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Review

The Potential Challenges and Limitations of Implementing Modern Office Design Features in Residential Spaces: A SPAR-4-SLR Approach

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Abstract: The COVID-19 pandemic has significantly altered how people work, with an increasing number transitioning to working from home (WFH). This paradigm shift has raised various challenges in adapting living spaces to meet the needs of remote work. Dedicated workspaces or home offices need to be customized for creativity and productivity. Thus, this systematic literature review explores the potential challenges and limitations of implementing modern office design features in residential environments. The study synthesizes findings from 108 peer-reviewed articles published within the last decade, focusing on ergonomics, productivity, work–life balance, and spatial constraints. The study found several challenges in translating office design features to home settings. Firstly, spatial limitations in residential areas often restrict the implementation of open-plan layouts and collaborative zones, which are hallmarks of modern office designs. Secondly, the integration of ergonomic furniture and adjustable workstations are limited by budget constraints and the dual-purpose nature of many home spaces. Furthermore, the review highlights the psychological challenges of maintaining work–life boundaries when professional and personal spaces overlap. Noise pollution and distractions emerge as significant factors impacting productivity in home offices, which contrasts controlled modern office environments. The review suggests that the complete replication of modern office design in homes may be impractical; a hybrid approach that adapts key features to residential constraints could enhance home office productivity. Potential solutions could include modular furniture designs, the simulation of collaborative spaces, and the development of noise-cancelling technologies specifically for home environments. This study contributes to the growing body of knowledge on remote work environments and provides valuable insights for enhancing work–life balance, environmental sustainability, and economic growth.

Keywords: modern office design; office buildings; office conservation; residential; home office; challenges

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1. Introduction

The COVID-19 pandemic has fundamentally transformed the global work landscape, with an unprecedented shift towards remote work arrangements. This paradigm shift has been particularly evident in New Zealand, where approximately 78% of the workforce now engages in remote work, either partially or full-time [1]. The widespread adoption of flexible work schedules by employers for their remote teams has become increasingly prevalent [2], reflecting a broader global trend towards more adaptable and employee-centric work models. This dramatic transition to working from home (WFH) has precipitated a revaluation of residential spaces, particularly in terms of their capacity to accommodate and facilitate productive work environments. The challenge of adapting living spaces to meet the dual demands of personal life and professional responsibilities has emerged as a critical issue for both employees and employers alike [3]. The need for dedicated workspaces or home offices that foster creativity and productivity has become paramount in this new work paradigm. Recent research has underscored the significant impact of the

home office environment on remote work satisfaction and productivity [4]. The spatial layout of these home workspaces has been found to have considerable implications for the well-being of remote workers [5].

This growing body of evidence has sparked renewed interest in the design and functionality of residential spaces, with a particular focus on creating healthy and appropriate dwellings that can effectively support remote work [6]. The integration of work and living spaces has led to a surge in research exploring the potential modifications in building designs, construction methodologies, and operational practises to enhance social well-being in the context of remote work [7,8]. This research trend reflects a growing recognition of the need to reimagine residential architecture to accommodate the evolving demands of the modern workforce. The transition to remote work has also highlighted disparities in home working conditions among different demographic groups. Factors such as housing quality, available space, and access to technology have emerged as significant determinants of remote work effectiveness and job satisfaction [9]. These disparities underscore the importance of developing inclusive design solutions capable of accommodating various living situations and work requirements.

Moreover, the shift to remote work has accelerated the adoption of digital technologies and virtual collaboration tools. This technological integration has blurred the boundaries between work and personal life, necessitating a more holistic approach to home office design that considers both physical and digital ergonomics [10]. The challenge lies in creating home workspaces that seamlessly integrate these technologies while maintaining a clear delineation between professional and personal spheres. The psychological impact of remote work has also come under scrutiny, with studies indicating that the design of home workspaces can significantly influence mental health and work–life balance [11]. Factors such as natural lighting, ventilation, and the presence of biophilic elements have been identified as crucial components in creating psychologically supportive home office environments [12].

Furthermore, the sustainability implications of the shift to remote work have gained attention. While reduced commuting has led to decreased carbon emissions, the increased energy consumption in residential settings presents new challenges for sustainable living [13,14]. This has sparked interest in developing energy-efficient home office designs that can minimize the environmental impact of remote work. The long-term implications of this shift towards remote work in urban planning and real estate markets are also beginning to emerge. The potential for a more distributed workforce has led to discussions about the future of urban centres and the possibility of revitalizing suburban and rural areas [15]. This trend may necessitate a reimagining of residential architecture to accommodate more flexible and multifunctional living spaces. In light of these multifaceted challenges and opportunities presented by the widespread adoption of remote work, there is a pressing need for research that can guide the development of home office spaces that are not only functional and productive but also conducive to overall well-being. This study aims to explore the potential challenges and limitations of implementing modern office design features in residential environments. It examines spatial constraints, technological infrastructure, work–life balance, environmental factors, ergonomics, workplace culture, financial barriers, regulatory compliance, and adaptability for diverse work styles. The research seeks to provide a comprehensive understanding of obstacles in integrating professional workspace features into home offices.

2. Research Methodology

This paper adopts the "scientific procedures and rationales for systematic literature review (SPAR-4-SLR)" methodology developed by Paul et al. [16] to comprehensively analyze significant research works from 2009 to 2024 in the academic literature from the Scopus database [17]. The SPAR-4-SLR protocol was adopted because it addresses the limitations of PRISMA by providing a framework designed specifically for SLRs. It presents a structured approach with clear rationales for decision-making that improves transparency and rigour.

This tailored protocol could enhance the quality and reproducibility of SLRs across various disciplines [16]. The review process is structured into three distinct stages as follows: (1) identification and acquisition of the relevant literature, (2) organization and purification of the literary synthesis, and (3) evaluation and reporting of the synthesized literature, as illustrated in Figure 1. This systematic approach ensures a thorough examination of the ever-changing home office design and remote work productivity. Following these stages, the study aims to provide a robust foundation for understanding the key features and functions required in home offices to effectively integrate modern office design principles, thereby enhancing productivity and well-being in remote work environments.

