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Impact of employee satisfaction with facilities on self-assessed productivity support

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Abstract

Purpose: This paper aims to explore the relationship between satisfaction with buildings, facilities and services and perceived productivity support and to test whether the findings from a similar study of Batenburg and Van der Voordt (2008) are confirmed in a repeat study after ten years with more recent data.

Design/methodology/approach: Data were traced from a database with data on user satisfaction and perceived productivity support. These data were collected through the Work Environment Diagnostic Tool WODI Light. The data include responses from 25,947 respondents and 191 organisations that have been analysed by stepwise multiple regression analyses.

Findings: 38% of the variation of office employees' satisfaction with support of productivity can be explained by employee satisfaction with facilities, the organisation, current work processes, and personal- and job-related characteristics. The most important predictor of self-assessed support of productivity is employee satisfaction with facilities. In particular psychological aspects, i.e. opportunities to concentrate and to communicate, privacy, level of openness, and functionality, comfort and diversity of the workplaces are very important.

The findings confirm that employee satisfaction with facilities correlates significantly with perceived productivity support. Other factors that are not included in the dataset, such as intrinsic motivation, labour circumstances and human resource management may have an impact as well.

Originality/value: This research provides a clear insight in the relation between employee satisfaction with facilities and the perceived support of productivity, based on survey data collected over almost 10 years in 191 organizations.

Keywords: Facility Management, employee satisfaction with facilities, self-assessed productivity support, WODI, office employees

Research paper

1. Introduction

Businesses face global markets in a rapidly changing and highly competitive world. In order to survive, the efficient and effective use of human, physical, technical, financial and informational resources is of utmost importance. Due to our current knowledge society, obtaining optimal productivity of knowledge workers is obviously a hot issue. Exploring the determinants of knowledge workers' productivity is not a simple task. The organizational structure and culture, the management style, the nature and complexity of the work done and the facilities provided may all have an impact on the quantity and quality of the output. Personal characteristics, individual and team competences, motivation, and the external context including economic pressure and the labour market will have an impact as well.

Research findings regarding productivity, job performance and organisational performance can be found in publications from different fields. Cummings and Worley (2009) discuss four types of possible interventions to support organisational development: human process interventions, technostructural interventions, human resources management interventions and strategic change interventions. Their types of interventions mainly concern people and processes. According to Käpylä et al. (2010), papers in the *International Journal of Productivity and Performance Management* also investigate productivity mainly from a managerial perspective. Popular themes include process management, strategic management, performance and productivity measurement, and quality management.

For instance, Almatrooshi et al. (2016) investigated the impact of cognitive, emotional, and social competencies on leadership competencies that in turn influence both employee and organizational performance. Habtoor (2016) focused on the influence of human factors on organisational performance. Katou (2017) examined the effects of human resource management on both proximal organisational outcomes (such as job satisfaction, motivation, and organisational commitment) and distal organisational outcomes (such as employee engagement, organisational citizen behaviour, co-operation among employees, intention to quit, and operational performance). Other researchers, for instance Sung and Choi (2014), also investigated the effects of various human resource development dimensions on organizational performance.

The impact of buildings, facilities and services are usually hardly or not at all incorporated in this kind of studies. According to Kämpf-Dern and Konkol (2017), many business managers still regard offices only as a space to house their employees, not being aware of the strategic dimension and potential effects on business outcomes of working environments. To provide smart and supportive places has mostly been the responsibility of Corporate Real Estate Management (CREM) and Facilities Management (FM). Until recently, a leading performance criterion for CREM and FM was cost per sqm or cost per desk. Nowadays, there seems to be a growing awareness that the whole work environment, including the physical workplace, significantly influences the performance of individuals, groups and the overall organization's success (Oseland and Burton, 2012; Jensen and Van der Voordt, 2017).

2. Impact of the physical work environment

Much has been written about the influence of workplace characteristics on employee productivity. Building on an overview by Palvalin et al. (2017) of physical variables that have an impact on individual and team productivity, and adding various other relevant papers, the following overview is presented:

- office lay-out and activity-based workplaces (Van der Voordt, 2003; Roper and Jujena, 2008; De Been and Beijer, 2014; Appel-Meulenbroek, 2014; Bodin Danielsson et al., 2014; Brunia et al., 2016; Candido et al., 2016; Kim et al., 2016; Plum et al., 2017; Yunus and Ernawati, 2018; Mesthrige et al., 2019; Sicotte et al., 2019);
- facilities and services (Von Felten et al., 2015);
- indoor climate, indoor air quality and thermal comfort (Seppänen et al., 2004; Horr et al. 2016, Tarantini et al., 2017);
- energy-efficient lighting (Katzev, 1992);
- sound and noise (Roelofsen, 2008; Kaarlela-Tuomaala et al.; 2009; Reinten et al., 2017);
- music (Furnham and Strbac, 2002);
- ergonomics (Fernandez, 1995; Barber, 2001);
- plants (Bakker and Van der Voordt, 2010);
- colour (Bakker et al., 2013; Bakker, 2014);
- materials (Gutnick, 2007);
- green buildings (Feige et al., 2013; Thatcher and Milner, 2014);
- multiple factors (e.g. Leesman, 2017);
- gender differences (e.g. Haynes et al., 2017; Bodin Danielsson and Theorell, 2018).

