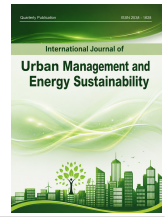
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An Integrated Evidence-Based Framework Linking Architectural Spatial Configuration to Organizational Performance: A Five-Stage Fuzzy Delphi Study

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ABSTRACT

This study aims to identify workplace spatial and environmental criteria relevant to employee productivity and develop an integrated conceptual framework for future empirical validation. It addresses the fragmentation of research concerning spatial configuration, environmental comfort, social interaction, sustainability, and employee performance. An exploratory, literature-informed design employed a five-round Fuzzy Delphi process. A literature-based screening identified 26 preliminary criteria, evaluated by 27 experts, including 17 CEOs, 2 managers, and 8 subject-matter experts. Experts used a five-point linguistic scale from Very Low (1) to Very High (5). Judgments were transformed into trapezoidal fuzzy numbers, and consensus was determined using a difference threshold of 0.20, with values ≤0.20 indicating consensus. From Round 2 onward, experts received feedback on differences between their judgments and aggregated group opinions and could revise or confirm their responses. The process showed progressive convergence: 4 criteria reached consensus after Round 2, 14 additional criteria in Round 3, 5 in Round 4, and the final 3 in Round 5, all with a difference value of 0.00. The consensual criteria were organized into five conceptual dimensions: Ergonomics and Environmental Comfort; Communication and Social Interaction; Spatial Layout and Organization; Sustainability and Energy Optimization; and Employee Productivity and Performance. The study provides an expert-informed framework integrating spatial, environmental, social, sustainability, and performance considerations and establishes a basis for future empirical testing.

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INTRODUCTION

Today, many companies view the office as more than just a place to carry out their day-to-day responsibilities; they see it as an important asset. Considering how much time employees spend at work, it comes as no surprise that the working environment affects their health, feelings, job satisfaction, and overall experience. A systematic review made by (Colenberg et al., 2021) shows that various elements of the workspace, such as spatial arrangements, lighting, noise level, biophilic features, and employees' control over their work environment, affect employees' public and private health. Research conducted by (James et al., 2021) found that open-plan offices harm health, satisfaction, productivity, and social relationships compared to cellular offices, and as a result, they described noise, distractions, poor privacy, lighting, and temperature control as the key issues, and financial benefits may be offset by negative worker outcomes. There is a general agreement in contemporary scholarly literature stating that good design can greatly enhance employee productivity and working conditions, based on the assessment by (Kegel, 2017), the impact of the physical work environment on organizational outcomes. When it comes to different elements of the workplace environment, the significance of architectural spatial configuration is worth noting. Essentially, this characteristic defines how the spaces are arranged and connected along with accessibility and the experience of their respective users, as the analysis by (Prince Ondia et al., 2018) demonstrates that design elements such as barriers and fields are powerful tools for influencing and guiding users' behavior within coworking spaces. This spatial configuration can shape movement patterns, visibility, closeness, comfort, and the possibility of interaction, causing changes in the working people's acts within their workplaces. Some studies analyzing office spatial concepts show that such forms of space, such as visibility and proximity, are essential for mobility or face-to-face communication (Sugiyama et al., 2021). There is also some research on the impact of the space layout on the possibility of performing various tasks and activities within the office; these analyses show that the setup of the space provides an opportunity for one certain activity while preventing the carrying out of others (De Croon et al., 2005). The importance of such relations is particularly evident now, as organizations that depend on knowledge rely on communication, knowledge sharing, cooperation, and creativity to ensure a successful business. Thus, the workplace should support cooperation and individual work but not concentrate on creating only one type of environment, which is shown in research by (Indergård & Hansen, 2025) that stresses the importance of putting together both forms of working, as it is important for productivity, well-being, and satisfaction in the job. Consequently, the workplace should be a combination of cooperative and individual work, in opposition to a one-sided focus on the particular working style. According to the studies reports on the designs of workplaces, they demonstrate not only the possibility for social interaction and informal meeting at the workplace, but also the factors that make this process difficult, such as noise and privacy issues (Indergård & Hansen, 2025). Thus, it can be concluded that the workplace design must be suitable for balancing social communication and individual work.

Despite extensive research on individual aspects of workplace design, environmental quality, employee interaction, sustainability, and productivity, these factors are often examined separately or within relatively narrow disciplinary perspectives (Taimur Sarwar et al., 2026). This creates a need for a more integrated framework capable of bringing together spatial, environmental, social, sustainability-related, and performance-oriented factors within a common conceptual structure. In particular, further clarification is needed regarding which factors should be retained through expert consensus and how these factors can be conceptually organized before subsequent empirical testing. There is an issue of conceptual fragmen-

tation of many models, as well as evidence, which should be associated with the underdevelopment of any empirically valid models and research works in relation to spatial configuration in architecture. Accordingly, this study aimed to answer two main questions. First, what spatial, environmental, social, sustainability-related, and performance-related criteria are identified in the literature as relevant to workplace performance, and which of these preliminary criteria achieve expert consensus through a five-round Fuzzy Delphi process? Second, how can the consensus-based criteria be conceptually organized into an integrated framework for understanding the relationships between workplace conditions and employee performance, and how can this framework be applied, operationalized, or validated in practice and future research? The first question combines the identification of relevant criteria from the literature with the establishment of expert consensus on those criteria, while the second question focuses on conceptually organizing the consensus-based criteria into an integrated framework and examining how that framework can be applied and validated. Together, these two questions provide a coherent progression from identifying and validating the criteria to building and applying an integrated framework that clarifies the relationship between workplace conditions and employee performance. Therefore, the main objective of this research is to create an evidence-based theoretical framework linking architectural spatial configuration with organizational performance through the identification and prioritization of the main spatial indicators, which are being incorporated into relevant behavioral and organizational mechanisms.

