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Research Article

Designing Workspaces For Success: A Refined Activity-Based Workspace Model for Boosting Employee Productivity

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Abstract

Activity-Based Workspace (ABW), offering diverse space options tailored to professional activities, is becoming the standard for companies seeking to enhance both employee productivity and space optimization. Despite growing adoption, challenges such as time lost in finding suitable workspaces, reduced privacy, and limited personalization raise concerns about whether ABW effectively balances employee well-being with spatial efficiency. One intrinsic constraint is the need to accommodate diverse job functions, each with distinct spatial requirements that do not necessarily align.

To address this, a data-driven decision-making model is introduced to facilitate ABW, evaluating the specific needs of different job categories within organizations. This study, conducted in collaboration with employees from Mantu, a global consulting company with 8,500 professionals in the service sector, proposes a cosine distance-based matching model to determine the optimal mix of workspace typologies. Four job category clusters—IT, Consultancy, Sales & Marketing, and Finance—are aligned with five workspace typologies classified by their degree of enclosure (open, closed, semi-closed) and suitability for individual or group work. Matching is guided by employee-voted criteria, including autonomy, collaboration, creativity, concentration, oral/visual privacy, and confidentiality. Findings indicate that IT and Finance require higher levels of autonomy, concentration, and privacy, leading to a greater need for closed individual workspaces. In contrast, Consultancy and Sales & Marketing maintain more balanced levels of these requirements, showing a stronger preference for semi-closed team spaces. The proposed model serves as a design tool to guide planners in creating efficient and inclusive workspaces.

Keywords: Activity-based workspace; decision-making; data mapping; workspace design tool

Highlights

- Open-space workstations are the least suitable for the activities carried out by knowledge workers.
- Semi-closed individual and group spaces are the most suitable workspace types for knowledge workers.
- Different job groups require distinct functional workspace, varying in terms of their distribution and allocation.

1 Introduction

In recent years, a growing number of organizations have begun rethinking their physical work environments and recognizing the value of activity-based workspace (ABW). This model, which originated in the 1970s by a Dutch engineer Erik Veldhoen, refers to office environments where individuals have the flexibility to choose their workspace from a variety of non-assigned areas based on the nature of the task or personal preferences. Unlike traditional offices, ABW do not assign desks; instead, individuals share various available workspaces, choosing the one that best suits each activity they undertake during their time in the office (Appel-Meulenbroek et al., 2011). Although activity-based work is becoming the "new normal" for companies, aiming to enhance both staff productivity and generate cost savings, this concept still encounters many failures in various contexts, often due to design errors, the inherent complexity of work, cultural barriers, and flawed implementation processes (Van Meel, 2020). Moreover, complaints about the time lost in finding a suitable workspace, reduced privacy, and difficulty of personalization put in question whether the ABW model truly balances employee well-being with space optimization. We argue that one of the intrinsic constraints in implementing ABW is that workplaces accommodate diverse job functions, each with distinct spatial requirements that do not necessarily align. To address this, this research introduces a data-driven decision-making model to facilitate the design of ABW, evaluating the specific needs of different job categories within organizations.

2 Existing Theories and Frameworks

The creation of ABW has been widely discussed in academic literature (Duffy & Powell, 1997; Appel-Meulenbroek et al., 2011; Hoendervanger, 2021; Van Meel, 2020, Engelen et al., 2019). In this context, various research axes have emerged. Numerous studies examine the effects of ABW on employee performance and satisfaction. For example, Palvalin (2024) compares different office types and shows that well-designed ABW spaces enhance productivity, although their effectiveness depends on employees' profiles and needs. Meanwhile, Wijk et al. (2023) report a decline in satisfaction after transitioning to an ABW environment among certain employee groups. Other studies highlight the influence of personal factors on ABW-related satisfaction. Halldorsson et al. (2024) indicate that employees' prior attitudes toward ABW strongly influence their perception of the new workspace. Haapakangas (2022), on the other hand, identifies factors such as age, gender, and hierarchical position as influencing the adoption of ABW spaces. Van den Berg et al. (2020) point out that educational level may be a more significant factor than age, gender, job rank, or working hours in how workers make use of ABW environments. Other studies break down the specific design characteristics of ABW and examine their direct and indirect impacts on employee satisfaction. Eiseman et al. (2021) develop the first space taxonomy of ABWs and analyze how different design parameters influence people's performance in ABWs, particularly in terms of communication, leadership, working styles, and overall work efficiency. Forooragh et al. (2023) explore the relationship between office design and employees' perceptions of privacy and social interactions. Stojanovic et al. (2024) examine how table shapes influence usage patterns, highlighting significant variations based on desk configuration. Van den Berg et al. (2020) identify the top three physical workspace factors—noise levels, degree of enclosure, and lighting—that most strongly influence employees when selecting a workspace for different tasks.

