Task variety relates to perceived support of productivity

The seventh hypothesis states that task variety relates to experienced support of activities and satisfaction with physical features, which mediates the relationship with perceived productivity support at home. The hypothesis consists of two parts. The first part explores the effects of task variety on experienced support of activity and satisfaction with physical features based on the path model results. For the latter part, mediation analysis is performed.

The task profile cluster 'concentration and meetings' has the largest positive effect on support of meetings (ß = 0.47, p < 0.01). Employees who have such a task profile experience meetings better supported than employees in the task profile cluster labeled 'concentration'. Employees in the task profile cluster 'various activities' experience both meetings (ß = 0.42, p < 0.01) and individual and concentrative work (ß = 0.38. p < 0.01) better supported compared to employees in the task profile cluster 'concentration'. The clusters 'various activities' and 'concentration and meetings' have moderate negative effects on collaborative and informal work. The employees in these clusters experience lower support for collaborative and informal activities than those in the task profile cluster labeled 'concentration'. In general, task variety positively relates to experienced support of activities in the home environment.

The employees with task profiles 'concentration and meetings' and 'various activities' show small negative effects on satisfaction with workstation + office equipment. The results indicate that employees who have these task profiles are less satisfied with their workstation + office equipment compared to those in the task profile labeled 'concentration'. All three task profiles show moderate positive effects on satisfaction with collaborative tools. Employees who have one of these three task profiles are more satisfied with collaborative tools at home compared to employees with task profile 'concentration'. In conclusion, moderate and weak effects are found for the relationships between task profiles and satisfaction with physical features of the home workspace. The first part of the hypothesis can be partly accepted for the home environment.

Part of the hypothesis includes the mediation effect of experienced support of activities and satisfaction with physical features on the relationship between task variety and perceived productivity support. Table 37 present the direct, indirect, and total effects of the different significant effects in the path model. Only the mediation effects of experienced support of activities are taken into account. The percentage of mediation is based on the theory discussed in Chapter 5.

Table 37: Results mediation analysis task variety and perceived productivity support at home

Task variety – Perceived support of productivity	Direct effect	Indirect effect	Total effect
Concentration and meetings	0.00	0.08	0.08
Concentration and collaborative work	-0.08	0.11	0.03
Various activities	-0.17	0.19	0.02

The results in Table 37 show that the relationship between the different task profiles and perceived support of productivity at home is strongly mediated by experienced support of activities and satisfaction with physical features. Previous sections concluded that employees in task profiles labeled 'concentration and collaborative work' and 'various activities' perceived support of productivity slightly higher than those in task profile 'concentration'. However, the mediation analysis shows that the direct effects of those task profiles are negative. This indicates that exactly the opposite, employees in task profile labeled 'concentration' perceive higher productivity support at home compared to the task profiles 'concentration and collaborative work' and 'various activities'. A larger indirect effect results in a positive total effect for these task profiles. This means that experienced support of activities and satisfaction with physical features positively affect the relationship between the task profiles and perceived productivity support. The results show a direct effect of zero for employees in task profile 'concentration and meetings'. This means that there is a very small difference between perceived productivity support for this task profile and employees in 'concentration'. It can be concluded that meetings are supported at home and do not affect perceived support of productivity. Employees who have to perform collaborative and multiple activities indicate lower productivity support in the home work environment. The employees in task profile labeled

'various activities' show the largest negative direct effect on perceived productivity support (ß = -0.17, p < 0.01). This indicates that employees who perform a larger number of different activities perceive lower productivity support in the office than those in task profile 'concentration'. In conclusion, the seventh hypothesis is accepted.

$H_{7\text{-home}}$: Task variety relates to experienced support of activities satisfaction with physical features which mediates the relationship with perceived support of productivity

The results of the path model yield information to accept or reject the hypotheses focusing on the relationship between home workplace settings and experienced support of activities. Dedicated home workplaces in an enclosed environment show moderate positive effect on both experienced support of individual and concentrative work (ß = 0.08, p < 0.01) and meeting (ß = 0.17, p < 0.01). The results indicate that employees who work in enclosed home settings experience better support for those activities compared to employees who work in open work settings. In contrast, flexible home workplaces in a shared environment yield moderate negative effects on both experienced support of collaborative and informal work (ß = -0.09, p < 0.01) and individual and concentrative work (ß = -0.11, p < 0.01). This indicates that employees who work in flexible settings experience lower support for those activities compared to employees in dedicated workplace settings. In general, the path model shows both positive and negative effects of different workplace settings on experienced support of activities at home. However, not all relationships are included in the path model. So, the eighth hypothesis is partly confirmed only based on the tested relationships in the model.

$H_{8\text{-home}}$: Workplace settings relate to experienced support of activities that relate to perceived productivity support

The fourth and ninth hypotheses include the mediation effect of satisfaction with physical features and experienced support of activities on the relationship between workplace settings and perceived support of productivity. Table 38 presents the direct, indirect, and total effects of the different significant effects in the path model. The percentage of mediation is based on the theory discussed in Chapter 5.

Table 38: Results mediation analysis home work environment

Workplace settings – Perceived support of productivity	Direct effect	Indirect effect	Total effect	Proportion of total mediation (%)	Total mediation by satisfaction with wp features (%)	Total mediation by exp support (%)
Dedicated workplace in an enclosed environment	0.08	0.10	0.18	56%	23%	33%
Flexible workplace in a shared environment	-0.08	-0.12	-0.20	60%	46%	14%

The results in Table 38 show that the relationship between the home workplace settings and perceived productivity support is mediated by satisfaction with physical features and experienced support of activities for more than 50%. This indicates that employees who work in dedicated workplaces in an enclosed environment perceive higher productivity support compared to those who work in shared environments. However, this increase in productivity can be designated for more 50% to experience support of activities and satisfaction with physical features. The relationship between dedicated workplaces in an enclosed environment with perceived support of productivity in the office is for 23% mediated by satisfaction with physical features of the workplace and for 33% by experienced support of activities. The proportion of mediation by experienced support of activities for enclosed environments is larger compared to flexible workplaces in a shared environment. This contrasts with

the proportion of mediation for flexible workplaces dominated by satisfaction with physical features, which mediates 46% of the relationship with perceived productivity support. In conclusion, the fourth and ninth hypotheses can be confirmed.