MATERIALS AND METHODS

The evidence found in one study indicated that measurement and employee performance accounted for 62.3% of the variance in organizational effectiveness. The study also showed the positive role of measurement and employee performance (Kushariyadi et al., 2025). In the survey based on 72 employees, it has been found that experience, commitment to the organization, and support improved the performance of employees (Arifin & Darmawan, 2021). Of interest is the finding that organizational learning has a positive correlation with organization's performance, operations productivity, and efficiency of management (Tan & Olaore, 2021). However, most of the evidence is more conceptual or review-based than substantial and indicates that organizational culture, ethos, transformational leadership, job design, employee well-being, and management effectiveness are the aspects that enhance organizational performance (Mishra, 2022). Diversity may help through inclusion and innovation but can also create communication and conflict challenges if poorly managed (Beevi Tks et al., 2026). The supplied sources provide insufficient evidence for causal comparisons across interventions or generalizable effect sizes. From this perspective, workplace design should be understood not only in terms of the physical characteristics of buildings but also in terms of how spatial and environmental conditions influence employees' experiences, behaviors, interactions, and work-related outcomes, as (Ashkanasy et al., 2014) count issues, including the effects of major characteristics of the physical environment of work, such as personal space and spatial density, personalization and identity, territoriality, conflict, and emotions, on employees. Previous studies have therefore examined workplace environments from different perspectives, including spatial configuration, environmental comfort, communication and social interaction, sustainability and energy efficiency, and employee productivity and well-being (Abdul Hamed et al., 2023).

Workplace Environment and Spatial Configuration

Size of rooms and design are aspects of the workplace that shape the behavior of employees. According to (Ilgin, 2021) spatial layout has a major impact on organizational workspaces. It influences movement, perception, communication, and

relations at work. Also, the configuration of the inner space defines such parameters as accessibility, visibility, territoriality, and possibilities of meeting between people (Voordt & Jensen, 2021) All these features will influence how workers access offices, communicate with their colleagues, and make use of communal facilities. The Significance of spatial configuration can be observed in the way office buildings are perceived by their users. Nowadays office buildings are perceived as dynamic environments where employees interact, concentrate on their work, and cooperate with each other (Lee et al., 2019). In particular, the spatial arrangement and composition of the office space determine how people navigate in the office and how they see and preserve territorial boundaries (Ilgin, 2021). Therefore, spatial configuration extends beyond the physical arrangement of rooms and circulation paths and can be related to broader patterns of workplace behavior and experience. Spatial characteristics are also associated with several outcomes of employees' activities, including communication efficiency, concentration, cognitive recovery, satisfaction with the work environment, and feelings of belonging to the organization. These relationships suggest that studying workplace performance requires attention not only to technical building characteristics but also how spatial conditions shape employees' experiences and activities. Accordingly, architectural spatial configuration represents an important starting point for examining the broader relationship between workplace environments and organizational outcomes.

Environmental Comfort and Workplace Experience

Comfort within the environment is another crucial component of quality in the workplace. This environment consists of one's overall feel of the physical workspace, with such aspects as temperature, lighting intensity, noise level, and indoor air quality being defined. (Megahed & Ghoneim, 2021) point out the necessity of taking into account the importance of various factors in the working environment, including solid-to-void ratios, patterns of movement, availability of daylight, and airflow. It is also important to note that environmental comfort is not a single concept, but rather it depends on architecture and is the result of the spatial and building decisions that have been made previously. Additionally, the research also indicates that concerns with architecture, such as window placements and building type, can affect the airflow, the air exchange efficiency, and the indoor conditions (Zidehsaraei & Agharabi, 2025). Also, the type of construction and arrangement of walls and windows also matter with regard to airflow and its efficiency. Thus, design solutions made at this stage are important in achieving the necessary environmental conditions. In order to find the perfect environmental conditions (Du et al., 2022) also identify relationships between spatial design characteristics, such as solid-to-void ratios, open spaces, and connections between different areas, and environmental factors including natural light and ventilation. Environmental comfort is therefore closely connected to the physical and experiential quality of workplace environments. Decisions concerning spatial organization, openings, natural lighting, ventilation, and other architectural characteristics can simultaneously affect the physical conditions of the workplace and the way employees experience those conditions. This suggests that environmental comfort should be considered together with spatial characteristics when identifying the factors that may be relevant to workplace performance.

Communication, Collaboration, and Social Interaction

Workplaces not only act as a platform for colleagues to connect, work together, share information, and bond socially but also have a role in porting to said interactions. For instance, spatial planning can to determine how and when employees may connect with each other and share ideas. On one hand, offices are spaces for formal and informal communication, providing a

supportive environment for knowledge sharing, innovative ideas, and teamwork. According to the study by (Bouncken et al., 2021) spatial elements like connections, accessibility, short distances, etc. maximize opportunities for communication and information sharing. On the other hand, while planning of workplaces should enhance interactions, it has to take into account the need of employees in their privacy. (Rahbar et al., 2022) It has been shown that excessive transparency can negatively affect the feeling of control among individuals and the capacity to concentrate, while too much space between the employees can lead to lack of collaboration and communication. Thus, appropriate workplace design should not be reduced only to achieving higher transparency or connection level. Instead, one should consider how spatial conditions can provide for better communications and collaboration while ensuring occasions to concentrate, have privacy and be in control. The connection between workplace environment and social interactions is also important in the context of employees' feelings and cognitive state. Studies have proved that emotion and cognition play a pivotal part in establishing efficient relations with the place (Mousavi et al., 2025). This perspective broadens the interpretation of workplace design by emphasizing that spatial environments influence not only physical movement and interaction but also how employees perceive, experience, and respond to their surroundings.

Sustainability, Energy Efficiency, and Workplace Quality

The significance of sustainable practices and energy efficiency in determining how quality jobs are constructed today has increased. The actions of architect's influence not only energy use and environment. Sustainability should therefore not be considered only as an engineering issue. The literature shows the effective role of renewable energy and smart buildings in terms of energy efficiency and sustainability (Nadalipour Kaldeh et al., 2025). At the same time, sustainability elements, such as natural light and natural ventilation influence the functioning of buildings and the impressions of users (Megahed & Ghoneim, 2021). The interaction between environmental performance and architecture is also reflected in work on the design of buildings, doors, and windows, and efficiency of ventilation (Zidehsaraei & Agharabi, 2025). The results indicate that workplace quality and sustainability are closely related, rather than being separate aspects. Sustainable design solutions should be applied along with environmental comfort to improve workplace quality. Consequently, sustainability-related issues should be included in the set of workplace aspects that will be explored in the investigation.