Due to limited space the next discussion will be limited to a number of highlights. The review of literature by Van der Voordt (2003) discussed various case studies showing strong effects of ergonomic furniture, high-quality lighting, noise reduction, design interventions to facilitate team work and the introduction of tele-working on a reduction of absenteeism, meeting time, duplicate files, and decrease in errors, as well as an increase in self-reported productivity. Kaczmarczyk et al. (2001) tried to find out which environmental variables were seen by office workers as having the greatest effect on their productivity. They found particularly high scores for advanced technology, adequate filing space, personal control of the internal climate, quiet offices and the possibility of personalizing one's worksite. Ergonomically designed chairs, a visually attractive working environment, options to adjust the lighting level, privacy, access to daylight and an (attractive) view from one's office window also scored high.

Brill and Weidemann (2001) came to similar conclusions on the basis of their famous BOSTI-studies of 13,000 office workers in the USA. Working conditions that were conducive to individual work without distraction and a spatial layout that was conducive to spontaneous interaction when desired came top and second on their list. Brill and Weidemann (2001) concluded that the physical workplace contributes 5 per cent to individual performance and 11 per cent to team performance. The review also discussed various studies from the seventies and eighties of the last century on open plan offices.

Open plan offices show to support ease of communication and social interaction (e.g. Ives and Ferdinands, 1974), whereas open plan offices may also hinder employee performance through various psychological processes such as stress, arousal, distraction, lack of privacy and fatigue (Hedge, 1982; Sundstrøm et al., 1980; Sundstrøm, 1986).

Haynes (2007, 2008) made a distinction between the physical dimension (environmental services, office layout, designated areas and comfort) and the social dimension of the workplace (distraction, interaction and informal interaction points). He found that the behavioural environment has the largest impact on office productivity. In particular, the dynamic elements of the office environment, interaction and distraction, are perceived as having the greatest positive and negative influences on self-assessed productivity. A PhD thesis by Appel-Meulenbroek (2014) confirmed that layout mechanisms have an impact on knowledge sharing among knowledge workers. In particular accessibility, proximity, position in the building, visibility and co-presence showed (modest) correlations (see also Appel-Meulenbroek et al., 2017). Chadburn et al. (2017) found that comfort, convenience, IT connectivity, good design and working to a specific time scale were strong drivers of personal productivity. Knowledge workers prefer a flexible range of office settings that enable both a stimulating open and connected work environment, knowledge sharing, and collaboration, as well as quiet concentration locations, free of distractions and noise. Moving into open-plan office space is commonly met with initial resistance. However, usually there is greater acceptance of open space after experiencing an actual move into open-plan, with benefits like improved teamwork and communication being highlighted.

Based on a review of 24 single studies and 35 meta-analyses, Plum et al. (2017) found six factors to be most strongly correlating with team performance of knowledge workers: social cohesion, perceived supervisory support, information sharing, vision and goal clarity, external communication or outreach, and trust. The authors also discuss how to connect these non-physical topics to the physical environment and the impact of proximity, a "free address approach" by non-territorial offices with desk sharing, creating a "home" to reinforce the sense of team identity, creating community places, support of visual persistence, touch downs to allow ad hoc team members to sit with their team, and an appropriate balance between transparency and privacy.

Palvalin et al. (2017) showed that management skills to organize one's work in an appropriate way are more important than physical factors, though physical factors contribute as well. Mesthrige et al. (2019) found that New Ways of Working i.e. shared use of activity based workplaces influences employee productivity to a certain degree. Though both physical and behavioural working environmental factors influence employee productivity in general, the latter factors were relatively more influential. Distraction elements (e.g. interruptions, overcrowding and noise) do have a negative influence on employee performance.

Overall the findings from former research suggest a top ten of most important factors to support employee productivity, see Table 1.

Table 1. Important workplace characteristics that support productivity (Palvalin et al., 2017)

- Appropriate spatial conditions for concentration i.e. opportunities to work alone without being distracted (quiet places, quiet zones)
- Appropriate spatial conditions for communication and social interaction such as favourable conditions for side-by-side work and a quick chat, visual and auditory accessibility, proximity, central location, shared facilities, and spaces for meetings and distraction-free group work
- Proper areas to take a break
- Workplace ergonomics (e.g. well-designed furniture)
- Access to advanced technology
- Sufficient and appropriate storage space
- High indoor air quality, high quality lighting and natural daylight
- Personal control over the indoor climate, temperature and air quality
- Fit with psychological needs such as privacy and the ability to personalize the workplace
- A well-considered implementation process, including appropriate leadership, clear information and communication, and well-thought change management.

3. Impact of employee satisfaction with facilities

The findings mentioned above provide evidence for the impact of many spatial and technical factors. In search for the impact of satisfaction with facilities on perceived support of employee productivity by buildings, facilities and services, Batenburg and Van der Voordt (2008) tested the relationship between satisfaction with the organization, the work itself and the physical environment and some personal characteristics as dependent variables, and self-assessed productivity support of various office tasks as an independent variable. They assumed that the relationship between satisfaction with facilities and self-assessed productivity support can be investigated in its own right but also *relative* to the impact of the employees' satisfaction with the organization and his/her work or job.

Data were collected by a survey using the WODI work environment diagnostic tool that has been developed by the Center for People and Buildings in Delft (Volker and Van der Voordt, 2005; Maarleveld et al., 2009). The WODI tool is a standardised tool that has been developed to measure employee satisfaction with various workplace characteristics including employee satisfaction with productivity support by the work environment. Satisfaction with facilities has been operationalised by the employees' level of satisfaction with 63 aspects of the working environment. All satisfaction items were measured with a 5-point Likert scale, ranging from 1 ('highly unsatisfied') till 5 ('completely satisfied'). The aspects were categorized in nine sub-dimensions, covering nearly all relevant aspects of the physical working environment. Perceived productivity has been measured in two different ways. Firstly, respondents were asked: "*During what percentage of your working time are you productive?*"

Secondly, they were asked to which extent the working environment supported 10 different aspects of their own productivity, such as efficient communication with colleagues and absence of health complaints. The response to this question was combined with the response to the

question in which respondents were asked to assign a mark to how well the overall working environment supports their productivity. Although self-assessed productivity does not measure actual productivity, it can be used as a reliable and valid indicator of employee performance (De Been et al., 2017).

