Review

A Comprehensive Review of Deterrents to the Practice of Sustainable Interior Architecture and Design

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Abstract: The interior environment as the place where people spend nearly 95% of their time in, has recently received considerable attention within the domain of the built environment. The concept of Sustainable Interior Architecture and Design (SIAD) and its significance have been recognized given its potential for energy conservation, and its impacts on occupants' satisfaction, comfort, as well as their physical and psychological wellbeing. Although the adoption of SIAD is crucial in achieving the sustainable development goals, its practice is still hindered by numerous deterrents. A number of studies have reported on these deterrents; however, there is no comprehensive review of the literature on this topic. Thus, as a first step toward addressing the present gap, this article provides a two decade (2000–2021) systematic review of the relevant literature that investigates a total of 51 publications. Furthermore, a scientometric analysis was conducted, and the co-citation and co-occurrence of journals and keywords were analyzed to illustrate the scientific landscape. A comprehensive summary table is provided consisting of 61 deterrents to the practice of SIAD that are categorized into five main categories: (1) economic; (2) attitude, knowledge, and awareness; (3) market, information, and technology; (4) education and training; as well as (5) government and professional bodies. Finally, the findings are deliberated upon and directions for future research are discussed.

Keywords: sustainability; interior design; barrier; architectural design; interior environment

1. Introduction

The built environment contributes significantly to society's needs by improving the quality of life [1]. Nevertheless, the substantial increase in construction activities, along with the rapid urbanization occurring throughout the world, have induced concerns among practitioners, academics, governments, and the general public. As a result, integration of principles of sustainability within the construction industry has been gaining much attention in recent years [2]. The idea of sustainability was first put forward by the World Commission on Environment and Development and is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" [3]. Similar to other professions in the built environment, sustainability has also been embedded into Interior Architecture and Design (IAD) [4].

IAD is primarily concerned with solving the complex issues and handling the ever-changing requirements of the environment in which we live, work, and play [5]. The importance and influence of IAD is further amplified, given that people spend almost 95% of their time indoors [6]. The comfort variables—usually referred to as Indoor Environmental Quality (IEQ)—involve lighting, humidity, thermal comfort, airborne contaminants, airflow, acoustics, and ventilation, which were found to have a significant effect on occupants' health, satisfaction, and productivity [7,8]. Moreover, previous studies have demonstrated that apart from IEQ, design characteristics of the interior environment similarly have a substantial impact on occupants' level of comfort, emotions, behaviors,

performance, as well as their general physiological and psychological health and well-being [9–12]. For instance, with respect to the impact of color, Cha et al. [13] found that participants immersed in a white colored virtual environment performed significantly better when completing a proofreading task, while the red color brought upon a tense and unpleasant emotion. Banaei et al. [14,15] investigated the impact of interior forms on occupants' emotions and found that curved geometries simulate a positive pleasure effect among the participants. Yin et al. [16] found that integration of greenery within the interior environment has restorative effects by reducing stress and anxiety.

There are myriad terms used to describe the integration of sustainability with IAD. Among the most used terminologies are: Environmentally Sustainable Interior Design [17]; Sustainable Interior Design [18]; Green Interior Design [19]; and Sustainable Interior Architectural Design [20]. However, the above terminologies do not holistically reflect the nature of sustainability and the domain of IAD. For instance, the term 'Environmentally Sustainable Interior Design' has been adopted by many scholars and is defined as an approach that "focuses on materials' intended application, aesthetic qualities, environmental and health impacts, availability, ease of instalment and maintenance, and initial and life cycle costs" [17]. As pointed out by Pilatowicz [21], for a long time, the efforts concerning the integration of sustainability within IAD field revolved around resource conservation, specification of local materials, recycled contents, and energy efficient lightings. Nonetheless, sustainability in IAD is a much broader notion that not only contemplates the impact of design decisions on the global environment, but also the physical and psychological impacts on occupants and everyone involved in a project, while endowing nourishing and multisensory experiences that go beyond functional and aesthetic needs [21].

Considering the sheer magnitude of the impact of design decisions as outlined above, it seems that focusing only on environmental aspects does not do justice to the holistic approach of sustainability. Besides, the term 'Sustainable' already entails the triple bottom line, and the addition of 'Environmentally' to the terminology seems unnecessary and rather baffling. Furthermore, within the academic community, when describing practitioners, the terms 'Interior Architect' and 'Interior Designer' are often used interchangeably. This is due to differences in the professional designations in varying contexts. For instance, in Australia, the term 'architect' is protected by law and cannot be used to describe any other profession [22]. Therefore, the terminology must be inclusive for all contexts. To this end and with considerations to all the above-mentioned factors, a more holistic terminology 'Sustainable Interior Architecture and Design' (SIAD) is proposed and will be used for the purpose of this article.

The implementation of SIAD is crucial in achieving the sustainable development goals (SDGs) both for new buildings and renovating the existing building stock. While the significance of SIAD has been recognized for a long time, yet, the imbalance between theory and practice—a phenomenon named 'the sustainability gap'—has been a major issue [23]. Throughout the years, numerous scholars have raised similar concerns about the deficiency in the practice of SIAD [20,21,24]. In order to facilitate the wider adoption of SIAD, the deterrents to its practice must first be identified so as to steer the subsequent efforts toward finding potential solutions. The existing literature has identified a number of deterrents such as a lack of awareness and interest from clients [25], overall higher costs [26], designers' resistance to change [27], and a lack of access to sustainable materials [28]. However, to date, there has not been a single systematic review of literature that provides a comprehensive summary of these deterrents. To this end, and in order to address the existing gap, this review paper sets out to investigate the literature in the last two decades (2000–2021) to identify deterrents to the practice of SIAD and categorize them based on the identified themes. The intention of this research is to provide the scientific community with a fundamental basis that can be used for rigorous future research into the underlying causes of the deficiency in the practice of SIAD, as well as the subsequent pursuit for potential solutions.

The remainder of this review is arranged as follows: Section 2 presents the review approach and article retrieval procedure used in this study. Section 3 reports the findings of the scientometric analysis that was carried out. Section 4 provides a deep dive and discusses the identified deterrents according to their categories. Section 5 presents a discussion on the findings, Section 6 outlines the limitations and provides directions for future research, and finally, Section 7 presents the concluding remarks.