Workplace Design, Employee Well-Being, and Productivity

Another section of the research refers to the connection between office design and the effectiveness and efficiency of workers. The spatial forms of the office affect workers' level of comfort, teamwork, judgements, and the overall performance of their work (Zou et al., 2021). Earlier researchers have found correlations between the design of the office and the job satisfaction of employees, their ability to focus on the working tasks, quality of communication, and understanding of the level of their own productivity (Pan et al., 2023). These correlations are referred to only one physical dimension. For example, the visual easiness and characteristics of the space such as openness, directivity, and social distance affect how much natural light the employees can use, how it influences the privacy levels, and how this contributes to their wellbeing (Goodarzi Ardakani et al., 2025). In addition, the spatial conditions that favor communication and collaboration are likely to help knowledge sharing and acting together. To conclude, it is recommended to consider employee productivity in the larger context of the office environment instead of attributing it only to some architectural features of the place. In this regard, the literature shows that

workplace design is related to various aspects of employee experience and performance, such as comfort, health, concentration, happiness, communication, collaboration, and productivity. Thus, it is important to analyze the residential environment using a unified approach based on a combination of physical, environmental, behavioral, and organizational aspects.

Integration of the Literature and Research Gap

Based on the literature review, it is evident that there is a connection between the workplace and its features. The layout of the office has an influence on its functionality and movement within the premises (Ilgin, 2021), (Voordt & Jensen, 2021) Environmental factors such as light, temperature, airflow, noise, and air quality impact the level of comfort that employees experience at work (Megahed & Ghoneim, 2021), (Zidehsaraei & Agharabi, 2025). The above factors are also responsible for communication and collaboration within the organization (Bouncken et al., 2021), (Rahbar et al., 2022). The role of ecological and energy-efficient design cannot be underestimated in the efficiency of the building and quality of work done (Nadalipour Kaldeh et al., 2025). The combination of the factors mentioned above leads to positive outcomes for employees such as health, satisfaction, focus, communication, and productivity (Zou et al., 2021), (Pan et al., 2023)., (Goodarzi Ardakani et al., 2025). It is evident from the existing body of research that there are an increasing number of investigations in the aforementioned area; however, the body of knowledge appears to be dispersed across various disciplinary and analytical perspectives. A number of previous studies have examined particular dimensions of places for work and organizations, such as environmental comfort, the effect of social interaction, and productivity, without revealing a wide range of relevant spatial and environmental factors (Latha et al., 2022), (Mostafavi et al., 2022). There is evidence that these authors underline the necessity of a broader approach that would combine spatial characteristics with behavioral, psychological, and organizational elements. Thus, the development of an integrated approach linking the spatial features of architecture with employees' behaviors and organizational outcomes is an important area of workplace research development (Alhammad et al., 2024). Research on the subject also supports the claim that more advanced empirical methods may be employed for examining relationships among various factors. Structural Equation Modeling (SEM) is a research method that allows for the simultaneous analysis of multiple relationships between hidden and observable variables. On account of its ability to investigate both direct and indirect relationships that certain spatial characteristics have with specific performance outcomes, SEM has gained popularity in built-environment studies. For instance, according to a recent SEM-PLS study, spatial configuration may indirectly affect working productivity due to environmental comfort and social interaction effects. These findings illustrate the usefulness of integrated empirical modeling but emphasize the need for proper formulation of criteria to investigate relationships statistically. Consequently, the current study deals with the identified gap associated with the criterion identification and conceptual structuring phases. Based on the literature review, it was possible to identify 26 preliminary criteria, covering the relevant environmental, spatial, social, sustainability-related, and employee-related characteristics of the work environment. The identified preliminary criteria were assessed by the expert panel following the so-called five-round Fuzzy Delphi procedure, meant to identify experts' agreement regarding the identified criteria rather than to test the causal relationships among these criteria. Once the consensual criteria were identified, they were combined and restructured within broader conceptual dimensions that later served as the foundation for the integrated conceptual framework presented in this study.

Theoretical Foundations and Conceptual Frame-

work

This study is based on the idea that the workplace is not simply a physical point for carrying out business processes, but a complex environment that influence the behavior of people working in it. Thus, this study raises the idea of using multiple theoretical principles based on Space Syntax Theory, Environmental Psychology, Organizational Behavior, and Human Resource Management to identify the link between the spatial characteristics of the workplace and the efficiency of office premises. Space Syntax Theory provides an architectural explanation of the workplace as a complete structure of spatial connections. In this context, the fundamental concepts of integration, connectivity, accessibility, visibility, depth, and intelligibility define the way people move and interact. In office environments, spatial configuration determines how easily people reach different areas of the office, the types of formal and informal interactions that take place there, and how spatial configuration correlates with the use of the office. Environmental psychology considers the spatial approach as it describes the assessment and experience of the environment by its users. Workplace attributes such as natural light, acoustics, temperature, quality of air, visual factors, privacy aspect, and openness have a strong impact on employees' comfort, concentration, perception, and behavior. Therefore, environmental psychology acts as a bridge between the environmental factors in the workplace and the way people respond to these factors. The organizational aspect of the model is shaped by organizational theory and human resource management, which are devoted to employee interactions, cooperation, information exchange, satisfaction, well-being, and effectiveness. The research shows that office building performance can be perceived as a complex and interrelated process. The research does not restrict itself to a simple or direct link between spatial factors and organizational outcomes. According to the conceptual framework developed in this paper, there are interlinked elements of workplace performance, including spatial organization, quality of environment, social interaction, sustainability, and employee-related outcomes. This interpretation is consistent with the data obtained in the fuzzy Delphi research, which indicates that various aspects must be approached simultaneously rather than unified into one single factor.

Methodology

This study adopted an applied-developmental, mixed-methods design within a pragmatic paradigm. The aim was to develop an integrated conceptual framework explaining how architectural spatial configuration influences office buildings, drawing on both theoretical and empirical evidence. The research proceeded in five phases: (1) a systematic literature review covering architectural spatial configuration, workplace design, environmental psychology, organizational behavior, human resource management and business performance; (2) theoretical synthesis of the identified indicators within three perspectives, namely Space Syntax Theory, Environmental Psychology, and Organizational Behavior and Human Resource Management; (3) expert evaluation using the Fuzzy Delphi Method (FDM); (4) assessment of convergence across successive Delphi rounds; and (5) integration of the results into a conceptual framework. The first two phases yielded 26 preliminary criteria. These were assessed through a structured questionnaire by a panel of 27 experts: 17 CEOs, 2 managers and 8 specialists in architectural design, work environments and organizational management. Experts rated the importance of each criterion on a five-point linguistic scale from "Very Low" to "Very High". Responses were converted into trapezoidal fuzzy numbers, aggregated into a collective fuzzy value for each criterion, and then defuzzified into crisp scores. The FDM was conducted over five rounds with controlled feedback. From the second round onward, experts were shown how their own judgments differed from the group estimate and could revise them. Consensus on a criterion was reached when the absolute difference between

its defuzzified scores in two consecutive rounds was ≤ 0.20. Criteria that reached consensus were removed from later rounds. Four criteria reached consensus after round 2, 14 after round 3 and 5 after round 4, and the remaining 3 reached consensus in round 5 with zero deviation, so the process ended there. Consensus and criterion selection were treated as separate analytical steps. Consensus measured how far expert judgments converged. Final selection applied the study's predefined selection requirements and combined the Delphi results with the theoretical foundations, so the framework did not rest on numerical convergence alone. (Fig. 1)

