An end user’s perspective on activity-based office concepts

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An end user’s perspective on activity-based office concepts

By: Rianne Appel-Meulenbroek*, Peter Groenen and Ingrid Janssen

Abstract
The modern office (design) serves a different function as twenty years ago. Not only does it reflect current social values but it also has evolved to accompany organizational changes and support New Ways of Working. This so-called activity-based office concept is set to increase productivity through the stimulation of interaction and communication while retaining employee satisfaction and reducing the accommodation costs. Although some research has gone into understanding the former, there is still a need for sound data on the relationship between office design and productivity. For this reason, an evaluative study on the effectiveness of activity-based office concepts was carried out to gain more insight in their use. The research methods consisted of a wide research of relevant literature on workplace design, both from environmental psychological and economical perspective, coupled with the collection and analysis of empirical data. The latter is based on both an observation and a survey of 182 end users from four different service organizations in the Netherlands, using questionnaires. The findings from these case studies underline some known benefits and disadvantages of activity-based office concepts. They provide insight in the importance of several physical, social and mental aspects of the office environment in employee choice behavior. The data from this research may be used by Corporate Real Estate Management (CREM) to support future decision making on accommodation policy.

Keywords: office users, CREM, activity-based office concept, observation, questionnaire

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Introduction

Office accommodation is a costly resource, often the second largest behind labor cost (Pole and Mackay, 2009). Although the main goal for corporate real estate might always be to limit these costs, the focus appears to be moving towards a cost/benefit ratio (Jensen, 2009; Pullen, Van der voordt and Hanekamp, 2009; Nenonen, 2005). So both efficiency and effectiveness of the accommodation are becoming part of the attention of corporate real estate managers (CREM). Van Ree (2002) describes how accommodation can add value to all 5 performance criteria of an organization, also relating it to productivity, flexibility and creativity (see Figure 1). He states that “Accommodation can have a positive impact on all five performance criteria, especially by influencing the production factor ‘people’” (Van Ree, 2002). The 5 performance criteria of an organization are highly interlinked; e.g. productivity relates effectiveness to efficiency, and flexibility is ‘built in’ productivity for the future, but supporting productivity appears more wise for an organization than cost reductions.

<table>
<thead>
<tr>
<th>Effective accommodation</th>
<th>Efficient accommodation</th>
<th>Productive accommodation</th>
<th>Flexible accommodation</th>
<th>Creative accommodation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing a varying working environment to support various tasks and activities.</td>
<td>Paying attention to a favorable gross/net ratio within an office building.</td>
<td>Look for possibilities to apply both approaches above at the same time equally</td>
<td>Realize possibilities for expanding or downsizing</td>
<td>Pay attention to interior design</td>
</tr>
<tr>
<td>Including areas in the office layout, which stimulate interaction (e.g. oversized circulation spaces with an open character).</td>
<td>Trying to reduce churn cost by providing uniform workplaces in a varying working environment.</td>
<td>Find the right balance through cost-benefit calculations</td>
<td>Look for possibilities for space dividing, assigning and rearranging</td>
<td>Pay attention to furnishing, dressing and color</td>
</tr>
<tr>
<td>Using supporting elements like meeting spaces, project rooms, libraries, and videoconference rooms.</td>
<td>Reducing the amount of space per person</td>
<td></td>
<td>Provide uniformity of furniture and communication tools</td>
<td></td>
</tr>
<tr>
<td>Providing informal spaces like coffee corners and casual meeting spaces.</td>
<td>Reducing the number of workspaces</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Office innovations have produced the so-called activity-based workplace to support the productivity of present-day knowledge workers who mostly populate offices. During the 1980s, the foundation for this concept came into being, called the CoCon-office (COMmunication and CONcentration). In the CoCon office people could use different types of office settings for different types of activities, but did have their own workplace as an operating base. In the ‘90s, the low occupancy rate of these types of offices brought about the sharing of office workplaces. Wireless technologies increasingly made working time and place independent, thus supporting this trend. People could choose the right type of workplace for their work and even change several times a day, when they started up a different activity. Because the workplaces are shared by everybody, there is a loss of possibilities for personification of the workplace (Becker, Sims and Davis, 1991).
This paper describes part of the influence of accommodation on people. We take a look at the effectiveness of activity-based office concepts by studying their use and the users’ preferences. The next section shortly describes the literature on human behavior in office environments, trying to identify the activities that employees have to perform. After that the research setup is discussed, followed by the results of our fieldwork. The paper ends with conclusions and recommendations for further research.