All these studies make it clear that ABW is not a one-size-fits-all solution for companies looking to implement it. It is a workspace design model deeply influenced by a company's values, employees' daily tasks, the roles they hold, and their behavioral patterns in how they use space. In fact, Skogland (2017) emphasizes the importance of understanding employees' work patterns, tasks, and preferences to design a workspace that is both flexible and customized to their needs. Given this, the Person-Environment Fit (P-E Fit) Theory has made significant contribution in multiple directions to the fundamental understanding of ABW design. The theory suggests that employees experience a higher perceived fit when their work settings align with their task requirements (Hoendervanger, 2021). This

perceived fit, in turn, contributes to improved work outcomes, including satisfaction with the work environment, performance, collaboration, job attitudes, and well-being (Gerdenitsch et al., 2017; Hoendervanger et al., 2019; Wohlers et al., 2017). The study emphasizes that there is an optimal match between environment and work activity, which improves outcomes in terms of employee productivity and satisfaction, and this match is highly influenced by job and task characteristics together with demographic behavioral, psychological needs. Although Hoendervanger (2021) states that job tasks are fundamental for a successful ABW design, the research does not provide any detailed analysis of job activities and their impact. Niekel et al. (2022) later build upon Hoendervanger's model and propose a taxonomy of knowledge workers' activities, in form of action verbs, to better understand activities that take place within offices. This seminal work aims to provide a framework that supports the design of ABW environments tailored to knowledge workers. However, while this taxonomy provides a useful starting point, it lacks the granularity needed to capture job-specific characteristics. As such, understanding work activities remains an intriguing area of research with the potential to significantly enhance the design and implementation of ABW.

2.1 Knowledge Gaps and Research Opportunities

An area that remains unexplored is how the design of ABW can vary in relation to different job sectors, particularly when considering the unique needs and characteristics of various job groups. Despite the substantial body of research on ABW, to the best of our knowledge, no research has explored on how ABW design might differ based on various job groups and their corresponding activities. Few studies exist in this direction that indicate it is a path worth exploring. Candido et al. (2021) reveal key differences in employee's satisfaction within ABW from five different industries in tertiary education, finance, property/asset management, construction and design/engineering. Infact, Budie et al. (2018) emphasize the need-based approach after examining employee satisfaction in different types of organizations, such as education, municipalities, and consultancy firms within Dutch organizations. They conclude that workspace use within ABW and employee satisfaction varies based on activities and personal preferences. Yet, today, the relationship between specific job profiles of knowledge workers and the design characteristics of ABW remains unexplored. Given that, there is no systematic methodology for designing ABW based on employee profiles, especially one that takes into account specific professional activities and links them to the design parameters of core functional workspaces. This research suggests that the optimal match between a job profile and workspace can be assessed by identifying a set of activities specific to each job group and criteria that are common across all job groups. To address this, a data-driven decision-making model is proposed, which evaluates the needs of different job groups and recommends the most suitable functional space mix for each. The model is tested and demonstrated on four knowledge worker job clusters: Sales & Marketing, Consultancy, Finance, and IT. The most adaptable workspace solutions for each job cluster are then proposed. The next section discusses the proposed model for matching job clusters with workspace solutions, utilizing multi-criteria analysis (MCA) in the context of ABW environments.