$H_{4\text{-}home}$: Satisfaction with physical features mediates the relationship between workplace settings and perceived support of productivity

$H_{9\text{-}office}$: Experienced support of activities mediates the relationship between workplace settings and perceived support of productivity

The tenth hypothesis describes the relationship between task variety and workplace settings. Both variables were recoded into dummy variables, which made it impossible to determine a relationship between these variables in the path analysis. The effect size matrix presented in Section 7.4 concludes a very weak relationship between task variety and home workplace settings ($r = 0.000$, $p = 0.000$). Based on this analysis the tenth hypothesis is rejected

$H_{10\text{-}home}$: Task variety relates to office workplace settings

The eleventh hypothesis elaborates on the relationship between satisfaction with physical features and experienced support of activities in both directions. Experienced support of meetings ($ß = 0.60$, $p < 0.01$) and individual and concentrative work ($ß = 0.20$, $p < 0.01$) show both large positive effects on satisfaction with collaborative tools. This indicates that employees who experience those activities as well supported are more satisfied with collaborative tools at home. In addition, experienced support of meetings has the largest positive influence on satisfaction with collaborative tools. So, experienced support of activities relates positively to satisfaction with physical features of the workplace. Satisfaction with collaborative tools shows a large negative effect on experienced support of meetings ($ß = -0.40$, $p < 0.01$). This indicates that meetings are experienced as under-supported when employees are satisfied with their workstation and equipment.

Satisfaction with workstation and equipment shows a positive effects on both experienced support of collaborative and informal work ($ß = 0.24$, $p < 0.01$) and individual and concentrative work ($ß = 0.19$, $p < 0.01$). Employees who are satisfied with their workstation and office equipment tend to experience those activities as better supported.

In conclusion, satisfaction with physical features and experienced support of activities positively relate to each other in both directions. The hypothesis is accepted for the included relationships that were tested in the path model. So, the eleventh hypothesis is partly accepted for the home work environment.

$H_{11\text{-}home}$: Satisfaction with physical features and experienced support of activities relate to each

8.4.4 Demographics at home

A hypothesis is drafted for the relationship between demographics and experienced support of activities. The demographic variable is divided into gender and age. First, gender is discussed followed by the age of the respondents. The path model yields a small negative relationship between gender and experienced support of meetings ($ß = -0.05$, $p < 0.01$). This indicates that females experience the support of meetings better than males in the home work environment. Older age employees show a moderate negative effect on experienced support of concentrative work ($ß = -0.10$, $p < 0.01$). The results indicate that younger employees experience concentrative work better supported than the older age category. Not all relationships are included in the path model so, the hypothesis can be partially confirmed.

$H_{12\text{-}home}$: demographics relate to experienced support of activities

The path model for the home environment does not include any relationships between gender and satisfaction with physical features. The age variable shows a moderate negative effect on satisfaction with workstation + office equipment aspects of the workplace (ß = -0.06, $p < 0.01$). The results indicate that employees who are higher aged are less satisfied with workstation + office equipment aspects of the workplace compared to younger aged employees. The hypothesis can only be partly accepted since the model does not include many relationships.

$H_{13\text{-}home}$: demographics relate to satisfaction with physical features

The hypothesis states that there is a relationship between demographics and perceived support of productivity. The results show a moderate effect of gender on perceived support of productivity in the home environment (ß = -0.06, $p < 0.01$). This means that females perceive productivity support in the home environment higher than the male category. The model does not include the relationship between age and perceived support of productivity at home. The hypothesis posed below is partly confirmed.

$H_{14\text{-}home}$: demographics relate to perceived support of productivity

The last hypothesis describes the relationship between demographics and workplace settings. Both demographic variables and workplace settings were recoded into dummy variables, making it impossible to determine an effect between these variables in the path analysis. The effect size matrix presented in Section 7.4 concludes a very weak relationship between demographics and home workplace settings ($r = 0.000$, $p = 0.000$). Based on this analysis this hypothesis is rejected

$H_{15\text{-}home}$: Demographics relate to home workplace settings

8.5 Discussion

The path models and bivariate analyses showed that employees who worked in assigned or dedicated offices perceived higher productivity support than those who worked in flexible workplace settings both in the home and office work environment. In addition, employees who worked in enclosed environments showed a significantly higher mean for perceived support of productivity than those in open workspaces. De Croon et al. (2005) and Haynes (2008b) did not conclude a direct relationship between workplace use and layout and employees' perceived productivity because there was limited evidence. In contrast, De Been & Beijer (2014) found that office employees in individual and shared room workplaces rated their perceived productivity support higher compared to employees working in more open layout settings. For the home work environment, Awada et al. (2021) found that employees reported higher productivity levels when they worked in dedicated home workspaces than those who did not. So, the current study results correspond with the findings of the studies by De Been & Beijer (2014) and Awada et al. (2021), showing a relationship between home and office workplace settings and perceived support of productivity.

The current study showed that employees who work in enclosed and dedicated work environments at home and in the office experienced the support of concentrative work more positively compared to those who worked in flexible and open workplaces. According to Erlich & Bichard (2008), concentrative work requires uninterrupted and longer attention spans, which is difficult within the open-plan office. In addition, employees prefer mostly the home work environment for performing concentration work (Van de Water, 2021).

The relationship between workplace settings at home and in the office and employees' perceived support of productivity is mediated by both satisfaction with physical features and experienced

support of activities. It could be concluded that the workplace has a limited direct effect on perceived productivity support. However, higher experienced support of activities at the work setting resulted in higher perceived support of productivity by the workplace. The results yielded a larger mediation effect for office workplace settings than in the home environment. It is assumed that a lower variety of workplace settings are available in the home environment than in the office, resulting in a larger direct effect of workplace settings on perceived productivity support. Experienced support of activities is more dominant in the mediation effect for dedicated or assigned workplaces in an enclosed environment in the office and at home. In the home work environment, satisfaction with physical features is more dominant in the mediation for flexible workplaces. An explanation could be the workplace use. In flexible workplace settings, employees can select a workplace including workplace features where they want to execute their work while those features are more fixed in assigned workplaces. This results in a larger contribution of experienced support by the workplace for a certain activity.

This study concluded that satisfaction with one or multiple workplace- and building- characteristics relates positively to perceived productivity support for the office. Satisfaction with crowdedness showed the largest effect on productivity support followed by satisfaction with indoor comfort. It was expected that availability of supportive spaces in the office also yielded a large significant effect on employees' perceived productivity support. However, the path analysis excluded the variable to achieve an acceptable model fit. Satisfaction with storage and office décor were excluded from the path analysis, because of weak correlations explored in the bivariate analyses. For the home work environment, the expectations were that most of the physical features had an equivalent impact as for the office environment. The current study's expectations and conclusions support the findings of Batenburg & Van der Voordt (2008) and Brill & Weideman (2001), where satisfaction with physical aspects of the workplaces related positively to employees' perceived productivity support. According to Maarleveld & De Been (2011), satisfaction with functionality and indoor climate was assumed to have the highest and second-highest correlation with perceived productivity support, while, archive and aesthetic aspects were assumed to have a limited impact. Satisfaction with functionality, mentioned by Batenburg & Van der Voordt (2008) and Maarleveld et al. (2009), has similarities with the crowdedness factor of this study.