2. Review Approach

In order to address the mentioned existing gap, a systematic literature review (SLR) approach was designed to achieve the aims of this study. An objective SLR contains five key phases: (1) identifying the problem and formulating research questions; (2) collecting data based on a defined strategy; (3) examining the discovered data; (4) analyzing and interpreting the data; and (5) reporting the findings [29]. Based on the phases above, a review approach was designed which outlines the three main steps of data collection, data examination, and results (refer to Figure 1). In the first step, since the existing literature on the topic is scarce, this review takes a broader approach and includes not only scientific articles but also conference proceedings, books and book chapters, as well as other review articles to paint a comprehensive picture. Additionally, since there are no other review studies on this topic, the period selected for this review covers two decades (from 2000 to 2021). For the purpose of this review, Elsevier's Scopus database was selected due to its substantially wider coverage [30,31], higher accuracy [32], better precision in searching strategies, and data retrieving procedures, as well as due to it covering more recent bibliometric data [33] compared to other wide-range covering databases such as Google Scholar and Web of Science [34]. Additionally, previous review articles within the construction industry have also employed bibliometric data from the Scopus database and have taken similar approaches (i.e., see [32,35,36]).
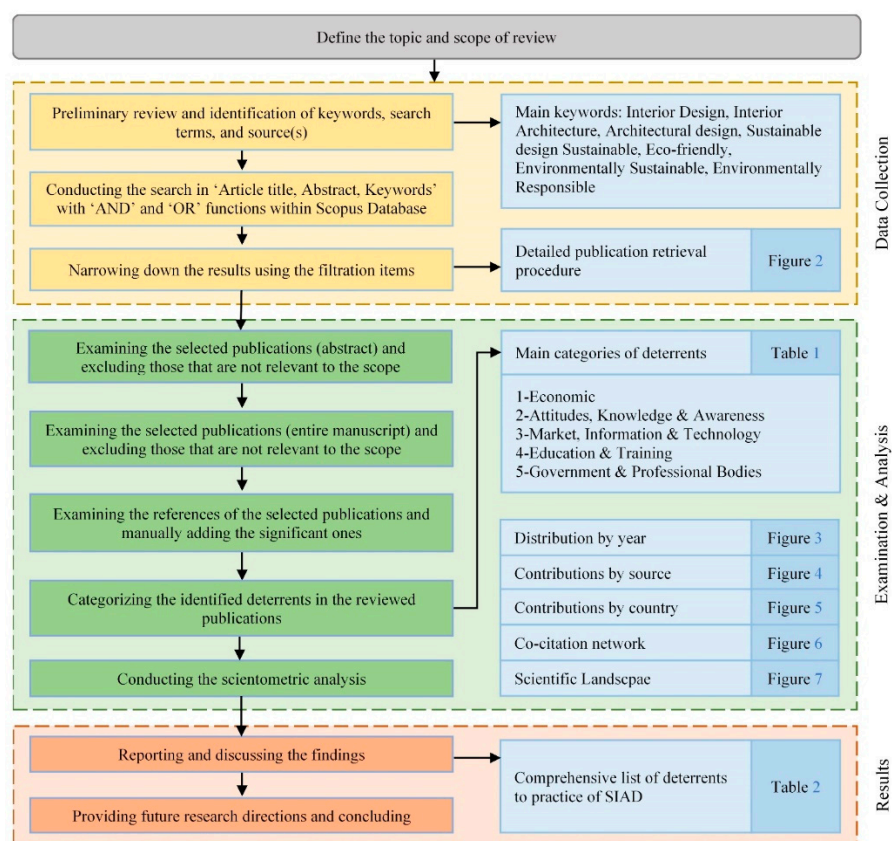

Figure 1. Review approach.

A preliminary review of literature was conducted to identify keywords and search terms. Subsequently, the initial search was carried out using the Boolean operators within the titles, abstract, and keywords of the Scopus database in February, 2021. As outlined in the publication retrieval procedure (see Figure 2), the initial search resulted in the identification of 419 publications. Next, in order to further refine the pool of publications, six main filtrations were applied and as a result, a total of 158 publications were retrieved for further examination and analysis.
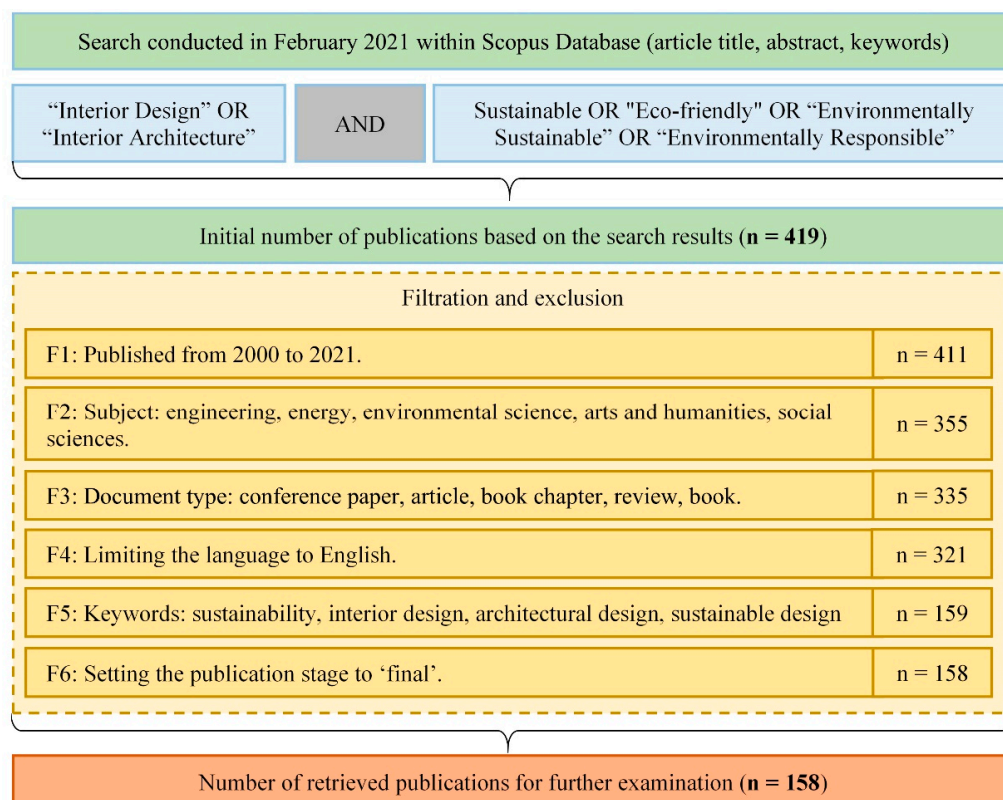
| Search conducted in February 2021 within Scopus Database (article title, abstract, keywords) |