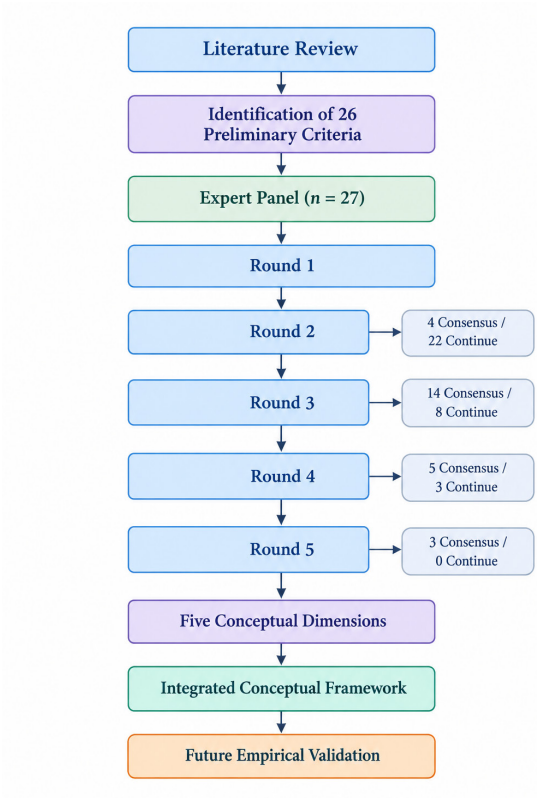


Figure 1: Research Process

FINDINGS AND DISCUSSION

The study initially identified 26 criteria from the literature and subjected them to expert evaluation. The expert panel consisted of 27 experts, including 17 CEOs, 2 managers, and 8 subject-matter experts. The fuzzy Delphi procedure was implemented iteratively rather than being restricted to a single comparison between two rounds. Expert judgments were reconsidered across five successive stages, with the criteria that had already achieved the predefined consensus condition being removed from subsequent rounds. This resulted in a progressively smaller set of criteria requiring further evaluation. The findings also distinguish between criterion-level consensus and higher-order conceptual classification. The fuzzy Delphi procedure was used to assess convergence among expert judgments concerning individual criteria. The subsequent grouping of the criteria into broader dimensions was based on their conceptual relationships and the theoretical foundations of the study. Thus, the dimensions reported below should not be interpreted as additional Delphi criteria.

Identification of the Preliminary Criteria

The first analytical stage involved identifying the architectural, environmental, spatial, behavioral, and organizational factors potentially associated with workplace performance. A systematic review of the literature resulted in an initial set of 26 preliminary criteria, which are presented in Table 1. (Tab. 1)

These criteria constituted the initial pool for expert assessment. The purpose of the Fuzzy Delphi procedure was not merely to obtain a ranking of these criteria but to examine whether expert judgments converged sufficiently when the criteria were reconsidered across successive stages.

Linguistic assessments were transformed into fuzzy values to represent the uncertainty associated with qualitative expert judgments. The fuzzy representation used in this study was based on the linguistic evaluation scale reported in the research, in which the response categories ranged from very low to very high. The corresponding linguistic judgments were converted into fuzzy numbers before aggregation. The linguistic evaluation scale is presented in Table 2. (Tab. 2)

Table 1:Main Preliminary Criteria

1	Level of Natural Light and Building Orientation	14	Location of Shared and Interactive Spaces
2	Quality of Ventilation and Temperature Control	15	Impact of Spatial Height and Dimensions on Productivity
3	Acoustic Design and Noise Reduction	16	Clarity and Legibility of Circulation Paths in the Building
4	Clarity and Legibility of Circulation Paths	17	Impact of Layout on Reducing Energy Consumption
5	Amount of Open Space and Access to Views	18	Use of Natural Light and Ventilation in Design
6	Distribution of Formal and Informal Spaces	19	Impact of Materials and Finishes on Environmental Sustainability
7	Impact of Spatial Transparency on Workplace Interaction	20	Adaptability of Spatial Layout to Green Technologies
8	Access to Meeting and Gathering Spaces	21	Relationship Between Energy Productivity and Work Efficiency
9	Impact of Circulation Paths on Employee Interaction	22	Impact of Enclosed and Open Spaces on Concentration
10	Impact of Rest and Social Spaces on Performance	23	Level of Privacy in Workspaces
11	Distribution of Public and Private Spaces	24	Role of Layout in Reducing Fatigue and Stress
12	Relationship Between Work and Service Spaces	25	Relationship Between Spatial Layout and Job Satisfaction
13	Flexibility of Office Layout	26	Impact of Workspace on Creativity and Innovation.

Table 2: Linguistic evaluation scale

Linguistic scale	Score
Very Low	1
Low	2
Moderate	3
High	4
Very High	5

The experts' judgments for each criterion were combined to obtain an aggregated fuzzy assessment. The resulting values were subsequently defuzzified to provide crisp values suitable for comparison between successive Delphi stages. The initial assessment demonstrated variations across the 26 criteria. Some criteria received consistently strong expert evaluations, whereas others showed greater dispersion. Importantly, the initial magnitude of a criterion's fuzzy mean was not treated as sufficient evidence of consensus. Consensus was determined by comprising of the results obtained in the successive Delphi stages.

First-Stage Delphi Results and Initial Consensus Screening

The first stage established a baseline assessment of the 26 preliminary criteria. The subsequent stage incorporated feedback to allow the experts to reconsider their initial judgments. In the second stage, the questionnaire was designed so that experts could observe the difference between their previous judgment and the aggregated opinion of the expert panel. They were then given the opportunity to modify or

confirm their previous responses. This feedback mechanism was retained in the subsequent stages of the Delphi process.

The comparison between the first and second stages (as presented in Tab. 3 and 4) showed that only four of the 26 criteria achieved the predefined convergence condition. These were:

•Level of Natural Light and Building Orientation

•Acoustic Design and Noise Reduction

•Amount of Open Space and Access to Views

•Impact of Workspace on Creativity and Innovation

The remaining 22 criteria did not meet the consensus condition at this point and were therefore carried forward to the third stage. Table 5 presents the calculation of disagreement between the first and second rounds of questionnaires.