Experienced support of concentrative work only had incoming arrows from satisfaction with physical aspects of the workplace. This is in contrast with the other experienced support of activity variables which mainly have outgoing arrows. This relationship indicates that employees who were satisfied with the physical aspects of the office environment experienced concentrative work as well supported. In addition, employees who experienced support of concentrative activities higher also perceived support of productivity higher in both work environments. The results complement the findings by De Been et al. (2016). They found that the support and satisfaction with concentrative tasks are considered most important for employees' productivity followed by the support of communicative tasks (De Been et al., 2016). In addition, Maarleveld & De Been (2011) stated that the ability to concentrate has a substantial influence on perceived productivity which supports the claim that experienced support of concentrative tasks is related to perceived productivity support.

Experienced support of meetings was positively related to satisfaction with indoor comfort in the office, which indicates that employees who experienced meetings as well supported were more satisfied with indoor comfort aspects of the work environment. This relationship was not expected or explored in previous literature. Satisfaction with indoor comfort contained aspects of acoustics and nuisance. It might be that especially noise control and acoustics aspects caused this strong positive relationship between these variables.

The path model for the home environment indicates that employees who were satisfied with collaborative tools experienced lower support of meetings. This relationship was not expected, because the factor collaborative tools included mainly physical aspects, such as WiFi network connectivity, remote access, and telephone equipment, that usually support online meetings well. A possible explanation could be that employees experienced most activities in this cluster as well supported, resulting in a more negative experience of 'physical' meetings than the other activities. This resulted in employees grading meetings as under-supported leading to a negative effect between the variables.

It was expected that the office environment supported employees better who had a more diverse task profile because it is assumed that the office offers a more diverse set of workplace settings. In addition, the expectations were that employees with a concentrative task profile experienced better support in the home environment. The results showed that employees who had a higher number of different tasks to perform, which is related to a more diverse task profile, perceived lower productivity support in both environments. However, employees who experienced higher support of activities and were more satisfied with physical features tended to perceive higher productivity support. Thus, experienced support of activities and satisfaction with physical features could convert this negative direct effect. In addition, employees who had concentration work and meetings in their task profile did not perceive support of productivity loss during their work compared to employees who only performed concentration work. This indicated that online meetings were experienced as well supported at home, while collaborative work was experienced as under-supported. In addition, Employees who performed concentration work and meetings experienced meetings better supported in both the home and office work environment than those who only performed concentrative tasks. This is similar for employees with a collaborative task profile. Those employees experienced collaborative and informal activities better supported than those who only did concentration work in the office.

Employees with different task profiles perceived productivity support differently. It is assumed that employees with different task profiles experienced support activities differently. Employees with a more diverse task profile showed larger positive effects on experienced activities support than those with a more unilateral task profile. Due to a difference in experience support of activities in both the home and office environment, employees perceived productivity support differently. According to Maher & von Hippel (2005), the relation between task profiles and productivity support was not evident. In addition, Wohlers & Hertel (2017) concluded that employees who always work on the same kind of task could not take advantage of the flexibility of the various office settings, as they do not need different working locations for their tasks. On the other hand, employees with a high task variety might switch workstations several times a day. Higher levels of strain might be experienced by employees when working in assigned workplaces or by switching too often (Wohlers & Hertel, 2017). This could result in reduced perceived productivity.

Males had a slightly higher perceived productivity support in the office, while women scored higher at home. The results align with previous studies, where the female category yielded a higher mean in perceived productivity than the male category (Kieft, 2021; Nakrošienė et al., 2019; Voulon, 2021). A possible explanation could be a better work-life balance to take care of their household. Younger employees experienced higher productivity support in the office, while older employees scored higher when working from home. The same trend is assumed for time with the organization. Employees with a shorter tenure indicated higher perceived productivity support than employees working over twelve years at the company. These results showed similarities with findings from Kieft (2021) in which older-aged employees yielded higher perceived productivity. A possible explanation could be the smaller

size of dwellings for younger employees. They most likely have to share their home workplace, whereas older respondents most likely have a dedicated workroom available. Additionally, older employees do probably not have children living at home anymore.

The path model did not include relationships between the demographic variables, age and gender, and home and office workplace settings. The results from the bivariate analysis showed weak effects of the demographic variables on workplace settings. This is in contrast with the expectation where a relationship was expected. Pullen (2014) concluded that employees below 30 are more positive about flexible office workplaces than cellular workplaces. Older employees prefer more quiet work environments and cell offices for concentration (Earle, 2003; Joy & Haynes, 2011).

8.6 Conclusion

This chapter aimed to identify the significant effects of the dependent variables and independent variables on perceived support of productivity. Furthermore, the hypotheses that were posed in the literature chapter are confirmed or rejected. Table 39 presents a brief overview of the performed tests and whether the hypothesis is accepted or rejected.

Table 39: Overview hypotheses accepted or rejected

Hypothesis	**Office**	**Home**
H_1: Workplace settings relate to perceived support of productivity	Accepted	Accepted
H_2: Satisfaction with physical features relates to perceived support of productivity in the home and office work environment	Accepted	Accepted
H_3: Workplace settings relate to satisfaction with physical features	Accepted	Accepted
H_4: Satisfaction with physical features mediates the relationship between workplace settings and perceived support of productivity	Accepted	Accepted
H_5: Experienced support of activities relates to perceived support of productivity	Accepted	Accepted
H_6: Task variety relates to perceived support of productivity	Accepted	Accepted
H_7: Task variety relates to experienced support of activities and satisfaction with physical features which mediate the relationship with perceived support of productivity	Accepted	Accepted
H_8: Workplace settings relate to experienced support of activities	Accepted	Accepted
H_9: Experienced support of activities mediates the relationship between workplace settings and perceived support of productivity	Accepted	Accepted
H_{10}: Task variety relates to workplace settings*	Accepted	Accepted
H_{11}: Satisfaction with physical features and experienced support of activities relate to each other	Accepted	Accepted
H_{12}: Demographics relate to experienced support of activities	Accepted	Accepted
H_{13}: Demographics relate to satisfaction with physical features	Accepted	Accepted
H_{14}: Demographics relate to perceived support of productivity	Accepted	Accepted
H_{15}: Demographics relate to workplace settings*	Accepted	Accepted

*For H_{10} and H_{15} only bivariate analyses are performed

First, various significant effects were identified between workplace settings and perceived productivity support. Perceived productivity support is higher when employees work in assigned or dedicated office settings than flexible open environments. In addition, those work settings seem to have the most positive effect on satisfaction with physical aspects of the workplace. Employees who are satisfied with the physical aspects of the workplace tend to perceive support of productivity higher, particularly when they are satisfied with crowdedness and indoor comfort aspects. The first four hypotheses were therefore accepted.

Second, both path models showed that perceived productivity support is higher when employees experience their activities as well supported. Concentrative work is considered better supported when office employees are satisfied with crowdedness aspects of the workplace. Employees who experience meetings as well supported at home tend to be more satisfied with the collaborative tools. The effects

between the task profile variables and perceived productivity were very weak yet significant. However, large indirect effects were discovered. It is assumed that satisfaction with the physical features and experienced activities support strongly mediated the relationship.

