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Effects of relocation to activity-based workplaces on perceived productivity: Importance of change-oriented leadership

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ABSTRACT

Activity-based workplaces (ABWs) are becoming popular in Western countries and were implemented at four office sites of a large Swedish government agency. A fifth office was used as a control group. The study aim was to examine the effects of relocation to ABW on perceived productivity among employees and to determine if perceived change-oriented leadership behavior *prior to* relocation moderates potential effects. Data were collected three months prior to relocation, and three and 12 months after. 407 respondents were included in linear mixed regression models. Perceived productivity decreased significantly after relocation compared to the control group and these effects persisted 12 months after the relocation. However, the decrease in perceived productivity was significantly smaller among employees perceiving high change-oriented leadership before relocation. Our results point out the importance of a change-oriented leadership behavior during the implementation to avoid productivity loss among employees when implementing ABWs.

1. Introduction

Relocation from traditional offices (private or open-plan offices) to activity-based workplaces (ABWs) is common in organisations in Western countries (Candido et al., 2018; Appel-Meulenbroek et al., 2011; Rolfö, 2018; Haapakangas et al., 2018a; Hoendervanger et al., 2016). One reason behind the implementation of ABWs in organisations is cost savings through more efficient use of office space. Today's technology enables greater flexibility in where, when and how to work, leading to, e.g., lower office occupancy and a need for fewer workplaces (van der Voordt, 2004; Wohlers and Hertel, 2017). Another reason for implementing this type of office design is to support various characteristics of today's office work, e.g., concentrating work, creative work, team work, and voice and video calls, by providing workers more autonomy in choosing and changing workspace according to their needs (Appel-Meulenbroek et al., 2011). Thus, the key principle of the ABW is the provision of unassigned and shared desks in functionally different workspaces, or "work zones" that support, for example, silent or

interactive work (Candido et al., 2018; Appel-Meulenbroek et al., 2011). Some offices allocate "home zones" (i.e. allocated areas with unassigned desks) for groups of employees who have specific needs or requirements (e.g., multiple screens or secrecy).

The ABW design may also aim to improve interaction and communication at the workplace (Hoendervanger et al., 2016; Blok et al., 2009) and, thus, to promote employee productivity (Engelen et al., 2018). Moreover, a successful implementation requires employees to adopt activity-based working strategies and workplace rules (Wohlers and Hertel, 2017). In practice, ABWs should facilitate individuals' flexibility at work, the use of optimal work spaces for different work tasks, and encourage employees to move more during workdays (Hoendervanger et al., 2016; Hallman et al., 2016). Therefore, the specific features of the ABW have the potential to influence working conditions positively and, thus, to affect organisational productivity (Wohlers and Hertel, 2017). The definition of productivity is by tradition a measure of input and output quantities in the production process (i.e. quantity produced by the man-hour used), which is difficult to apply in businesses where

Abbreviations: ABW, activity-based workplace; GP, general productivity; OSP, office supports productivity; OSQ, office supports quality.

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knowledge work is the output (Drucker, 1999). Knowledge work requires advanced theoretical and analytical knowledge to solve problems and develop products and services, whereas manual work involves mainly physical tasks. To address productivity in knowledge work, subjective measurements of perceived productivity among employees are commonly used (Drucker, 1999; Feige et al., 2013; Haynes, 2008). The productivity perspective in this study also includes the aspect of quality. Quality is defined as the ability to satisfy, or preferable exceed, the needs and expectations of the customers (Bergman and Klefsjö, 2003). Both aspects of high productivity and quality are necessary to create a long-term successful organization, and in this study there is a focus on how the ABW office design effects the ability to support perceived productivity and quality of work among employees.

When implementing changes in an organization there is likely a need for a manager who can be a promoter of change (Neves, 2009; Nielsen et al., 2010; Nielsen and Abildgaard, 2013), is future-oriented (i.e. change-oriented leadership) (Yukl, 2012), and can guide and promote employees' wellbeing and performance in the new ABW environment. However, little is known, and research is conflicting, about whether employees' productivity is affected by working in an ABW, while even less is known about the importance of leadership behavior during this implementation.