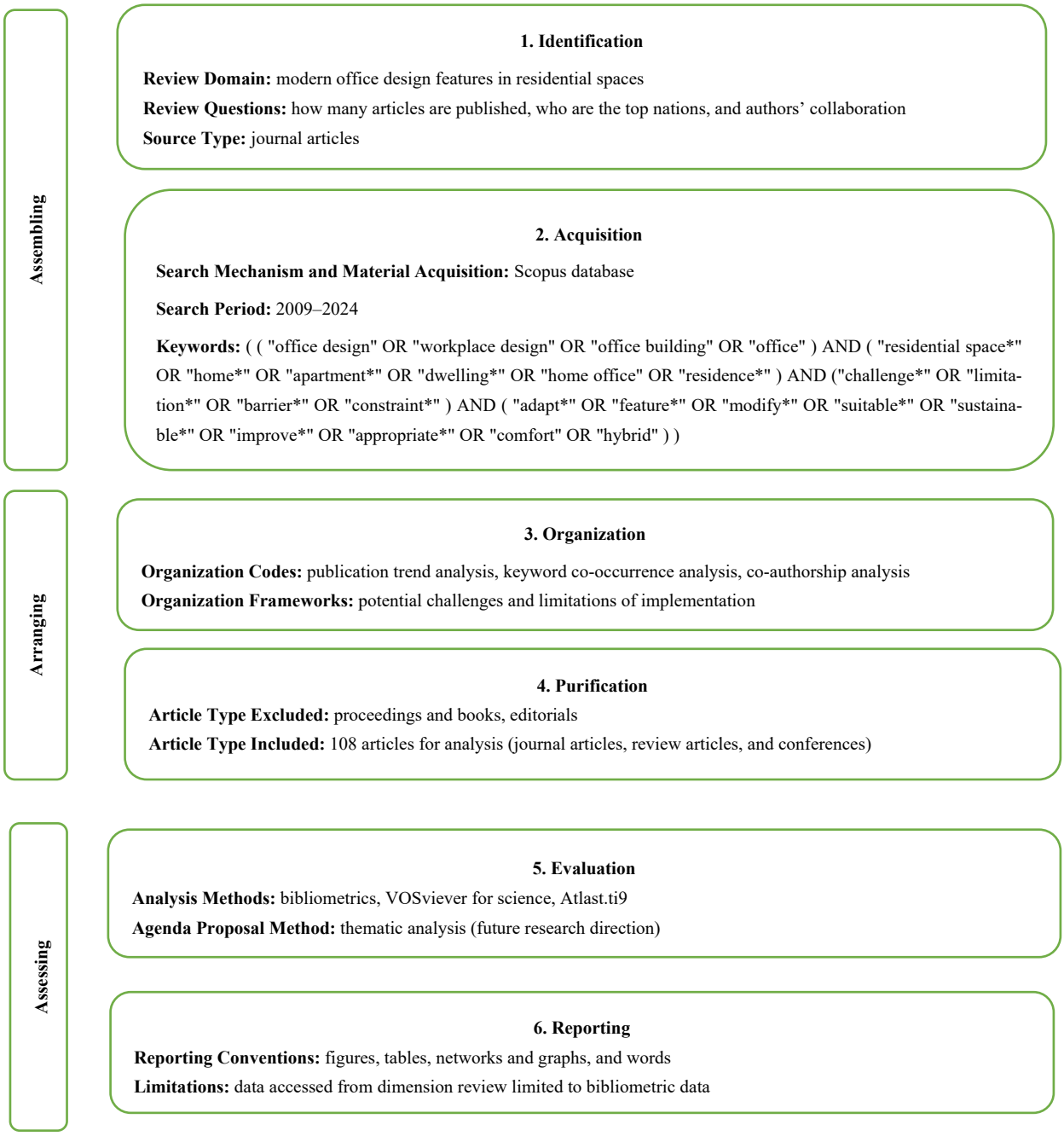

Figure 1. Overview of SPAR-4-SLR protocol framework (source: adapted from Paul et al. [16]).

2.1. Assembling

The first step in the process involves collecting publications for analysis, known as assembling. This employs a comprehensive literature collection process, using the Scopus database in August 2024, to identify publications focusing on modern office design features in residential spaces and related concepts. Scopus was selected for its high-quality publications and substantial influence on research advancement across multiple disciplines; the researchers acknowledge that the exclusive use of this database represents a limitation of the study. Scopus, although extensive, does not encompass all available scientific publications. This choice may have led to the exclusion of relevant research published on other platforms or indexed in different databases. However, the Scopus database has been identified as one of the largest citation databases of the peer-reviewed literature, offering global research output across various fields [18]. To mitigate this limitation, the researchers employed a rigorous systematic review process and analyzed a large sample of 299 publications and Scopus indexes of a wide range of influential journals in this field, as evidenced by the findings. The initial search, encompassing works from 2009 to August 2024, yielded 299 publications. The Elsevier Mapping Initiative's Science-Metrix group was chosen for its seamless integration with Scopus search criteria, enhancing the precision of our literature identification [19].

Following the preliminary screening, 108 articles were retained for metadata evaluation. A thorough review process ensued, involving careful examination of titles and abstracts to ensure relevance to the study's focus on modern office design features in residential contexts. Articles were systematically categorized based on central themes, with cross-referencing employed to maintain consistency and relevance [20]. The selection process involved multiple iterations of abstract analysis, refining the corpus to align precisely with the study's objectives. This rigorous approach ensures a comprehensive and focused literature base, capturing the evolving landscape of home office design in the context of remote work. This methodical literature selection process forms the foundation for a robust analysis of trends, innovations, and best practises in integrating modern office design principles into residential spaces, contributing to the understanding of effective home workspace design in the contemporary work environment.

2.2. Arranging

The arranging phase involves the systematic organization and refinement of articles through defined inclusion and exclusion criteria [19]. Key metadata elements, including the journal title, author name, publication title, and country of affiliation, were utilized as coding categories to structure the search data. This coding framework enabled a more rigorous and systematic analysis of the literature corpus [21]. The filtering process maintained an inclusive approach, retaining publications from all journals to ensure comprehensive coverage of the field. This methodical organization and coding strategy facilitates a thorough examination of trends and patterns in home office design research, providing a solid foundation for the subsequent analysis and synthesis of findings.

2.3. Assessing

The final phase of the study encompasses assessment, incorporating the evaluation and reporting of findings [17]. The evaluation segment provides a comprehensive overview of the analytical methodology employed and acknowledges the study's limitations. For data analysis and trend identification, ATLAS.ti 9 and VOSviewer version 1.6.20 software were utilized, leveraging their advanced capabilities in qualitative data analysis and bibliometric visualization [22]. These tools facilitated a rigorous examination of patterns and themes within the literature corpus. Given that the review relied exclusively on secondary data accessible through the Scopus database, ethical approval was not required for this research [23]. This approach ensures transparency in the research process while maintaining adherence to ethical standards in systematic review practises. From the initial corpus of 299 articles retrieved from the Scopus database, a refined selection of 108 publications

were subjected to in-depth analysis using VOSviewer and ATLAS.ti 9 software. This advanced qualitative data analysis tool was employed to extract nuanced insights and identify emerging patterns within the literature [24]. It is widely considered a potent software for qualitative analysis, particularly in situations involving substantial amounts of textual and graphical data [25]. The results from the ATLAS.ti software are presented, including some visualizations for easy understanding.

3. Findings

3.1. Bibliometric Techniques and Tools

Five bibliometric techniques were applied to analyze the 108 downloaded articles. The first technique, publication trend analysis, assesses changes in the number of publications over time, revealing development trends in modern office design features for residential spaces. The second technique, keyword co-occurrence analysis, maps keywords based on their co-occurrences in documents, depicting the knowledge body in the field. The third technique, co-authorship analysis, uncovers collaboration patterns between authors and countries, discovering the collaboration network in the research community using bibliographic coupling analysis. Lastly, an assessment of challenges and limitations evaluates the difficulties in implementing modern office design features in residential spaces. Table 1 summarizes these techniques and their purposes. Two widely adopted tools were used to perform these analyses. VOSviewer constructs and visualizes networks of publications, journals, researchers, organizations, countries, and keywords [26]. ATLAS.ti 9 assists in qualitative data analysis, particularly for the assessment of challenges and limitations.

Table 1. Bibliometric techniques and tools adopted.

Technique	Tools	Purpose
Assesses changes in the number of publications over time	VOSviewer	To reveal development trends in modern office design features for residential spaces
Keyword co-occurrence analysis	VOSviewer	To maps keywords based on their co-occurrences in documents
Co-authorship analysis	VOSviewer	Uncovers collaboration patterns between authors and countries
Assessment of challenges and limitations	ATLAS.ti 9	To evaluate the difficulties in implementing modern office design features in residential spaces

3.1.1. Analysis of the Number of Publications

The literature search was conducted in August 2024, initially yielding 299 documents. After applying rigorous inclusion and exclusion criteria, 108 publications were retained for an in-depth analysis. Figure 2 illustrates the temporal distribution of these publications based on the specified keywords. The field's nascent stage is evident from the earliest relevant publication dating back to 2009, with a modest four articles that year. There was sporadic activity, with singular publications in 2021 and 2022. The subject area gained traction gradually, reaching 24 publications in 2022. However, a slight dip occurred in 2023, with only 19 publications.

In 2024, research output has markedly increased. As of August 2024, 19 articles had already been published, suggesting sustained interest and growth in the research area. The observed trend indicates a growing scholarly focus on modern office design features in residential spaces. If this momentum continues, we can anticipate an increase in publications in the coming years, potentially establishing this as a significant niche within interior design and architecture research.

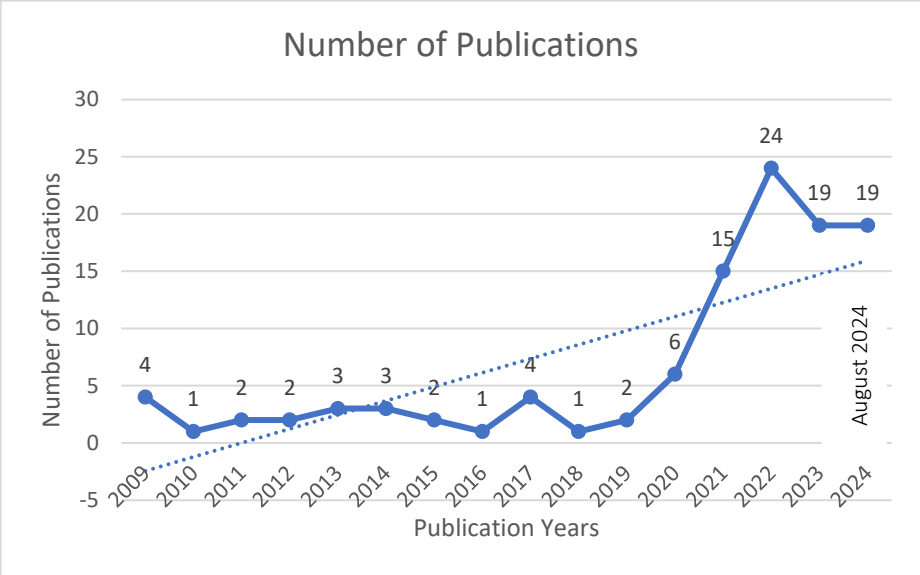

Figure 2. Number of publications per year.