2.2 Proposed Conceptual Model: Activity - Space Match Model

To identify the needs of each job group and determine the most suitable functional space solutions, the research applies a specially designed MCA. This decision-support method allows for the assessment of multiple options by considering various criteria simultaneously. This is a scientific method that provides concrete support to decision-makers when they need to take multiple, often conflicting, objectives into account at the same time. For this research problem, MCA is used to rank the most and the least suitable workspace solutions for each specific job cluster. The analysis is conducted following these steps:

1. Define the job roles, clusters and map the corresponding activities: Construct a mapping of activities for each cluster.

2. Identify the criteria for the evaluation: Establish a list of relevant factors that will influence the decision.
3. Define the set of solutions: Draw the set of workspace solutions and evaluate them based on the defined criteria.
4. Score the criteria for the list of activities: Ask employees of the specific job cluster to assign a score to each activity for each criterion based on their daily and personal experience.
5. Construct the decision matrix and select the model: Choose the type of MCA calculation and build the matrix for running the model. This study suggests Cosine distance – based matching.
6. Classify the options and rank the closeness to the best match: Run the model and based on the distance scores, rank the solutions from closest to farthest match.
7. Convert distances to percentages: Assign percentages to each solution that can be used as index ratios for functional space distribution.

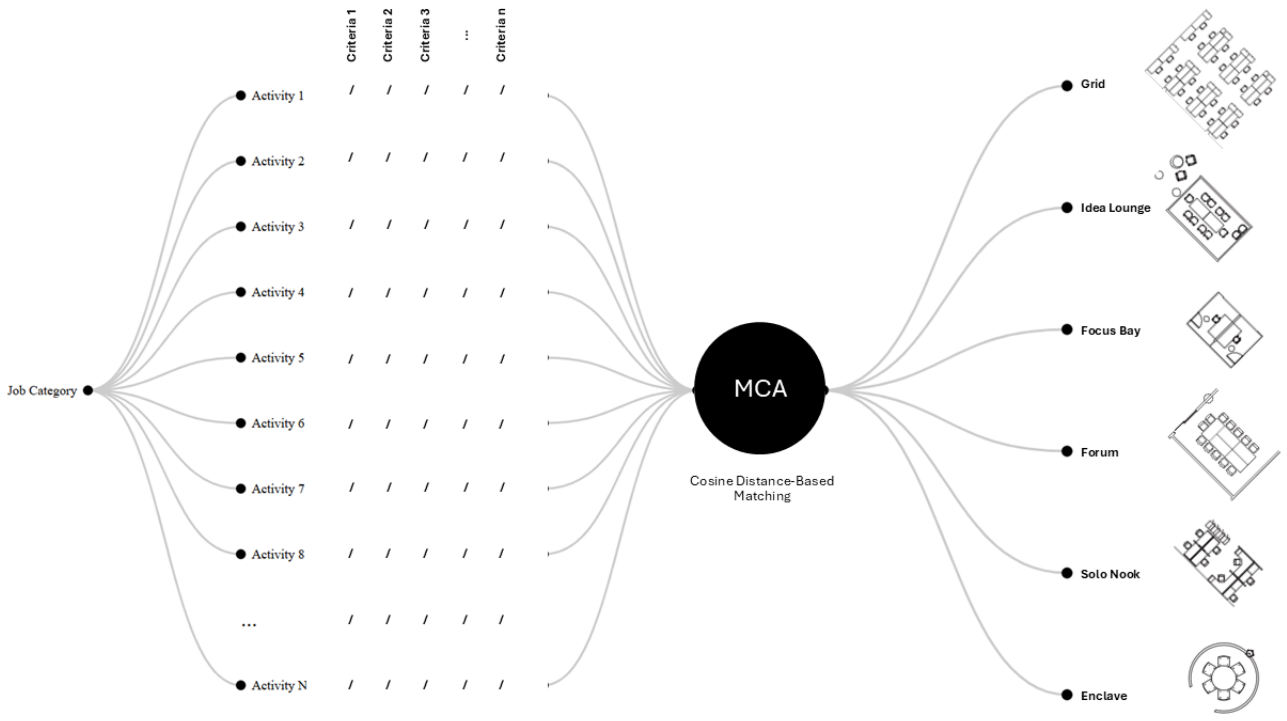


Figure 1. Conceptual model of the MCA applied for defining functional spaces of ABW.