The existing research on ABWs focuses largely on employee perceptions of work conditions, satisfaction with the new office environment (Candido et al., 2018; Appel-Meulenbroek et al., 2011; Haapakangas et al., 2018a, 2018b; Engelen et al., 2018; Rolfö et al., 2018; Bernstein et al., 1998), and productivity (Candido et al., 2018; van der Voordt, 2004; Haapakangas et al., 2018b; Rolfö et al., 2018; Seddigh et al., 2015; Kim et al., 2016; Arundell et al., 2018; Meijer et al., 2009). However, the results on productivity are somewhat conflicting with differences in research designs and measures contributing to mixed findings. Relocation studies investigating employee perception before and after moving to ABWs have observed improvements in perceived productivity compared to open-plan offices (van der Voordt, 2004; Blok et al., 2009; Foley et al., 2016), decreased productivity in comparison to private offices (van der Voordt, 2004), or no effects (Arundell et al., 2018; Meijer et al., 2009). The methodological quality of these studies varies. Only Arundell et al. (2018) included a control group while only Meijer et al. (2009) included two follow-up measurements after the relocation. Several studies have reported qualitative observations of factors of the ABW design that might influence productivity positively (e.g., collaboration possibilities, choice of workspaces) or negatively (e.g., distractions, time spent finding workspaces and colleagues) (van der Voordt, 2004; Haapakangas et al., 2018b; Kim et al., 2016; Arundell et al., 2018). Hence, there is a clear need for more high-quality longitudinal studies, with repeated measures, to better understand the effects of moving into an ABW on perceived productivity.

The measures used in previous studies on productivity in ABWs can be roughly categorized into ratings of productivity in general (Haapakangas et al., 2018b; Arundell et al., 2018; Meijer et al., 2009) and ratings of how well the office spaces are perceived to support one's productivity (van der Voordt, 2004; Kim et al., 2016; De Been and Beijer, 2014). Studies using the latter measures tend to report greater differences between ABWs and other office types (van der Voordt, 2004; Kim et al., 2016; De Been and Beijer, 2014) than studies using general measures of productivity (Arundell et al., 2018; Meijer et al., 2009; Foley et al., 2016), suggesting that these measures assess different aspects of the effects of office design. However, we are not aware of any study that has included both types of productivity measures, which would provide more information on their relation. In this study, we are interested in how employees perceive their productivity in general, as well as the support for their productivity from the office environment after a relocation to an ABW from traditional offices (i.e. cell-offices, private rooms, shared rooms or open-plan offices).

After relocation to ABWs, individuals seem to differ considerably in their ability to accommodate and use the office appropriately, in an

activity-based manner, which appears to be an important prerequisite for a positive experience of the ABW (Appel-Meulenbroek et al., 2011; van der Voordt, 2004; Wohlers and Hertel, 2017). There are likely several factors contributing to the appropriate use of the ABW among individuals. Gerdenitsch et al. (2017) described that if employees perceived a "need-supply fit", i.e. a fit between work requirements and office facilities, their satisfaction with workspaces was higher (Gerdenitsch et al., 2017). Another factor, suggested to be of particular importance in facilitating an appropriate use of ABWs, is the leadership behavior (Wohlers and Hertel, 2017).

When implementing changes or interventions the managerial leadership behaviors are important for the intervention outcome (Neves, 2009; Nielsen and Randall, 2009; Nielsen et al., 2007; Murta et al., 2007). Research suggests that, prior to implementing interventions, managers are key actors in promoting employees' feelings of readiness for change, and thus, in achieving rapid experience of benefits and adopting changes (Neves, 2009). Leaders can also enhance employees' performance by using specific task-, relation- and change-oriented behaviors relevant for different situations (Larsson and Vinberg, 2010). Accordingly, the implementation of an ABW is a situation where a change-oriented leadership may be significantly important, since it represents a major change in work settings. The change-oriented leadership behavior was introduced to improve intervention and adoption to changes, and was identified as a separate leadership behavior dimension during the 1990s because of the increase of societal and organisational changes (Ekvall and Arvonen, 1991). This leadership dimension displays the manager as being a promoter of change, having a creative attitude, preferring new ways of doing things, seeing possibilities, being willing to take risks, and being future-oriented (Yukl, 2012). In this study we want to assess if perceived change-oriented leadership behavior, prior to a relocation to an ABW, can explain employees' perceptions of productivity and quality at work after moving to an ABW.