3.1.2. Co-Occurrence of Keywords

The keyword co-occurrence analysis revealed "office building" as the most frequent term, appearing 29 times, followed by "COVID-19" (26 occurrences), "housing" (14), and "sustainable development" (12). Table 2 presents the top seven keywords identified through this analysis. Figure 3 illustrates the network structure of keyword co-occurrence, unveiling four distinct clusters. This visualization employs colour-coded nodes to represent different themes and topics, with interconnecting lines depicting relationships between concepts. The network visualization illuminates the complex interplay between working from home, building sustainability, and the COVID-19 pandemic.

Table 2. Co-occurrence of keywords.

Keywords	Occurrences	Total Link Strength
Office building	29	70
COVID-19	26	46
Housing	14	50
Sustainable development	12	34
Workplace	11	31
Home office	10	11
Working from home	8	8

Each of the four clusters was meticulously examined to uncover underlying themes, the clusters being remote work adaptations, sustainable building practises, pandemic-driven changes, and residential space optimization. These clusters highlight the multi-faceted nature of the research field, showcasing how the pandemic has accelerated the integration of office features into residential spaces while emphasizing sustainability concerns. The visualization also underscores the evolving relationship between work and living spaces, reflecting broader societal shifts towards flexible work arrangements and environmentally conscious design solutions. This analysis provides valuable insights into current research trends and potential future directions in the field of modern office design features in residential spaces.

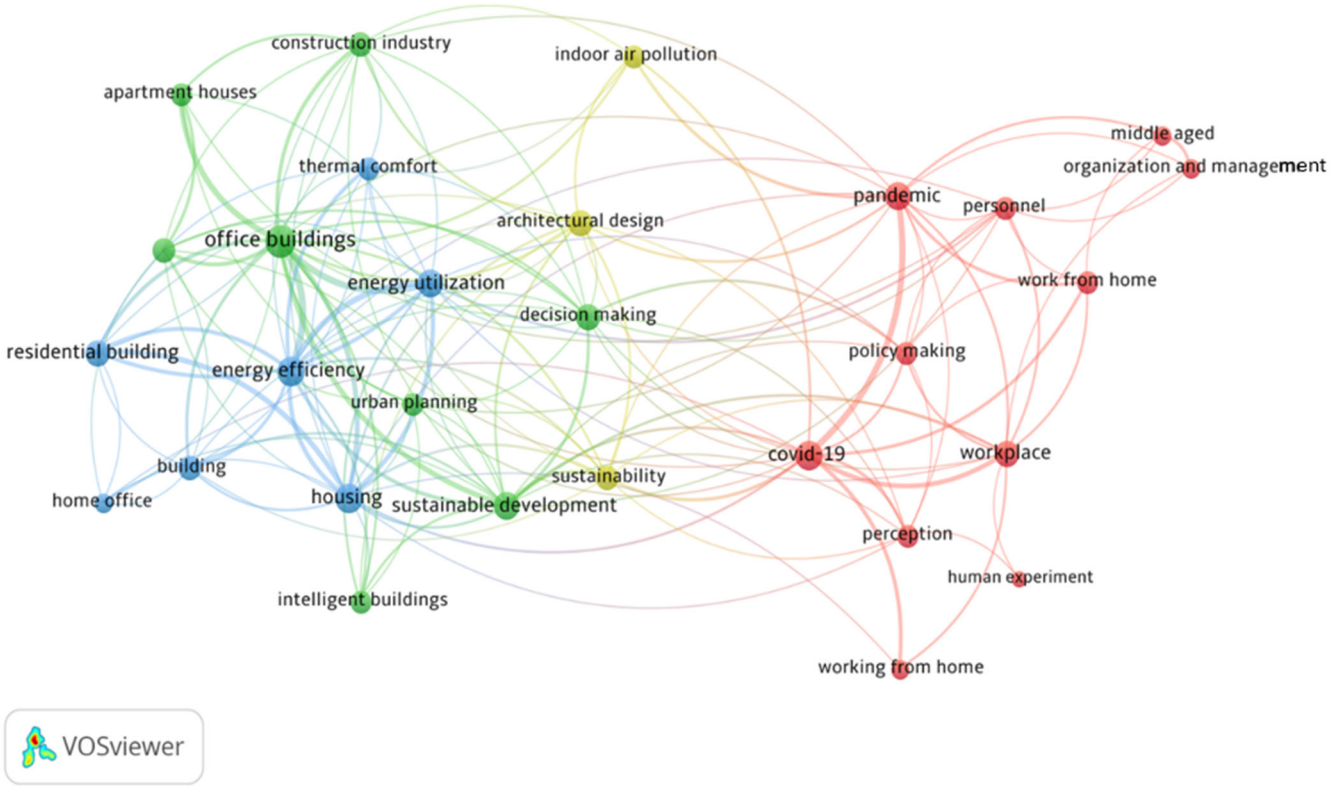

Figure 3. Co-occurrence of keywords in clusters.

- Cluster 1 (red) in the visualization centres around the COVID-19 pandemic and its profound impact on work practises and home environments. The prominent nodes for "COVID-19" and "pandemic" serve as the focal points, interconnecting with concepts like "working from home" and "workplace". This red cluster illustrates the seismic shift in work dynamics precipitated by the global health crisis. The pandemic has catalyzed a rapid adoption of home offices, blurring the boundaries between professional and personal spaces. This transformation has brought to the forefront the need for modern office design features in residential settings, a trend that appears likely to persist beyond the immediate crisis.

Within the cluster, we observe connections to "policy making" and "decision making", highlighting the organizational and governmental responses to the changing work landscape. The presence of "perception" and "human experiment" nodes suggests ongoing research into the psychological and social impacts of this abrupt transition to remote work. The cluster also touches on demographic considerations, with "middle-aged" and "personnel" nodes indicating a focus on how different workforce segments are adapting to these changes. The "organisation and management" node points to the challenges faced by businesses in navigating this new terrain.

The cluster reveals links to concepts of resilience and career adaptability, though these are not explicitly labelled in the visualization. Lansmann et al. [27] investigated factors influencing IT professionals' intentions to work from home. Their findings suggest that characteristics of the worker, such as segmentation preference, have a stronger influence on work-from-home intentions than characteristics of the workspace or work context. They also found that perceived productivity during enforced working from home and gender significantly predict work-from-home intentions. These connections underscore the importance of developing personal and professional flexibility in an era of uncertainty. The ability to effectively adapt individual home environments for work purposes has become a crucial skill, influencing both job performance and overall life satisfaction.

Moreover, the visualization hints at the role of social support systems in this transition. While not directly labelled, the interconnectedness of the nodes suggests that support from peers, family, and organizations plays a vital role in successfully implementing modern office design features in residential spaces and adapting to the new work-from-home paradigm. This red cluster effectively captures the multifaceted nature of the pandemic's impact on work environments, highlighting the complex interplay between public health, workplace design, policy, and individual adaptation.

- Cluster 2 (green) in the visualization centres on buildings and construction, encompassing key terms like "office buildings", "apartment houses", "construction industry", and "sustainable development". This green cluster represents the physical infrastructure and development aspects of the urban environment, highlighting the growing importance of sustainable practises in modern construction and urban planning. As society evolves towards greater innovation, there is an increasing emphasis on the interconnectedness of office buildings, residential spaces, sustainable development, and intelligent building systems. This shift reflects a broader trend towards integrating modern office design features into residential spaces, blurring the lines between work and home environments.

The cluster reveals a focus on "thermal comfort" and "energy efficiency", underscoring the importance of creating environmentally conscious and comfortable living–working spaces. The presence of "urban planning" in this group suggests a holistic approach to city development that considers both residential and commercial needs. "Intelligent buildings" emerge as a key concept, pointing to the integration of smart technologies in both office and home settings. Aczel et al. [28] surveyed 704 academics working from home during the pandemic. Their research revealed that while the lockdown decreased work efficiency for almost half of the researchers, around a quarter were more efficient during this time compared to before. Interestingly, 70% of the researchers believed they would be similarly or more efficient than before if they could spend more of their work time at home in the future. This trend aligns with the growing demand for flexible, tech-enabled spaces that can adapt to changing work patterns and lifestyle needs. The connection to "decision making" within this cluster highlights the complex choices faced by developers, architects, and urban planners in creating sustainable, multi-functional spaces. It also reflects the increasing role of data-driven decision-making in the construction and real estate industries.