Human behavior in the office
Tabak (2009) tried to make a taxonomy of activities of office workers. He distinguished 3 different ways to differentiate activities:

1. Nature of the activity → social, physiological or job related;
2. Individual or group activities;
3. Planned or unplanned activities.

Applied to typical office activities, this could lead to the matrix of activities in Figure 2.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Social</th>
<th>Physiological</th>
<th>Job related</th>
<th>Individual</th>
<th>Group</th>
<th>Planned</th>
<th>Unplanned</th>
</tr>
</thead>
<tbody>
<tr>
<td>behind the computer</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>writing</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>reading</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>on the phone</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>archiving</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>in a meeting</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>informal talk</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>presenting</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>lunch</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>toilet visit</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>coffee break</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>other break</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Figure 2 Activities of office workers (adapted from Tabak, 2009)

As Tabak indicates, activities can also differ from each other because of attributes like duration, frequency and importance. Depending on the activity a certain workstation is necessary with certain/specific facilities. But it is not only the activity at hand that makes a person select a certain workplace. In the field of environmental psychology, the behavior of humans in their work environment is studied in much more depth. Within the current knowledge economy this field is gaining more and more interest, because employees have become the most important company resource for many organizations. Therefore, CREM has to balance the organizational interests (productivity through effectiveness and efficiency) with the interests of the employee (physical and mental well-being). History has produced several theories on how to increase employee productivity based on their interests (Sundstrom and Sundstrom, 1986; Van der Voordt and Van Meel, 2002) e.g.:

- the scientific-management theory of Taylor from the 1920’s, saying that productivity is mainly increased by financial stimuli;
- the human-relations approach that rose as a reaction to Taylorism, saying that not only economic reasons but also the need for social interaction is why people work;
- the human-resources approach, saying that people work to gain personal growth and development.
Most CRE managers try to support all these human interests with the work environment. Therefore, below we discuss all the aspects that should be taken into account.

First of all, the design of the layout receives a lot of attention. The relative location of a workplace could have a lot of impact on the activities that could be performed there. One could think of things like being close to team-/project partners, friends or all kind of facilities. And also aspects like having a view outside and the number of passers-by can influence a person. With the increasing amount of work done on computers, ICT-facilities on a certain location are also very important.

Next, a lot of attention (especially through laws and regulations) goes to the ergonomics of the workplace. The upcoming computer-related diseases (grouped under the name Repetitive Strain Injury) have moved the focus from lifting weights and other heavy work to office work. Also the comfort of the workplace and the personal control of the indoor climate have been shown to influence sick days. The need for personal control over the environment differs, and especially the perceived control has an important effect on behavior (Lee and Brand, 2005). Lately, the use of colors and materials has also been proven to have an effect on humans. It can be inspiring (for the human-resources approach), but it can also be a distraction.

The influence of the environment on human behavior is more complex than just ergonomics, facilities and layout design, because many psychological mechanisms take place. Van der Voordt and Van Meel (2002) discuss two of these mechanisms: privacy and interaction needs (the human-relations approach). Interaction is a very important activity these days. As Raymond and Cunliffe (1997) state, “communication is the activity that links all other ones”. Especially informal interaction has been shown to transfer a lot of knowledge and information (Brill and Weidemann, 2001). The acceptable amount of stimuli to execute a task at an optimum productivity level depends on both the complexity of the task at hand and on the personal aspects (Yerkes-Dodson law). Also, some people need more personal space and show more territoriality then others. Van der Voordt and Van Meel (2002) distinguish 4 relevant types of privacy: visual, auditive, territorial and informative (control which information about oneself is seen by others). Besides privacy issues, Barker’s behavior setting theory (Barker, 1968) indicates that office culture makes that certain places are used in a certain way. This culture depends on the organization and can be very different for different types of office organizations. The interaction between employees also depends on this culture.

CREM has to balance all these (underlined) aspects and thus gather information on them. We have done so too in our fieldwork, which was set up with two underlying thoughts. First, of course, we try to further scientific research on this subject. And second, we hope to advance applications of this office concept in practice. Up till now the introduction is slow, because it usually starts with a standardized pilot-study for a small portion of the employees. Since each organization is unique, it takes a lot of time to adjust the concept appropriately. More insight in how it this concept is used by individuals, might shorten the implementation period in the future.