Thus, the aim of this study is to examine the effects of moving from traditional offices (i.e., private, shared and open-plan offices) to an ABW on employees' perceptions of productivity in general (GP) and on perceived office support for their productivity (OSP) and quality of work (OSQ). A second aim is to assess if perceived change-oriented leadership behavior prior to the relocation moderates the effects of the relocation to an ABW on productivity outcomes (GP, OSP and OSQ).

2. Methods

2.1. Background

This study is part of an extensive intervention in a large Swedish government agency (the Swedish Transport Administration) implementing ABW. Four office sites at different geographical locations implemented ABWs (intervention group) and a fifth office site (control group) did not. Two offices were relocated to other buildings in a nearby area and two offices were renovated and re-designed as ABWs. Business areas within the agency e.g. planning, operation, maintenance, investment, main project, information and communication technology with a large extent of highly educated employees in the areas of e.g. engineering, economics, legal experts, project management, communication and human resource were represented in the offices and involved in the relocation. The ABWs in general contained web-meeting rooms, project rooms, single rooms for telephone calls, conversation rooms, meeting rooms, large open plan rooms, quiet rooms/zones and conference rooms (for more details see Haapakangas et al., 2018). The ABWs were designed and implemented by the organization without involvement of the research group. All participants signed an informed consent prior to participation. The study was approved by the Regional Ethical Review Board in Uppsala, Sweden (Dnr. 2015/118).

2.2. Study design and participants

Longitudinal data for this study were collected among the intervention control groups during the planning and implementation period of ABWs from May 2015 to January 2017. Data collection was conducted at three points: three months prior to relocation and three and twelve months after relocation. The baseline questionnaire was available for between five and ten weeks for different offices, including three reminders. Follow up questionnaires were available for four weeks, all with three reminders one week apart. The study design, recruitment and methods have been previously described in more detail (Haapakangas et al., 2018b).

During May to Sept 2015 all eligible employees ($n = 863$) at the four intervention offices and the control office were approached with a web-based questionnaire prior to relocation. The response rate was 57% ($n = 493$) (Fig. 1).

Three months after relocation (Nov 2015–Apr, 2016), the first follow-up questionnaire (same as at baseline) was sent to those responding to the baseline questionnaire ($n = 471$), after excluding those on parental or sick leave by the time for this first follow-up. Response rate at the first follow-up was 78% ($n = 369$) of the employees that had responded at baseline, after drop-out due to non-responders and excluding those having prioritized seats, i.e. priority to specific seats that is otherwise available to everyone, at the ABW (Fig. 1).

Twelve months after relocation (Sep 2016–Jan 2017), the second follow-up questionnaire was sent to all eligible employees working at the ABW ($n = 708$). Response rate after additional drop-out due to non-responders and excluding those receiving prioritized seats was 49% ($n = 331$) (Fig. 1).

A total of 407 employees responded to the baseline questionnaire and at least one of the three and 12-months follow-up questionnaires and were included in this study. Respondents were excluded if they had only answered to the baseline questionnaire or the three or 12-month follow-up, received prioritized seats in the ABW, had not moved to ABW, were on sick leave or parental leave or knew in advance about a job change or retirement which would unable follow-up measurements during the study.

2.3. Questionnaire

Demographic factors in the questionnaire included age (years), gender (woman or man), the current office type defined as cell-office

(private room) or shared room (2–3 persons)/open-plan office (4–24 persons) and managerial position.

General productivity (GP) was measured using the question “What score would you give to your overall productivity over the past month”, which was rated using an 11-point scale (scale 0–10) ranging from “not at all productive” to “maximally productive” (19).

Employees’ perceptions on how well the office supports productivity (OSP) and quality (OSQ) of work were assessed using two questions, “To what extent would you say that the office design supports your ability to be productive at work?” and “To what extent would you say that the office design supports your ability to do your work with good quality?”. Both questions were rated using an 11-point scale (scale 0–10) ranging from “not at all” to “to a great extent”.

The perceived change-oriented leadership behavior dimension was measured with five items from Ekvall and Arvonen (1991; 1994). The items concerned the extent to which the manager encourages development, tests new work methods, communicates visions, discusses new ideas and propositions, and starts development projects. The items were rated on a 6-point scale (Candido et al., 2018; Appel-Meulenbroek et al., 2011; Rolfö, 2018; Haapakangas et al., 2018a; Hoendervanger et al., 2016; van der Voordt, 2004) from “do not agree” to “totally agree”. After a test showing high internal consistency of the items (Cronbach’s alpha 0.9) an index score was calculated as the mean of the five items.

