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Batenburg, RS; van der Voordt, DJM

Publication date

2008

Document Version

Accepted author manuscript

Published in

Proceedings of the EFMC 7th EuroFM Research Symposium

Citation (APA)

Batenburg, RS., & van der Voordt, DJM. (2008). Do facilities matter? The influence of facility satisfaction on perceived labour productivity of office employee. In *Proceedings of the EFMC 7th EuroFM Research Symposium* (pp. 139-150). IBC EUROFORUM GmbH.

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Do facilities matter?

The influence of facility satisfaction on perceived labour productivity of office employee

Dr. Ronald S Batenburg

University of Utrecht, Faculty of Beta Sciences & Research and consultancy firm Dialogic. E: R.S.Batenburg@cs.uu.nl. W: www.dialologic.nl

Dr. Theo JM van der Voordt

Delft University of Technology, Faculty of Architecture & Center for People and Buildings, Delft. E: D.J.M.vanderVoordt@tudelft.nl. W: www.re-h.nl & www.cfpb.nl.

ABSTRACT

Purpose: Companies spend a lot of money to provide facilities such as a nice, effective and efficient building, well designed ergonomic furniture, sophisticated IT, cleaning services, catering, and safety services. Both from a theoretical perspective as well as from a managerial point of view, it is important to know if and how strongly facilities do affect employee satisfaction and labour productivity. The paper discusses the results of research on this issue.

Methods: A brief review of literature and statistical analyses of a database of the Delft Center for People and Buildings, with 2197 respondents from 17 different office environments. The database includes data from Diagnostic Post-Occupancy Evaluations on user satisfaction with regard to the organization, working processes, the office concept and a number of facilities.

Findings: Most annual and biannual surveys among Dutch office employees use questionnaires with hardly any questions about the physical environment. Statistical analyses of the Delft database showed a significant but weak correlation between user satisfaction on facilities and self estimated percentage of time that one is being productive. Much stronger correlations came up when satisfaction about facilities is linked to users' perceptions of the supporting impact of the working environment on ones own productivity.

Implications: The results showed statistical support for the added value of facility provisions. But other variables have their impact, too. A more intensive co-operation between scholars, facility managers and Human Resource managers may help to improve our understanding of the complex relationships between the working environment and perceived labour productivity.

Keywords: facilities; perception; satisfaction; productivity; POE.

INTRODUCTION

Exploring the determinants of labour productivity is similar to searching for the Holy Grail. As is known from a long tradition of (socio)-economic research, labour productivity is influenced by many factors. The productivity of office workers does not seem to be an exception. The organizational structure and culture, the management style, the nature and complexity of the work done and the facilities provided play a major role in determining the amount and quality of the output from our labour. Personal characteristics, competences and motivation play an important part too. Both scholars and facility services providers are interested for a long time in the relationship between facilities and labour productivity. The key question is expressed in the title of this contribution: do facilities matter? And if so: to what extend and in what way?

In this paper we present the results of a study executed by the Delft knowledge centre Center for People and Buildings (CfPB) and research and consultancy group Dialogic from Utrecht. The study aims to debunk the relationship between facility satisfaction and labour productivity of office employees in the Netherlands. The study is performed at the request of the Facilicom Services Group, one of the largest Dutch providers of cleaning services, catering, safety services, and construction and maintenance of buildings.

In the following sections, we subsequently present a comprehensive overview of the literature, and the dataset that enabled the empirical exploration of how the working environment is used and perceived by over 2.197 Dutch employees from 17 different organizations. The statistical analyses focus on the relationship between facility satisfaction and perceived labour productivity. These analyses are based on the idea that the relationship between satisfaction with facilities and perceived productivity can be estimated in its own right but *also* relative to the impact of the employees' satisfaction with the organization and his or her work or job. In addition, the analyses take the potential effects of personal and job-related characteristics into account. Figure 1 provides a representation of our basic research model.