Moreover, the green cluster suggests a shift in thinking about residential buildings, viewing them not just as living spaces but as potential work environments. This perspective encourages innovative approaches to apartment and house design, incorporating features traditionally found in office settings. The emphasis on sustainable development within this cluster indicates a growing awareness of the environmental impact of buildings and the construction industry. It suggests a move towards more eco-friendly building practises, materials, and designs that can support both residential comfort and professional productivity. The green cluster captures the evolving nature of urban spaces, reflecting a trend towards sustainable, flexible, and intelligent building designs that can accommodate the changing dynamics of work and home life.

- Cluster 3 (blue) in the visualization centres around energy efficiency and building management concepts, highlighting the growing emphasis on sustainable practises in both residential and commercial spaces. This blue cluster is particularly relevant given the increasing prevalence of home offices and the blending of work and living environments. Key nodes in this cluster include "energy efficiency", "energy utilization", "residential building", and "home office". These interconnected concepts underscore the evolving nature of our living spaces and the technical challenges associated with optimizing energy use in hybrid work–home environments. The prominence of "residential building" and "home office" nodes reflects the shifting paradigm in how we conceptualize and utilize our homes. As remote work becomes more commonplace, there is an increasing need to integrate office functionalities into residential spaces

without compromising energy efficiency or comfort. "Energy utilization" emerges as a critical concept, linking to both residential and commercial applications. Tekler, Low, and Blessing [29] investigated user perceptions on the adoption of smart energy management systems in the workplace. Their findings highlight the importance of considering factors such as user appeal, control, reliability, ease of use, and data privacy when implementing these systems. They also propose several design implications and organization-level policies to guide the design of future systems in the workplace. This suggests a growing focus on how energy is consumed across different types of buildings and how this consumption pattern changes when homes double as workspaces.

The blue cluster's connection to "urban planning" indicates a broader perspective on energy efficiency, extending beyond individual buildings to encompass city-wide strategies for sustainable development. This holistic approach is crucial for creating energy-efficient communities that can support the evolving needs of a remote workforce. Attractively, the cluster also links to "decision making", highlighting the complex choices faced by homeowners, builders, and policymakers in balancing energy efficiency with the functional requirements of home offices. This connection suggests an increasing need for informed decision-making tools and strategies in residential design and energy management. The relationship between energy utilization and home offices is likely to be a major area of study in the coming years. As more people work from home, understanding and optimizing residential energy consumption patterns will become increasingly important. This could lead to innovations in smart home technologies, energy-efficient office equipment designed for residential use, and new approaches to heating, cooling, and lighting that can adapt to flexible work–home scenarios.

- Cluster 4 (yellow) in the visualization highlights the intersection of environmental health and architectural design, with key nodes including "indoor air pollution" and "architectural design". This yellow cluster emphasizes the critical importance of creating healthy indoor environments through thoughtful and innovative design practises, particularly as the lines between home and office spaces continue to blur. As remote work becomes more prevalent, the focus on indoor air quality in residential spaces is expected to intensify. Future research will likely explore the integration of modern office design features in homes, with a particular emphasis on mitigating indoor air pollution. Edalatnia and Das [30] presented a novel approach for landscape health activity space design, using reliability multi-objective optimization to create sustainable and user-centric outdoor environments. Their model computes a balance between greenery density, pathway length, and accessibility while considering budget constraints, offering valuable insights for designing healthier and more sustainable outdoor spaces. This shift reflects a growing awareness of the impact of indoor environments on both physical health and cognitive performance.

The yellow cluster suggests an emerging trend towards holistic design approaches that consider not only esthetics and functionality but also the long-term health implications of built environments. As homes increasingly double as workspaces, architects and designers will need to incorporate strategies to maintain optimal air quality, natural lighting, and ergonomic features traditionally associated with office spaces. Moreover, this cluster hints at the potential integration of positive psychology principles in architectural design. Future interventions may aim to cultivate and enhance workplace performance, well-being, and personal growth within residential settings. These approaches could draw on modern office design features that promote productivity and comfort while nurturing the psychological needs of individuals working from home. The connection to decision-making nodes in a broader visualization suggests that future architectural designs will increasingly be informed by interdisciplinary research, combining insights from environmental science, psychology, and workplace studies. This holistic approach aims to create living–working spaces that not only minimize health risks associated with indoor air pollution but also

actively contribute to the occupants' overall well-being and life satisfaction. As this field evolves, there is an expectation to see innovative design solutions that seamlessly blend health-promoting features with the functional requirements of home offices, ultimately fostering environments that support both professional productivity and personal flourishing.

3.1.3. Influential Countries

Figure 4 illustrates the intricate collaboration network among countries in scientific publications. The network's nodes represent individual countries, with their size proportional to the number of publications co-authored with researchers from other nations. This visual representation offers insights into the global interconnectedness of scientific research and highlights key players in international collaboration. The thickness of edges connecting nodes indicates the strength of collaborative relationships between country pairs. Clusters within the network may reveal regional or thematic collaboration patterns. Colour coding can be employed to distinguish continents or research fields, providing additional layers of information. Table 3 complements the visual data by ranking the top nine countries according to two critical network metrics, the hub score and betweenness centrality. These measures offer quantitative insights into each country's influence and role as a connector in the global research ecosystem.

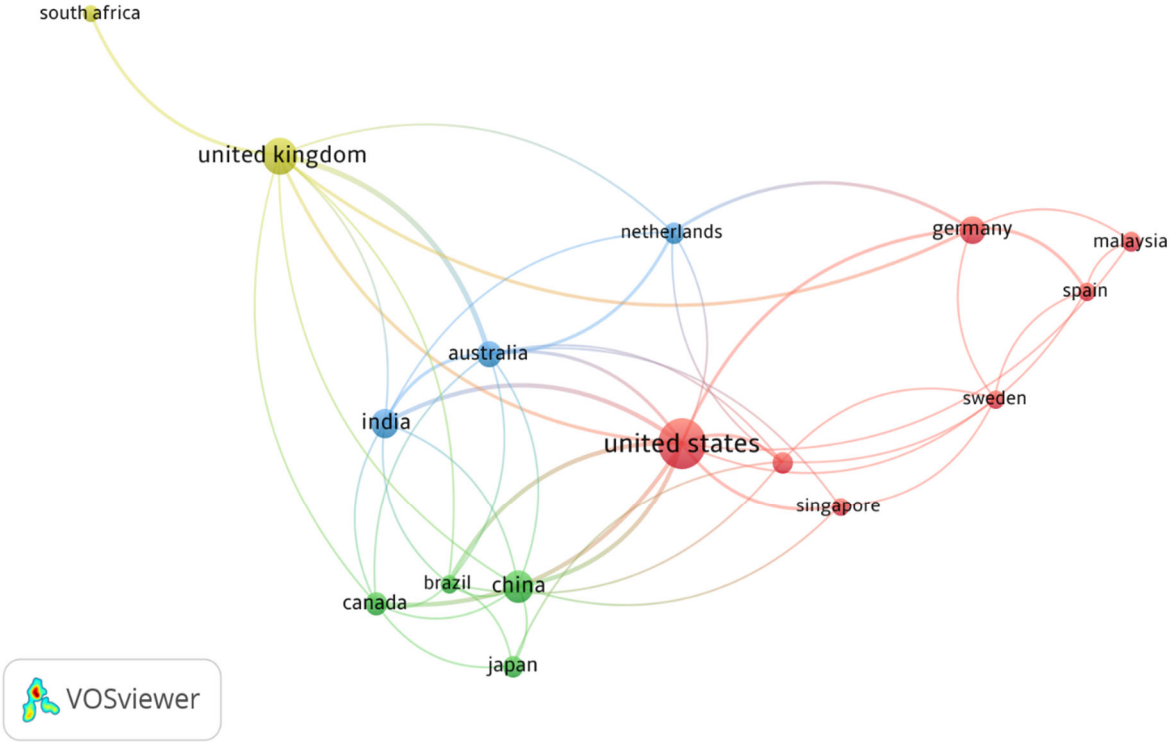

Figure 4. Network of countries.

Based on Figure 4 and Table 3, several significant findings emerge regarding international collaboration in research on modern office design features in residential spaces. The bibliographic records reveal a collaboration network comprising 16 countries, organized into five distinct clusters. This substantial representation suggests that the development of modern office design features for residential spaces draws upon a diverse range of cross-context cases and comparative studies, enhancing the robustness and applicability of the research. Researchers from countries not included in this network should exercise caution when conducting studies in this field. They must pay particular attention to the relevance and generalizability of their findings, considering the potential limitations of their local context.

Table 3. Top ten countries in bibliographic coupling and total link strength.