3 Methodology

3.1 Mapping of activities

The model is tested on the employees and their respective work activities at Mantu which is a global consulting firm with 8,500 professionals in the service sector, making it a prime example of a knowledge-based organization. To build a comprehensive mapping of role-specific activities, data was first extracted from Mantu's internal functions management tool that outlines the organisational chart, job titles, and associated tasks. This HR-collected information served as the foundation for job clustering and activity mapping. After analysing the nature of each job title, a clustering was proposed based on functional similarities. In total, 760 distinct roles were identified and grouped into 13 job clusters. This paper presents only a sample of four job groups—Sales & Marketing (17 roles), Consultancy (5 roles), IT (27 roles), and Finance (34 roles)—representing 83 different job roles in total.

For the activity mapping, employees from each job group were instructed to review internal source materials alongside their own work experience. They were then asked to synthesize the information into a list of 10 to 15 specific work activities they regularly perform. To ensure accuracy and relevance, each list of activities was blind reviewed by three different individuals from the same job category as part of the validation process. This allows to construct a portfolio of activities that are executed by different type of workers as a common knowledge base (Figure 2). In total, 162 activities are mapped correspondingly 42 for Sales&Marketing, 19 for Consultancy, 57 for IT and 44 for finance. Activities are sorted from highly occurring tasks to rarely occurring ones and it formed the basis for the evaluation of the employees' needs.

Figure 2. Mapping of activities for 4 groups of workers in Mantu

3.2 Defining and assessing criteria

To select the evaluation criteria, a longitudinal study was conducted, covering research on workspace design and activity-based workspace models published between 1987 and 2024. Through a meta-analysis of these studies, key themes, emerging trends, and the most frequently cited factors influencing employee productivity were identified. The reviewed literature addressed various subjects, including comfort, ergonomics, privacy, and task-related needs. This analysis led to the identification of a set of recurring parameters that significantly impact employee productivity and need to be translated into actionable design considerations for workspace solutions. As a result, 8 specific criteria were defined, synthesizing the most prevalent concepts in ABW research. These criteria serve as the reference framework for the matching matrix. The predefined criteria are as follows:

- **Level of autonomy**: Indicates if a task requires collaboration or can be done independently.
- **Level of concentration**: Evaluates a task's cognitive demand and distraction sensitivity.
- **Level of formality**: Identifies whether a task involves formal meetings or informal discussions.
- **Level of oral privacy**: Examines the required acoustic insulation needed for conversations.
- **Level of visual privacy**: Examines the required visual transparency a task may require.
- **Level of confidentiality**: Evaluates the level of confidentiality required for carrying out the activity.
- **Level of creativity**: Evaluates the creativity level a task may require.
- **Level of in-person interaction**: Define the type of interaction being physical, virtual, or both.

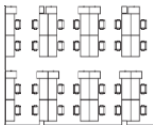
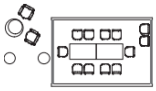
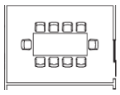
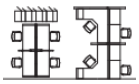
For the evaluation of activities, an employee-based scoring approach was implemented. The list of activities for each job category group was distributed to employees working in the corresponding job clusters. They were asked to assess the activities based on their daily work experience using the predefined criteria. Each employee was instructed to carefully review each activity and assign a score—High, Medium, or Low—for each of the nine criteria. Their responses were collected, and an average value between 1 (Low) and 3 (High) was calculated using Python to generate a unique score for each of the four distinct job categories across each criterion. In this study, all criteria were considered equally important, and no weighting was applied in the assessment.