| "Interior Design" OR "Interior Architecture" | AND | Sustainable OR "Eco-friendly" OR "Environmentally Sustainable" OR "Environmentally Responsible" |

| Initial number of publications based on the search results (**n = 419**) |

Filtration and exclusion	
F1: Published from 2000 to 2021.	n = 411
F2: Subject: engineering, energy, environmental science, arts and humanities, social sciences.	n = 355
F3: Document type: conference paper, article, book chapter, review, book.	n = 335
F4: Limiting the language to English.	n = 321
F5: Keywords: sustainability, interior design, architectural design, sustainable design	n = 159
F6: Setting the publication stage to 'final'.	n = 158

| Number of retrieved publications for further examination (**n = 158**) |

Figure 2. Publication retrieval procedure.

In the next step, the selected publications were downloaded as a Comma Separated Value (CSV) file which contains a complete set of information (i.e., title, abstract, authors, keywords, references, publisher, country, etc.) of each publication that would be later used for scientometric analysis. Similar review articles have adopted abstract and manuscript screening approaches to further exclude articles in accordance with the scope of work (i.e., see [35,37,38]). To this end, and in order to ensure the relevancy of the retrieved articles with the scope of the current review, the abstracts were screened by the authors and those that were deemed irrelevant to the scope were excluded from further analysis. Next, the entire manuscripts of the shortlisted publications were carefully examined, and summaries were added to the spreadsheets for next phases. Similarly, in this round of evaluation, the publications that did not fall under the scope of this review were omitted. Upon completion of this stage and conducting rounds of discussion among authors, out of the initial 168 publications, a total of 36 documents were shortlisted.

Additionally, through a rigorous inspection of the reference list of the selected documents, a total of 15 other publications with significant contributions were identified. Nine (9) documents were indexed by Scopus and were manually added to the CSV file for the scientometric analysis. Six (6) of them were not indexed by Scopus, among which, three (3) were examples of gray literature (i.e., a thesis). Therefore, while the findings of all 51 documents are reported in this review, only the 45 Scopus-indexed publications were selected for the scientometric analysis stage, since such a stage relies on bibliographic data.

3. Scientometric Analysis

This section outlines the scientometric analysis of the reviewed publications, considering the contribution by year of publication, source, country, as well as co-citation network of the sources, and co-occurrence of keywords. Figure 3 illustrates the number of publications throughout the studied period. It is notable to mention that while the selected period was from the year 2000 to 2021, there were no publications found in the period of 2000 to 2005, and in the year 2012. Additionally, there seems to be a two-year up-and-down trend with respect to the number of publications. However, overall, a steady growth in publications focusing on SIAD practices was observed. Considering the sheer emphasis that is being put on sustainable practices nowadays, it is expected that this growth would further increase in the future.
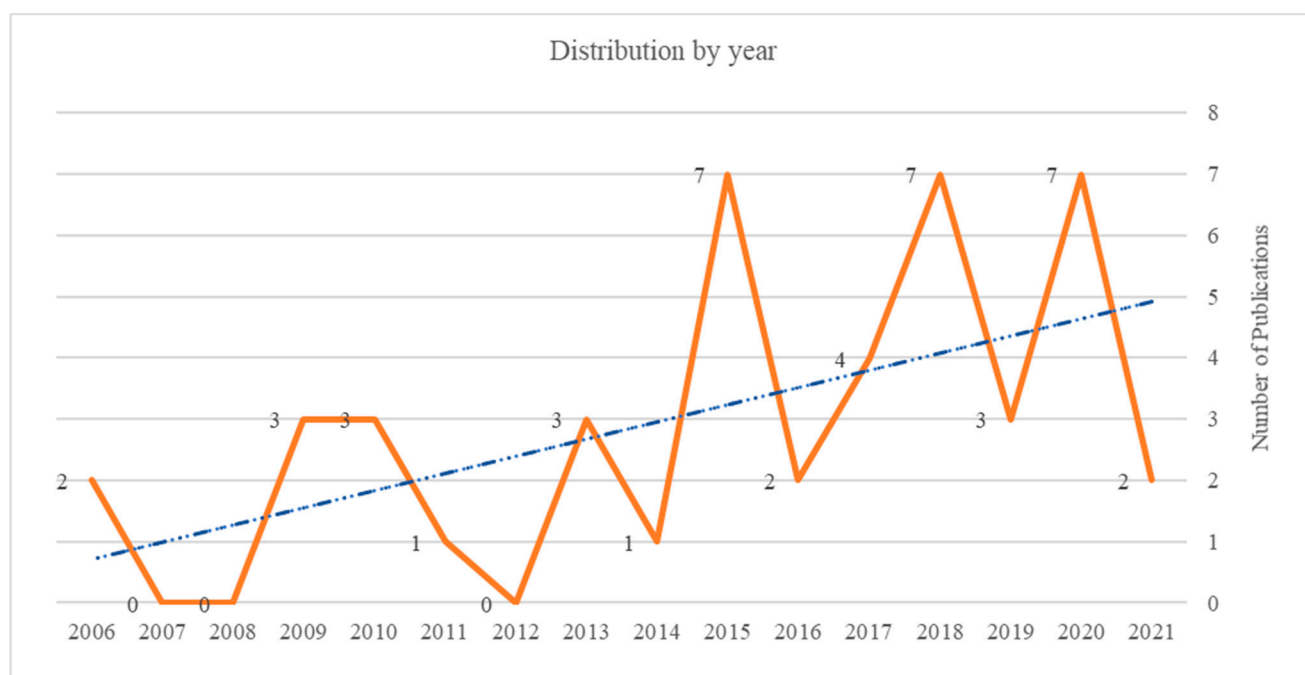

Figure 3. Distribution of the reviewed publications by year.

The most contributing journals among the selected publications, together with the number of citations of their documents are outlined in Figure 4. As can be seen, Sustainability, Journal of Interior Design, International Journal of Art and Design Education, International Journal of Sustainability in Higher Education, and Open House International have the highest number of articles. Additionally, Journal of Interior Design, followed closely by Design Issues, and Journal of Building Engineering have the highest number of citations.