The WODI data have been used to test a detailed conceptual model, see Figure 1. The boxes outlined in red and the thick red line represent the central relationship addressed in this study.
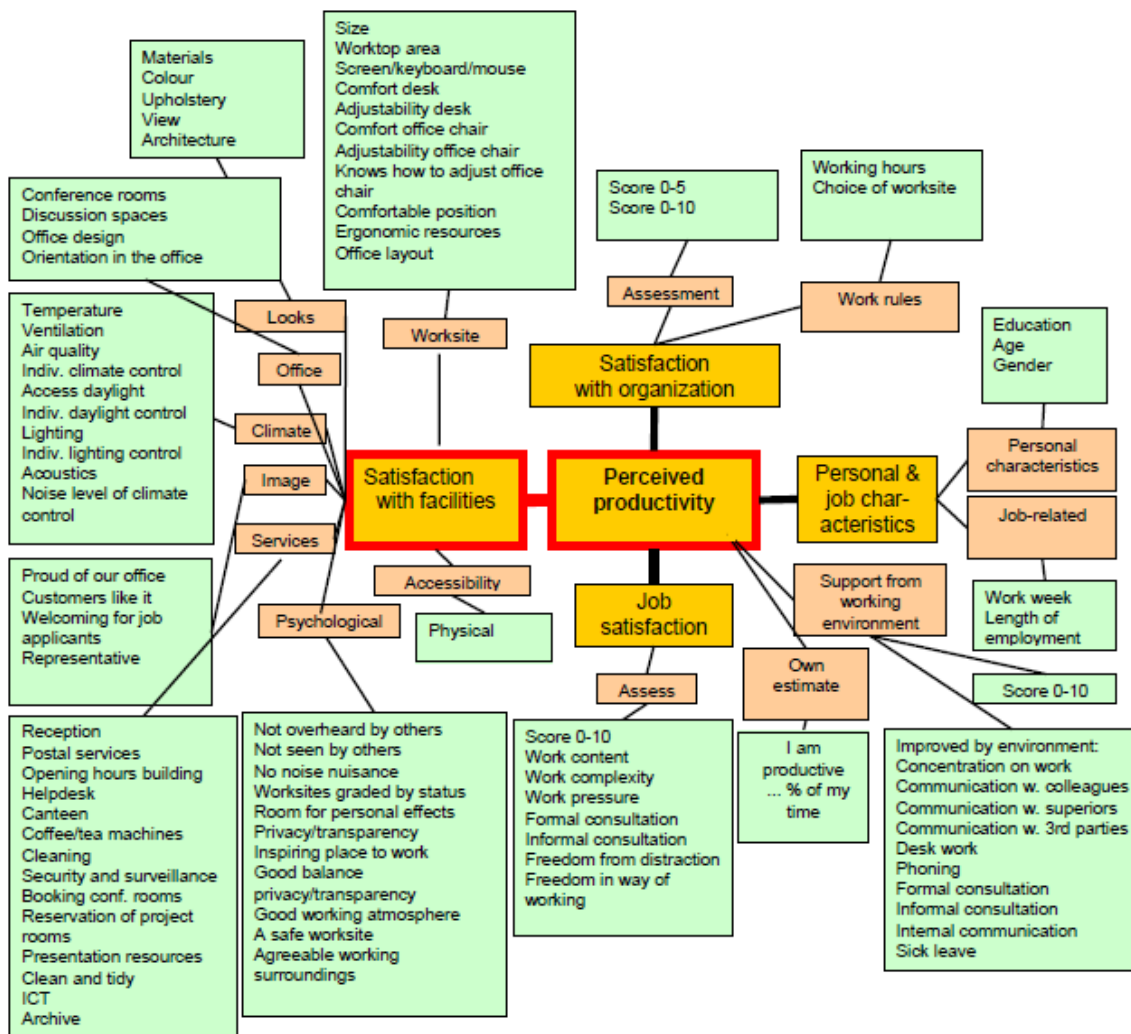

Figure 1: Conceptual model first study

Statistical analyses of the responses from 2197 respondents from 17 different office environments showed the following:

- The average estimated time of being productive was 78%; some respondents stated a much higher percentage (up to 100%) and some a much lower value.
- The average satisfaction score regarding perceived productivity support of various office activities was 3.3 on a 5-point scale, indicating that the respondents were reasonably satisfied with the perceived productivity support.
- The average mark assigned to self-assessed productivity support was 6.4 on a 10-point scale, which agrees well with the mean score of 3.3 on a 5-point scale.
- The most important predictor for self-assessed support of productivity was 'Satisfaction with facilities' (Beta=,60). The second most important predictor was 'Job satisfaction' (Beta= ,23). The elements 'Satisfaction with organisation' and 'Personal- and job-related characteristics' (education, age, gender, working week and years of employment in the current organisation) were not significant.
- The net relationship between the employee's estimate of his/her estimated percentage of productive working time and facility satisfaction was significant, but its regression coefficient was smaller compared to the effect of job satisfaction. The personal and job characteristics and the organizational satisfaction were not significantly related to this measurement of perceived labour productivity. The overall model explained only 11% of the observed variance in the estimated time of being productive.
- Employees who are satisfied with the facilities rated the degree of support for their productivity provided by the working environment significantly higher. The effect of this factor on self-assessed productivity support was considerably larger than the effect of job satisfaction, satisfaction with the organization and personal and job-related characteristics. 54% of the variance in self-assessed productivity support could be explained by the four key factors and underlying characteristics.