3.3 Defining the set of workspace solutions

The set of solutions consists of functional space layouts that can be distinctly identified in architectural floor plans. Six archetypal configurations were established based on an analysis of ABW-implemented workspaces (Table 1). For the analysis, the taxonomy of core functional spaces proposed by Tobias T. Eismann et al. (2021) serves as a baseline reference for categorization. They define four categories across two axes: open vs. closed spaces and spaces for individual vs. group work. This research introduces a six-group taxonomy, adding semi-closed spaces between the extremes of open and closed spaces. Semi-closed spaces emerge as crucial design solutions for occupant needs that cannot be met by open or closed spaces, yet are often overlooked in workspace design. For the individual and group axis, two dimensions are retained, but individual spaces are defined for single users or one-on-one interactions, while group spaces are designed for both small and large groups. Only productive workspace areas were considered, excluding supportive spaces such as relaxation areas, cafeterias, and storage. Existing building plans from The Activity-Based Working Practice Guide by Juriaan Van Meel and others, through supplementary research, were analysed. Each case study building's floor plan was broken down into smaller typologies, assigned to the corresponding functional space, and recomposed to create a catalogue of similar and dissimilar design solutions across six main functional workspace categories. From this catalogue, one archetype

per functional space was drawn, forming the set of predefined solutions used for the matching matrix. Each solution was evaluated and assigned a scale (1, 2, 3) for the defined set of criteria. The following table presents the six types of design solutions identified through the analysis used in contemporary workspaces:

Table 1. Six functional workspace typologies

Functional workspaces	Type of closure	Recommended for	Best for	Architype
S1 - GRID	Open	Individual / One-on-one work	Routine tasks	
S2 – IDEA LOUNGE	Open	Small / Large team works	Creative tasks	
S3 - FOCUS BAY	Closed	Individual / One-on-one work	Concentration demanding and confidential tasks	
S4 - FORUM	Closed	Small / Large team works	Collaborative and confidential tasks	
S5 – SOLO NOOK	Semi-closed	Individual / One-on-one work	Operational tasks	
S6 - ENCLAVE	Semi-closed	Small / Large team works	Co-creative tasks	

3.4 Cosine Distance-Based Matching

Traditional MCAs, such as TOPSIS, use Euclidean distance to rank alternatives by comparing their distance to an ideal and anti-ideal solution (Hwang & Yoon, 1981). For this research, Euclidean distance was replaced with Cosine distance to match the job categories with the best possible combination of workspace solutions. The Cosine distance calculation proves to be more accurate in capturing the relative similarity when comparing multiple attributes in order to rank the most similar alternatives rather than simply the closest in absolute terms (Huang, 2008). For the calculation, the decision matrix was built using Python. Four vectors representing each job cluster and six vectors representing functional workspaces are defined. These vectors which contain different levels of requirements for job groups and characteristics for workspaces, were then compared to each other. To ensure accurate comparison, values were normalized. For the normalization process the Min-Max Normalization is chosen since the criterion was scored with the same scale using (low-medium-high). Later, the Cosine distances, which is a measure used to calculate the similarity between two vectors, were calculated among all 10 vectors. Cosine distance ranges from 0 to 1. The closer the Cosine

Distance is to 0, the more similar the two vectors are while, the closer the Cosine Distance is to 1, the less similar the two vectors are. Therefore, the ideal solution as the best possible match is identified through its closeness to 0, while the anti-ideal solution as the worst possible to 1. Through distance scores, the workspace solutions are ranked and their distribution in terms of percentages is calculated for each of the four job clusters. For the conversion of cosine distances into percentages, the distance values are inverted (1/distance), so that smaller distances correspond to larger inverted values. Then, each row is normalized so that the sum equals 100%. Next, each inverted distance is divided by the sum of all the values in the row and multiplied by 100 to obtain the percentages. This process ensures that the shorter the distance, the stronger the correspondence between a job and a workspace arrangement. The step of converting distances into percentages is an insightful action, as it provides a recommended surface division index as a concrete guideline for designers, architects, and planners to be used in activity-based workspace design.