In terms of distributions of the selected publications by country, as shown in Figure 5, the United States has the largest number of publications (15), followed by Malaysia, Poland, and Turkey with five (5) articles each. China, Indonesia, Iraq, the United Kingdom, and Vietnam have each published two (2) documents on the topics related to deterrents to the practice of SIAD. Moreover, publications from the United States, Oman, and the United Kingdom have received the highest number of citations.
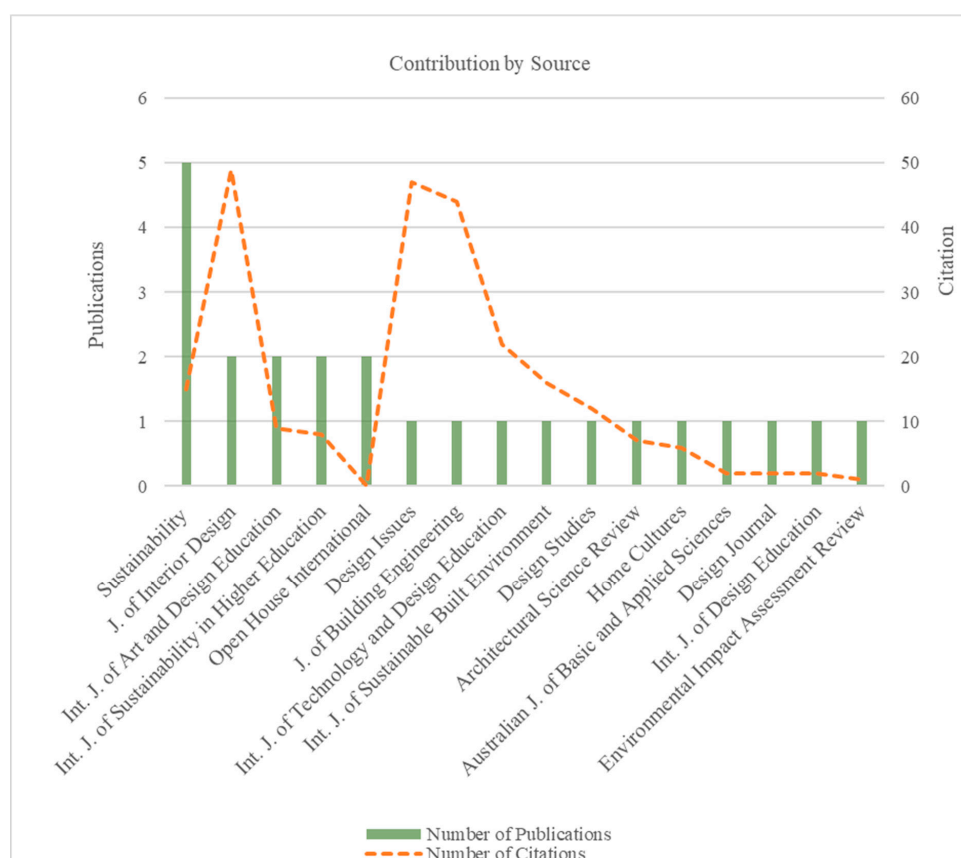
Figure 4. Contribution of the reviewed publications by source.

In an attempt to better showcase the influential journals, a co-citation network of the sources was produced by feeding the bibliographical data (CSV file) to the VOSviewer, a free text mining software [39]. Co-citation happens as a result of two documents receiving a citation from the same third document. As can be seen in Figure 6, some of the most influential journals within the field of SIAD are the Journal of Interior Design, Sustainability, International Journal of Sustainability in Higher Education, Journal of Environment and Behavior, as well as the Journal of Building and Environment.