The path models yielded moderate effects between demographic variables and other independent variables. Experienced support of meetings in the office is higher perceived by males, while females indicated higher experienced support of meetings in the home work environment than males. In addition, older employees are less satisfied with crowdedness aspects of the office environment than younger employees. Also, males tend to be more satisfied with indoor comfort aspects in the office compared to women. There were also slight differences in perceived productivity between men and women in both environments. Additionally, perceived support of productivity is lower when the age of the office employee is higher.

9.0 Discussion, limitations, and recommendation

Chapter nine aims to present a summary of the research findings and provide an answer to the research question. The chapter discusses the contribution to current literature theories and new findings from this study. In addition, the scientific and societal implications are elaborated. The limitations of the current study are discussed briefly. Last, the chapter finishes with a recommendation for further research.

9.1 Summary of findings

This study aimed to contribute to the knowledge gap by exploring employees' perceived productivity support while working from home and in the office. Additionally, the relationships between task variety, satisfaction with physical features of the workplace, experienced support of activities and the employees' perceived support of productivity in both work environments were elaborated. Multiple sub-research questions were posed in the introduction and answered in the literature chapter. In addition, different quantitative analyses were performed to obtain insights into the effects of the variables on perceived support of productivity. The main research question was formulated as:

How are workplace settings, personal characteristics, satisfaction with physical features of the workplace and experienced support of activities related to perceived support of productivity at home and at the office?

Satisfaction with physical features and experienced support of activities are strongly related to perceived support of productivity both in the home and office work environment. Especially the support of concentrative activities and satisfaction with crowdedness aspects had a strong relationship with employees' perceived productivity support, both at home and in the office. In addition, assigned or dedicated workplaces had a stronger positive relationship with perceived productivity support than flexible/shared workplace settings. However, a large part of this relationship is mediated by the experienced support of activities and satisfaction with physical workspace features, showing that workplace setting had a limited direct effect on perceived productivity support however, a higher experienced support of activities at the work setting resulted in a higher perceived support of productivity by the workplace. Personal characteristics were subdivided into demographics and task variety. Employees who had a high task variety, a high number of different tasks and a more diverse task profile, perceived lower productivity support in both environments. However, experienced support of activities and satisfaction with physical features again strongly mediated this relationship in both work environments, which resulted in a slightly positive effect of task variety on perceived productivity support. Last, younger employees perceived higher productivity support in the office while older employees scored higher when working from home. In addition, males had a slightly higher perceived productivity support in the office while women scored higher at home.

Employees who worked in assigned workplaces in an enclosed environment in the office experienced higher support of concentrative work than those in flexible workplace settings. In contrast, employees who worked in assigned workplaces in enclosed settings experienced collaborative and informal activities as under-supported. This is in line with the findings of the home work environment where employees who worked in assigned and enclosed home settings experienced better support for individual and concentrative work and meetings compared to employees who worked in flexible and open work settings. Office employees who worked in assigned workplace settings were more satisfied with crowdedness and workstation aspects than employees who worked in flexible settings. For the home work environment, employees were also more satisfied with their workstation + office equipment when working in enclosed settings compared to shared environments.

In the office, males tended to be more satisfied with indoor comfort aspects than women. Younger employees experienced concentrative work better supported compared to the older age category. In addition, they were also more satisfied with crowdedness aspects of the workplace compared to older employees. Employees in the more diverse task profiles experienced better support of activities than employees who only had concentration tasks. Employees with a higher task variety were more satisfied with collaborative tools than those who only performed concentration work for the home work environment. Experienced support of activities and satisfaction with physical features strongly mediated the relationship between task variety and perceived productivity support.

The relationship between personal characteristics and workplace settings is only tested with bivariate analyses. It could not be tested in the path model because dichotomous variables are only allowed in the path model as exogenous variables. Based on the literature study, relationships between age and workplace settings and task variety and workplace settings were expected. Employees with a concentrative task profile may require greater freedom from distraction and, consequently, may require more physical privacy to enhance workplace satisfaction and productivity. Employees prefer enclosed working settings when they have a concentrative task profile. The bivariate analyses showed weak correlations between personal characteristics and workplace settings.

The majority of the relationships indicated that employees who were satisfied with the physical aspects of the office environment experienced concentrative work as well supported. Especially office employees who were satisfied with crowdedness aspects of the workplace experienced concentrative work as better supported. For the home environment, employees who experienced meetings and concentration activities as well supported are more satisfied with collaborative tools.

In conclusion, the answer to the main question is formulated in the paragraphs above how the variables relate to each other and to perceived support of productivity.

9.2 Discussion

The discussion focuses on scientific and societal implications. First, the scientific implications are discussed, which elaborate on the contribution to current literature findings. Second, the societal implications are elaborated.

9.2.1 Scientific implications

This section focuses on the scientific implications. The current study results are compared with the conclusion of previous ones. The aim is to elaborate on the contribution of the current study compared to the existing literature. Previous studies investigated the effective support of the workforce, either at the office- or the home-working environment. On the one hand, the impact of the physical workplace characteristics on workplace satisfaction and self-assessed productivity support in different office settings has been studied (Brunia et al., 2016; Danielsson & Bodin, 2008; De Been & Beijer, 2014; de Croon et al., 2005; Kim & de Dear, 2013; Seddigh et al., 2014; Van der Voordt, 2004). On the other hand, the impact of teleworking on individual outcomes such as job satisfaction and self-assessed productivity support has also been studied (de Croon et al., 2005; Fonner & Roloff, 2010; Gajendran & Harrison, 2007; Kieft, 2021; Marzban et al., 2021; Ng, 2010). However, only a few studies simultaneously investigated employees' perceived productivity and workplace satisfaction in both working environments. In a recent study, Awada et al. (2021) concluded that workers' overall perception of productivity level did not change relative to their in-office productivity. In contrast, Moretti et al. (2020) stated that 40% of the respondents indicated to be less productive while working from home. Few studies are available to make a decisive conclusion on the difference in perceived productivity support in both work environments. It is important to have insight into the support of activities at different workplaces and environments to better accommodate employees and reduce

operating costs. This study aimed to contribute to this knowledge gap by simultaneously exploring employees' perceived productivity support in the home and office work environment. The experienced support of different activities is compared in both work environments too. This study is also distinctive because the respondents filled in the survey for home and office work environments. The data is analyzed in an integral model which results in a better prediction of perceived productivity support. Additionally, the current study explored the mediating role of satisfaction with physical features and experienced support of activities on the relationship between task variety and perceived productivity support. Few researchers included task variety in their study and if they did, the results were insignificant or focused on different aspects of task variety.