4 Results- Key Findings

The results of the distance analysis for all the variables are shown in Table 2 and the percentages in Table 3. It can be concluded that S5 and S6, which correspond to semi-closed individual and group spaces, are the workspace types most suitable for the majority of workers. Meanwhile, S1 and S2, which represent open individual and group spaces, are the least suitable overall. The presented results demonstrate that different job groups require distinct workspace types, each with a specific ranking and a corresponding percentage of functional space distribution. Sales & Marketing roles require the highest proportion of semi-closed team workstations, followed by semi-closed individual spaces, while open individual spaces are the least needed. Consultancy roles follow a similar pattern, primarily requiring semi-closed team workstations, but with a secondary need for closed team spaces, with both workspace types having nearly equal percentages. For individual work, semi-closed spaces are significantly more adaptable than open work settings, which are the least suitable among all job categories, with the highest cosine distance value of 0.86. On the contrary, IT professionals mainly require individual workstations, with semi-closed individual spaces being the best fit, having the lowest cosine distance value of 0.14 among all matches, followed by closed individual spaces. IT is the only job group where open individual workspaces do not rank at the bottom of the list; instead, they are 4th in the ranking, with a cosine distance of 0.37 for the Grid-type solution among all job categories. Similarly, the Finance group aligns with IT professionals in prioritizing individual spaces over group spaces, with closed individual workspaces being the best match, followed by semi-closed workstations. The least needed remain open individual and open group spaces, with cosine distances that are nearly equal. The findings suggest that Sales & Marketing and Consultancy exhibit similar workspace needs, as both job categories conduct highly collaborative work activities while maintaining a balance between autonomy, concentration, privacy, confidentiality, and creativity. Meanwhile, IT and Finance groups display a significantly higher need for concentration, creativity, and confidentiality. IT professionals stand out from all other job groups, exhibiting the highest autonomy and the lowest level of formal interactions in their work activities. To support a comprehensive and comparative interpretation of the results, a Sankey diagram was generated using Python (Figure 3). This visualization method effectively illustrates the overall distribution and relationships between vectors, thereby facilitating informed decision-making.

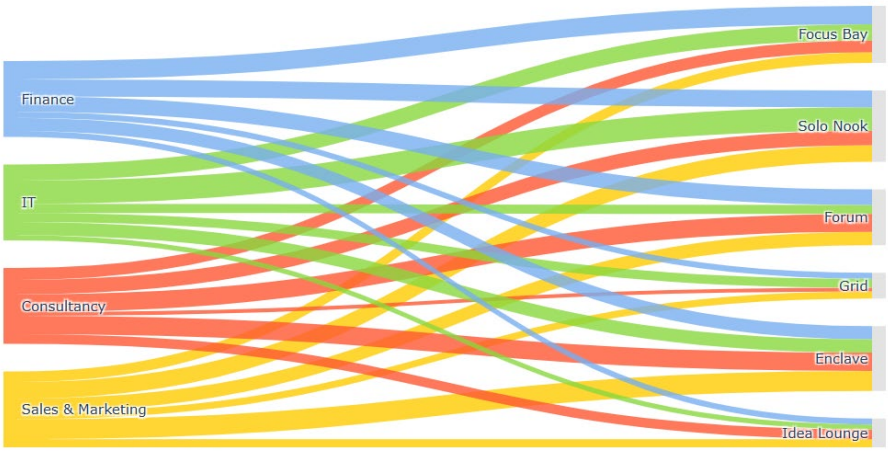
Table 2. The Cosine Distance calculation results per job category

Job Category	S1 - Grid	S2 - Idea Lounge	S3 - Focus Bay	S4 - Forum	S5 - Solo Nook	S6 - Enclave
Sales & Marketing	0.691	0.600	0.458	0.362	0.293	0.244
Consultancy	0.861	0.330	0.268	0.179	0.220	0.174
IT	0.371	0.669	0.210	0.375	0.144	0.253
Finance	0.763	0.760	0.244	0.289	0.266	0.342

Table 3. The allocation of functional workspaces in percentages per job category

Job Category	S1 - Grid	S2 - Idea Lounge	S3 - Focus Bay	S4 - Forum	S5 - Solo Nook	S6 - Enclave
Sales & Marketing	9%	11%	14%	18%	22%	26%
Consultancy	5%	13%	16%	23%	19%	24%
IT	12%	7%	21%	12%	31%	17%
Finance	8%	8%	24%	21%	22%	17%