The researchers concluded that facilities matter, though satisfaction with facilities had a limited effect on the estimated time of being productive. When asking people how satisfied they are about the support of the working environment to be able to perform a number of activities, satisfaction with the facilities had a significant influence on the self-assessed productivity support. Further in-depth analyses revealed that psychological aspects of the working environment – such as agreeable working surroundings, adequate privacy and inspiring office design – have a marked effect on both self-assessed labour productivity and productivity support. It is likely that other factors such as employees' health, quality of life and motivation, which were not included in this study, may explain part of the variance in self-assessed productivity and productivity support as well. Another conclusion was that a more intensive collaboration between scholars, Facility Managers and Human Resource managers would be helpful to improve our understanding of the complex relationships between the working environment and labour productivity.

4. Repeat study

Offices are rapidly changing and probably also the way office employees perceive their work environments and cope with modern facilities. For this reason, a repeat study has been conducted as a follow-up study of Batenburg and Van der Voordt (Ypma, 2017), with as the main research questions: is satisfaction with facilities still significantly correlated with perceived productivity support? Do similar findings come to the fore after ten years, using a larger sample with more recent data? Again, the influence of satisfaction with facilities, the organisation, work itself and productivity support are taken into account in this follow-up research, as well as personal- and job-related characteristics.

5. Methodology

This repeat study used the current dataset collected by the Center for People and Buildings (CfPB) in the Netherlands by means of its Work Environment Diagnosis Instrument WODI (Maarleveld et al., 2009). However, the repeat study did not use the original long version ("WODI Classic"), but a shortened version ("WODI Light"). This light version has been developed in order to cope with complaints about the time needed to execute a WODI classic (Volker and Maarleveld, 2007). Filling in the WODI Light questionnaire takes only 10 minutes per respondent. The WODI Light questionnaire is less thorough and less-time consuming but still a scientific evaluation tool that can be used in case of an indicative evaluation. WODI Light includes a short questionnaire with a focus on issues that have turned out to be of utmost importance to overall employee satisfaction and (self-assessed) labour productivity, according to employees' responses and based on statistical path analysis. The WODI Light questions are clustered into themes such as organization and work, the building, the direct work environment, privacy, workplaces, concentration, communication, archive, IT, indoor climate, external services and self-assessed work productivity, and completed with questions on personal characteristics and overall questions. In the WODI light survey, two questions measure the extent to which the work environment supports productivity i.e. employee satisfaction with individual and with team productivity support. Satisfaction with the organisation and job satisfaction are each measured with one item. Satisfaction with facilities is measured with 16 questions, covering comfort of the work site (1 item), workplaces (2 items), indoor climate (3 items), services (3 items), looks (2 items), psychological factors (4 items), an accessibility of the building (1 item). Respondents are asked to rate all aspects using a five-point Likert scale, ranging from very dissatisfied (1) to very satisfied (5). Furthermore, the actual use of the workplace is asked for, and also which activities are performed by the employees during the day (in per cent of their working time).

Figure 2 shows the research model for the repeat study. It tests the same overall model, but with less detailed operationalisations of the main variables than the model by Batenburg and Van der Voordt (2008).
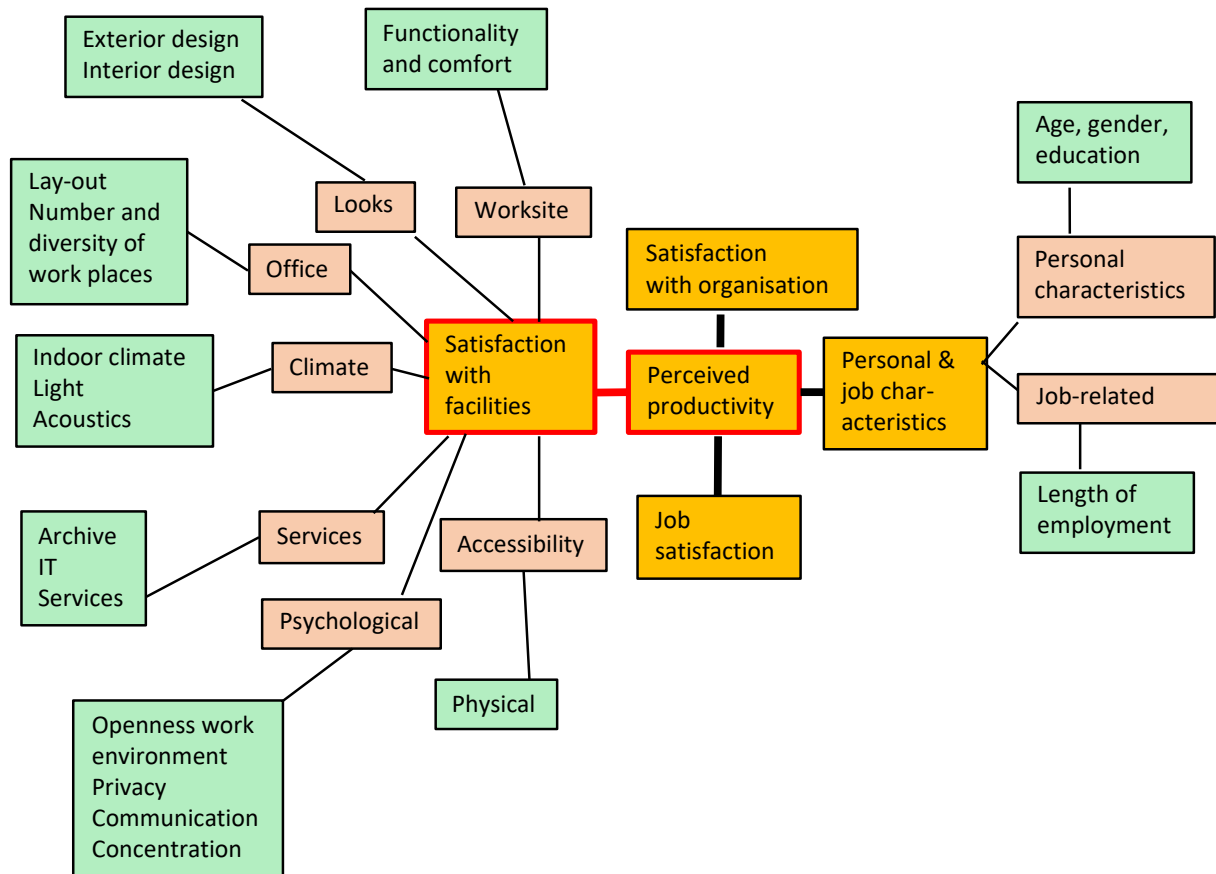
Figure 2: Conceptual model repeat study