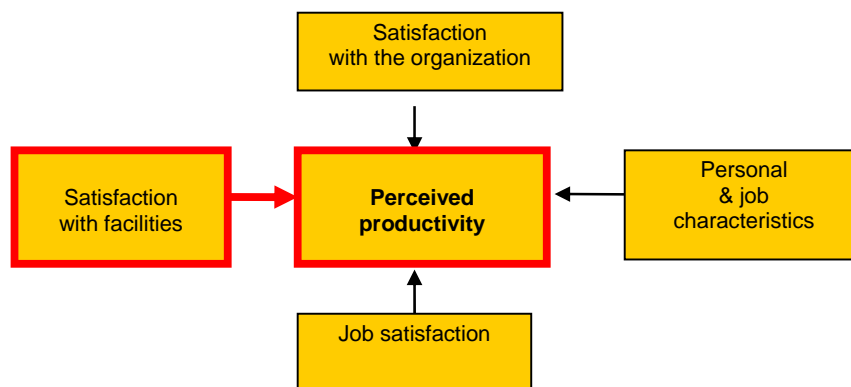


Figure 1: Impact of four components on perceived labour productivity

THEORETICAL BACKGROUND

In scientific papers, productivity is commonly defined as the ratio of output (production) to input i.e. labour, capital, information, technology and facility provisions (Aronoff and Kaplan, 1995; Van der Voordt, 2003; Frankema, 2003). Office workers tend to regard this term as referring solely to the output without regard to the input. The term 'facilities' also has different meanings for different people. Employees associate this concept mainly with services and material in such fields as IT, furnishing, catering, cleaning and security. The Dutch standard *NEN 2748, Termen voor facilitaire voorzieningen – Rubricering en definiëring* (Facility management terms, Classification and definitions), defines facilities as a coordinated offering of support services, subdivided into 1) accommodation (buildings, maintenance and building management); 2) services and equipment (provision of worksites and conference space, catering, reception, surveillance, security, cleaning, document management etc.; 3) IT (infrastructure, hardware and software, training); 4) external provisions (external worksites and conference space); and 5) factors governing facility management (including facilities policy, marketing, innovation and

legislation and industry standards concerning health, safety and the environment). The standard was drawn up to permit unambiguous classification of facility management costs as a basis for clear benchmarking. However, most studies of the use of facilities focus on the way these facilities are perceived by users on a day-to-day basis. The terminology applied thus differs from that found in NEN 2748 with its fivefold classification.

The starting point of our study is that well designed facilities potentially have a considerable effect on labour productivity, for instance by delivering a good balance between openness – in order to support communication, social interaction and rapid exchange of knowledge and competencies – and seclusion – in order to support concentration and privacy. Other examples are short distances between frequently consulted colleagues and frequently used facilities, a well performing information and communication technology, a quick response of a helpdesk in case of problems, and a high level of indoor air quality. Another assumption is that other factors will have a greater impact. For instance effective human resource management, inspiring leadership, interesting and challenging work that fits with employees' interests, knowledge and skills, healthy and highly motivated employees and stimuli such as a high salary and getting attention and appreciation by ones superiors and colleagues. These factors are partly connected. A well designed environment with good facilities may affect ones productivity in a direct way, but also indirectly, as a sign or symbol of the organisation paying attention to its employees. Facilities may be used to support labour productivity, as well as to avoid low productivity. For instance by taking care for thermal comfort, people feel more comfortable and work better, whereas poor indoor air quality may evoke the so-called Sick Building Syndrome leading to absence through illness. A third assumption is that both personal characteristics and job characteristics will affect labour productivity, too. Men and women make different demands on facilities. Older people often estimate their labour productivity on a lower level than younger people. These examples show clearly that (too) many variables have their impact, with complex direct and indirect cause-effect relationships.

RELATED STUDIES

A review of the biggest and most representative employee surveys in the Netherlands shows that these contain hardly any specific questions about the physical working environment and facilities such as cleaning, security and catering (Batenburg, 2007). This statement applies e.g. to the annual Dutch labour force survey (*Enquête Beroepsbevolking, EBB*) carried out by Statistics Netherlands (the official Dutch statistical office) that covers over 100,000 employees. It also applies to the biennial National Survey of Working Conditions (*Nationale Enquête Arbeidsomstandigheden, NEA*) conducted since 2003 by the TNO Dutch Organization for Applied Scientific Research covering 20,000 employees. We assume the situation is much the same in surveys carried out in other developed countries. For example, where researchers investigate the relationship with the level of satisfaction felt by employees at work, the focus is generally on job satisfaction rather than satisfaction with the facilities provided. Fortunately, however, there are some studies that do focus on the physical working environment. Practically all these studies concentrate on the *perceived* influence of the physical environment on the *perceived* productivity. This is understandable, since it is hardly possible to measure the actual productivity of office workers for most tasks. Any studies that have attempted to measure the

influence on the actual productivity have mainly been restricted to the effect of an isolated environmental factor on the performance of a routine task. A well-known example is provided by the Hawthorne experiments, performed by the American researcher Elton Mayo (1933). He investigated the influence of stronger or weaker lighting on the productivity of 20,000 factory workers. The most striking finding was that all workers performed better when the lighting level was changed, no matter whether the level was raised or lowered. It was concluded that the key factor influencing the productivity was the attention the workers received from the researchers.