**Research setup**
In august 2009, 4 different office organizations with activity-based workplaces were studied. The employees using these workplaces were asked to fill in a questionnaire (to ask about the
use) and their use of the different types of workplaces was observed. These cases were 2 municipalities, a housing association and an energy and petrochemical multinational.

<table>
<thead>
<tr>
<th>4 case studies</th>
<th>Workplaces observed</th>
<th>Questionnaires</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population</td>
<td>Respondents</td>
</tr>
<tr>
<td>Municipality D</td>
<td>25</td>
<td>28</td>
</tr>
<tr>
<td>Municipality M</td>
<td>(642*)</td>
<td>289</td>
</tr>
<tr>
<td>Housing association</td>
<td>85</td>
<td>76</td>
</tr>
<tr>
<td>Multinational</td>
<td>45</td>
<td>41</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>154</td>
<td>182</td>
</tr>
</tbody>
</table>

*Observation results were obtained in January 2009 by the designer of the office concept. Due to the recent study, no new observations were allowed.

At the time of writing this paper, the research was still in progress. Therefore only the observations of the housing association are discussed here. First results of the questionnaire analyses will be discussed for all 182 respondents of the 4 cases.

Due to the observation method, the list of office activities mentioned in the previous section has been adapted a little. When the workplace was empty, a distinction is made between absence of a person and absence but with a visible use by someone through the presence of a coat, bag or personal documents. Also working behind the computer has been subdivided further when possible. The different physiological activities have not been observed due to their personal nature and/or the fact that they might not take place at the workplace. For all interactions, the number of people involved was noted. Because the (in-)formal meetings could not be disturbed, it is difficult to know their exact nature without access to MS Outlook agenda, e.g. whether they are planned or spontaneous. Therefore ‘presenting’ was not used as a separate category. This led to the following list of activities distinguished during the observation:

1. absent
2. absent but visibly in use
3. behind the computer
   a. MS Office programs in use
   b. MS Outlook programs in use
   c. Internet and search for information
   d. other
4. reading, writing
5. on the phone
6. archiving and other paperwork / Paper handling
7. informal talk
8. formal work consult
9. pausing at the workplace

The observed employees of the Housing Association belong to 4 departments and use the ground and 1st floor of 1 building. Both floors contain all distinguished types of workplaces (see table on next page). All the lockers/mail boxes are on the 1st floor. The large meeting rooms and the lunch area are on the ground floor. From the 24th till the 28th of August 2009, 10 rounds per day were made (each hour, between 8am and 5 pm) to see what was happening at these workstations. The next section presents the results so far.
<table>
<thead>
<tr>
<th>Workplaces</th>
<th>Ground floor</th>
<th>1st floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration wp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cockpit</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Library (= 6 wp)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Semi-open wp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single lounge</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Coupé workplace</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Duo lounge (1 duo lounge = 2 wp)</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Open wp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production table (6 wp)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Open workplace</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>(closed) Meeting facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team- / meetingspace (4 - 6 persons)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Meeting room (10 – 12 – 14 persons)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Other facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main table / Large ‘dining’ table</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pantry or kitchen</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lunch area</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total workplaces</strong></td>
<td><strong>31</strong></td>
<td><strong>54</strong></td>
</tr>
</tbody>
</table>

### Results

In an average week, the respondents spent most of their working time in the office. Each day between 74-94% of the respondents is present, with an average of 86%. The questionnaire contained several questions to see whether the goals of an activity-based workplace are reached and how this activity-setting is used. About 60% of the respondents feel that there is a suitable workplace for each activity, but the balance between individual and team workplaces is off (according to 48%). When asked how many different types of workplaces are used during an average week, 19% only uses 1 type, 37% uses 2 different types, 32% uses 3 different types and 12% more than 3 types. This does not seem to match the idea of an activity-based office concept. And although 42% mention that workplace aspects (e.g. comfort, ergonomics, ambiance) can cause a change of workplace when a workplace becomes available, which is more suitable to the functional and personal needs at that time, 68% never changes workplace during an average day, and another 14% only changes once. With regard to claiming behavior of the non-personal workplaces, 28% says they still claim a workplace by using personal stuff and 35% indicates avoiding certain workplaces because another person usually sits there. Only 8% said to regularly choose a different workplace with the purpose to get to know more colleagues better.
We asked them to rank 5 aspects on influencing their choice for a workplace most, with the following result (n=170, average score from 1-5):

1. Ergonomics (2.26)
2. Comfort (2.35)
3. Ambiance (2.81)
4. Use of materials (3.61)
5. Use of colors (3.96)

Further questions on ergonomics show that 82% finds ergonomics in general important and says to change a workplace to his/her personal settings before starting to work.