The results of the path model indicated that employees who experienced concentrative tasks as well supported, perceived higher support of productivity in both the office and home work environment. In addition, employees who worked in assigned workplaces in an enclosed environment perceived higher productivity support than employees in flexible and open work settings in both work environments. Also, employees who worked in those types of workspaces experienced higher support for concentrative work in both work environments. It is thus important for employees to have the possibility to work in a separate enclosed workplace, as it has a positive influence on perceived productivity support. Erlich & Bichard (2008) mentioned that concentration activities require an uninterrupted and longer attention span. Background noise is the most significant and consistent cause of distraction. These distractions can be better controlled in enclosed work environments than in an open plan office layout. As Maarleveld & De Been (2011) indicated, respondents who are more satisfied with the ability to do concentration work perceived the workplace as supportive for their productivity. The current study contributed to the findings by De Been & Beijer (2014) and Awada et al. (2021) who stated that employees in dedicated enclosed offices are assumed to have the largest effect on perceived productivity by distinguishing between the workplace categorization presented by De Croon et al. (2005). The effect of location, layout, and use aspects of the home and office workplace on employees' perceived productivity support was not studied together.

In addition, this study contributed to the existing literature by exploring the mediation effect between different workplace settings and perceived productivity support. It is assumed that workplace use played a dominant role in this mediation. In flexible workplace settings, employees can select a workplace including workplace features where they want to execute their work while those features are more fixed in assigned workplaces. This results in a larger contribution of experienced support by the workplace for a certain activity.

The relationship between satisfaction with physical features of the workplace and perceived productivity support was explored in the current study. The results contributed to existing conclusions presented by Maarleveld & De Been (2011) and Batenburg & Van der Voordt (2008). Satisfaction with functionality and indoor climate had the highest and second-highest correlation with perceived productivity support in the office, while archive and esthetic aspects had a limited impact. Satisfaction with crowdedness aspects of the workplace included functionality aspects of the workplace as well as privacy aspects. As discussed in the previous paragraph, enclosed workplaces offering more privacy positively influence employees' perceived productivity support. In addition, indoor comfort aspects showed large positive effects on employees' perceived productivity support. The indoor climate factor included among other things temperature control and noise levels. Frontczak et al. (2012) and Toftum et al. (2012) also concluded that bad acoustics and noise can result in dissatisfaction with the office environment, negatively affecting office workers' productivity. This study contributed to the existing findings by confirming the current literature. In addition, this study used a integrated path model which provides better insight into the mutual relations of the physical workplace feature factors.

The current study contributed to a clearer understanding of the relationships between satisfaction with physical workplace features and experienced support of activities. An interesting finding is that office employees who experienced meetings as well supported were more satisfied with indoor comfort aspects of the workplace. This relationship was not yet explored in previous studies. A possible explanation could be that satisfaction with indoor comfort contained aspects of acoustics and nuisance. It could be that, especially noise control and acoustic aspects of the office work environment strongly impact the experienced support of meetings.

This study distinguished itself by focusing on task variety and its relationship to perceived productivity support. The current study provided new insights into this relationship and added to the scarcity in the literature concerning task variety, which was stressed by Kaarlela-Tuomaala et al. (2009). As indicated by Sims et al. (1976), jobs that involve the performance of several different work activities are likely to be more interesting and enjoyable to perform. This study is unique because it explores different task profiles by making use of cluster analysis. Employees are divided into four clusters, each of them including concentration work. The clusters range from only concentration work, meetings, collaborative activities, and a diverse task profile. A negative direct relationship is explored for employees who have a higher number of different tasks and a more diverse task profile. This results in lower perceived productivity support in both work environments for those employees. Nonetheless, those employees experienced higher support of activities and were more satisfied with physical features. The experienced support of activities and satisfaction with workplace features converted the lower perceived productivity support into a small positive effect. In the end, employees with a more diverse task profile perceived higher productivity support because of this mediation effect. It is concluded that experienced support of activities and satisfaction with physical features mediated this relationship.

Furthermore, the results from this study confirmed the current knowledge regarding demographics and its relationship with employees' perceived support of productivity. The study results showed that office employees who are younger perceived higher support of productivity than older employees. The bivariate analysis showed that older aged employees perceived higher productivity at home, which is in line with the study by Kieft (2021). In addition, the study revealed that males are more satisfied with indoor climate aspects in the office environment compared to females. This supports the current literature, which states that female employees are less satisfied with indoor climate and thermal comfort aspects (Karjalainen, 2007, 2012; Rothe et al., 2011).

This study also contributed to the current knowledge by using an integrated path model analysis, which better predicts of the relationships between the dependent variables and employees' perceived support of productivity in the office and at home. First, different bivariate analyses were conducted followed by integral path analysis. Using an integral model makes a better prediction of the effects between variables possible because multiple relationships are included in the model. Other authors studied the similar relationship using only bivariate analysis or simple analyses methods, which have lower predicting power.

In conclusion, this study contributed to the current knowledge on workplace settings and demographics and their relationship with perceived support of productivity. The study also revealed new insights on the relationship between satisfaction with physical features of the workplace, experienced support of activities and the employees' perceived support of productivity in both work environments. In addition, more research is added on the relationship between task variety components and perceived support of productivity.

9.2.2 Societal implications

In this section, the societal implications are elaborated. Employees are an important asset of knowledge-based organizations. Supporting and facilitating office employees in suitable workplace settings might result in higher workplace satisfaction, lower discomfort, and increased productivity.

The conclusions presented in this study provide insights into work settings and physical features of the workplace enabling employees to work productively, which might help corporate real estate managers better understand how to accommodate and facilitate the employee. CRE managers and facility managers can use these new insights to enhance their organizations' policies regarding home-based teleworking. Currently, this is particularly relevant in the context of expected post-COVID-19 changes in work practices. As shown pre-COVID, enhanced home-based telework policies might affect the average employee satisfaction and turnover intentions (Kröll & Nüesch, 2019).

The respondents indicated that telephone conversations, private conversations, and reading are better supported at home. The results indirectly hint at a lack of space offering sufficient visual and auditory privacy to support confidential (telephone) conversations in the office environment. The results also stressed the importance of satisfaction with privacy and distractions as productivity enhancers. It is recommended to invest and incorporate sufficient and adequate workplaces in the office building offering more privacy for confidential and concentrative activities; particularly for those that cannot do this well at home. Activity-Based Working settings (ABW) aim to provide a diversity of settings that may improve the negative effects of reduced productivity. Dissatisfaction regarding auditory privacy may be reduced by switching to a more quiet workplace. As a knowledge worker, if you have a collaborative task profile or if you perform various tasks during a day, the office work environment is recommended. In addition, if you want to work concentrated or have to perform tasks requiring more privacy, such as private or confidential conversations, the home environment suits your needs better.