Next, similarly to other recent review articles [40,41] and in order to visualize the scientific landscape of SIAD and its practices, VOSviewer was utilized to analyze the co-occurrence of keywords used by authors. Furthermore, the overlay function was utilized to showcase the time period of keyword occurrences. As illustrated in Figure 7, 'interior design', 'sustainability', and 'sustainable design' were among the most used keywords. In addition, as can be seen, terms such as 'design education', 'prefabrication', 'computer aided design', and 'design process' are the terminologies that were used in older publications, whereas 'sustainability', 'sustainable design', 'green interior design', and 'green building' are among the more recent ones. Finally, keywords such as 'human factors', 'interior architectural design', and 'ergonomic design' are some of the latest terminologies used. The above demonstrates the growing interest in sustainability-related research within the field of IAD.
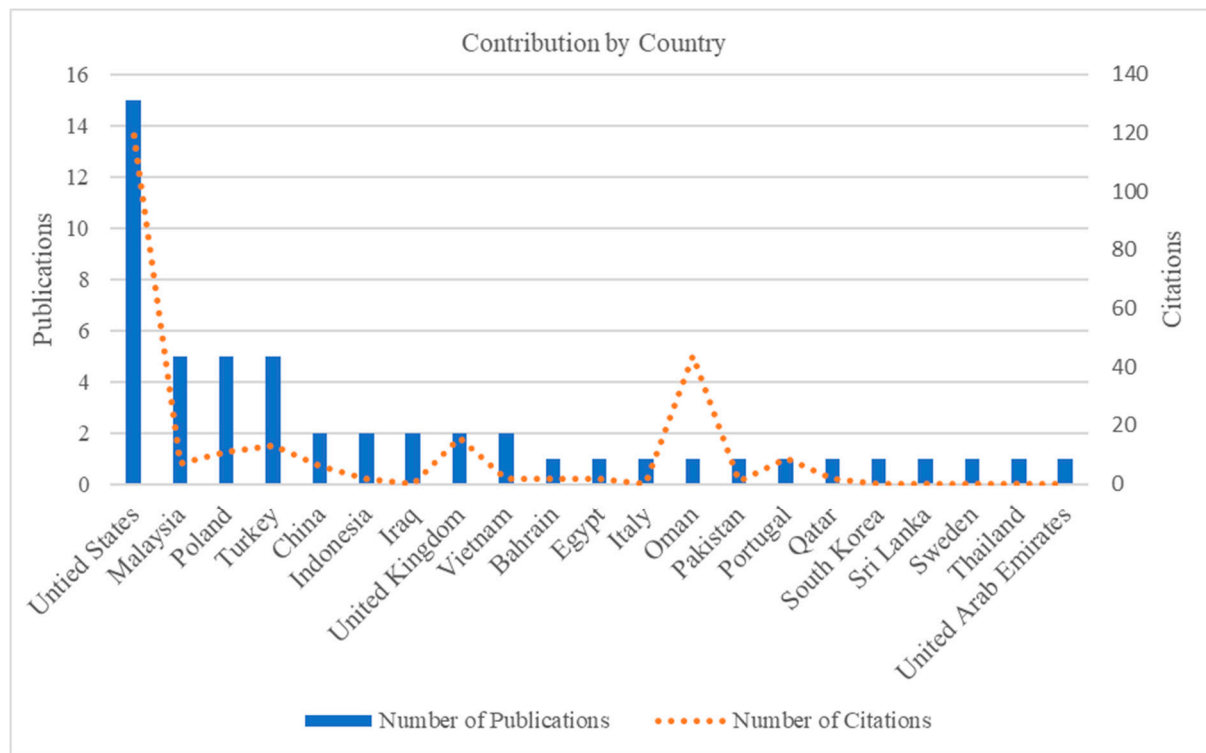
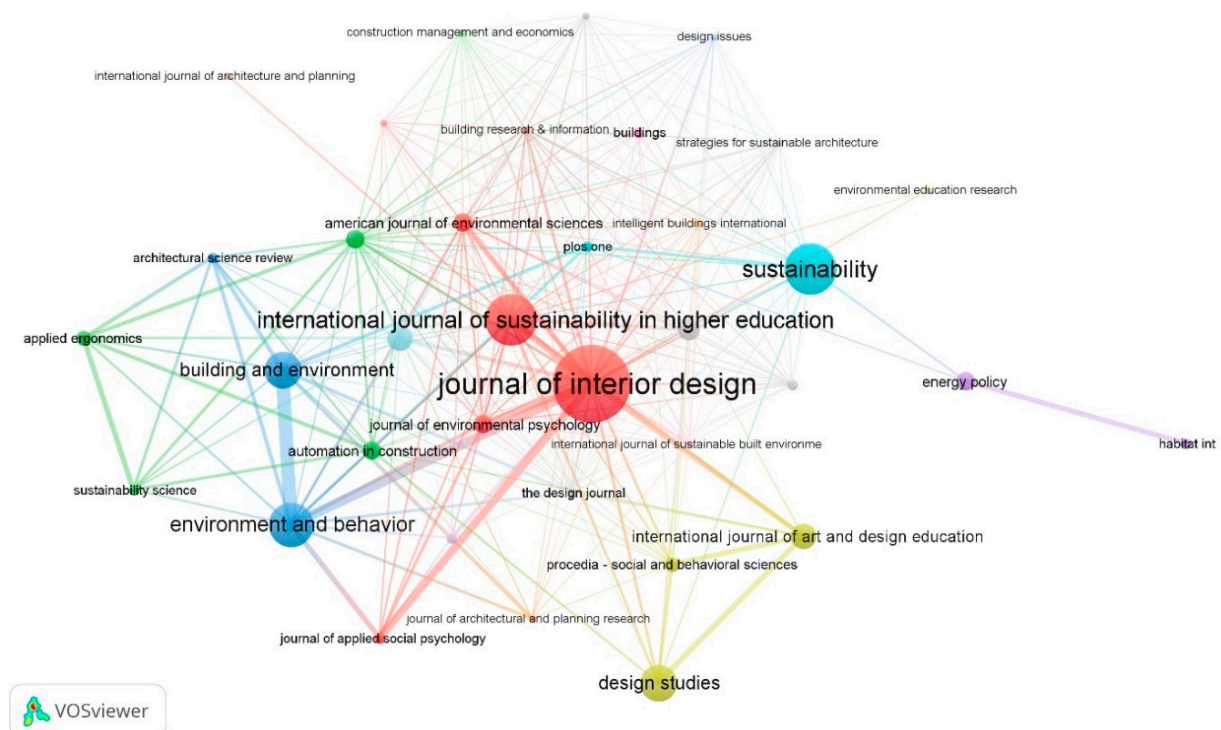**Figure 5.** Contributions of the reviewed publications by country.

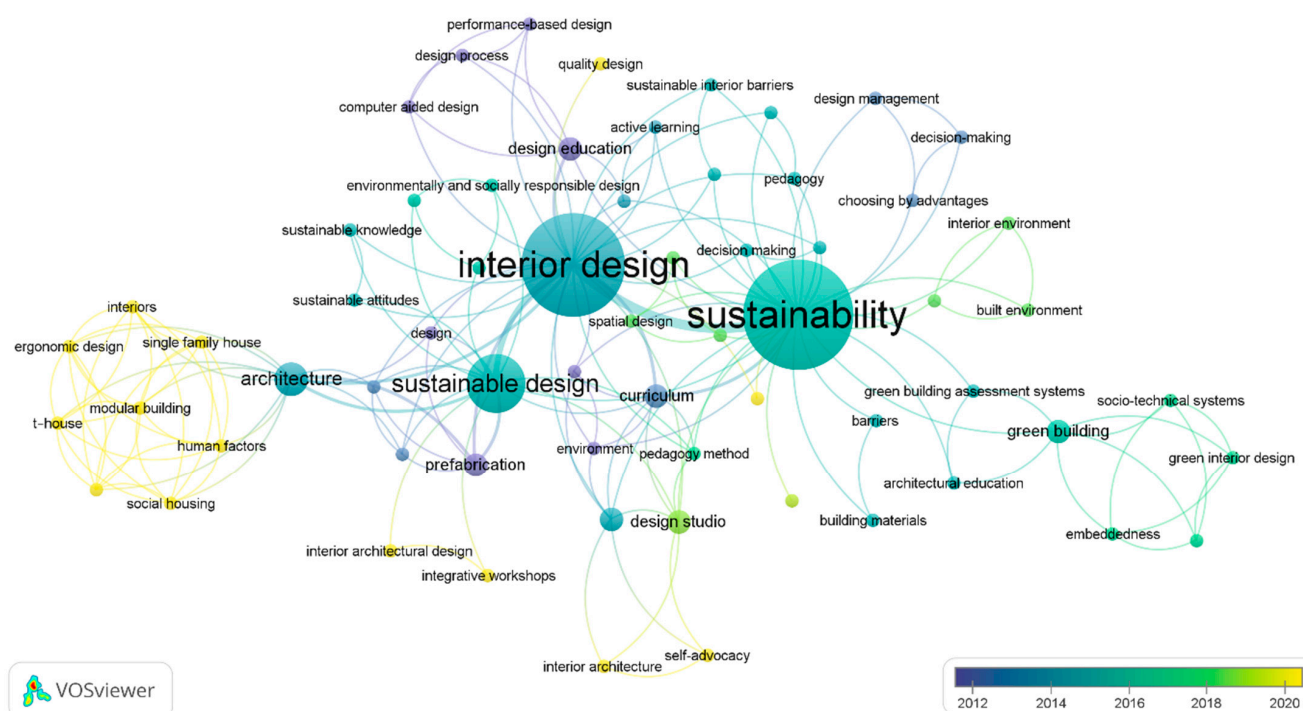**Figure 6.** Co-citation network of the sources.