The four criteria that reached a consensus at this stage should be interpreted as criteria for which expert judgments converged sufficiently according to the predefined Delphi rule. Their early convergence does not imply that the remaining criteria are unimportant. Rather, the remaining criteria required additional rounds because greater dispersion remained in the expert judgments. (Tab. 3)

Table 3: Results of the First Round of Expert Survey

Row	Criterion	Overall Averaging				Defuzzified Value
		a_1	a_2	a_3	a_4	Total Mean
1	Level of natural lighting and building orientation	7.82	8.82	9.82	9.91	9.09
2	Ventilation quality and temperature control	5.45	6.45	7.45	8.45	6.95
3	Acoustic design and noise reduction	7.82	8.82	9.82	9.91	9.09
4	Degree of clarity and legibility of circulation paths within the building	5.09	6.09	7.09	8.00	6.57
5	Extent of open space and access to views	4.09	5.18	6.18	7.18	5.66
6	Distribution pattern of formal and informal spaces	6.91	7.91	8.91	9.45	8.30
7	Effect of spatial transparency on work interactions	4.09	5.09	6.09	7.18	5.61
8	Degree of access to meeting and gathering spaces	6.91	7.91	8.91	9.45	8.30
9	Effect of circulation paths on staff interaction	6.36	7.36	8.36	9.18	7.82
10	Effect of rest and social spaces on performance	5.09	6.09	7.09	8.00	6.57
11	Distribution of public and private spaces	4.91	5.91	6.91	7.82	6.39
12	Relationship between work and service spaces	3.82	5.00	6.00	7.00	5.45
13	Degree of flexibility in office layout	7.27	8.27	9.27	9.64	8.61
14	Placement of shared and interactive spaces	5.36	6.45	7.45	8.45	6.93
15	Effect of ceiling height and spatial dimensions on productivity	5.27	6.27	7.27	8.18	6.75
16	Degree of clarity and legibility of circulation paths within the building	5.09	6.09	7.09	8.09	6.59
17	Effect of layout configuration on energy consumption reduction	6.55	7.55	8.55	9.27	7.98
18	Use of natural light and ventilation in design	4.36	5.55	6.55	7.55	6.00
19	Effect of materials on environmental sustainability	7.27	8.27	9.27	9.64	8.61
20	Degree of layout adaptability to green technologies	3.27	4.64	5.64	6.64	5.05

21	Relationship between energy efficiency and work efficiency	3.73	4.73	5.73	6.82	5.25
22	Effect of enclosed versus open spaces on concentration	4.00	5.18	6.18	7.18	5.64
23	Degree of privacy in work spaces	3.36	4.55	5.55	6.64	5.02
24	Role of layout in reducing fatigue and stress	5.09	6.09	7.09	8.00	6.57
25	Relationship between spatial layout and job satisfaction	6.55	7.55	8.55	9.27	7.98
26	Effect of workspace on creativity and innovation	7.09	7.18	8.18	8.18	8.66

Table 4: Results of the Second Round of Expert Survey

Row	Criterion	Overall Averaging				Defuzzified Value
		a_1	a_2	a_3	a_4	Total Mean
1	Level of natural lighting and building orientation	8.00	9.00	10.00	10.00	9.25
2	Ventilation quality and temperature control	8.00	9.00	10.00	10.00	9.25
3	Acoustic design and noise reduction	8.00	9.00	10.00	10.00	9.25
4	Degree of clarity and legibility of circulation paths within the building	4.18	5.18	6.18	7.18	5.68
5	Extent of open space and access to views	4.00	5.00	6.00	7.00	5.50
6	Distribution pattern of formal and informal spaces	8.00	9.00	10.00	10.00	9.25
7	Effect of spatial transparency on work interactions	3.73	4.82	5.82	6.82	5.30
8	Degree of access to meeting and gathering spaces	7.82	8.82	9.82	9.91	9.09
9	Effect of circulation paths on staff interaction	8.00	9.00	10.00	10.00	9.25
10	Effect of rest and social spaces on performance	4.00	5.00	6.00	7.00	5.50
11	Distribution of public and private spaces	4.00	5.00	6.00	7.00	5.50
12	Relationship between work and service spaces	3.45	4.64	5.64	6.64	5.09
13	Degree of flexibility in office layout	8.00	9.00	10.00	10.00	9.25
14	Placement of shared and interactive spaces	4.00	5.00	6.00	7.00	5.50
15	Effect of ceiling height and spatial dimensions on productivity	4.18	5.18	6.18	7.18	5.68
16	Degree of clarity and legibility of circulation paths within the building	4.00	5.00	6.00	7.00	5.50
17	Effect of layout configuration on energy consumption reduction	8.00	9.00	10.00	10.00	9.25
18	Use of natural light and ventilation in design	3.73	4.82	5.82	6.82	5.30

19	Effect of materials on environmental sustainability	7.82	8.82	9.82	9.91	9.09
20	Degree of layout adaptability to green technologies	2.91	4.27	5.27	6.27	4.68
21	Relationship between energy efficiency and work efficiency	2.36	3.91	4.91	5.91	4.27
22	Effect of enclosed versus open spaces on concentration	2.36	3.91	4.91	5.91	4.27
23	Degree of privacy in work spaces	2.00	3.45	4.45	5.55	3.86
24	Role of layout in reducing fatigue and stress	2.82	4.27	5.27	6.27	4.66
25	Relationship between spatial layout and job satisfaction	7.09	8.09	9.09	9.55	8.45
26	Effect of workspace on creativity and innovation	7.91	5.00	7.00	8.00	8.48

Table 5: Calculation of Disagreement Between the First and Second Rounds of Questionnaire Distribution