2.4. Statistical analyses

Descriptive statistics on baseline data are presented as means and standard deviations (SD), frequencies and percentages. Differences in baseline data between the intervention and control groups were determined using *t*-test for continuous variables and Chi²-tests for proportions. Correlations between OSP and OSQ and between OSP, OSQ and GP were tested in intervention and control group with Person (2-tailed) and the values across the three measurement points were presented.

The effects of relocation on productivity outcomes (GP, OSP, OSQ) were determined using linear mixed models. Missing data were considered as missing at random. Participants with missing data at three or 12-months follow-up were included in the analyses. The models were constructed with *group* (two levels: intervention and control), *time* (three levels: baseline, three months follow-up and 12 months follow-up) and the interaction (*group* × *time*) as fixed factors, and subject and intercept were included as random effects.

Effects of perceived change-oriented leadership before relocation on productivity outcomes (GP, OSP, OSQ) after relocation were determined by adding leadership (three categories based on tertiles, low, medium and high) as a fixed effect to the models explained above. The moderation effect of leadership behavior was determined by the three-way interaction between *group*, *time* and *leadership* (*group* × *time* × *leadership*). Participants and intercept were treated as random effects in all models.

Models were adjusted for age, gender and baseline office type as basic covariates that may affect the associations. Effect estimates of the interaction were determined with 95% confidence intervals (CI). The level of statistical significance was set at 0.05.

Statistical analyses were conducted using IBM SPSS Statistics 24 (Armonk, NY: IBM Corp).

3. Results

Descriptive baseline data for the intervention (relocation) and control groups are shown in Table 1. The groups did not differ significantly in age ($p = 0.30$) and gender ($p > 0.5$) and both groups included slightly more men than women (Table 1). Before the relocation, most participants worked in cell-offices in both intervention and control groups with a slightly higher proportion of cell-offices in the control group ($p = 0.02$). Open-plan offices were more common in the intervention group.

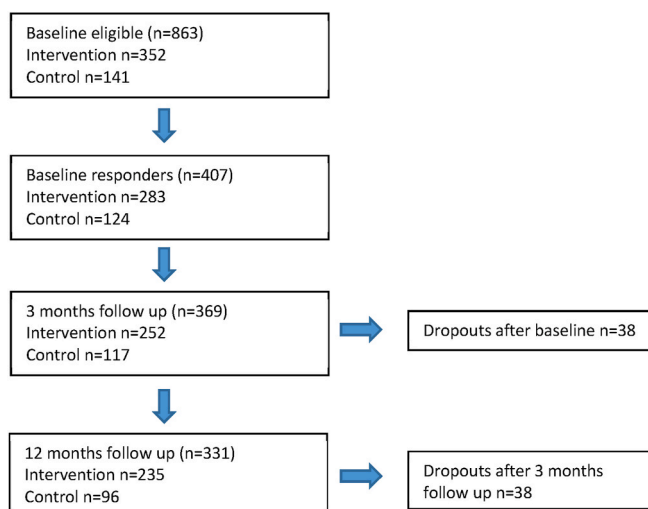


Fig. 1. Questionnaire response rates and dropouts for intervention and control groups at baseline, three and 12 months follow up.

Table 1

Descriptive data for the intervention (n=283) and control group (n=124) at baseline before relocation to activity-based workplaces.

Variables	Intervention		Control	
	n (%)	Mean (SD)	n (%)	Mean (SD)
Women	120 (42)		53 (43)	
Men	163 (58)		71 (57)	
Manager position	48 (17)		17 (14)	
Cell office	167 (59)		87 (70)	
Shared room/open-plan office	116 (41)		37 (30)	
Age		47.5 (9.5)		48.5 (8.6)
Change-oriented leadership ^a		4.29 (1.11)		4.12 (1.14)
Change-oriented leadership - high	99 (35)	5.41 (0.36)	34 (27)	5.36 (0.34)
Change-oriented leadership - medium	84 (30)	4.45 (0.27)	50 (40)	4.31 (0.30)
Change-oriented leadership - low	100 (35)	3.06 (0.74)	40 (32)	2.82 (0.86)
Productivity outcomes^b				
General productivity (GP)		7.79 (1.81)		7.74 (1.62)
Office supports productivity (OSP)		7.20 (2.80)		7.44 (2.39)
Office supports quality of work (OSQ)		7.31 (2.76)		7.90 (2.26)

^a Measured on a 6-point scale (1–6).