The results also indicated that concentrated and interactive activities were better supported at home than at the office. The home working environment better supported the activities that require controlling distractions and noise. In contrast, collaborative and facility dependent activities show better-experienced support in the office environment. It is recommended that decision-makers implement well-designed telework programs to assist employees who prefer to work from home, to find the optimal balance between the most suited locations to perform different activities and task profiles. Organizations and companies should take a supporting and facilitating role in assisting the employees to perform their activities most productively and in their preferred location. In addition, it is recommended that organizations provide meeting spaces in the office that offer auditory privacy, such as concentration cells or telephone booths, because employees who were satisfied with crowdedness aspects of the workplace experienced higher support of concentrative work. It is recommended that office organisations provide workplace features enhancing visual and auditory privacy to enhance experienced support of concentration work. Logically, employees who experienced meetings as better supported were more satisfied with collaborative tools in the home work environment. It is recommended to provide employees with adequate communication equipment to enhance employees' experienced support of online meetings and conversations at home and achieve higher perceived support of productivity.

Regarding practical implications, it is recommended to invest and incorporate sufficient and adequate workplaces in the office building, offering more privacy for confidential and concentrative activities. In addition, it is recommended that corporate real estate managers and decision-makers implement well-designed telework programs to assist employees to find an optimal balance between the most

suitable locations to perform different types of activities. Organizations and companies should take a supporting and facilitating role in assisting the employees to perform their activities most productively and in their preferred working setting or location.

9.3 Limitations

This study is conducted during the COVID-19 pandemic lockdowns, which could be considered as a turbulent period. Employees had to work from home mandatory, which might have affected personal and societal circumstances influencing the perception of productivity support, satisfaction with physical workplace features, and the experienced support of activities. Therefore, this might limit the generalizability of the current study's findings. In normal circumstances, employees choose to work from home or the office, depending on the suitability of the home-work environment. However, during the pandemic lockdowns, employees with unsuitable home environments were obliged to work from home. This unique situation could result in a more negative response towards working from home, because employees had to stay home mandatory and were not allowed to go to the office.

The respondents of the questionnaire might be influenced by different factors, such as the mood during filling in the survey and their concentration. This could influence the outcomes of the subjective questions regarding perceived productivity, satisfaction, and experienced support. Respondents could tend to provide more socially desired answers to the survey questions, resulting in higher positive outcomes of the questionnaire. The questionnaire does not optimally reflect the way employees really feel or behave in their work environment.

The Leesman survey did not include many similar questions regarding satisfaction with physical features of the workplace of both work environments. This made it more difficult to compare both work environments. The questionnaire by Leesman did not contain information concerning the actual conditions of many aspects of the physical environment, such as indoor temperature, lighting, air quality, and noise levels, which were identified by Marzban et al. (2021) as the main sources for dissatisfaction with the workplace while working from home. Similarly, the survey included no questions regarding network and ICT facilities in the office work environment. This made it more difficult to compare the characteristics of satisfaction with physical features of the workplace.

Another limitation of the dataset is the division of the respondents over the globe. The spread of employees over the continents is not representative for the world population. Half of the respondents are from European soil while, the Southern continents are represented by less than 5% of the respondents. In addition, the males are better represented in the Leesman sample compared to the females.

This study explored two separate path models, one for the office and one for the home work environment. However, the available data makes it possible to conduct an integrated path model analysis combining both work environments. Office workplace characteristics could be tested against experienced support of activities in the home environment. With the separation of the current models, this comparison is not possible.

Last, not all hypotheses posed in the literature review could be answered by the path model. The results are limited by the methodological and practical limitations of the integral path analysis method. Dichotomous variables are only allowed in the path model as exogenous variables, which means that they have no incoming arrows. Both workplace settings and the demographic variables are transformed into dummy variables. Some studies revealed an effect between age and different workplace settings. Unfortunately, this relationship could not be tested in the path model, only with bivariate analyses.

9.4 Recommendations for future research

For future research, it is recommended to approach the available data differently. The current study explores two separate path models, one for the office and one for the home work environment. In future studies with the Leesman dataset, an integrated model is recommended by combining the home and office work environments in the same path model. Additionally, characteristics of the physical home and office workplace, such as temperature, indoor air quality, network, and access to files, should be included in the questionnaire.

In addition, it could be interesting to monitor and investigate the work policies and employee behavior after the COVID pandemic lockdowns. This dataset included information of respondents who had to work from home mandatory. As discussed, this could influence the perception of perceived productivity support of the home workplace, since employees did not have the choice to work in the office. It is recommended to set out another questionnaire which gathers data of a hybrid way of working. Further research could explore a hybrid work scenario and how this influences perceived support of productivity.

It might interesting to investigate if the employees in Southern continents perceive support of productivity differently. The Leesman survey should be spread more among employees in the Southern continents, since the current dataset only has 5% of the respondents from these continents. It is recommended to do the study again including different cultural characteristics.

Last, it might be interesting to consider different personality traits of employees and investigate the differences between extrovert or introvert employees on workplace location and experienced support of activities. In addition, more research into the relationship between task variety and perceived productivity support and the mediating role of other variables might yield valuable insights to optimize Activity-Based Working settings.

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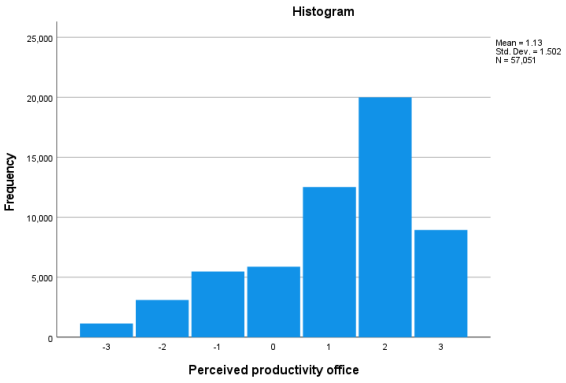
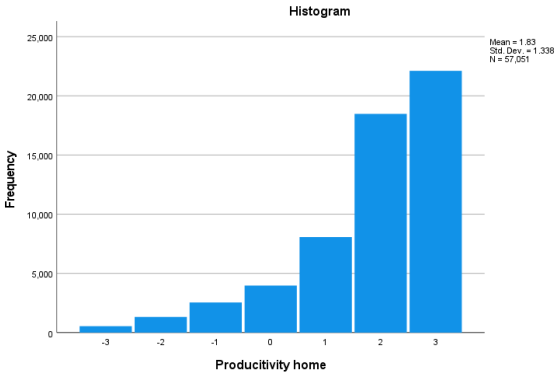
Appendix

Appendix I – Recoding variables

String variable	String value	New string value	Numeric value
Gender	Female		0
	Male		1
	Prefer not to say		1
Age group	Under 25 years		0
	25 – 34 years		1
	35 – 44 years		2
	45 – 54 years		3
	55 – 64 years		4
	Over 65 years		5
	Prefer not to say		6
Time with organization	0 – 6 months		0
	6 – 18 months		1
	18 months – 3 years		2
	3 – 8 years		3
	8 – 12 years		4
	Over 12 years		5
Home workplace settings	Dedicated home workplace in a shared environment		0
	Dedicated home workplace in an enclosed environment		1
	Flexible home workplace in a shared environment		2
	Other		3
Office workplace settings	Flexible workplace in an enclosed environment		0
	Flexible workplace in an open environment		1
	Assigned workplace in an open environment		2
	Assigned workplace in an enclosed environment		3
	Assigned workplace in a shared room		4
	A meeting or project room		5
	Other		6