Using the current WODI Light database provided the opportunity to analyse the responses from much more respondents than in the first study by Batenburg and Van der Voordt (2008), and to compare the outcomes with the first study that was based on data collected before 2008 with WODI Classic.

The complete database contains input from 28,360 respondents and more than 209 organisations, and contains both WODI classic and WODI light data, representing 18 and 191 organisations, respectively. The WODI light data, used for the current analysis, comprise 25,947 respondents from 191 organisation. These data have been collected in a period of ten years, after Batenburg and Van der Voordt conducted their study with the WODI classic survey (2008). The first step in the analysis was to determine correlation coefficients between all constructs. Next, a stepwise multiple regression analysis was performed to determine to what extent the overall rating of self-assessed productivity support is predicted by satisfaction with the provided facilities, job satisfaction, satisfaction with the organisation, and personal characteristics (age, gender). Further stepwise multiple regression analyses were carried out in order to establish which aspects within satisfaction with the provided facilities are the most important ones.

The constructs in both studies are similar but not identical, due to differences in the questionnaire. In the WODI Light the construct for self-assessed productivity support is the mean of perceived individual productivity and perceived team productivity, whereas in Batenburg and Van der Voordt (2008) the emphasis is on individual productivity in connection to different work activities. Job satisfaction in the WODI Light regards the content and complexity of the work, and does not take issues such as work pressure and freedom in ways of working into account. Satisfaction with the organisation is measured as one general item, instead of a number of items considering e.g. work rules. The constructs within satisfaction with facilities have also been condensed into fewer items.

Respondents were not obliged to answer all questions. Therefore, the number of respondents may differ per question.

6. Research findings

6.1 Characteristics of the sample and descriptive statistics

The characteristics of the respondents used for the current study are shown in Table 2: 58% of the respondents are men, about 70% of the respondents have a degree from a university (of applied sciences), about 65% are 41 years or older, and they work on average about 15 years for their organisation. In comparison to the sample of the first study, the current sample includes slightly more women. The percentage of employees with higher education is rather similar, with a little more respondents with a degree of a university of applied sciences in the repeat study and less with a university degree from a research university. On average, the respondents in the repeat study work one more year at the same organisation (15 year versus 14 years in the first study).

The mean, standard deviation (s.d.) and Cronbach's alpha for all constructs are shown in Table 3. Table 3 shows that the average office employee in the sample is reasonably satisfied with his/her job, organisation, and the facilities provided, although there is obviously room for improvement given the average scores between 3.1 and 3.97 on the 5-points Likert-scale. In Table 2 data from the first study of Batenburg and Van der Voordt (2008) have been added between parentheses and in italics. . Due to the differences between the questionnaires in both studies, not all data can be easily compared The constructs in the repeat study show lower average values for satisfaction with (comfort of the) worksite, higher average satisfaction with looks and accessibility and job satisfaction, somewhat higher satisfaction with organisation, and slightly lower satisfaction with self-assessed productivity support. Overall, the differences in satisfaction in the first study and the repeat study are small.

Table 2. Characteristics of the respondents in the original data set (2008) and the second dataset (2017).

	dataset 2008, N=2,284	dataset 2017, N = 25,947
Gender	59.7% male	58.3% male
	40.3% female	41.7% female
Education	0.9% primary education	0.3% primary education
	10,2% secondary education	8.6% secondary education
	21.1% intermediate vocational education	19.3% intermediate vocational education
	26.7% university of applied sciences	35.3% university of applied sciences
	40.2% (research) university	34.8% (research) university
Age	< 31 15.2.%	< 31 11.7%
	31-40 27.3%	31-40 23.6%
	41-50 33.5%	41-50 31.4%
	51-60 23.1%	51-60 29.0%
	> 60 1.0%	> 60 4.3%
How long have you been working for this organization?	14±12 years	15±12 years

Table 3. Mean, standard deviation and Cronbach's α for all constructs for dataset 2017*. Descriptions and values in italics indicate Mean and SD for data set 2008.