The findings of investigations of office environments were less clear-cut. A study by Haynes et al. (2000) among more than 1,000 respondents in 27 different office environments showed that 70% regarded the influence of the working environment as important or very important. A study by Barber (2001) that sought to determine which environmental variables were seen by office workers as having the *greatest* effect on their productivity showed 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, variability of the lighting level, privacy and the ability to see daylight and to have 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. The overall conclusion from the many studies of the effect of the internal climate was that a good internal climate could increase the perceived productivity by 10–15% (Clements-Croome, 2000; Leijten, 2002; Stoelinga, 2007).

DATA AND METHODS OF THE PRESENT STUDY

For this study we used the so-called WODI dataset, as a result of an extensive empirical research program of the CfPB, for which office employees have been surveyed during the past 5 years. The data have been collected with the so-called Working Environment Diagnostic toolkit (Volker and Van der Voordt, 2005; Volker and Maarleveld, 2007; Maarleveld et al, forthcoming). The dataset is unique for the Netherlands. In this paper, we actually build upon the results of a number of earlier studies that has been performed by the CfPB. One of these studies showed a large variance in user satisfaction with the facilities. Based on average scores and scores of high performing working environments, a so-called satisfaction index has been developed. This index can be used for benchmark purposes (Van der Voordt and Maarleveld, 2006 a,b; Volker and Maarleveld, 2007). The study showed that new buildings are appreciated on a higher level than older buildings, particularly with respect to functional aspects, architectural quality and image. Image and appearance, thermal comfort, lighting, acoustics and level of openness and transparency strongly affect employees' wellbeing and working atmosphere. Statistical analyses of employee satisfaction with perceived support of the working environment to ones labour productivity revealed the predominant importance of 'soft' factors such as image and looks, the contribution of the working environment to well-being and a good working atmosphere, and a proper balance between privacy and transparency (Van der Voordt, Maarleveld and Attema, 2006; Volker and Maarleveld, 2007). Freedom from distraction at the worksite was also found to be very important for the perceived productivity.

The WODI dataset that is analyzed for this paper, contains information on nearly 2.200 office employees. Thanks to this large number of respondents and the wide variety of questions put to them, it is possible to investigate the direct relationship between the level of satisfaction of office employees with the facilities provided and the degree of satisfaction with the impact of the working environment on perceived productivity. If compared with the Dutch labour force survey, our sample can be considered as a good representation of the active Dutch labour market population. The representation of male respondents in our data set is similar to labour force survey (60%), and the same holds true for the respondents' average age (40,2), the average number of hours at work per week (35) and the average year employed (14). Deviation does occur with regard to education however, as 41% of our dataset consists of higher educated respondents, against 11% in the Dutch active labour force.

The questionnaire used for this survey asks the respondents to indicate their degree of satisfaction with no fewer than 63 aspects of the physical working environment. All satisfaction items were measured with the traditional 5-point Likert scale; answers were coded as 1 ('highly unsatisfied') until 5 ('completely satisfied'). The aspects were categorized in nine sub-dimensions, covering nearly all relevant aspects of the physical working environment. For each dimension, a varying number of items were queried, dependent on the complexity of the sub-dimension. This measurement model enabled us to investigate both the overall satisfaction as well as the level of satisfaction with regard to specific dimensions, such as the image of the building or the internal climate conditions. Table 1 below summarizes the number of items (i.e. survey questions) for each dimension, their average and standard deviation score on a 5-point satisfaction scale, and the Chronbach's alpha as a test of internal validation for each of the nine dimensional item sets. Figure 2 at the end of this section provides the keywords for all the items/questions that are part of each of the sub-dimensions.

Table 1: Descriptive statistics of the 9 sub-dimensions measuring the respondents' physical working environment satisfaction and their items.

Dimension	Number of items	Mean	Standard deviation	Chronbach's alpha
Worksite	12	4.42	0.64	0.89
Appearance	5	2.93	0.84	0.85
Office	4	3.27	0.69	0.73
Climate	10	2.99	0.70	0.88
Image	5	2.67	0.85	0.91
Services	11	3.43	0.49	0.76
Psychological aspects	15	3.08	0.59	0.80
Accessibility	1	3.54	0.78	NA
Overall	63	3.18	0.48	0.83

Table 1 shows that the average office employee in our sample is reasonably satisfied with the facilities provided, although there is obviously room for improvement given the average score is 3.1 on the 5-points scale

The most satisfactory sub-dimension is the worksite (4.42), indicating that desks are generally comfortable and ergonomic. The average satisfaction with the climate conditions is relatively low (2.99), a result that resembles earlier research findings. All items for each dimension contribute to a reliable scale according to the rules of thumb as indicated by Hair et al. (1998) and Nunnally & Burnstien (1994), i.e. Cronbach's Alpha's are 0.70 or higher.