Figure 7. Co-occurrence of keywords—scientific landscape.

4. In-Depth Review of the Deterrents to SIAD Practice

As a result of reviewing the selected publications, together with the secondary (Scopus-indexed and non-indexed) documents discovered in the reference lists, a total of 61 deterrents to the practice of SIAD were identified and were further classified into five main categories: (1) economic; (2) attitude, knowledge, and awareness; (3) market, information, and technology, (4) education and training; and (5) government and professional bodies. Table 1 outlines the main categories, the explanation of what they entail, as well as references that have provided information on the topics. It is notable to mention that since a variety of deterrents are discussed in these publications, some are repeated (i.e., an article discusses deterrents that fall under both economic, and government and professional bodies categories). These categories along with the individual deterrents are discussed in detail in the succeeding sections.

Table 1. Overview of the main categories of deterrents with their references.

Categories	Explanation	Contributing Publications	
		[1] Primary and [2] Secondary Scopus-Indexed	Secondary [3] Non-Indexed
Economic *(10 deterrents)*	Direct and indirect costs, time, research, and development.	10 publications [17,19,24,26,28,42–46]	4 publications [5,27,47,48]
Attitudes, knowledge, and awareness *(19 deterrents)*	Designers', clients', and stakeholders' attitudes, knowledge, and awareness	17 publications [19,23–26,28,43,49–58]	5 publications [5,27,47,48,59]
Market, information, and technology *(11 deterrents)*	Market limitations, databases, and technical tools and software.	10 publications [17,23,24,26,28,44,46,54,60,61]	2 publications [48,59]
Education and training *(14 deterrents)*	Educational frameworks, integrated topics, and training approaches.	15 publications [20,23,24,28,61–71]	4 publications [27,47,48,72]
Government and professional bodies *(7 deterrents)*	Motivations, incentives, regulations, frameworks, assessment schemes, and professional development.	6 publications [19,23,26,28,54,56]	-

[1] Primary refers to the publications originally retrieved from the Scopus database. [2] Secondary refers to documents identified by examining the reference list of primary sources. [3] Non-indexed refers to publications not found in the Scopus database, or gray literature (i.e., a thesis).

4.1. Economic

Similar to other sustainable practices within the built environment [73,74], economic deterrents are reported as some of the most important obstacles in adopting SIAD practices [26]. This is partially due to the overall higher upfront costs and the required investment [24,42], as well as the indirect costs that occur due to the additional required time for research and development [17,19,28]. Formulating sustainable design strategies often demands more time to research, which results in a longer designing stage. Consequently, practitioners need to increase consultation fees in order to compensate for the extra effort [27]. Moreover, involvement of interior architects/designers at a later stage of a project significantly reduces their time for proper research; this in turn may result in additional pressure, potential extensions, and potential delays which impose costs for both clients and designers [19,26]. The costs associated with training and the required software and hardware (i.e., for simulations, BIM integration, etc.), the higher cost of sustainable materials, products, and components, as well as costs associated with conducting sustainability assessment and obtaining certifications (i.e., LEED, BREAM, etc.), are also mentioned as other economic related deterrents [5,44]. Finally, considering that interior architecture/design by nature is a collaborative and interdisciplinary practice, decision-making regarding the variety of sustainable strategies in a project can often be very time-consuming and result in delays [46,75].

4.2. Attitude, Knowledge and Awareness

The attitude of practicing interior architects/designers and its impact on the practice of SIAD has been one of the centers of attention in the literature. Among the most important deterrents is the lack of enthusiasm from designers to persuade clients to adopt SIAD [19,25,28,49]. Design consultants are required to educate clients regarding sustainable solutions [76], yet many designers fail to do so [27]. Stieg [23] noted that designers' lack of pro-sustainability attitudes stems from their lack of awareness about the potential negative effects of their design decisions. This is also mentioned about other stakeholders involved such as architects, engineers, and contractors. In fact, the lack of stakeholders' awareness and support for SIAD [24], or their lack of interest and different stance on the issue [58], are regarded as deterrents that may lead to a lack of appropriate coordination among all parties [19]. Additionally, designers' resistance to change and opting for familiar/common practices—as well as giving their preference to trends and fashions rather than sustainability concerns—have been mentioned as significant deterrents [5,26]. This could be related to the perception among designers that opting for SIAD significantly reduces their ability to achieve aesthetic preferences outlined by the client [50], as they are unaware of the existing sustainable material databases, and other potential resources [48]. On the other hand, designers' lack of considerations with respect to the human-factor, user-centered approaches, and incorporating flexibility and ergonomic factors has also been mentioned as a deterrent [57].

Another area of focus has been the knowledge of SIAD among interior architects/designers, clients, and other stakeholders. Designers' lack of fundamental knowledge about principles of SIAD [51], their lack of practical knowledge and hands-on experience [24,28], as well as their lack of evidence-based knowledge—particularly for those within specialized fields such as healthcare and hospitality—has been regarded as significant deterrents [52]. While many designers do have the required knowledge, it has been reported that some lack the confidence in their own understanding of SIAD, which affects their decision-making concerning sustainable strategies [47,59]. More recently, and with a shift of focus on the social aspect of sustainability, a number of studies have reported designers' lack of knowledge and consideration of the local context as a significant deterrent. These issues include their lack of knowledge of sociocultural values, local heritage, identities, and crafts, and their failure to incorporate local vernacular strategies and materials [19,53–56]. Additionally, the idea of SIAD is not widely known by clients and many lack awareness of it [24,25,28]. On the other hand, although some clients may be aware of the concept of

SIAD, they may still have a distrust towards its benefits [5], or lack a willingness to bear additional costs [43].