Row	Criterion	Mean Difference	Status
1	Level of natural lighting and building orientation	0.16	✓
2	Ventilation quality and temperature control	2.30	✗
3	Acoustic design and noise reduction	0.16	✓
4	Degree of clarity and legibility of circulation paths within the building	0.89	✗
5	Extent of open space and access to views	0.16	✓
6	Distribution pattern of formal and informal spaces	0.95	✗
7	Effect of spatial transparency on work interactions	0.32	✗
8	Degree of access to meeting and gathering spaces	0.80	✗
9	Effect of circulation paths on staff interaction	1.43	✗
10	Effect of rest and social spaces on performance	1.07	✗
11	Distribution of public and private spaces	0.89	✗
12	Relationship between work and service spaces	0.36	✗
13	Degree of flexibility in office layout	0.64	✗
14	Placement of shared and interactive spaces	1.43	✗
15	Effect of ceiling height and spatial dimensions on productivity	1.07	✗
16	Degree of clarity and legibility of circulation paths within the building	1.09	✗
17	Effect of layout configuration on energy consumption reduction	1.27	✗
18	Use of natural light and ventilation in design	0.70	✗
19	Effect of materials on environmental sustainability	0.48	✗
20	Degree of layout adaptability to green technologies	0.36	✗
21	Relationship between energy efficiency and work efficiency	0.98	✗
22	Effect of enclosed versus open spaces on concentration	1.36	✗
23	Degree of privacy in work spaces	1.16	✗
24	Role of layout in reducing fatigue and stress	1.91	✗

25	Relationship between spatial layout and job satisfaction	0.48	✗
26	Effect of workspace on creativity and innovation	0.18	✓

Third-Stage Delphi Assessment

The 22 criteria that had not reached consensus in the previous stage were reassessed in the third Delphi stage. This stage aimed to provide another opportunity for convergence following the feedback provided from the preceding assessment. The comparison between the second and third stages demonstrated substantial further convergence. According to the third step, the results presented 14 of the 22 remaining criteria achieved the predefined consensus condition. Table 6 presents the calculation of the disagreement between the second and third rounds of questionnaires. Consequently, only eight criteria continued to the fourth stage. The results explicitly reported that the 14 criteria had no meaningful difference exceeding the 0.20 threshold, whereas eight criteria remained subject to disagreement.

This result demonstrates the cumulative effect of the iterative Delphi procedure. After three stages, the original set of 26 criteria was progressively reduced to a much smaller group requiring additional expert reconsideration. The findings also show that convergence did not occur uniformly across all types of criteria. Criteria involving direct environmental or spatial characteristics tended to reach agreement at different rates from criteria involving more complex relationships between spatial configuration, employee experience, and organizational outcomes. The iterative procedure therefore allowed the research to retain potentially relevant criteria while giving experts additional opportunities to reconsider judgments where disagreement persisted. (Tab. 6)

Table 6: Calculation of Disagreement Between the Second and Third Rounds of Questionnaire Distribution

Row	Criterion	Mean Difference	Status
1	Ventilation quality and temperature control	0.00	✓
2	Degree of clarity and legibility of circulation paths within the building	0.18	✓
3	Distribution pattern of formal and informal spaces	0.00	✓
4	Effect of spatial transparency on work interactions	0.20	✗
5	Degree of access to meeting and gathering spaces	0.16	✓
6	Effect of circulation paths on staff interaction	0.00	✓
7	Effect of rest and social spaces on performance	0.00	✓
8	Distribution of public and private spaces	0.00	✓
9	Relationship between work and service spaces	0.41	✗
10	Degree of flexibility in office layout	0.00	✓
11	Placement of shared and interactive spaces	0.00	✓
12	Effect of ceiling height and spatial dimensions on productivity	0.18	✓
13	Degree of clarity and legibility of circulation paths within the building	0.00	✓
14	Effect of layout configuration on energy consumption reduction	0.00	✓
15	Use of natural light and ventilation in design	1.64	✗
16	Effect of materials on environmental sustainability	0.16	✓
17	Degree of layout adaptability to green technologies	0.02	✓
18	Relationship between energy efficiency and work efficiency	0.82	✗

19	Effect of enclosed versus open spaces on concentration	1.02	✗
20	Degree of privacy in work spaces	1.23	✗
21	Role of layout in reducing fatigue and stress	1.41	✗
22	Relationship between spatial layout and job satisfaction	0.64	✗

Fourth-Stage Delphi Assessment

The eight criteria that remained after the third-stage assessment were subjected to a fourth Delphi stage. At this stage, the difference between the third- and fourth-stage results was calculated for each remaining criterion. Table 7 presents the calculation of disagreement between the third and fourth rounds of questionnaires. The results showed that five of the eight criteria achieved consensus, while three criteria remained above the predefined disagreement threshold. The dissertation reports explicitly that five criteria had no significant difference greater than 0.20 and therefore achieved agreement, while three criteria remained for further evaluation. This stage is important because it demonstrates that the Fuzzy Delphi procedure was not terminated after the initial four consensual criteria. Instead, the study continued the iterative process until the remaining disagreement was resolved. (Tab. 7)

Table 7: calculation of disagreement between the third and fourth rounds of questionnaire

Row	Criterion	Mean Difference	Status
1	Effect of spatial transparency on work interactions	0.00	✓
2	Relationship between work and service spaces	0.00	✓
3	Use of natural light and ventilation in design	0.00	✓
4	Relationship between energy efficiency and work efficiency	0.20	✗
5	Effect of enclosed versus open spaces on concentration	0.20	✗
6	Degree of privacy in work spaces	0.41	✗
7	Role of layout in reducing fatigue and stress	0.00	✓
8	Relationship between spatial layout and job satisfaction	0.16	✓

Fifth-Stage Delphi Assessment and Completion of Consensus

The final three criteria were carried forward to the fifth and final stage. The purpose of this stage was to determine whether the remaining disagreements could be resolved following another round of expert feedback and reconsideration.

The remaining three criteria were:

•Relationship Between Energy Productivity and Work Efficiency

•Impact of Enclosed and Open Spaces on Concentration

•Level of Privacy in Workspaces

The comparison between the fourth- and fifth-stage assessments resulted in a mean difference of 0.00 for all three criteria. Thus, all three criteria achieved the predefined consensus condition in the fifth stage. The completion of this stage ended the iterative Fuzzy Delphi process. In other words, the fifth stage did not introduce another independent group of criteria; rather, it resolved the remaining disagreement among the three criteria that had persisted through the previous stages. Table 8 presents the calculation of the disagreement between the fourth and fifth rounds of questionnaires. (Tab. 8)

Table 8: Calculation of Disagreement Between the Fourth and Fifth Rounds of Questionnaire Distribution

Row	Criterion	Mean Difference	Status
1	Relationship between energy efficiency and work efficiency	0.00	✓
2	Effect of enclosed versus open spaces on concentration	0.00	✓
3	Degree of privacy in work spaces	0.00	✓

The overall progression of the Delphi process can therefore be summarized in Table 9. (Tab. 9)