The central concept of our research model, the perceived productivity of employees, was measured in two different ways by the WODI-survey. Firstly, respondents were asked, "*During what percentage of your working time are you productive?*" (Model A). The average response was 78%, though some respondents stated a much higher percentage (up to 100%) and some a much lower value. Secondly, they were asked the extent to which the working environment supported 10 different aspects of their own productivity, such as efficient communication with colleagues and absence of health complaints. The average score here was 3.3 on a 5-point scale, indicating that the respondents were reasonably satisfied with the perceived productivity support. The response to this question was combined with the response to the question in which respondents were asked to assign a mark to the degree to which the overall working environment supported their own productivity (Model B). Here we used the scale to which they were accustomed from school and university (where 6 is a pass, 8 very good and 10 outstanding). The average mark assigned was 6.4, which agrees well with the mean score of 3.3 on a 5-point scale.

On beforehand, one might argue that employees who estimate their own productivity to be higher are also those who express a higher level of satisfaction with the physical working environment, and vice versa. However, it is by no means self-evident that this should be so: employees may estimate their own productivity to be high while still being very unsatisfied with the facilities. Conversely, employees may be satisfied with the facilities without believing that these facilities contribute to their own productivity. So we consider the added value of the physical working environment for productivity explicitly as 'a search for evidence', i.e. a hypothesis to be tested. As our research model depicts, this hypothesis is tested as stringent as possible by taken into account three other factors that can be expected to influence the (perceived) productivity of office employees: the level of job satisfaction, the level of satisfaction with the organization, and personal and job characteristics. The employees surveyed were asked seven different questions about their level of job satisfaction; five items measured their satisfaction with the organization. The background characteristics of the office workers were gender, age, education, number of weekly hours worked and years of work experience.

Figure 2 shows all the measurements as described above in one picture based on the basic research model as presented in Figure 1. We recall that the boxes outlined in red and the thick red line between represent the central question addressed in this study: what is the net added value of facilities satisfaction to labour productivity, taking into account the differences in job satisfaction, satisfaction with the organization and personal and job-related characteristics? This research question can be investigated by applying multivariate (regression) analysis. All concepts and variables that were measured appear to be normally distributed. This applied also to the error terms of the estimated regression model, demonstrating no problems of heteroscedascity.

RESULTS

The results of the linear regression analyses are shown in Table 2. Two main results can be discerned. Looking at Model A, the net relationship between the employee's estimate of his or her own productivity (proportion of total working time spent productively) and his facility satisfaction is significant, but its regression coefficient is smaller compared to the effect of job satisfaction. Quite remarkable, the personal and job characteristics and the organizational satisfaction are not significantly related to this measurement of perceived labour productivity. The explanatory power of Model A is relatively low, as the explicative variables only account for 11% of the observed variance in the dependent variable.

Table 2: Regression analysis results

	Model A	Model B
Independent variable	Dependent variable: Response to “I am productive ...% of the time”	Dependent variable: Response to “extent to which the working environment supports productivity”
Satisfaction with the organization	Not significant	Not significant
Job satisfaction	.21***	.23***
Satisfaction with facilities	.14***	.60***
Personal and job-related characteristics	Not significant	Not significant
Explained variance of the model (R^2)	11%	54%

*** = $P < 0.01$; ** = $p < 0.05$

Model B clearly shows that employees who are satisfied with the facilities rate the degree of support for their productivity provided by the working environment significantly higher. The effect of this factor on the perceived productivity is considerably larger than the effect of job satisfaction, satisfaction with the organization and personal and job-related characteristics. Fifty-four per cent of the variance in perceived productivity is explained by the four key factors and underlying characteristics considered in our model.

Specifically focussing on the relationship between facility satisfaction and perceived labour productivity, the scatter diagram with z-scores shows that both models are linear. However, particularly Model A shows a great deal of spread around the theoretical line with its slight positive slope derived from the regression analysis.