Appendix II – Histogram perceived productivity support





Appendix III – K-means ANOVA task profiles

ANOVA

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	Sig.
Individual focused work desk-based	36.372	3	0.080	57047	452.062	0.000
Individual focused work away from your desk	772.552	3	0.162	57047	4779.283	0.000
Individual routine tasks	735.370	3	0.203	57047	3622.386	0.000
Reading	1046.308	3	0.184	57047	5689.620	0.000
Collaborating on focused work	958.181	3	0.188	57047	5107.230	0.000
Collaborating on creative work	1156.898	3	0.176	57047	6582.273	0.000
Informal unplanned meetings	1333.262	3	0.177	57047	7542.520	0.000
Planned meetings	456.370	3	0.132	57047	3457.336	0.000
Informal social interaction	1495.197	3	0.170	57047	8812.764	0.000
Business confidential discussions	1558.090	3	0.145	57047	10770.656	0.000
Private conversations	1370.899	3	0.159	57047	8647.474	0.000
Telephone conversations	1229.193	3	0.178	57047	6917.609	0.000
Thinking/creative thinking	1370.487	3	0.167	57047	8193.428	0.000
Learning from others	1847.640	3	0.150	57047	12280.854	0.000
Audio conferences	1200.527	3	0.185	57047	6495.637	0.000
Spreading out paper or materials	877.584	3	0.107	57047	8195.764	0.000
Using technical specialist equipment	580.957	3	0.107	57047	5414.389	0.000
Relaxing/taking a break	1289.756	3	0.182	57047	7091.283	0.000
Larger group meetings or audiences	1522.864	3	0.147	57047	10367.575	0.000
Hosting visitors. client or customers	1103.544	3	0.124	57047	8929.657	0.000
Video conferences	1601.997	3	0.166	57047	9666.801	0.000

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

Appendix IV – ANOVA office workplace settings

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Perceived productivity office	Based on Mean	60.161	6	57044	0.000
	Based on Median	81.832	6	57044	0.000
	Based on Median and with adjusted df	81.832	6	52740.697	0.000
	Based on trimmed mean	69.552	6	57044	0.000

ANOVA

Perceived productivity office

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2267.093	6	377.849	170.357	0.000
Within Groups	126522.294	57044	2.218		
Total	128789.387	57050			

Multiple Comparisons

Dependent Variable: Perceived productivity office

Games-Howell

(I) Office work setting numerical		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
.00	1.00	-.186*	0.051	0.005	-0.34	-0.04
	2.00	-.275*	0.051	0.000	-0.43	-0.13
	3.00	-.702*	0.052	0.000	-0.86	-0.55
	4.00	-.577*	0.054	0.000	-0.74	-0.42
	5.00	.304*	0.074	0.001	0.09	0.52
	6.00	-0.142	0.075	0.488	-0.36	0.08
1.00	.00	.186*	0.051	0.005	0.04	0.34
	2.00	-.089*	0.015	0.000	-0.13	-0.05
	3.00	-.516*	0.019	0.000	-0.57	-0.46
	4.00	-.390*	0.023	0.000	-0.46	-0.32
	5.00	.491*	0.056	0.000	0.33	0.66
	6.00	0.045	0.057	0.986	-0.12	0.21
2.00	.00	.275*	0.051	0.000	0.13	0.43
	1.00	.089*	0.015	0.000	0.05	0.13
	3.00	-.427*	0.019	0.000	-0.48	-0.37
	4.00	-.301*	0.023	0.000	-0.37	-0.23
	5.00	.579*	0.056	0.000	0.42	0.74
	6.00	0.134	0.057	0.221	-0.03	0.30
3.00	.00	.702*	0.052	0.000	0.55	0.86

	1.00	.516*	0.019	0.000	0.46	0.57
	2.00	.427*	0.019	0.000	0.37	0.48
	4.00	.126*	0.026	0.000	0.05	0.20
	5.00	1.006*	0.057	0.000	0.84	1.17
	6.00	.561*	0.058	0.000	0.39	0.73
4.00	.00	.577*	0.054	0.000	0.42	0.74
	1.00	.390*	0.023	0.000	0.32	0.46
	2.00	.301*	0.023	0.000	0.23	0.37
	3.00	-.126*	0.026	0.000	-0.20	-0.05
	5.00	.881*	0.058	0.000	0.71	1.05
	6.00	.435*	0.060	0.000	0.26	0.61
5.00	.00	-.304*	0.074	0.001	-0.52	-0.09
	1.00	-.491*	0.056	0.000	-0.66	-0.33
	2.00	-.579*	0.056	0.000	-0.74	-0.42
	3.00	-1.006*	0.057	0.000	-1.17	-0.84
	4.00	-.881*	0.058	0.000	-1.05	-0.71
	6.00	-.446*	0.078	0.000	-0.68	-0.21
6.00	.00	0.142	0.075	0.488	-0.08	0.36
	1.00	-0.045	0.057	0.986	-0.21	0.12
	2.00	-0.134	0.057	0.221	-0.30	0.03
	3.00	-.561*	0.058	0.000	-0.73	-0.39
	4.00	-.435*	0.060	0.000	-0.61	-0.26
	5.00	.446*	0.078	0.000	0.21	0.68

*. The mean difference is significant at the 0.05 level.

Appendix V – Kruskal-Wallis H test home workplace settings

Ranks

Home work settings		N	Mean Rank
Productivity home	.00	17292	27766.84
	1.00	25381	33375.13
	2.00	13770	20832.41
	3.00	608	21934.51
	Total	57051	

Test Statistics[a.b]

	Productivity home
Kruskal-Wallis H	5903.287
df	3
Asymp. Sig.	0.000

Appendix VI – Independent t-test gender

Group Statistics

Gender		N	Mean	Std. Deviation	Std. Error Mean
Perceived productivity office	.00	20679	1.06	1.514	0.011
	1.00	36372	1.16	1.495	0.008

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
Gender		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Perceived productivity office	Equal variances assumed	2.425	0.119	-7.551	57049	0.000	-0.099	0.013	-0.124	-0.073
	Equal variances not assumed			-7.524	42515.701	0.000	-0.099	0.013	-0.124	-0.073

Test Statistics[a]