With regard to visual privacy, more than half (54%) did not feel that their workplace was too much in sight of others, and 44% said to be easily distracted when you see things happening around you. Some (34%) choose their workplace purposely for having direct eye contact with colleagues, but also some (28%) purposely avoid it (the rest is neutral). In the open workspace of the office, 63% feel comfortable enough to hold a confidential talk or discussion. This is surprising when you see that 55% says to be distracted often by conversations of others, while only 34% is distracted by other sounds (doors, copiers, etc.). Only 30% find it a discomfort when others can see on their screen what they are doing, but 59% does want the possibility to shield of the screen when needed.

According to 54% of the respondents, the different types of workplaces provide the opportunity to regulate the amount of social interaction with others. But, on busy days 62% indicates to work at home to achieve better productivity. Exactly half of the respondents intentionally come to the office to keep in touch with colleagues, and 59% tries to have lunch together. Also 59% purposely walks over to a (non-visible) colleague for an informal talk. People say that they only choose a concentration workplace when it is absolutely necessary for the activities planned (67%), but 57% does choose a workplace with as many visual privacy as possible. Only 25% chooses a workplace so that it is easy for others to pull up a chair.

We also asked the respondents to rank aspects of a preferred relative location of the workplace (n=172, average score from 1-7):

1. Near team-/project partners (2.70)
2. Workplace known to others (3.64)
3. Unobstructed view outside (3.78)
4. Near support facilities (3.88)
5. Near friends (4.00)
6. Number of people passing by (4.58)
7. Near meeting facilities (5.41)

Last, we asked them to rank all the different aspects from the literature section, plus ‘dimensions of the working surface’, because in this case it varied a lot. They were asked which aspects most positively influence their choice for a certain workplace (n=168) and constructed the following list (average score from 1-9):

1. Ergonomics (3.66)
2. Quality of ICT facilities (4.05)
3. Comfort (4.23)
4. Control of privacy and social interaction (4.29)
5. Dimensions working surface (5.04)
6. Relative location of the workplace (5.27)
7. Ambiance (5.49)
8. Control of indoor climate (5.54)
9. Use of colors and materials (7.43)
The questionnaires also contained organization specific questions about the present types of workplaces. Those results are discussed next for the observed housing association, intertwined with the observation data. On average more than 55% of the time the workplaces were not in use (see Figure 3). Though it is normal that activity-based workplaces are not used 100% of the time, this percentage is extremely low because of the summer period. The advantage of using this period to do the observation rounds, is that people can express their actual preference. In normal times they might prefer other workplaces with different attributes, but more often run into a shortage of capacity and have to evade to a next best option. Due to meetings and physiological activities the workplaces in use were still empty at the time of the round for 38% of the times. Main activities are working behind the computer (34%), informal talk (12%) and being on the phone (6%). Now we shortly discuss each type of workplace. Due to the small number of respondents in this case (38), we have not used percentages to display further results.

![Average activity 'when in use'](image)

*Figure 3 Activities at the housing association*
Concentration workplaces
The cockpit is a closed, individual workplace. It is meant for concentrated work and positively rated to support that (34/38 respondents). Besides working behind the computer and reading/writing, it also supports making phone calls (according to 31/38). Especially the offered visual/auditive privacy, the ICT facilities and the ergonomics of the cockpit are highly valued. Despite the ergonomics, many do not consider this type of workplace to offer comfort (28/38). Overall, it has the highest score for the list of positive aspects. The library is a concentration zone for 6 people with books and magazines. But the possibility to work in concentration is not valued by many (7/38). Only the ambiance (15/38) and the materials used (15/38) get some positive ratings. Observation showed it being used several times for a meeting, which is not its intended function. An explanation for this is not known, while the most positively valued aspects are not rated higher than for the meeting rooms.