^b Measured on an 11-point scale (0–10).

Table 2

Effect estimates of relocation to activity-based workplaces on general productivity (GP), perceived office support on productivity (OSP) and office support on quality (OSQ) at three and 12 months follow up. Estimates (B) indicate the change from baseline in the intervention group compared with the control group (no relocation).

	Unadjusted B (95% CI)	Adjusted B (95% CI)
General productivity^a		
Intercept	7.74 (7.39–8.09)*	8.93 (7.57–10.30)*
Follow up 3 months	–1.68 (–2.15 to –1.20)*	–1.85 (–2.31 to –1.39)*
Follow up 12 months	–1.31 (–1.85 to –0.77)*	–1.46 (–1.20 to –0.93)*
Office supports productivity^a		
Intercept	7.44 (6.95–7.94)*	10.38 (8.51–12.24)*
Follow up 3 months	–3.04 (–3.76 to –2.32)*	–3.43 (–4.16 to –2.71)*
Follow up 12 months	–3.3 (–4.19 to –2.48)*	–3.73 (–4.49 to –2.98)*
Office supports quality^a		
Intercept	7.90 (7.41–8.39)*	10.81 (8.97–12.65)*
Follow up 3 months	–2.75 (–3.43 to –2.07)*	–3.13 (–3.82 to –2.44)*
Follow up 12 months	–2.83 (–3.65 to –2.01)*	–2.87 (–3.69 to –2.05)*

* $p < 0.001$.

^a Measured on an 11-point scale (0–10). Adjusted for age, sex and office type at baseline.

The level of change-oriented leadership at baseline was high on average and did not differ between intervention and control groups ($p = 0.10$). Change-oriented leadership did not change over time ($p > 0.05$), and

this did not differ between intervention and control groups ($p > 0.05$).

Both the intervention and control groups rated reasonably high levels of perceived productivity (GP, OSP and OSQ) at baseline, with a significant difference between the groups in OSQ ($p = 0.04$) (Table 1). The correlations between OSP and OSQ were $r = 0.85$ – 0.88 in the intervention group and $r = 0.88$ in the control group across the three measurement points (all p values < 0.001). The corresponding correlations between these outcomes and GP were $r = 0.54$ – 0.61 in the intervention group and $r = 0.49$ – 0.69 in the control group (all p values < 0.001).

3.1. Effects of relocation to ABWs on perceived productivity and work quality

The effect estimates (group \times time interaction) of relocation to the ABW on productivity outcomes are shown in Table 2. The intervention group showed significantly (all $p < 0.001$) reduced ratings of GP, OSP, and OSQ after moving to ABW compared with the control group. At the three-month follow-up, GP was reduced by 1.7 units, OSP by 3.0 units, and OSQ by 2.7 units in the intervention group (all scales 0–10). The size and statistical significance of these effects did not change to any marked extent at the 12-month follow-up. Adjusting for age, gender and office increased the negative effects somewhat (Table 2). At both three and 12 months, the effect sizes were larger for perceived OSP and OSQ compared with GP.

3.2. Moderation by change-oriented leadership

The effects of relocation to the ABW on perceived productivity were moderated by the level of change-oriented leadership perceived at baseline (Figs. 2–4), as indicated by statistically significant three-way interactions (group \times time \times leadership) on GP ($p = 0.038$), OSP ($p = 0.028$) and OSQ ($p = 0.028$). The intervention effects stratified by levels of change-oriented leadership (low, medium and high) are shown in Table 3. Those perceiving high change-oriented leadership at baseline showed smaller reductions in all productivity outcomes three and 12 months after the relocation, compared with employees perceiving low change-oriented leadership at baseline. In fact, the decrease in GP was statistically non-significant ($p > 0.05$) among those perceiving high levels of change-oriented leadership at both follow-ups. This indicates that given a high level of change-oriented leadership, there may be no effects on GP one year after relocation to ABW.