Table 9: overall progression of the Delphi process

Stages	Consensus Criteria	Remaining Criteria
26 preliminary criteria	4 criteria reaching consensus after Stage 2	22 criteria
continuing to Stage 3	14 additional criteria reaching consensus	8 criteria
continuing to Stage 4	5 additional criteria reaching consensus	3 criteria
continuing to Stage 5	all 3 remaining criteria reaching consensus	0 criteria

Overall Fuzzy Delphi Outcome

Therefore, the principal outcome of the fuzzy Delphi procedure was expert convergence across the five successive stages. The process began with 26 literature-derived criteria and continued until all remaining criteria satisfied the convergence condition. The consensus criterion was a maximum acceptable difference of 0.20 between successive-stage results. Accordingly, criteria with a difference not exceeding 0.20 were treated as having achieved consensus, while criteria with a larger difference were retained for further evaluation. This rule was applied sequentially throughout the Delphi process. This finding requires an important interpretive distinction. The fuzzy Delphi analysis demonstrated convergence of expert opinions; it did not establish that one architectural characteristic causes a particular organizational outcome. The results provide expert-supported evidence concerning the relevance and stability of the identified criteria, while causal relationships remain theoretical propositions requiring future empirical testing.

Classification of the Criteria into Higher-Order Dimensions

Following the Delphi assessment, the criteria were organized into broader, conceptual dimensions. This classification represents a theoretical synthesis of the retained criteria rather than an additional Delphi round. The underlying research subsequently organized the criteria into

five principal dimensions.

A1. Ergonomics and Environmental Comfort

This dimension indicates the physical and environmental qualities of the workplace that influence the environmental experience of its users. Its characteristics are defined by factors such as natural light, building direction, ventilation, thermal environment, noise level, and other aspects related to environmental comfort. This shows that the physical environment is one of the key elements of the workplace's quality. The findings of the fuzzy Delphi method confirm the significance of some of the criteria within this dimension, particularly natural light and building direction, and the method of noise design and reduction.

A2. Communication and Social Interaction

The second dimension refers to the extent to which spatial configuration promotes communication, interaction, accessibility, and socio-technical exchange among employees. This dimension is based on several criteria linked to formal/informal spaces, meeting and gathering

spaces, circulation patterns, spatial transparency, and common areas. This dimension supports the traditional view that an office layout is not simply a physical vessel for activities but a spatial system capable of facilitating or restricting interactions.

A3. Spatial Layout and Organization
The third dimension focuses directly on the organization and configuration of the workplace space. It encompasses spatial distribution, circulation, flexibility, the relationship between different functional areas, and the arrangement of shared, public, private, and work-related spaces. This dimension provides the principal architectural basis of the proposed framework because spatial organization constitutes the environmental antecedent through which many of the identified workplace experiences and behavioral mechanisms may operate.

A4. Sustainability and Energy Optimization
The fourth aspect relates to the subject of the connection between design and ecological sustainability. It covers the impact of design on energy consumption, natural light and ventilation, the choice of materials used, and the degree of applicability of green technologies. This aspect has special relevance for criteria related to energy efficiency, ecological sustainability, and the connection between design and energy efficiency.

A5. Employee Productivity and Performance
The fifth-dimension captures employee- and performance-oriented consequences associated with workplace configuration. It includes criteria concerning productivity, work efficiency, creativity and innovation, concentration, fatigue and stress, job satisfaction, and related workplace outcomes. The identification of this dimension is important because it provides a conceptual bridge between architectural characteristics and organizational performance. However, the research does not, interpret the Delphi results as direct empirical proof of causal effects on productivity or organizational performance.
Therefore, five-dimensional classification is more comprehensive than the three broad domains used in the earlier version of the article. It reflects the structure subsequently established in the underlying research, where the five dimensions were explicitly identified as A1: Ergonomics and Environmental Comfort, A2: Communication and Social Interaction, A3: Spatial Layout and Organization, A4: Sustainability and Energy Optimization, and A5: Employee Productivity and Performance.

Relationship Between the Delphi Results and the Five Dimensions
The classification of the criteria into five dimensions provides a bridge between the criterion-level Delphi findings and the higher-order conceptual framework. At the criterion level, the fuzzy Delphi procedure examines individual indicators such as natural light, acoustic quality, spatial flexibility, circulation, energy-related layout, privacy, concentration, job satisfaction, and creativity. At the dimensional level, these individual indicators are interpreted as components of broader constructs representing environmental comfort, social interaction, spatial organization, sustainability, and employee performance. This distinction is analytically important. A criterion does not become a conceptual dimension simply because it achieves Delphi consensus. Rather, the dimensional structure emerges from the theoretical relationships among multiple criteria and their relevance to the conceptual model. Consequently, the five dimensions should be interpreted as an organizing structure for the evidence generated by the study. The fuzzy Delphi findings provide expert validation at the indicator level, while the theoretical synthesis provides the rationale for grouping related indicators into broader conceptual dimensions.

Implications for the Proposed Conceptual Frame-

work

The results give both empirical and theoretical rationale behind the outlined structure. The criteria of space provide an environmental basis of the structure. The model is structured around dimensions of environment, interactions, mind, and activity.

The results show particularly the significance of environmental factors like daylight and sounds, spatial characteristics such as openness, interconnectivity, flexibility, and space design, as well as parameters related to people's work like focus, creativity, performance, privacy, and job satisfaction.

Nevertheless, it should be noted that these results ought not to be regarded as evidence of statistically established cause-and-effect linkages. The study does not have field-specific performance data and did not conduct an SEM analysis. Thus, the theoretical relationships illustrated in the framework are merely educated guesses based on literary analysis and experts' opinions.

Thus, the framework that has been created can now be utilized for practical research. Future studies may provide an operational definition of the identified parameters and criteria since they will involve various office conditions and collect field samples for Structural Equation Modeling.