Country	Documents	Citations	Total Link Strength
United States	27	603	346
United Kingdom	08	100	182
China	06	37	6
India	05	13	148
Germany	06	15	200
Australia	08	87	276
Canada	08	77	72
Italy	05	250	67
Japan	05	26	87
Netherlands	5	194	279

The United States emerges as the hub of international collaboration, forging the most diverse collaborative links. Partnerships include those with the United Kingdom, China, Canada, and Sweden. This extensive network positions the U.S. as a central node in the global research ecosystem for this topic. The United States also leads in publication quantity through collaborative research, indicating its dominant role in shaping the discourse on modern office design features in residential spaces. The centrality of U.S.-based authors in connecting research activities with scholars from other influential countries suggests their pivotal role in driving the field forwards. This position likely allows them to synthesize diverse perspectives and methodologies, potentially leading to more comprehensive and globally applicable findings. The collaborative nature of this research field facilitates the cross-pollination of ideas and methodologies across different cultural and geographic contexts, potentially accelerating innovation and the development of best practises in residential office design. The observed collaboration patterns may inform future research strategies, encouraging increased international partnerships to address gaps in the current knowledge base and explore underrepresented contexts.

3.1.4. Bibliographic Coupling Analysis

The bibliographic coupling analysis was conducted using VOSviewer, with the minimum number of citations for a document set from one to nine, as shown in Table 4. Table 4 presents the representative of each cluster, which is the citing document with the most co-cited documents among all other citing documents in that cluster. The total link strength indicates the number of co-cited documents for a representative. According to the principle of bibliographic coupling [26], the representative can be considered the publication that shares the most thematic similarity with other documents within a cluster. The similarity relations between documents in a cluster remain stable once the time boundaries of a bibliographic dataset are established. For each cluster, the total link strength value is relative to the number of documents, typically close to or higher than one. This indicates strong relationships between documents within the same cluster (see Table 4).

The bibliographic coupling analysis reveals significant insights into the research landscape of modern office design features in residential spaces. Table 4 presents the top 10 documents based on their total link strength and citations. Among these, five publications stand out as particularly influential. Lansmann et al. [27] leads with a total link strength of 30, followed by Urbaniec et al. [31] at a 23 total link strength, Dhanpat et al. [32] at a 19 total link strength, Shao et al. [33] at a 12 total link strength, and Alotaibi [34] at an 11 total link strength. These works appear to be central to the current discourse in the field, serving as key reference points for other researchers.

Table 4. Bibliographic coupling patterns from VOS clustering.

Documents	Citations	Total Link Strength
Lansmann et al. [27]	2	30
Urbaniec et al. [31]	22	23
Dhanpat et al. [32]	5	19
Shao et al. [33]	1	12
Alotaibi [34]	1	11
Chafi et al. [35]	116	11
Aczel et al. [28]	88	11
Wang et al. [36]	6	10
De-Toledo et al. [37]	3	9
Kong et al. [38]	37	8

The network visualization in Figure 5 offers a more nuanced view of the research landscape, depicting nine significant clusters that represent distinct thematic areas within the field. This visual representation allows for a deeper understanding of how different research topics relate to one another. Cluster 1, coloured red and centred around Dhanpat et al.'s study [32], forms a separate and prominent group, suggesting a distinct research focus that stands apart from other themes. In contrast, clusters 2 (green, including Alotaibi [34]) and 3 (orange, featuring Breideband et al. [39]) show a closer relationship, indicating potential thematic overlap or complementary research areas.

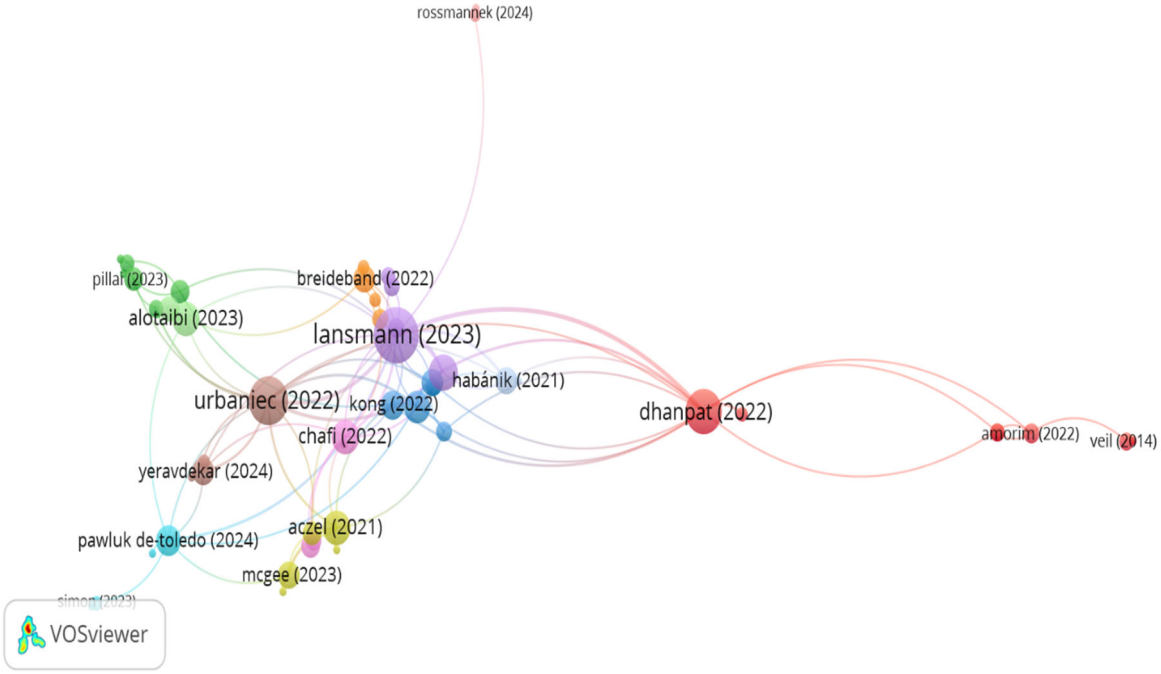

Figure 5. Bibliographic coupling network [27,28,31–38,40–45].

A further examination of the network reveals additional interesting patterns. Clusters 4 (yellow, with Aczel et al. [28]) and 5 (brown, featuring Urbaniec et al. [31]) demonstrate some connection while maintaining their distinct identities, possibly representing related but separate research streams. Clusters 6 (purple, dominated by Lansmann et al. [27]) and 7 (blue, including Kong et al. [38]) are positioned near the red cluster, suggesting related but distinct research areas that may share some common ground with the themes in cluster 1.

The visualization also highlights several smaller clusters on the periphery, such as those represented by De-Toledo et al. [37] and Rossmannek et al. [46]. These may indicate emerging or niche research directions that are beginning to gain traction in the field. The central position of Lansmann et al. [27] in the network is particularly noteworthy, as it suggests that this publication plays a significant role in bridging multiple research themes, potentially serving as a cornerstone for integrating diverse aspects of modern office design in residential spaces.

3.2. Challenges and Limitations of Implementing Modern Office Design Features in Residential Spaces

This section examines the challenges and limitations of incorporating modern office design elements into residential spaces. Drawing from a comprehensive review of 108 papers sourced from the Scopus database, it provides an objective analysis of the obstacles encountered when adapting homes to meet professional work requirements. The study explores various factors, including spatial constraints, ergonomic considerations, technological integration, and work–life balance in home settings. Understanding these challenges is essential for improving home-based work environments. This research area demands a thorough analysis of current situations and user experiences to develop effective solutions that balance professional needs with residential comfort and functionality. The primary issues affecting home office spaces can be categorized into two main areas (see Figure 6), space design and user comfort and well-being. Space design challenges include poor utilization of limited areas, difficulties in integrating professional features while maintaining residential esthetics, and the need for multifunctional, adaptable furniture solutions [47]. Additionally, many homes lack the necessary technical setup to support a full office environment, leading to potential costly upgrades.