4. Discussion

In this study we examined perceived productivity among office employees before and after relocating from traditional offices to ABWs. We also examined whether the level of change-oriented leadership behavior, perceived by the employees before the relocation, affected their productivity three and 12-months after the relocation. We found a decrease in all productivity measures among employees who moved to ABWs compared with a control group from the same organization. This decrease in productivity was moderated by perceived leadership. The perception of high change-oriented leadership behavior prior to the relocation was associated with a smaller, or even no, reduction in perceived productivity at three- and 12-months follow-ups, depending on the productivity measure.

4.1. Effects on perceived productivity

Our main finding is that perceived productivity was significantly decreased three months after moving to an ABW and remained so at the 12-month follow-up, compared to the control group who did not move. Earlier findings on the effects of implementing an ABW on perceived productivity have been inconsistent and seem to depend on the preceding office type (van der Voordt, 2004; Arundell et al., 2018; Meijer

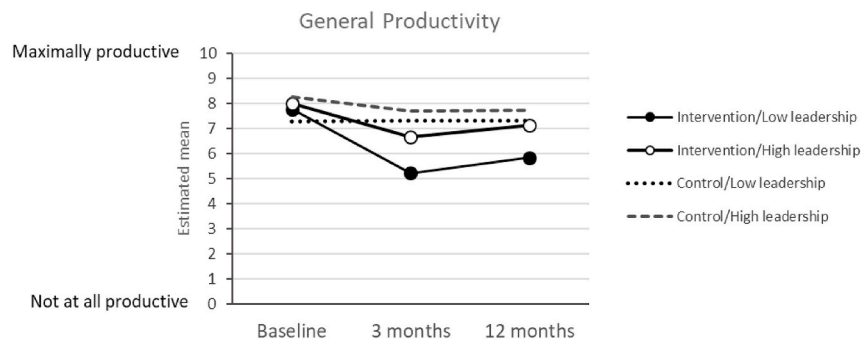


Fig. 2. Estimated means for perceived general productivity (GP) at baseline, 3 and 12-months follow-up for intervention and control groups according to high and low change oriented leadership.

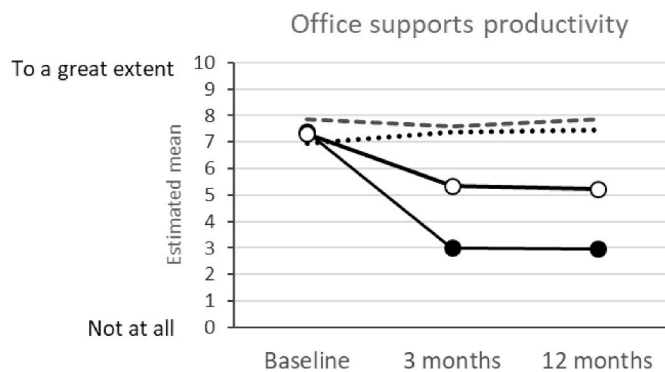


Fig. 3. Estimated means for perceived office support on productivity (OSP) at baseline, 3 and 12-months follow-up for intervention and control groups according to high and low change oriented leadership.

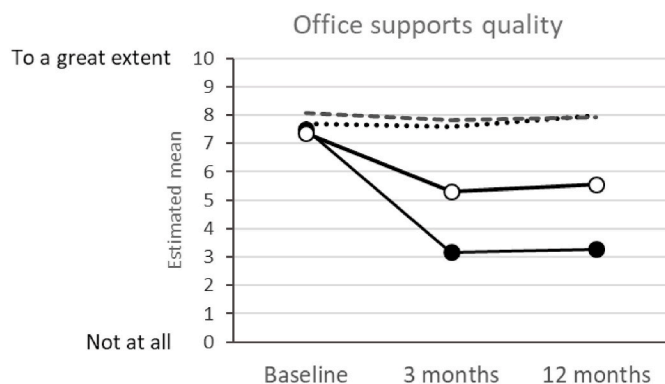


Fig. 4. Estimated means for perceived office support on quality (OSQ) at baseline, 3 and 12-months follow-up for intervention and control groups according to high and low change oriented leadership.

Table 3

Effects of relocation to activity-based workplaces on perceived productivity, stratified by the level of change-oriented leadership behavior (low, medium and high) perceived at baseline. Estimates (B) indicate the change from baseline in the intervention group compared with the control group (no relocation).