4.3. Market, Information, and Technology

Lack of or limited supply of locally produced and certified sustainable materials, products, and components in the market has been reported as a major deterrent to the practice of SIAD [17,28]. This could be due to a lack of demand combined with a monopolized market that limits the available choices and retains high prices [28]. While in some countries—particularly those that have championed integrations of sustainability regulations within the construction industry—this issue has been addressed due to the resulting increased demand [5], it remains a deterrent in other regions that rely on imported goods, or lack high-quality local products [26]. On the other hand, a lack of or insufficient access to information and reliable research on sustainable materials, products, and components renders adopting them even more complicated [17,24]. Similarly, a lack of national or regional databases focusing on locally produced sustainable materials, their properties, and vernacular application practices has been cited as an important deterrent, specially concerning the sociocultural aspect of SIAD [54]. Other studies have also pointed out the inaccurate or insufficient information provided by vendors as a deterrent [26,46]. This further signifies the need for databases, as well as awareness and knowledge of designers [17,48]. A number of studies have reported the lack of accessible information on real-world examples of SIAD, and innovative sustainable practices both locally and internationally as deterrents [23,24,26].

The increase in incorporation of technological tools and software in the design process [35,77] has uncovered a few other deterrents hindering SIAD practice. Examples of this include the lack of access/utilization of technical tools such as Augmented and Virtual Reality (AR and VR) technologies [60], a lack of wide adoption of BIM within the IAD industry [44], and a lack of straightforward simulation-based software to be used by interior architects/designers [61]. These technologies are particularly beneficial in identifying best user-centered design strategies based on feedback (AR, VR), easing the documentation procedures and coordination among stakeholders (BIM), as well as identifying suitable energy saving strategies (simulation-based software).

4.4. Education and Training

The issue of educating interior architects/designers about SIAD has received significant attention within the literature. While much consideration has been given to the environmental aspect of SIAD both in academia and industry, there is a lack of attention given to the social and economic facets of it [71]. Numerous studies have reported that integration of comprehensive sustainability modules encompassing all three pillars of sustainability is not sufficient within the curriculum [20,64,66,68]. Focus on theoretical aspects and a lack of incorporation of practical aspects of SIAD within the educational framework is also considered as a deterrent [62,63,65]. This further develops the imbalance between theory and practice, giving way to what is referred to as the 'sustainability gap' [23]. In addition, there is a lack of integration of innovative design solutions [20], prefabrication [70], performance-based design [61], industry collaborations [69], as well as contextually inspired (i.e., culture, history, geography, climate, etc.) and vernacular strategies [54,68] in the IAD curriculum. While students have generally shown interest in acquiring knowledge related to sustainability [20,78], there is a lack of trained and knowledgeable academic staff [28,72], and a lack of inner-faculty collaborations with other disciplines such as engineering, architecture, and planning [66]. This is important, since IAD is considered a multidisciplinary field and requires constant collaboration with other disciplines. Other studies have reported that the IAD educational framework lacks the development of social and communicational skills such as self-advocacy as an important tool for future designers to persuade clients [67]. Similarly, there is a lack of psycho-behavioral interventions that encourage a pro-sustainable attitude [62].

A number of studies have reported a general lack of designers' continuing education and training that stem from a lack of coordination among academy, industry, and professional bodies [23,48]. In fact, a lack of SIAD training (i.e., courses, seminars, conferences, etc.) specifically designed for practicing designers [27,28,68], as well as those provided by design firms for junior interior architects/designers [47] have been reported as deterrents hindering SIAD practice.

4.5. Government and Professional Bodies

The role of government in forming regulations, providing incentives, and promoting sustainable practices within the construction industry has been mentioned numerous times in the literature [73,79,80]. With respect to the practice of SIAD, this review revealed that there is a lack of motivational incentives (i.e., tax reduction, processing fees elimination, etc.) by the government to encourage SIAD practices [19,28]. Similarly, there is a lack of promotion of SIAD by the government, mandatory regulations requiring integration of principles of SIAD in interior architecture/design projects, as well as a lack of proper guidelines and frameworks by both the government and statutory authorities [19,26,28]. Considering the importance of locally produced materials and products—particularly those that have sociocultural values—some studies reported a lack of restrictive regulations on the import of similar goods as a deterrent [54,56]. On the other hand, a lack of proper sustainability assessment schemes that are designed specifically for interior architecture/design projects and with consideration to the local context [26,56], as well as the lack of provision of regular professional development courses and workshops concerning the practice of SIAD by professional bodies [28], have been reported as other deterrents. Table 2 provides a comprehensive overview and summary of the deterrents identified and discussed in this review from both the Scopus-index and non-index sources.

Table 2. Comprehensive list of deterrents to the practice of SIAD.

Category	No.	Deterrent	References	
			[1] Primary and [2] Secondary Scopus-Indexed	Secondary [3] Non-Indexed
Economic	1	High cost of SIAD assessment schemes and certification costs.	-	[5,27]
	2	Higher upfront cost of sustainable materials, products, and components.	[24,26,42,43]	[47]
	3	Additional cost of training designers.	[26]	-
	4	Research and development costs associated with SIAD projects.	[28]	[27]
	5	Software and hardware costs (i.e., BIM related, simulations related, etc.).	[26,44]	-
	6	Obtaining information on sustainable materials, products, and components is time consuming.	[17,28]	[27,48]
	7	Designers lack the time to research and learn all aspects of SIAD for a certain project.	[26,28]	-
	8	Involvement in later stages of projects reduces the time for research and development and proper coordination.	[19,26]	-
	9	Project schedule pressure and potential extensions and delays faced due to the adoption of SIAD solutions.	[19,26,45]	-
	10	Decision-making regarding the variety of sustainable strategies is a complex and time-consuming process that requires agreement from all stakeholders.	[46,75]	-
Attitudes, Knowledge & Awareness	11	Designers' resistance to change and opting for current/familiar practices.	-	[5,27]
	12	Designers' lack of enthusiasm towards persuading clients to adopt SIAD and informing them of the benefits.	[19,25,28,49]	[27,48]
	13	Designers' lack of pro-sustainability attitudes due to a lack of awareness about the potential negatives impacting their design decisions.	[23]	-
	14	Designers' lack of awareness about existing sustainable material databases and resources.	-	[48]
	15	The perception among designers that opting for SIAD practices does not achieve aesthetic preferences outlined by the client (i.e., due to the limited access to a range of sustainable materials, products, and components).	[50]	-
	16	Designers' lack of fundamental knowledge about sustainability.	[51]	-
	17	Designer's lack of hands-on experience/practical knowledge of SIAD.	[24,28]	-
	18	Designers give their preference to trends/fashions rather than SIAD.	[26]	-