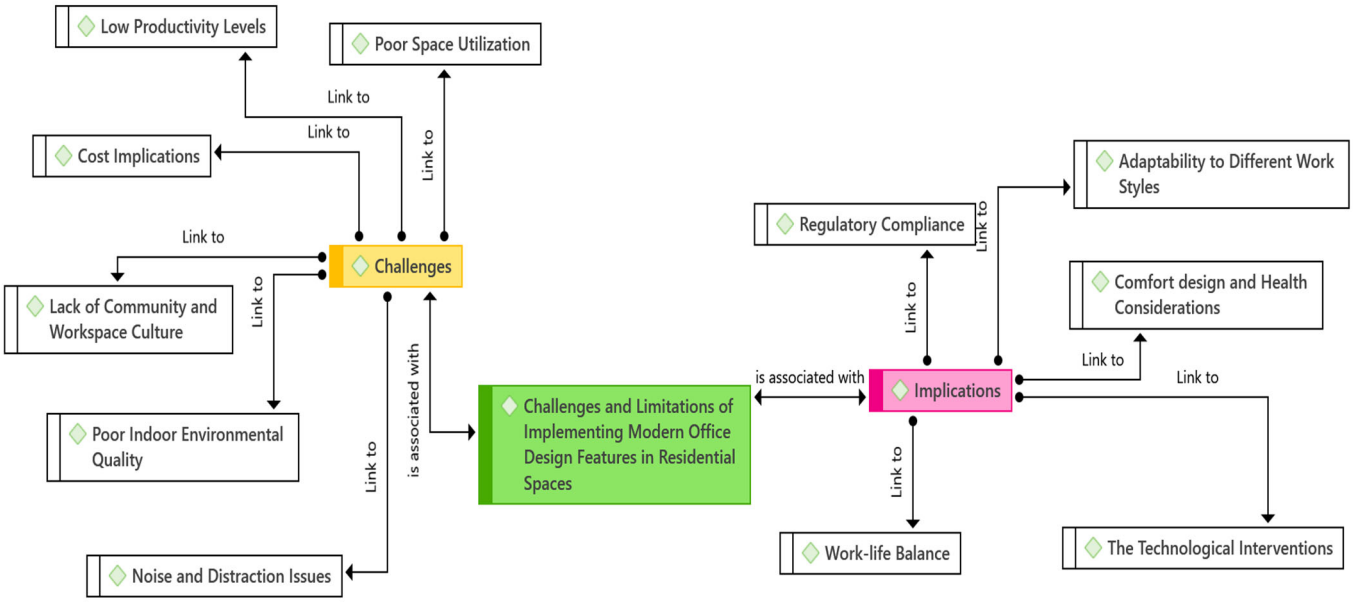

Figure 6. Incorporating office design features in residences: challenges and implications.

User comfort and well-being concerns encompass ergonomic considerations, work–life balance struggles, and the impact of noise and distractions on productivity. Poor indoor environmental quality, including inadequate lighting and ventilation, can significantly affect employee performance and health. The lack of a distinct workspace culture and community feeling in home offices can also lead to reduced motivation and job satisfaction. Furthermore, regulatory compliance and cost implications present additional hurdles for implementing comprehensive home office solutions. Addressing these multifaceted challenges requires innovative design approaches, technological interventions, and a deep understanding of the evolving nature of remote work.

3.2.1. Challenges

➢ Poor Space Utilization

Residential spaces frequently fall short of the dimensions found in dedicated office environments, presenting a significant challenge when attempting to incorporate desired office features without encroaching on vital living areas. This spatial constraint necessitates innovative solutions and thoughtful design compromises to create functional home workspaces. Hiyasat, Sosa, and Ahmad [48] assessed user satisfaction of workspaces modified at home in response to the COVID-19 pandemic in the United Arab Emirates. Their analysis revealed that demographic variables played a crucial role in affecting satisfaction with various elements, from indoor air quality to the amount of natural light received by the space. They found that participants who felt the need to add colour and change the furniture layout experienced feelings of productivity, commitment, and motivation by working from home. Robelski et al. [49] found that inefficient space utilization in home offices often stems from designs ill-suited to users' needs, a lack of spatial variety, and the absence of planned extension areas, ultimately leading to cramped conditions that negatively impact user productivity and well-being.

To address these challenges, homeowners and designers must adopt multifaceted approaches that maximize available space while maintaining a harmonious balance between work and living areas. This may involve implementing versatile furniture solutions, such as modular or convertible pieces that serve dual purposes. Additionally, the strategic use of vertical space, including wall-mounted shelving and storage systems, can help alleviate floor clutter and create a more organized work environment. Proper lighting, both natural and artificial, plays a crucial role in enhancing the perceived spaciousness of home offices while contributing to improved focus and productivity.

➢ Low Productivity Levels

Employee productivity in remote work settings can be significantly impacted by a myriad of factors, including crowded home workspaces, job dissatisfaction, and suboptimal physical environments. According to Gibson et al. [50], the COVID-19 pandemic has dramatically altered expectations for where and when work should take place. Their study found that while many executives are now expecting employees to return to the office, there is strong resistance from workers who have experienced well-being, productivity, and autonomy benefits from remote and hybrid work arrangements. A comprehensive study by Marikyan et al. [51] emphasized that providing suitable environments that foster creativity, encourage regular interaction, and enhance productivity is crucial for remote work success. Their research revealed that employees working in well-designed home offices reported higher levels of job satisfaction and demonstrated increased output compared to those in cramped or makeshift spaces. To address these challenges, companies are increasingly investing in ergonomic furniture and technology solutions for their remote workforce. Additionally, implementing flexible work policies that allow employees to customize their schedules can help mitigate the negative effects of shared living spaces during peak hours. Virtual collaboration tools and regular check-ins have also proven effective in maintaining team cohesion and combating feelings of isolation. Furthermore, organizations are exploring innovative approaches such as providing access to co-working spaces or offering stipends for home office improvements. By prioritizing the creation of conducive work environments, businesses can unlock the full potential of their remote employees, leading to enhanced productivity, job satisfaction, and overall organizational success.

➢ Lack of Community and Workspace Culture

Many existing home office spaces feel uninspiring and lack the vibrant culture found in traditional workplaces. Lucius et al. [52] investigated how working from home affects the relationship between internal corporate social responsibility (ICSR) and employee creativity during uncertain times. Their empirical results show that ICSR activities increase employee creativity, partly by reducing one harmful aspect of stress, namely threats. However, they

found that the higher the degree of working from home, the weaker the ICSR activities' effects are. Thompson, Williams and Brown [53] noted that home offices often prioritize practicality over creativity and interaction, resulting in environments that fail to foster a sense of community or distinct workplace culture. This disconnect can lead to decreased motivation and engagement among remote workers. To address this challenge, companies are exploring innovative solutions to infuse home offices with elements of corporate culture. Virtual reality platforms are being utilized to create immersive digital workspaces that replicate office environments and facilitate spontaneous interactions. Additionally, businesses are implementing regular virtual team-building activities and providing employees with branded decor to enhance the sense of belonging. Designers are also reimagining home office layouts to incorporate collaborative zones and creative spaces, even with limited square footage. Integrating elements that stimulate creativity and promote social connection, such as adjustable lighting and nature-inspired decor, home offices can evolve into dynamic environments that rival traditional workplaces in fostering innovation and team cohesion.

➢ Poor Indoor Environmental Quality

Striking a harmonious balance between professional needs and home comfort presents significant challenges in the era of remote work. Recent research by Pang et al. [54] revealed that improvements in indoor environmental conditions can boost employee productivity by 4–10%, highlighting the critical importance of optimizing home office environments. This finding underscores the need for the thoughtful design and implementation of workspace solutions within residential settings. To achieve this delicate equilibrium, homeowners and remote workers are increasingly turning to innovative approaches. Modular furniture systems that seamlessly transition between work and leisure modes are gaining popularity, allowing for efficient space utilization without compromising comfort. Additionally, the integration of biophilic design elements, such as natural lighting and indoor plants, has been shown to reduce stress and enhance cognitive function in home office settings.

Acoustics play a crucial role in maintaining focus and productivity. The implementation of sound-absorbing materials and the strategic placement of workspaces can significantly reduce noise distractions, a common issue in shared living environments. Furthermore, the adoption of smart home technologies enables users to automate and customize their work environment, adjusting lighting, temperature, and even background sounds to create optimal conditions for productivity throughout the day. By addressing these various aspects, individuals can create home offices that not only meet professional requirements but also contribute positively to overall well-being and work–life balance.

➢ Noise and Distraction Issues

Residential settings frequently lack adequate sound insulation, leading to significant privacy concerns and work interruptions for remote employees. A comprehensive study by Ramantswana, Mmamabolo, and Appel-Meulenbroek [55] found that the absence of reflection spaces and quiet areas in home offices negatively impacts user well-being and productivity, especially for those sensitive to noise and distractions. This issue is particularly pronounced in shared living spaces or densely populated urban environments. To address these challenges, innovative solutions are emerging. Acoustic panels and sound-absorbing materials are being integrated into home office designs, helping to create quieter work zones within open layouts. Noise-cancelling headphones and white noise machines have become essential tools for many remote workers, providing a personal audio bubble that enhances focus. Some homeowners are exploring more substantial renovations, such as installing soundproof windows or constructing dedicated office pods within larger rooms. Additionally, the concept of "virtual sound masking" is gaining traction, where AI-powered systems generate subtle background noise to cover disruptive sounds without being intrusive themselves. These technological and design interventions, when combined with thoughtful space planning and clear communication with cohabitants, can significantly

improve the acoustic environment of home offices, leading to enhanced productivity and job satisfaction.