	Change-oriented leadership		
	High B (95% CI)	Medium B (95% CI)	Low B (95% CI)
General productivity^a			
Intercept	7.57 (5.85–9.30)**	7.28 (5.36–9.21)**	8.83 (6.90–10.77)**
Follow up 3 months	–0.75 (–1.56–0.06)	–1.61 (–2.43 to –0.79)**	–2.46 (–3.32 to –1.60)**
Follow up 12 months	–0.38 (–1.36–0.61)	–1.55 (–2.48 to –0.63)**	–1.96 (–2.92 to –1.01)**
Office supports productivity^a			
Intercept	8.32 (6.09–10.56)**	8.27 (5.78–10.77)**	9.99 (7.65–12.34)**
Follow up 3 months	–1.58 (–3.01 to –0.15)*	–3.04 (–4.32 to –1.76)**	–4.35 (–5.60 to –3.10)**
Follow up 12 months	–2.03 (–3.52 to –0.53)**	–3.47 (–4.81 to –2.12)**	–4.72 (–6.03 to –3.41)**
Office supports quality^a			
Intercept	8.58 (6.24–10.92)**	7.78 (.22–10.33)**	9.85 (7.52–12.20)**
Follow up 3 months	–1.62 (–3.05 to –0.20)*	–2.60 (–3.81 to –1.39)**	–3.88 (–5.03 to –2.72)**
Follow up 12 months	–1.53 (–3.02 to –0.04)*	–2.87 (–4.14 to –1.59)**	–4.36 (–5.57 to –3.15)**

* $p < 0.05$.

** $p < 0.01$.

^a Measured on an 11-point scale (0–). Model adjusted for age, sex and office type.

et al., 2009; Foley et al., 2016). Distractions and decreased privacy may particularly affect the productivity of such employees at the ABW (Haapakangas et al., 2018b; Bodin Danielsson and Bodin, 2009; Candido et al., 2016) while regular workspace switching may also increase unproductive working time (van der Voordt, 2004; Haapakangas et al., 2018b; Kim et al., 2016). As employees from cell offices seem more likely to be negatively affected by such an environmental change (van der Voordt, 2004; Berthelsen et al., 2018), the large proportion of employees moving from cell offices (59%) could have explained the observed decrease in perceived productivity in our study. However, as our results did not change after adjusting for office type, the baseline office type does not appear to completely explain the effects of relocation to ABW on productivity in this population.

There is little previous research on the time patterns of the effects of ABWs as the follow-up periods have not usually extended to even one year and few studies have included more than one follow-up. In our study, the sizes of the estimates suggest that, for perceived productivity in general, there may have been a tendency for the negative productivity effects to decrease over time even though productivity still remained below baseline one year after the relocation (Table 2). Only Meijer et al. (2009) have used a longer follow-up time of 15 months, showing a tendency for the negative short-term reactions to dissipate during a longer follow-up period. However, the negative effects seemed to increase over time for perceived office support for productivity in our study (OSP, Table 2). The effect of time on productivity outcomes is not straightforward and further research with longer follow-up times is needed.

Furthermore, our study appears to be the first to include both a general measure of perceived productivity (GP) and measures of

perceived office support for productivity (OSP) and quality of work (OSQ). The latter two outcomes showed an even higher drop in productivity and quality than GP after the implementation of the ABW. These results fit well with the existing literature where measures of perceived office support on productivity have yielded greater differences between ABWs and other office types (van der Voordt, 2004; Kim et al., 2016; De Been and Beijer, 2014) than general measures of productivity (Arundell et al., 2018; Meijer et al., 2009; Foley et al., 2016). The observed correlations between these productivity and quality measures show that the self-estimated effects of the office design on one's productivity (i.e., OSP and OSQ) represent a different construct than perceived productivity in general (GP). These constructs are, however, partly overlapping as OSP and OSQ explain 24–48% of variance in GP. As GP is determined, possibly primarily, by other factors than the physical work environment (e.g., leadership, reward system, individual's skills, motivation, and health), it is logically less affected by changes in the physical work environment than productivity and quality measures that specifically address the perceived relation between the office environment and one's productivity and quality (OSP and OSQ). Our results suggest that office design has implications on employees' perceived productivity but that measures of perceived office support for productivity should not be interpreted as indicators of general productivity effects in this research field.