RESULTS AND CONCLUSION

The findings of this study provide a multidimensional interpretation of the relationship between architectural spatial organization and the performance of office buildings. The five-stage fuzzy Delphi process demonstrated that the assessment of office building efficiency cannot be reduced to a single spatial or environmental attribute. Rather, the expert judgments converged around a set of interconnected criteria addressing environmental quality, spatial organization, human interaction, sustainability, and employee performance. This finding is consistent with the broader conceptual orientation of the dissertation, in which office-building performance is understood as the outcome of interactions among physical, functional, behavioral, social, managerial, and environmental components rather than the effect of an isolated design variable An important discovery of the research is the gradual convergence of specialist assessments during the five stages of the Delphi method. By using the literature review, 26 variables were identified, and experts minimized the differences through several iterations of the process. In the next stage, they agreed on four variables, which were followed by most criteria agreeing on 14 in the third step, five in the fourth, and three in the last step. The fact that the remaining three criteria reached a difference value of 0.00 means the convergence of expert evaluations was completed. The need for several Delphi stages does not necessarily indicate that the less rapidly converging criteria were unimportant. Instead, it suggests that some aspects of office-building performance are more context-dependent and require greater deliberation among experts. Criteria associated with privacy, concentration, and the relationship between energy performance and work efficiency, for example, remained subject to evaluation for longer before reaching complete agreement. Their eventual convergence indicates that these issues form part of the expert-defined understanding of an efficient office environment, even though agreement concerning them required a longer iterative process. The Delphi findings therefore support a broader interpretation of office-building efficiency. Efficiency is not represented only by easily measurable physical characteristics, but also by qualities that influence how users perceive, experience, and interact with the workplace. This interpretation is consistent with the research's argument that the value of an office building becomes evident when its spatial structure supports user behavior, organizational communication, professional activities, health, satisfaction, and productivity.

From Individual Criteria to an Integrated Framework

The identified criteria can be interpreted at a higher conceptual level through five dimensions (as presented in Diagram 3). Their value lies in showing how individual indicators can be organized into a coherent framework for interpreting office building performance. The framework comprises five interrelated dimensions. Ergonomics and Environmental Comfort concerns how employees experience the workplace, treating natural light, acoustics, and views as determinants of user–environment interaction, concentration, and performance. Communication and Social Interaction address the social consequences of spatial organization, positioning interaction and collaboration as mediating components between spatial structure and organizational outcomes. The Spatial Layout and Organization aspect is key to architecture, meaning how accessibility, circulation, and legibility are utilized by users and how activities are done and carried out. The Sustainability and Energy Optimization aspect refers to the efficient but environmentally friendly implementation of architectural performance in the sense that the structure of the building influences its energy performance as well as its indoor climate. In turn, the Employee Productivity and Performance aspect is connected with the overall architectural perception of a working space in a way that it reflects of organizational activities in a company and thus is productive-oriented when creating a structure.

The Importance of a Systemic Interpretation

One of the most important implications of the results is the idea that in considering the efficiency of office buildings, one should perceive it an interaction of multiple phenomena rather than simply adding together independent indicators. All the indicators mentioned above are interrelated and not clear to the comprehension unless analyzed in relation to other components of the active working environment. For instance, redistribution of space may cause the way in which employees move around the office to influence the ease of communication; the ease of communication might affect cooperation with colleagues, and so on. The same can be said about the environmental aspects of performing work (for example, daylight, ventilation, noise, and the level of convenience) that influence the work process. This systemic interpretation represents an important contribution of the study. Conventional approaches to office design may evaluate spatial adequacy, environmental performance, or energy consumption separately. Instead, the present framework suggests that these dimensions should be considered simultaneously. A spatial arrangement may be efficient in terms of circulation but inadequate in terms of privacy or concentration; an open-plan environment may facilitate interaction but create acoustic or concentration problems; and energy-saving strategies may be environmentally beneficial but need to be coordinated with indoor environmental quality. Therefore, the effectiveness of a design decision depends not only on its individual performance but also on its compatibility with the wider workplace system. The results also imply a broader definition of sustainability. Energy efficiency is typically viewed as a technical and ecological target that can be estimated independently of employee performance. Nonetheless, the theoretical framework created in this study proves that both energy and human performance can be regarded as parts of the same system. Thus, sustainability should not only imply decreased energy usage. In office buildings, sustainability can be understood as the ability to preserve good environmental quality, assist users, reduce operating costs, and ensure that the building remains functional for an extended period of time.

Flexibility and Long-Term Performance

Another significant implication of the results is the importance of spatial flexibility in office organization. Office organization functions as a dynamic system because structural, labor, technological, managerial, and work changes can impact the spatial needs of an organization. Thus,

a particular building whose operation is efficient at the beginning may not be efficient years after its launch. Therefore, this discovery changes the understanding of the efficiency concept from the one associated with short-term effectiveness to the one involving long-term adaptability. Flexible offices are capable of adapting to organizational changes without significant repairs, ensuring that spatial resources may be effectively utilized. Thus, flexibility should be seen not just as a preference of the architecture but as an important aspect of the long-term performance of a building.

The results have important implications for practical applications. First, architectural programming and space planning should be based on knowledge of organizational activities, communication patterns, movement, privacy needs, and user preferences instead of geometric or quantity criteria. Spatial analysis can act as a decision-making tool during the construction process, allowing one to assess access, personnel movement, organization of space, and possible functional conflicts. Finally, the office must provide conditions for various spatial situations instead of one major design combining the elements of work concentration or privacy, which makes it possible for the user to choose a suitable environment for the task. Fourth, environmental and energy considerations must be included in spatial planning beginning at the design stage. Orientation, daylight, ventilation, thermal effect, acoustic quality, etc. should be dealt with in the context of one another, rather than as independent technical decisions. Fifth, the framework can also facilitate post-occupancy evaluation and management of workplaces, to allow for criteria for evaluation of the office environment on a regular basis and for studying the areas needing changes in space planning, environmental management, etc. This study developed an integrated conceptual framework for understanding workplace spatial, environmental, social, sustainability-related, and performance-oriented factors through a five-round Fuzzy Delphi process. The study began with 26 literature-derived preliminary criteria and used a panel of 27 experts to progressively assess and refine these criteria through successive rounds of linguistic evaluation, fuzzy aggregation, and consensus assessment. The results showed progression in competition throughout the five Delphi rounds, with 4 criteria being agreed upon in round 2, 14 extra criteria being decided in round 3, 5 extra criteria being accepted in round 4, and finally the last 3 criteria being confirmed in round 5. These criteria that had been agreed upon were reclassified in five conceptual dimensions. The first is Ergonomics and Environmental Comfort, the second is Communication and Social Interaction, the third is Spatial Layout and Organization, the fourth is Sustainability and Energy Optimization, and the last is Employee Productivity and Performance.

The created framework gives an integrated theoretical framework for the understanding of performance at workplaces and shows the interplay of space, environment, social factors, sustainability, and human performance. The framework is important as it is not a causal model tested statistically, but a theoretical model that is supported by experts. Further research in the form of empirical studies with quantitative and longitudinal approaches should be conducted to test relationships and verify their use in different types of organizations.

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