➢ Cost Implications

Implementing professional office features in residential spaces can be prohibitively expensive for many remote workers, creating a significant barrier to optimal work environments. A comprehensive market analysis by Lansmann et al. [27] found that the high cost of quality ergonomic furniture and equipment presents a substantial financial hurdle for individuals setting up home offices. This economic constraint often leads to suboptimal work setups, potentially resulting in decreased productivity and increased health risks for those unable to invest in proper ergonomic solutions. Cattani, Magrini, and Chiari [56] discussed the energy efficiency of smart working as a solution to traditional work-approach issues. Their study on a real residential building in northern Italy revealed a 15% average increase in energy consumption when all work tasks are performed from home. They proposed four novel indices to assess the energy efficiency of smart working initiatives, aiming to mitigate disparities arising from a transfer of burdens to employees. To address this challenge, innovative and cost-effective solutions are emerging in the market. Subscription-based office furniture services are gaining popularity, allowing workers to access high-quality equipment without large upfront costs. These services often include options to upgrade or swap out furniture as needs change, providing flexibility for evolving work situations.

Additionally, forward-thinking companies are offering stipends or reimbursement programmes for home office setups, recognizing the long-term benefits of supporting their remote workforce's productivity and well-being. Some organizations are partnering with furniture manufacturers to provide employee discounts, further easing the financial burden. The growing demand for affordable home office solutions has also spurred innovation in product design. Manufacturers are developing space-efficient, multi-functional furniture that does not compromise on ergonomics or quality. These products often incorporate modular designs, allowing for limited space and budget customisation.

Furthermore, the rise of the circular economy has introduced refurbished and upcycled office furniture options, offering professional-grade equipment at more accessible price points. Online marketplaces specializing in pre-owned office furniture have expanded, providing budget-conscious remote workers with quality alternatives. As the remote work trend continues to evolve, these market responses are making professional-grade home offices increasingly accessible to a wider range of workers, democratizing access to ergonomic and productive work environments regardless of individual financial constraints.

3.2.2. Limitations

➢ The Technological Interventions

Many residential spaces lack the necessary infrastructure to support a full-fledged office environment, presenting significant challenges for remote workers. Biswakarma et al. [57] explored the challenges faced by academic institutions during the transition to remote work. They identified issues such as transitioning from classroom to remote teaching and conducting research activities from home offices. The study emphasizes the need for improved overall infrastructure in academic institutions to better handle future crises. This infrastructural deficit can lead to suboptimal work conditions, reduced productivity, and increased stress for employees attempting to replicate professional setups in their homes. Mäkelä [58] observed that the integration of recent technologies in home offices is often hindered by inadequate electrical, network, or lighting setups, with upgrades being costly and potentially requiring professional installation.

To address these limitations, innovative solutions are emerging. Wireless charging pads and battery-powered devices are helping to alleviate the need for extensive electrical upgrades. Mesh Wi-Fi systems and portable hotspots are improving network coverage and reliability without requiring complex wiring. Smart lighting systems that can be easily installed and controlled via smartphone apps are enhancing workspace illumination

without major renovations. Some homeowners are exploring modular office pods that can be placed in gardens or unused spaces, complete with their own power and network connections. Additionally, furniture manufacturers are developing desks and storage units with built-in power distribution and cable management systems. These advancements, coupled with the rising trend in energy-efficient and compact office equipment, are making it increasingly feasible to create professional-grade home offices without extensive structural modifications. As remote work continues to evolve, the demand for flexible plug-and-play office solutions is driving further innovations in this space.

➢ Comfort Design and Health Considerations

Ensuring proper ergonomics in limited home office spaces presents a significant challenge for remote workers, with potential long-term consequences for health and productivity. Chafi et al. [35] examined the needs and challenges in remote and hybrid work from an occupational health and wellbeing perspective. Their results describe opportunities and challenges with the adoption of remote and hybrid work from individual, group, and leadership perspectives. They found that hybrid work was perceived to provide the best of both worlds of remote and office work, given that employees and managers develop new skills and competencies to adjust to new ways of working. A comprehensive longitudinal study by Khader [59] concluded that inadequate ergonomic setups in home offices can lead to a range of musculoskeletal disorders, increased stress levels, and decreased productivity over time. This research emphasizes the critical need for tailored ergonomic solutions in residential work environments, underscoring the importance of adapting living spaces to accommodate healthy work practises, even when square footage is at a premium. To address these concerns, innovative furniture designs are emerging that prioritize ergonomics without sacrificing space efficiency. Height-adjustable desks, which allow for seamless transitions between sitting and standing positions, are becoming increasingly compact and affordable. Ergonomic chairs with adjustable lumbar support, armrests, and seat depth are being designed with space-saving features, ensuring comfort without overwhelming small rooms. Modular workstations that can be easily reconfigured to suit different tasks and body positions are gaining popularity among home workers, offering flexibility in limited spaces.

The integration of technology is playing a crucial role in enhancing ergonomics. Wearable devices that monitor posture and provide real-time feedback are helping individuals maintain proper alignment throughout the workday. AI-powered posture correction apps use computer vision to analyze work setups and offer personalized recommendations for improvement. Some of these applications even provide periodic reminders to take breaks, stretch, or adjust position, combating the sedentary nature of desk work. Recognizing the importance of proper ergonomics, many companies are investing in their remote workforce's well-being. Some are offering ergonomic assessments via video calls, where trained professionals evaluate home office setups and provide personalized recommendations. Others are providing stipends specifically for ergonomic equipment or partnering with furniture manufacturers to offer discounts to employees. Prioritizing ergonomics in home office design through a combination of innovative furniture, technology integration, and corporate support, workers can mitigate health risks associated with prolonged desk work. This holistic approach not only optimizes productivity in residential settings but also contributes to the long-term health and job satisfaction of remote workers, ensuring sustainability in the evolving landscape of remote work.

➢ Work–Life Balance

The integration of workspaces into residential areas presents a significant challenge for remote workers, often blurring the boundaries between professional and personal life. Research by Patel and Nguyen [60] suggests that this merging of domains frequently leads to difficulties in maintaining a healthy work–life balance, necessitating strategies for a clear delineation between professional and personal spheres. Urbaniec et al. [31] examined the impact of various factors on the benefits of and barriers to remote working, as perceived by

managerial staff in Poland. Their results suggest that the way the company and employees are managed in a crisis, the approach of superiors to the evaluation and control of work effects, and the adaptation of support to the real needs of employees all play fundamental roles in the success of remote working arrangements. To address this issue, innovative design solutions are emerging. Foldable desks and hidden office nooks allow workers to physically "close" their workspace at the end of the day, creating a visual and spatial separation between work and leisure areas. Smart home systems are being programmed to automatically adjust lighting, temperature, and even ambient sounds to signal the transition between work and personal time, helping to create distinct environmental cues for different modes of living.

Some individuals are adopting "work uniforms" or creating pre- and post-work rituals to mentally separate their professional and personal lives [61]. These practises serve as psychological anchors, helping to create a mental shift between work and home mindsets despite the shared physical space. Companies are also implementing policies to respect employees' personal time, such as establishing "no-contact" hours and encouraging the use of separate work devices. These organizational practises help reinforce the boundaries between work and personal time, reducing the temptation for employees to engage in work activities during off-hours. Additionally, the concept of "third spaces" is gaining traction, where individuals utilize local coworking spaces or cafes for part of their work week. This approach provides a physical change in environment, helping to maintain the home as a primarily personal space. By combining thoughtful design, technology, personal rituals, and organizational practises, remote workers can create more distinct boundaries between their work and personal lives, even within the confines of their homes. This holistic approach to managing the work-from-home environment is crucial for maintaining long-term productivity, job satisfaction, and overall well-being in the evolving landscape of remote work.

➢ Regulatory Compliance

Local regulations can significantly constrain the extent of home office implementations, creating unexpected hurdles for remote workers. Högberg and Willermark [62] conducted a longitudinal case study of knowledge-based workers in three firms in Sweden from March 2020 to March 2023. Their study shows how the intricate interaction between rules and norms for interaction and work must be renegotiated as well as un- and relearned when the physical work environment no longer frames the work context. They emphasize that individuals learned through trial and error, modifying practises if outcomes were poor. A comprehensive policy review by Verderber et al. [63] revealed that zoning laws and residential use regulations in many areas restrict the extent to which residential spaces can be converted into work areas, posing challenges for comprehensive home office setups. These restrictions can range from limitations on external modifications to prohibitions on certain types of business activities conducted from home, impacting not only the physical workspace but also the nature of work that can be performed. To navigate these regulatory complexities, homeowners and remote workers are adopting creative solutions. Some are exploring temporary or reversible modifications that comply with local codes while still enhancing their work environment. This includes the use of portable partitions, foldable furniture, and versatile storage solutions that can quickly transform living spaces into professional settings without permanent alterations. Others are seeking variances or special permits from local authorities to accommodate their home office needs, a process that often requires demonstrating a minimal impact on neighbourhood characteristics and residential tranquillity. In response to the growing trend in remote work, some forward-thinking municipalities are revising their zoning laws to be more accommodating of home-based businesses, recognizing the economic and environmental benefits of reduced commuting.