4.2. Importance of change-oriented leadership

We assumed that change-oriented leadership behavior, perceived prior to moving, would be important for perceived productivity at the ABW and for the adoption to the activity-based working, through its effects on the implementation process and readiness of change (Neves, 2009; Smith, 2005) among employees. The observation that the decrease in productivity was moderated by perceived leadership behavior support our assumption. The decrease in perceived office support for productivity and quality (OSP and OSQ) was approximately three units smaller among employees perceiving high change-oriented leadership behavior before moving, suggesting a substantial difference compared to employees perceiving low change-oriented leadership (Table 3). Importantly, perceived productivity in general (GP) did not decrease among the employees perceiving high change-oriented leadership, and the negative effects on perceived office support for quality (OSQ) were also attenuated at the 12-month follow-up, possibly due to more effective adoption to activity-based working facilitated by high change-oriented leadership.

Our results are also supported by research concerning implementation of organisational changes which assign that involvement and support from managers, during implementation, play an important role for employees' perception of a new intervention (Nielsen and Randall, 2009; Murta et al., 2007). Besides, there is strong support in the literature for managers to enhance employee performance by different behaviors relevant for the situation, e.g. change-oriented leadership behavior prior to organisational and behavioral changes (Yukl, 2012; Larsson and Vinberg, 2010). However, it is unclear to what extent the first line managers were involved in the planning and implementation process of this organisational change. Differences in how managers advocate the new ABW concept, support and prepare employees for the change, may depend on managers' level of a change-oriented leadership which, in turn, might have an impact on employees' perception of how well the office supports productivity in our study. Further, the need for this relocation to ABW was communicated from the top management and may not have affected enough employees to perceive or accept the need for change which is an important first step in organisational changes (Smith, 2005). Another key to prepare employees for change, prior to adopt changes, is to help them to see their role in new ways of doing things, to build confidence and commitment underway (Neves, 2009; Smith, 2005; Madsen et al., 2005). This requires managers to pay attention to the need to create readiness for change, time and effort for

activities underway (Smith, 2005). Accordingly, our results are in line with Brunia et al. (2016) who showed that the leadership style and employee satisfaction with the implementation process are associated with the perception of the ABW. Therefore, we advocate a carefully planned implementation process when implementing ABWs and an activity-based way of working, to prevent potential negative effects on employee productivity. Thus, as a practical implication our results can be included in programs aiming to prepare managers to promote implementation of ABWs.

4.3. Strength and limitations

Our study is unique in including both a comparable control group from the same organization and two follow-ups of the effects of the relocation. The information gained from the use of two types of productivity measures contributes to the use and interpretation of productivity measures in this research field. Few studies have previously addressed the role of perceived leadership behaviors on employee outcomes in ABWs and they have only been based on cross-sectional data (Wohlers and Hertel, 2017; Brunia et al., 2016; Bodin Danielsson et al., 2013). To the best of our knowledge, our study is the first to have investigated and demonstrated moderating effects of perceived leadership behavior (at baseline) on employee outcomes after the relocation to an ABW.

While the inclusion of a control group enabled possible contextual factors to be under control, the results should be carefully generalized to other conditions as the study is restricted to only one large Swedish organization. In addition, the results may not generalize beyond a one-year period after the relocation. Longer longitudinal studies would be needed to investigate whether the observed effects are permanent and if additional time is needed for employees to adopt to the new ABW office design and work strategies.

Measuring perceived productivity is common (Drucker, 1999; Feige et al., 2013; Haynes, 2008) due to the difficulties of measuring productivity objectively in knowledge work. However, the development of objective ways to measure productivity is needed to strengthen this research area as well as the results from this study.

5. Conclusions

Our results showed that relocating to ABW significantly decreased employees perceived productivity. The decrease remained at three and 12 months follow-up with a larger negative impact (i.e. effect sizes) on the measures for how much the office support productivity (OSP) and quality (OSQ), compared to perceived productivity in general (GP). A higher level of a change-oriented leadership before relocation showed a less decrease in productivity and no effects were found on GP one year after relocation. These findings point out that organisations planning for ABWs need to consider a potential drop in performance when estimating cost savings. Further, our results show the importance of a change-oriented leadership during the implementation process to prevent this productivity loss related to a relocation from traditional offices to ABWs. By showing that a change-oriented leadership has an impact on productivity outcomes after the implementation of ABW, our study highlights the importance of the leadership behavior when implementing organisational changes such as an ABW. Our study also points to an urgent need for better knowledge about other factors than for e.g. the leadership, that influence the implementation process of ABW.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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