	Gender - Producitivity home
Z	-147.716[b]
Asymp. Sig. (2-tailed)	0.000

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

Appendix VII – ANOVA time with organization

Descriptives

Perceived productivity office

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
.00	1856	1.38	1.391	0.032	1.32	1.45	-3	3
1.00	6059	1.30	1.438	0.018	1.27	1.34	-3	3
2.00	7784	1.16	1.470	0.017	1.13	1.19	-3	3
3.00	15064	1.19	1.489	0.012	1.17	1.21	-3	3
4.00	8122	1.18	1.486	0.016	1.14	1.21	-3	3
5.00	18166	0.95	1.549	0.011	0.93	0.97	-3	3
Total	57051	1.13	1.502	0.006	1.11	1.14	-3	3

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Perceived productivity office	Based on Mean	16.252	5	57045	0.000
	Based on Median	23.739	5	57045	0.000
	Based on Median and with adjusted df	23.739	5	54385.103	0.000
	Based on trimmed mean	13.095	5	57045	0.000

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Perceived productivity office	Between Groups	959.157	5	191.831	85.606	0.000
	Within Groups	127830.230	57045	2.241		
	Total	128789.387	57050			

Multiple Comparisons

Games-Howell

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Perceived productivity office	.00	1.00	0.082	0.037	0.239	-0.02	0.19
		2.00	.223*	0.036	0.000	0.12	0.33
		3.00	.195*	0.034	0.000	0.10	0.29
		4.00	.207*	0.036	0.000	0.10	0.31
		5.00	.433*	0.034	0.000	0.34	0.53
	1.00	.00	-0.082	0.037	0.239	-0.19	0.02
		2.00	.141*	0.025	0.000	0.07	0.21
		3.00	.113*	0.022	0.000	0.05	0.18
		4.00	.125*	0.025	0.000	0.05	0.20
		5.00	.351*	0.022	0.000	0.29	0.41
	2.00	.00	-.223*	0.036	0.000	-0.33	-0.12
		1.00	-.141*	0.025	0.000	-0.21	-0.07
		3.00	-0.028	0.021	0.750	-0.09	0.03
		4.00	-0.016	0.023	0.983	-0.08	0.05
		5.00	.210*	0.020	0.000	0.15	0.27
	3.00	.00	-.195*	0.034	0.000	-0.29	-0.10
		1.00	-.113*	0.022	0.000	-0.18	-0.05
		2.00	0.028	0.021	0.750	-0.03	0.09
		4.00	0.012	0.020	0.992	-0.05	0.07
		5.00	.238*	0.017	0.000	0.19	0.29
	4.00	.00	-.207*	0.036	0.000	-0.31	-0.10
		1.00	-.125*	0.025	0.000	-0.20	-0.05
		2.00	0.016	0.023	0.983	-0.05	0.08
		3.00	-0.012	0.020	0.992	-0.07	0.05
		5.00	.226*	0.020	0.000	0.17	0.28
	5.00	.00	-.433*	0.034	0.000	-0.53	-0.34
		1.00	-.351*	0.022	0.000	-0.41	-0.29
		2.00	-.210*	0.020	0.000	-0.27	-0.15
		3.00	-.238*	0.017	0.000	-0.29	-0.19

	4.00	-.226*	0.020	0.000	-0.28	-0.17

*. The mean difference is significant at the 0.05 level.

Ranks

Time with organization		N	Mean Rank
Productivity home	.00	1856	27658.07
	1.00	6059	28693.95
	2.00	7784	28066.94
	3.00	15064	28661.66
	4.00	8122	27875.90
	5.00	18166	28933.53
	Total	57051	

Test Statistics[a,b]

	Productivity home
Kruskal-Wallis H	40.501
df	5
Asymp. Sig.	0.000

a. Kruskal Wallis Test

b. Grouping Variable: Time with organization

Appendix VIII – Goodness of fit statistics

Goodness of Fit Statistics Office

Degrees of Freedom = 41
Minimum Fit Function Chi-Square = 2216.09 (P = 0.0)
Normal Theory Weighted Least Squares Chi-Square = 2186.78 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 2145.78
90 Percent Confidence Interval for NCP = (1996.28 ; 2302.62)

Minimum Fit Function Value = 0.039
Population Discrepancy Function Value (F0) = 0.038
90 Percent Confidence Interval for F0 = (0.035 ; 0.040)
Root Mean Square Error of Approximation (RMSEA) = 0.030
90 Percent Confidence Interval for RMSEA = (0.029 ; 0.031)
P-Value for Test of Close Fit (RMSEA < 0.05) = 1.00

Expected Cross-Validation Index (ECVI) = 0.042
90 Percent Confidence Interval for ECVI = (0.040 ; 0.045)
ECVI for Saturated Model = 0.0054
ECVI for Independence Model = 2.17

Chi-Square for Independence Model with 136 Degrees of Freedom = 123425.48
Independence AIC = 123459.48
Model AIC = 2410.78
Saturated AIC = 306.00
Independence CAIC = 123628.64
Model CAIC = 3525.23
Saturated CAIC = 1828.42

Normed Fit Index (NFI) = 0.98
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.30
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.94

Critical N (CN) = 1671.01

Root Mean Square Residual (RMR) = 0.013
Standardized RMR = 0.016
Goodness of Fit Index (GFI) = 1.00
Adjusted Goodness of Fit Index (AGFI) = 0.98
Parsimony Goodness of Fit Index (PGFI) = 0.27

Goodness of Fit Statistics Home

Degrees of Freedom = 17
Minimum Fit Function Chi-Square = 2086.58 (P = 0.0)
Normal Theory Weighted Least Squares Chi-Square = 2082.90 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 2065.90
90 Percent Confidence Interval for NCP = (1919.68 ; 2219.45)

Minimum Fit Function Value = 0.037
Population Discrepancy Function Value (F0) = 0.036
90 Percent Confidence Interval for F0 = (0.034 ; 0.039)
Root Mean Square Error of Approximation (RMSEA) = 0.046
90 Percent Confidence Interval for RMSEA = (0.045 ; 0.048)
P-Value for Test of Close Fit (RMSEA < 0.05) = 1.00

Expected Cross-Validation Index (ECVI) = 0.039
90 Percent Confidence Interval for ECVI = (0.037 ; 0.042)
ECVI for Saturated Model = 0.0032
ECVI for Independence Model = 2.19

Chi-Square for Independence Model with 78 Degrees of Freedom = 124518.45
Independence AIC = 124544.45
Model AIC = 2230.90
Saturated AIC = 182.00
Independence CAIC = 124673.81
Model CAIC = 2967.23
Saturated CAIC = 1087.49

Normed Fit Index (NFI) = 0.98
Non-Normed Fit Index (NNFI) = 0.92
Parsimony Normed Fit Index (PNFI) = 0.21
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.92

Critical N (CN) = 913.38

Root Mean Square Residual (RMR) = 0.013
Standardized RMR = 0.016
Goodness of Fit Index (GFI) = 0.99
Adjusted Goodness of Fit Index (AGFI) = 0.97
Parsimony Goodness of Fit Index (PGFI) = 0.19