	Number of items	Mean ± s.d.	Cronbach's α	Description
Satisfaction with productivity support	2	3.13± .90	.853	Individual and team productivity
- Individual productivity	1	3.13 ± .99	n.a.	
- Team productivity	1	3.14 ± .93	n.a.	*Support of concentration, communication, desk work, phone*
- *(Overall)*	*12*	*3.33 ±.50*	*.80*	*calls, sick leave, overall mark)*
Satisfaction with organisation	1	3.60 ± .91	n.a.	Overall satisfaction
	3	*3.43 ±.73*	*.68*	*Autonomy (time of working, place, at home)*
Job satisfaction	1	4.03 ± .81	n.a.	Satisfaction with content and complexity of work
	7	*3.62 ±.49*	*.67*	*Ditto, but more detailed)*
Satisfaction with facilities	16	3.27 ± .62	.677	Overall satisfaction, 7 constructs
	60	*3.18 ±.48*	*.83*	*Ditto, 8 constructs, includes Image*
- Workplaces (office)	2	3.24 ± .90	.751	Lay-out and diversity of workplaces
	4	*3.27 ±.69*	*.73*	*Ditto + spaces for formal and informal meetings, spatial layout, wayfinding*
- Services	3	3.28 ± .73	.611	Facility services, archives, IT
	11	*3,43 ±.49*		*Ditto + coffee, cleaning, security*
- Accessibility	1	3.97 ± 1.01	n.a.	Accessibility of the building
	1	*3.54 ±.78*	n.a.	*Ditto*
- Psychological factors	4	3.19 ± .80	.781	Openness and privacy of workspace, support for communication and concentration
	11	*3.08 ±.59*	*.80*	*Visual/auditory privacy, status, personalisation, atmosphere*
- Climate	3	2.99 ± .90	.690	Indoor climate, light, acoustics
	10	*3.18 ±.91*	*.88*	*Ditto*
- Looks	2	3.35 ± .94	.66	Interior and exterior design
	5	*2.93 ±.84*	*.85*	*Ditto*
- Comfort of workspace (worksite)	1	3.33 ± 1.07	n.a.	Not specified
	12	*3.42 ±.64*	*.89*	*Desk, chair*

*) The construct 'Satisfaction with facilities' is a summation of the constructs comfort of workspace, workplaces, climate, services, psychological factors, accessibility and looks.

Next, the correlation between all constructs was determined (Table 4). Self-assessed support of productivity showed to be strongly correlated with satisfaction with facilities, in particular with workplaces and psychological factors. Although satisfaction with the organisation and job satisfaction also correlate positively with perceived support of productivity, these correlations are weaker.

Table 4. Pearson's correlations of Perceived support of productivity with Job satisfaction, Satisfaction with organisation, and Satisfaction with facilities. All correlation coefficients are significant at p<0.01 level.

	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12
1. Self-assessed support of productivity	3.13 (.90)	*(.853)*											
2. Idem, Individual productivity	3.13 (.99)	.938	-										
3. Idem, team productivity	3.14 (.93)	.930	.745	-									
4. Job satisfaction	4.03 (.81)	.176	.173	.155	-								
5. Satisfaction with organisation	3.60 (.91)	.323	.300	.295	.371	-							
6. Overall Satisfaction with facilities	*3.27* (.62)	.614	.586	.554	.224	.410	*(.677)*						
7. Workplaces	3.24 (.90)	.503	.470	.463	.140	.313	.792	*(.751)*					
8. Services	3.28 (.73)	.397	.370	.367	.153	.330	.667	.417	*(.611)*				
9. Accessibility	3.97 (1.01)	.181	.175	.161	.140	.216	.419	.261	.212	-			
10.Psychological factors	3.19 (.80)	.619	.601	.546	.192	.344	.845	.663	.439	.239	*(.781)*		
11. Climate	2.99 (.90)	.396	.381	.356	.172	.250	.689	.455	.380	.224	.492	*(.690)*	
12. Looks	3.35 (.94)	.327	.305	.306	.164	.277	.687	.515	.342	.345	.420	.454	
13. Comfort of workspace	3.33 (1.07)	.480	.467	.420	.162	.293	.727	.554	.412	.221	.591	.470	.479

Note: Italic values between parentheses indicate Cronbach's alpha

6.2   Regression analyses

In order to determine what factors predict self-assessed support of productivity, a stepwise multiple regression was performed. Gender, age, nor the duration of the contract with the company predict employee satisfaction with productivity support. Due to the fact that for most respondents age is measured on ordinal level, this analysis is based on those 4,710 respondents that filled in their age on scale level. As age turned out to have no predictive value (Table 5, step 4), age was not included in subsequent analyses, thereby increasing the number of cases included in the analyses. Instead, years with the organisation was used as control variable.

In this larger sample, personal characteristics (gender and years with organisation) predict a mere 0.6% of self-assessed productivity support (Table 6, step 1). Job satisfaction and satisfaction with the organisation together with personal characteristics predict about 11% of employee satisfaction with productivity support (R^2=0.112) (Table 6, step 3). However, a model that combines job satisfaction, satisfaction with the organisation and satisfaction with facilities is a much better model (Table 6, step 4: R^2=0.383). Furthermore, satisfaction with facilities significantly lowers the Beta-value for satisfaction with the organisation (Table 6, step 4 versus step 3). Because of the low predictive value of personal characteristics, these have not been taken into account in further analyses of the data.

Table 5. Stepwise multiple regression analysis on factors predicting perceived productivity support; independent variables are satisfaction with job, organisation, and facilities.