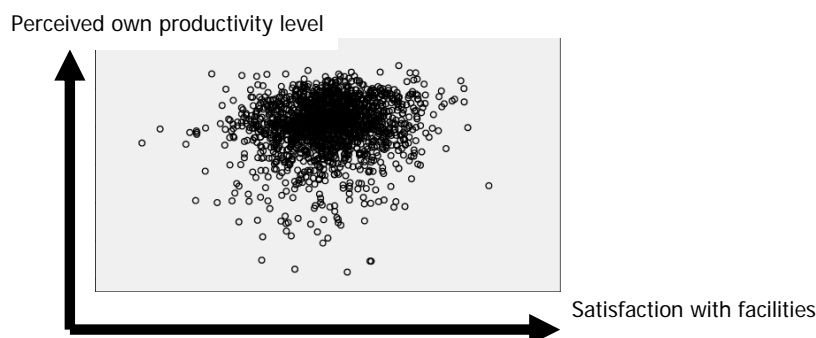


Figure 3: Scatter diagram relating satisfaction with facilities and estimated own productivity

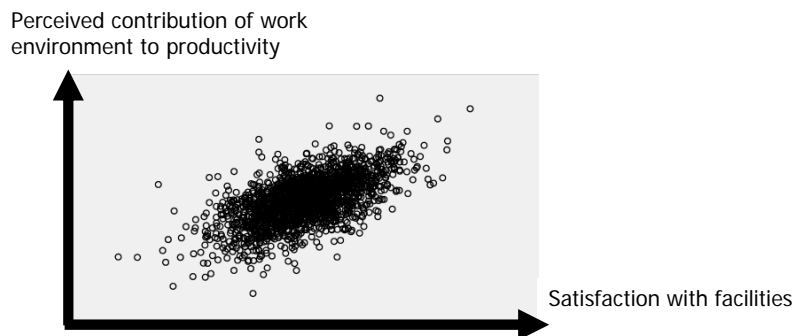


Figure 4: Scatter diagram relating satisfaction with facilities and perceived degree of support for productivity from working environment

DISCUSSION

Based on the multivariate regression analyses, it can be concluded all in all that the working environment has a fairly limited effect on the perceived productivity, especially in relation to the many other factors that were not considered in our model. However, when asking people how satisfied they are about the support of the working environment to being able to perform a number of activities, in particular satisfaction with the facilities showed to have a substantial influence on the perceived productivity. Further analyses in depth revealed that it is the psychological aspects of the working environment – such as agreeable working surroundings, adequate privacy and inspiring office design – that have a particularly marked effect on perceived labour productivity.

In real life situations the impact of separate variables can not be studied in isolation. So analyzing correlations between perceived facility performance and perceived labour productivity is one thing. But to be able to open the black box in order *to explain* what we found is a different story. On the one hand, the low explained variance in our first model – linking user satisfaction about the facilities, the organisation and the working processes to the estimated percentage of time being productive – is a little surprising. One might expect that the triple effect of these factors would account much more strongly. On the other hand, this research finding is in line with our a priori assumption that a wide variety of other factors that were not included in the investigation must also play a role. These might include such things as the respondents' intrinsic motivation, knowledge and skills, their health, living conditions away from the work environment etc. (Woods, 2000; Mawson, 2002). The high level of explained variance of our second model – linking user satisfaction about the facilities, the organisation and the working processes to the perceived level of support of the working environment to ones productivity with regard to a number of activities – confirms our hypothesis. It is quite understandable that a good feeling about ones organisation and ones work and employee satisfaction about the facilities i.e. the building as a whole, the workplaces, furniture, IT, cleaning services and so on will support labour productivity. Although probably we all know people that feel very comfortable and at the same time are not very productive, the data conform the popular statement of 'a happy worker is a productive worker' that was found in earlier studies into the relationship between job satisfaction and job performance (e.g. Petty et al, 1984).

Finally it should be emphasized that the focus of the research discussed here was on the relationship between *satisfaction* and *perceived* labour productivity, and not on the connection between *objective* facility performance indicators and *actual* labour productivity. An earlier review of literature (Van der Voordt, 2003) traced a number of 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 drop in absenteeism, reduction in meeting time, reduction in duplicate files, decrease in errors and higher self-reported productivity (e.g. Kleeman et al., 1991; Kaczmarczyk et al, 2001). An interesting further step in the research would be to link further statistical analyses in depth with research findings from this kind of studies and reflections from experts, both scientists and facility managers working in practice. There is still much work to do!

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About the authors

Dr Ronald Batenburg is a senior researcher and consultant at Dialogic innovatie + interactie in Utrecht and associate professor in the Faculty of Science at Utrecht University.

Dr Theo van der Voordt is a senior researcher at the Center for People and Buildings in Delft and associate professor in the Department of Real Estate & Housing of the Faculty of Architecture at TU Delft.