Professional organizations and advocacy groups are also working to educate policy-makers on the evolving nature of work, pushing for more flexible regulations that balance neighbourhood preservation with the needs of the modern workforce. These efforts often highlight the potential for home-based businesses to revitalize communities and support

local economies. As remote work becomes increasingly prevalent, finding a harmonious balance between residential regulations and home office requirements remains an ongoing challenge. This evolving landscape necessitates continued dialogue between residents, policymakers, and urban planners to create adaptive frameworks that support the changing dynamics of work while preserving the essence of residential communities.

➢ Adaptability to Different Work Styles

Home offices must accommodate an increasingly diverse array of work styles and job requirements, presenting a unique design challenge. According to Umishio et al. [64], the COVID-19 pandemic has drastically changed work styles and environments. Their study of 916 workers in 22 offices in Japan found that while average workdays at the offices decreased, those at home increased. The wider implication on offices is the calibration of spatial capacities to accommodate hybrid work [65]. Thus, compared to the office, satisfaction rates were lower for lighting, spatial, and IT environments at home, but higher for thermal, air, and sound environments. They also found that a lower PM2.5 concentration was associated with greater satisfaction with COVID-19 countermeasures, potentially increasing work productivity. Moshaver [66] emphasized that creating flexible residential workspaces capable of supporting various work styles is significantly more challenging than in purpose-built office environments, necessitating innovative and adaptable design approaches. To address this complexity, multifunctional furniture solutions are gaining popularity. Convertible desks that transform from standing to sitting configurations, modular storage systems, and acoustically treated room dividers allow for rapid workspace reconfiguration. Smart home technology is being integrated to automate environmental adjustments, catering to different tasks and personal preferences throughout the workday. Some homeowners are exploring the concept of "zoned" home offices, where different areas are optimized for specific work modes such as focused individual work, virtual collaboration, and creative brainstorming. This approach allows for a more nuanced and efficient use of limited residential space.

Additionally, the rise of augmented and virtual reality technologies is enabling workers to create customizable virtual workspaces that can be instantly adapted to various tasks, supplementing physical home office setups. These immersive technologies offer the potential to expand perceived workspaces beyond physical limitations, providing access to virtual tools and environments tailored to specific job requirements. As remote work continues to evolve, the ability to create versatile, responsive home office environments will be crucial for supporting diverse professional needs and maximizing productivity. The integration of adaptive furniture, smart technology, and virtual solutions is paving the way for a new era of home office design that blends functionality, comfort, and innovation.

4. Conclusions

This systematic literature review of 108 peer-reviewed articles reveals significant trends and challenges in implementing modern office design features within residential spaces. This comprehensive analysis provides crucial insights into the evolving landscape of home-based work environments. The study illustrates a clear upwards trajectory in research output since 2021, with a notable peak of 24 publications in 2022. This surge in scholarly interest shows the growing importance of home office design, particularly in the wake of the COVID-19 pandemic and the subsequent shift towards remote work. The sustained momentum, evidenced by 19 publications already in August 2024, suggests that this field is likely to remain a focal point of research in the coming years.

The keyword co-occurrence analysis depicted in the study provides valuable insights into the multifaceted nature of the research landscape. The emergence of four distinct clusters highlights the complexity of integrating office features into residential spaces. The red cluster, centred around COVID-19 and its impact, emphasizes the pandemic's role as a catalyst for the rapid adoption of home offices. The green cluster, which focuses on sustainable development and intelligent buildings, emphasizes eco-friendly and technologically advanced home office solutions. The blue cluster, highlighting energy efficiency

and residential buildings, points to the increasing importance of optimizing energy use in hybrid work–home environments. The yellow cluster, emphasizing indoor air quality and architectural design, underscores the critical importance of creating healthy indoor work environments similar to performance expectations in modern offices. It may be worthwhile in this cluster, for the purposes of currency, to compare performance with more environmentally friendly (green) office buildings [67].

The network analysis of international collaboration reveals the United States as the hub of research in this field, with strong connections to the United Kingdom, China, and other nations. This global collaboration network suggests that the development of modern office design features for residential spaces benefits from diverse cross-cultural perspectives and comparative studies. However, the limited number of countries (16) in the collaboration network also indicates potential gaps in global representation, particularly from developing nations.

The study identifies several key challenges in implementing modern office design features in residential spaces. Spatial constraints often limit the ability to create open-plan layouts and collaborative zones typical of contemporary offices. Many residences fall short in technological infrastructure, potentially necessitating costly upgrades. The blurring of boundaries between professional and personal spaces emerges as a critical psychological challenge, impacting both productivity and overall well-being. Environmental factors such as poor lighting, inadequate ventilation, and noise pollution in residential settings can significantly affect employee performance and health. Additionally, the implementation of proper ergonomic solutions in limited home spaces presents a challenge with potential long-term health implications.

The research shows a lack of distinct workspace culture and community feeling in home offices, which can lead to reduced motivation and job satisfaction. Financial constraints pose another significant hurdle, as the high cost of quality ergonomic furniture and equipment can be prohibitive for many individuals setting up home offices. Local zoning laws and residential use regulations further complicate matters, often constraining the extent of home office implementations. The study also notes the difficulty in creating flexible residential workspaces that support various work styles, a challenge more pronounced in homes than in purpose-built office environments.

These findings have far-reaching implications across multiple sectors. They highlight the need for innovative design solutions to maximize limited residential spaces while maintaining a clear delineation between work and personal areas. The growing demand for the seamless integration of office technologies into residential settings may drive advancements in smart home systems and portable office solutions. Organizations may need to revise their remote work policies to address the identified challenges, including providing support for home office setups and ensuring work–life balance. Furthermore, there is the increasing need to facilitate digitalised and more mobile work teams to leverage on cutting-edge technological innovations [65]. This supports current concepts for creating opportunities to work from everywhere [68]. The research also emphasizes the importance of prioritizing employee health and well-being in remote work settings, potentially leading to new corporate wellness initiatives tailored for home workers.

From an economic perspective, the financial barriers to creating optimal home offices may exacerbate workforce inequalities, necessitating corporate or policy interventions. On a broader scale, the shift towards remote work could influence future residential architecture and urban planning, potentially leading to new housing designs that better accommodate home offices. These have wider implications on real estate market dynamics [69,70], which is outside the scope of the current study. However, based on our findings, we propose several policy implications to address the challenges of implementing modern office design features in residential spaces. Policymakers should consider revising zoning laws and building codes to accommodate the growing trend in home-based work, potentially creating a new category for live–work spaces with specific guidelines for safety, ergonomics, and infrastructure. Local governments could offer tax incentives or grants for homeowners

and landlords to upgrade residential spaces with proper technological infrastructure and ergonomic setups. Employers should be encouraged through policy frameworks to provide stipends or equipment for home office setups, ensuring equitable access to quality work environments. Urban planners should be mandated to incorporate flexible, multi-use spaces in new residential developments, anticipating future needs for home offices. Additionally, policies promoting the development of local co-working spaces could provide alternatives for those unable to create suitable home offices. Also, labour laws should be updated to address work–life balance issues in remote work settings, potentially including "right to disconnect" provisions. Local governments may need to reassess and potentially revise zoning laws and building codes to better accommodate the growing trend in home-based work. While the complete replication of modern home office design may be impractical, the research suggests that a hybrid approach, adapting key features to residential constraints, could enhance home office productivity and worker well-being. As remote work continues to shape the future of employment, addressing these challenges will be crucial for creating productive, healthy, and sustainable home working environments. Future research could focus on developing innovative solutions that balance the needs of remote workers with the limitations of residential spaces while also considering the broader implications for urban development, sustainability, and workforce equity.

The study has limitations that are worth noting. By exclusively using the Scopus database for the literature collection, there is the likelihood that relevant research published on other platforms or indexed in different databases may have been overlooked. Although Scopus is a comprehensive database, it does not encompass all available scientific publications. Furthermore, the review's focus on peer-reviewed articles may have overlooked valuable insights from the grey literature, industry reports, or conference proceedings. Additionally, the temporal scope of the study, covering publications from 2009 to 2024, may have missed historical context or very recent developments not yet captured in the academic literature. Finally, the rapid evolution of remote work practises, especially in the context of the COVID-19 pandemic, means that some findings may quickly become outdated, requiring ongoing research in this dynamic and emerging field.

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