	Self-assessed productivity support; N=4,710			
	Step1	Step 2	Step 3	Step 4
Control variables				
Age	-.053***	ns	n.s.	n.s.
Gender (dummy)	.110***	.101***	.102***	n.s.
Independent variables				
Satisfaction with organisation		.332***	.339***	.065***
Job satisfaction			n.s.	n.s.
Satisfaction with facilities				.648***
Regression model				
F	27***	216***	163***	800***
Adjusted R^2	.011	.121	.121	.459

*p < .05. **p < .01. ***p<.005

Table 6. Stepwise multiple regressions analysis with age excluded.

	Self-assessed productivity support (N=22,620)			
	Step1	Step 2	Step 3	Step 4
Control variables				
Years with organisation	-.076***	-.038***	-.041***	-.027***
Gender (dummy)	.026***	.030***	.027***	-.017**
Independent variables				
Satisfaction with organisation		.323***	.298***	.072***
Job satisfaction			.064***	.018**
Satisfaction with facilities				.578***
Regression model				
F	65***	916***	712***	2807***
Adjusted R^2	.006	.108	.112	.383

*$p < .05$. **$p < .01$. ***p<.005

Differentiating into self-assessed support for individual and team productivity shows small differences in betas, a higher R^2 for self-assessed support for individual productivity, and no significant effect of job satisfaction on self-assessed support for team productivity (Table 7).

In order to determine what aspects are most important, the stepwise multiple regression analysis was repeated using the different aspects of "satisfaction with facilities" as predictors (see Table 3). As Table 8 (step 3) shows, the psychological aspects are most important, with comfort of workspace and services coming next. When comparing the result for individual and team productivity support, psychological factors showed to be more important for self-assessed individual productivity support than for self-assessed team productivity support, whereas workplace is more important for team productivity support. Not surprisingly, these aspects are even more important to employees with university education (Table 9, right-most column).

Table 7. Multiple regressions analysis on perceived individual, team, and combined productivity.

	Self-assessed productivity support		
	team+individual productivity N = 23,092	individual productivity N = 23,916	team productivity N = 23,151
Independent Variables			
Job satisfaction	.016**	.025***	ns
Satisfaction with organisation	.077***	.063***	.076***
Satisfaction with facilities	.579***	.554***	.520***
Regression model			
F	4790	4256	3511
Adjusted R^2	.384	.348	.313

*$p < .05$. **$p < .01$. ***p<.005

Table 8. Stepwise multiple regression analysis, with satisfaction with facilities split into various items.

	Self-assessed productivity support				
	Team + individual productivity			*Individual productivity*	*Team productivity*
	N = 21,987			*N = 22,663*	*N = 22,041*
Independent Variables:	Step1	Step 2	Step 3	Step 3	Step 3
Satisfaction with:					
Organisation	.327***	.305***	.078***	.064***	.076***
Job		.061***	.017**	.024***	ns
Workplaces			.097***	.066***	.116***
Services			.092***	.080**	.097***
Accessibility			ns	ns	-.031*
Psychological factors			.410***	.416***	.341***
Climate			.059***	.054***	.055***
Looks			-.031***	-.041***	-.014*
Comfort of workplace			.105***	.118***	.070***
Regression model					
F	2637	1362	1861	1673	1292
Adjusted R^2	.107	.110	.432	.399	.345

Note: for the analysis of self-assessed support for productivity all steps are shown, for self-assessed support for either individual or team productivity only step 3 is shown. *$p < .05$. **$p < .01$. ***p<.005

Table 9. Stepwise multiple regression analysis for individual productivity of respondents with higher education.*

	Self-assessed support for individual productivity, for respondents with higher education		
	All	>50% communication work	>50% concentration work
	N = 13,395	N = 426	N = 1,027
Independent Variables:			
Satisfaction with:			
Organisation	.061***	.143*	.057*
Job	.019**	ns	ns
Workplaces	.082***	.238**	.071*
Services	.070***	ns	.073**
Accessibility	ns	ns	ns
Psychological factors	.470***	.209***	.539***
Climate	.064***	ns	ns
Looks	-.036***	ns	ns
Comfort	.128***	.153*	.134***
Regression model			
F	1419	20	138
Adjusted R^2	.488	.422	.549

Note: for the analysis of self-assessed support for productivity all steps are shown, for self-assessed support for either individual or team productivity only step 3 is shown.
*$p < .05$. **$p < .01$. ***p<.005

Although the differences in self-assessed support for individual and team productivity are rather small, this does not mean that satisfaction with facilities has the same importance for all respondents. Therefore, the importance of facilities for (self-assessed) individual productivity support was determined for employees with higher education (university of applied sciences or university), that either need to communicate or to concentrate more than 50% of the time. Table 8 shows that individual concentrated work is especially supported by psychological factors, whereas communication is supported more by workplaces than by psychological factors. Furthermore, the R^2 for these analyses are (much) higher than for the complete database, indicating that for some groups of employees the predictive power of the model is significantly higher than 38.4%.

7. Discussion and conclusions

7.1 Comparisons with the first study and other studies

Regarding the comparability of both studies, it should be noticed that the research designs are similar, whereas the research techniques and the samples are a bit different. The first study used the extended WODI Classic questionnaire, with more and also more detailed questions than the WODI Light version that was used in the repeat study. In the repeat study the number of respondents is much higher and more recent data are included. Furthermore, WODI classic data were excluded from the repeat study, due to the fact that many questions from the WODI classic have been rephrased and/or combined in the WODI light, e.g. in the questions regarding indoor climate, multiple WODI classic questions were combined into one WODI light question. The demographics of the respondents in the repeat study (age and gender), the level of education and the average number of years working for this organisation are rather similar in both studies. These personal characteristics showed to have no significant influence on self-assessed productivity support.