Semi-open workplaces
The single (see picture) and duo lounge workplace consists of an active lounge chair integrated in a couch, with an adjustable table (in height and longitudinal direction). The chair can be adjusted ergonomically in many ways. Because of the integration in a couch, one or two employees can sit down with the user for a short period of time. The lounge workplaces have the highest score of all workplaces with regard to ambiance (27 = 20/38) and comfort (26 +23/38). The possibility to work in concentration at the single lounge is supported by a lot less people than for the cockpit (18/38 vs. 34/38), but much higher than for the other semi-open workplaces (coupé 9, duo lounge 6). Actually, from the 3 semi-open workplace types, the single lounge scores best on almost every aspect, which was visible in the observation too because they were used most. The duo-lounge places were not used much at all. An earlier evaluation (Veldhoen + Company, 2009) showed that the ergonomics are not so good, because the second person that arrives has to work on the table height set by the other user. The coupé only beats both lounge workplaces with better rated ICT-facilities. The half-length acoustic panels of the coupé do not increase the perceive visual or auditive privacy.

Open workplaces
As expected, privacy and concentration issues are the main reasons to avoid the open workplaces. The production table is valued less than the regular open workplaces on all stated aspects. It is a large table, without docking station or ICT-facilities, and cannot be adjusted ergonomically. Aspects that are all present in the regular open workplaces. Both production tables were in use only 30% of the observation times. The regular open workplaces are in use a lot, sometimes almost all of them. They are valued highest of all workplaces for their size of the working surface (24/38), and for ICT-facilities (26) and ergonomics (21) second and third behind the cockpit and (the ergonomics of) the single lounge. They are even valued higher to support working as a team than the team spaces (24/38 vs 23/38).
Meeting facilities
All team spaces were designed in consultation with the users and have received a unique ambiance through use of color and materials. One even has bean bags instead of chairs and another one wooden beach chairs. Although all meeting facilities were used very little due to the summer period, especially these 2 rooms were not used much or at all. The questionnaire does not show which aspects could be responsible for this. Apparently, users prefer more conventional designed and furnished meeting facilities.

Other facilities
The main / dining tables are close to both pantries (which includes a kitchen on the ground floor). As expected, these workplaces provide the best opportunity for informal talk. Their ambiance is highly valued (20/38). Due to the nice summer weather the lunch area was hardly used.

After the analysis of the data we have tried to set up a preliminary model that includes all relevant aspects in choosing a workplace in these types of offices (see Figure 4). As a start, the functional need for certain types of workplaces must be determined, based on the nature of the activities, and the (person/organization-dependent) need for privacy and interaction. Next, the preference for a certain type of workplace is influenced by the (person/organization-dependent) preference for certain aspects of the environment and relative locations. The actual use of a certain workplace is based on preference, availability and personal control.

![Figure 4 Preliminary model for choosing a workplace in an activity-based office concept](image-url)
Conclusions and recommendations
There are many things that a CRE manager has to think off when making accommodation decisions. The aspects mentioned in the preliminary model of this paper help with the evaluation of (the use of) the increasingly popular activity-based office concept. If the office concept is already in use, the combination of observation and questionnaires on these aspects can shed light on both the efficiency as the effectiveness of the different types of workplaces. That way a revised strategy could be formulated (if necessary) that helps in reaching organizational goals.

The case studied in depth in this paper showed, that the office concept is not always used as intended. People’s personal preferences seem to have a bigger effect on the use of certain types of workplaces than workplace facilities, although ergonomics and ICT-facilities are expected to be in order everywhere in compliance with Arbo-regulations. The differing need for privacy and interaction of employees makes it hard to design a general concept. In this paper, again, mixed results come forward on how to support these very personal needs (with many other influences). Even the choice for the relative location of a workplace depends on it. We also saw that too much ambiance in meeting spaces (also a trend these days) can cause a decreased use of these facilities. Special props might seem funny at the time of planning the room, but can turn out to be unpractical. Last, it was surprising to see that control of the indoor climate has less impact on the choice behavior as expected.

Obviously, this field of research still has many openings for further research. First of all, the type of study we did can be repeated in a more comprehensive way. Downfalls of our methods are that some activities are more frequent and/or last longer, and therefore have a bigger chance to be observed than others. Observation should be more intense, but without causing the Hawthorne-effect (influencing the observed too much). Modern technologies can make this possible, through registration of access, use of phones/computers, GPS tracking, etc, but come up against ethical issues and do comply with the thoughts behind the New Ways of Working. Besides intensity of observation, the period of observation is also relevant; especially for trustworthy data on efficiency of the workplace concept. With more sound data, a model like ours could be tested on actual causal relationships, which is absolutely necessary to build it further. That way it can be developed into a guide for CREM to deliver custom-made activity-based offices right away instead of starting with a general pilot-study.

References
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