Figure 3. Allocation of adaptable functional workspaces per job category



5 Discussion

This study provides new knowledge and insights into the nature of activities conducted by knowledge workers in relation to the workspace design. It contributes to a better understanding of how ABW should be designed based on the type of skilled workers it will host. For the four studied knowledge worker groups, the results demonstrate that IT and Finance exhibit similar needs, requiring higher levels of autonomy, concentration, and privacy due to the confidential and attention-demanding nature of their tasks. As a result, they are better suited to closed or semi-closed individual workspaces. In contrast, Consultancy and Sales & Marketing have more moderate requirements in terms of autonomy, privacy, and creativity due to the transversal nature of the tasks they perform. They are better suited to hybrid semi-closed or open workspaces, while also requiring more team spaces than IT and Finance workers. Moreover, the findings show that semi-closed spaces consistently outperform open-layout workspaces which are increasingly adopted by the industry for their space optimization benefits. Semi-closed workstations provide greater privacy and support for concentration compared to open spaces, while still maintaining moderate levels across other key parameters. Their versatility makes them well-suited for a wide range of tasks, highlighting their potential as a workspace

typology that should be more widely adopted in the industry. This study's findings align with the literature's emphasis on the perceived fit between the workspace and the activity performed as a key factor in ABW (Hoendervanger et al., 2021) and demonstrates that refined taxonomy of knowledge workers' activities makes a significant difference in understanding task-related necessities and can be used as a design tool (Niekel et al., 2022). Finally, the research highlights the importance of applying a multi-criteria analysis in the field of ABW to align knowledge worker profiles with the workspace design characteristics. Nevertheless, the findings represent preliminary results of ongoing research and are subject to several limitations. First, the scoring results require further validation, as respondents were drawn from a single company. The study is also limited to four job clusters and a specific sample of workers; future research should expand the sample size to ensure broader representativeness across knowledge workers. Second, the model's criteria were restricted to a predefined set, all weighted equally. Introducing additional criteria or assigning different weights across job groups—or even within a single group—could alter the results. Future studies should incorporate weighted criteria and conduct parametric analyses to assess their impact. Finally, while cosine distance proved to be the most effective statistical model for this research problem, the inclusion of more data in future analyses may necessitate reevaluating alternative models, such as Euclidean distance, Minkowski distance, Manhattan distance, and Jensen-Shannon distance, to enable a more comprehensive comparative analysis.

6 Conclusions

Thoughtful workspace design can boost talent attraction and retention, improve work-life balance, and strengthen organisational culture. By aligning the physical environment with employees' task-related needs, well-designed spaces can reduce stress and frustration. This sense of comfort increases job satisfaction, occupancy rates, and can reduce sick leave. Flexible layouts also encourage informal interactions, flatten hierarchies, and support the sharing of tacit knowledge, all key to promoting a transparent and innovative organisational culture. In this regard, Activity-Based Working represents a significant evolution in workspace design, offering benefits in flexibility and Space optimization. However, its success depends on an implementation that aligns with employees' needs and considers the factors influencing their satisfaction and productivity. This paper addresses a knowledge gap by analyzing the activities of four groups of knowledge workers and identifying the most suitable workspace solutions to enhance employee satisfaction and productivity. Accordingly, it proposes a decision-making model that optimally matches job groups with workspaces based on the demands of various activities. Moreover, it proposes a six-category workspace taxonomy, introducing semi-closed individual and team spaces as an update to the traditional four-category model, highlighting the vital importance of semi-closed workstations that are usually overlooked in the industry. The proposed model, accounting for an organization's job profile mix, serves as a design tool to guide planners and designers in creating efficient and inclusive workspaces that balance employee well-being with spatial efficiency.

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Data Availability Statement
The data supporting the results of this research are internal to the Amaris Research Unit and and Amaris Consulting France, they are not publicly available due to privacy and confidentiality restrictions.

Conflicts of Interest
The authors declare no conflict of interest.

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