The repeat study shows that satisfaction levels with one's job, the organisation and building characteristics such as its looks and accessibility hardly changed in the last ten years. Satisfaction with indoor climate, productivity support, and psychological factors such as concentration and privacy (on average 2.99, 3.13 and 3,19 on a 5-point Likert scale) is still not very high. The average satisfaction with productivity support by the work environment decreased from 3.33 to 3.13. This is remarkable, because most companies seem to spend more attention to this topic nowadays, due to a growing awareness of the contribution of human capital to organisational performance and competitive advantage.

The repeat study confirmed self-assessed support of productivity to be significantly correlated with satisfaction with facilities, in particular with psychological aspects i.e. opportunities for concentration and communication, privacy, and level of openness, and the workplaces themselves (functionality and comfort, diversity). Although satisfaction with the organisation and job satisfaction also correlate positively with self-assessed support of productivity, these correlations are weaker. Satisfaction with facilities, satisfaction with the organisation and job satisfaction and personal and job-related characteristics all together explain 54% (first study) and 38% (repeat study, Table 6) of the variance in self-assessed productivity support. This lower percentage may be caused by differences in constructs, especially due to the fact that Batenburg and Van der Voordt (2008) focussed on self-assessed individual productivity support, whereas the repeat study looked at a combination of individual and team productivity support. It might also be that factors not taken into account have increased in importance, e.g. work pressure.

Maarleveld and de Been (2011) have shown that the explained variance of self-assessed individual productivity support exceeds the explained variance of team or organisational productivity support (values for R^2 are 0.47 and 0.37, respectively). Secondly, in the repeat study job satisfaction does not predict self-assessed productivity support.

This is in contrast to the original study by Batenburg and Van der Voordt (2008), but in accordance with Maarleveld and De Been (2011). The difference with the first study may be partly caused by the fact that in the repeat study job satisfaction was measured by satisfaction with the level and complexity of work, whereas more aspects were included in measuring job satisfaction using WODI Classic. Furthermore, it should be noted that Workspaces was valued significantly lower in the current WODI light database than in the dataset of Batenburg and Van der Voordt (2008). Satisfaction with the workplaces is the second most important factor that predicts self-assessed productivity support (Table 8, step 3), which may be another reason why the predictive value of the model in the WODI light database is lower than in the WODI classic database (Batenburg and Van der Voordt, 2008). However, an explanatory power of 38% is still high, given that (self-assessed) productivity support is influenced by many factors. Narrowing down to specific groups such as employees with higher education and primarily concentrated work, the explained variance is much higher, namely almost 55% (Table 9).

Although people may feel very comfortable and at the same time may be not very productive, the data confirm the popular statement of 'a happy worker is a productive worker' that was found in earlier studies on the relationship between job satisfaction and job performance (e.g. Wright et al., 2002; Zelenski et al., 2008; Taris and Schreurs, 2009).

A limitation of both studies is the focus on the relationship between *satisfaction* and *perceived* labour productivity (measured by self-assessed productivity support i.e. employee satisfaction with productivity support), and not on the connection between *objective* facility performance and *actual* labour productivity. The actual productivity – quantitatively and qualitatively - has not been measured. It could well be that measuring satisfaction about different topics, including satisfaction with perceived productivity support, all measure an underlying construct i.e. a general level of satisfaction about the organisation, the job and the facilities all together. Another limitation is that both studies just focussed on four factors that may influence the self-assessed productivity support of office employees. Other aspects may also have an influence on the perceived support of productivity. Reality is much more complex than its representation by a conceptual model with four main variables. Intrinsic labour motivation, competences, and personal living conditions will play a role as well.

7.2 Conclusions and recommendations

The high level of explained variance of self-assessed productivity support of various office activities by user satisfaction with the facilities, the organisation and the working processes show that both the social and physical environment including various facilities matter. It makes sense that a good feeling about one's organisation and one's work and appreciation of the building, the workplaces, and facilities will support labour productivity. In particular psychological aspects i.e. opportunities for concentration and communication, privacy and level of openness, and the(functionality, comfort and diversity of the workplaces have a significant influence. This is in line with the findings from former studies that have been presented briefly in the introduction section. The impact of satisfaction with indoor climate and the interior and exterior design is less dominant and lower than expected. The impact of plants and music has not been measured in the current study. Although facility and corporate real estate managers

should take all aspects into account in workplace management, a sound balance between opportunities to concentrate and privacy and opportunities to communicate is leading in perceived productivity support. This pleads for the provision of choice between open work settings and more closed workplaces with less distraction, in an activity-based workplace concept, as it allows employees to choose the most appropriate workplace for a task. Besides, an appropriate work environment from a more psychological point of view (e.g. atmosphere) adds value as well, due to its significant contribution to self-assed productivity support. Furthermore, improvement of the indoor climate shows to be a continuous point of attention.

An interesting next research step could be to (also) measure actual building and facilities performance indicators and actual labour productivity, for instance by measuring sick leave (being non-productive), profit per person, team or the organisation as a whole, number of translated words per day in a translation office, number of successful phone calls in a call centre etc. Another interesting further research step would be to compare the research findings with additional studies into the impact of the built environment, facilities and services on actual and perceived labour productivity and productivity support, and to discuss the findings with academics from different disciplines (psychologists, HRM, IT, organisational scientists) and practitioners working in different fields (offices, education, health care, retail and leisure and so on). More interdisciplinary and transdisciplinary research and exchange of knowledge, research methods, research findings and reflections on it could be helpful to get a better insight in the complex relationships between many influencing factors and productivity.

Acknowledgement

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