Table 2. *Cont.*

Category	No.	Deterrent	[1] Primary and [2] Secondary Scopus-Indexed	Secondary [3] Non-Indexed
	19	Designers in specialized fields (i.e., hospitality, healthcare, etc.) lack the explicit evidence-based knowledge required for their field.	[52]	-
	20	Designers' lack of knowledge about the sociocultural values, local heritage, crafts, vernacular strategies, and materials within the local context and failure to incorporate them in their designs.	[19,53–56]	-
	21	Designers' lack of considerations of the human-factor, user-centered approaches, flexibility, and ergonomic factors.	[57]	-
	22	Designer's lack of confidence in their understanding and knowledge of SIAD.	-	[47,59]
	23	Clients' lack of awareness and knowledge of SIAD and its positive effects.	[24,25,28]	[5]
	24	Clients may be aware of SIAD, yet they distrust its positive impacts.	-	[5]
	25	Clients' lack of interest due to a lack of willingness to bear additional costs.	[43]	-
	26	The perception among clients that SIAD does not benefit them financially in the long run/preference given to immediate savings.	[28]	-
	27	SIAD requires a multidisciplinary effort and not all other stakeholders (i.e., architects, engineers, contractors, etc.) share the same view or interest.	[58]	-
	28	Lack of knowledge, awareness, and a proactive support of SIAD practices among other stakeholders (i.e., architects, engineers, contractors, etc.).	[24]	-
	29	Lack of appropriate and sufficient communication and coordination among stakeholders in order to achieve SIAD.	[19]	-
Market, Information & Technology	30	Lack of reliable sustainable materials, products, and components in the local market (i.e., certified by local or international associations).	[26,28]	-
	31	Limited supply of sustainable materials, products, and components.	[17,28]	-
	32	Lack of competition in market (monopoly)/limited choices and high prices.	[26,28]	-
	33	Lack of locally produced sustainable materials, products, and components due to a lack of demand.	[28]	-
	34	Lack of or insufficient access to information and credible research regarding sustainable materials, equipment, and components.	[17,24]	[59]
	35	Insufficient or inaccurate information provided by vendors regarding sustainable materials, equipment, and components.	[17,26,46]	[48]
	36	Lack of accessible information and databases of the real-world examples of SIAD and sustainable practices.	[23,24,26]	-
	37	Lack of databases focusing on locally produced materials, products, and components, as well as their properties considering the context.	[54]	-
	38	Lack of a wide implementation of BIM within the IAD industry.	[44]	-
	39	Lack of technical tools (i.e., software, models, AR, VR) to better identify design strategies and/or receive feedback from a client who experiences the design in immersive environments.	[60]	-
	40	Lack of straightforward and easier simulation-based software to be used by interior architects/designers.	[61]	-
Education & Training	41	Designers' lack of continuing education and training on the topic of SIAD.	[23]	[48]
	42	Lack of incorporation of combined theoretical and practical aspects of SIAD throughout IAD curriculums.	[62–65]	-
	43	Lack of sufficient sustainability modules (encompassing all the pillars of sustainability) in the IAD educational framework.	[20,50,64,66,68]	-
	44	Lack of incorporation of innovative and sustainable design solutions (i.e., prefabrication, simulations, performance-based design, etc.) for SIAD adoption in the IAD curriculums.	[20,61,70]	-
	45	IAD curriculums do not brush up students' self-advocacy skills, which could allow them to persuade clients for the adoption of SIAD in their future practices.	[67]	-
	46	Lack of incorporation of psycho-behavioral interventions to encourage pro sustainable behavior and attitudes.	[24,62]	-
	47	Lack of incorporation of cultural and historical aspects of design (vernacular) based on the local context.	[68]	-
	48	Lack of trained and knowledgeable academic staff to educate future designers on the topic of SIAD.	[28,61,64]	[72]
	49	Lack of industry collaborations during IAD studio courses.	[69]	-
	50	Lack of inner-faculty collaborations of IAD and other disciplines (engineering, architecture, etc.) to prepare students for interdisciplinary design processes.	[66]	-

Table 2. *Cont.*

Category	No.	Deterrent	References	
			[1] **Primary and** [2] **Secondary Scopus-Indexed**	**Secondary** [3] **Non-Indexed**
	51	Focus has been mainly on the environmental aspect of SIAD, while lack of attention has been given to social and economic pillars of SIAD by the academic world and practitioners.	[71]	-
	52	Lack of coordination among academia, industry, and professional bodies.	[23]	-
	53	Lack of training for practicing interior architects/designers involving SIAD (i.e., seminars, conferences, courses, etc.).	[23,28,68]	[27]
	54	Lack of training provided by firms and senior interior architects/designers to junior ones on the SIAD practices.	-	[47]
Government & Professional Bodies	55	Lack of incentives by the government to encourage SIAD adoption for clients, designers, and other stakeholders.	[19,28]	-
	56	Lack of mandatory laws and regulations put in place by statutory authorities and governmental bodies requiring the adoption of SIAD.	[19,26,28]	-
	57	Lack of promotion of SIAD by authorities.	[28]	-
	58	Lack of proper guidelines and frameworks for SIAD practice provided by statutory authorities and governmental bodies.	[28]	-
	59	Lack of restrictive regulations (taxation, customs, etc.) on the import of goods (materials, equipment, and components) and promotion of locally made goods.	[54,56]	-
	60	Lack of provision of professional development courses, and workshops about SIAD practices by professional bodies.	[28]	-
	61	Lack of proper assessment schemes specifically designed for SIAD with considerations to the local context.	[23,26,56]	-

[1] Primary refers to the publications originally retrieved from the Scopus database. [2] Secondary refers to documents identified by examining the reference list of primary sources. [3] Non-indexed refers to publications not found in the Scopus database, or gray literature (i.e., a thesis).

5. Discussion

Although much attention has been given to the notion of sustainability within the built environment, the practice of SIAD still falls short. Reviewing two decades of publications on the topic has shed light on the nature of deterrents hindering its further practice. It has been previously mentioned that it is the responsibility of interior architects/designers to be advocates for SIAD and educate clients in an attempt to persuade them to adopt it [59,76]. This requires an equilibrium between attitudes, knowledge and awareness, as well as education and training of the designers. It was interesting to find that the category of attitudes, knowledge and awareness has the greatest number of deterrents. It could be argued that the lack of appropriate education and training—which was the second category with most deterrents—may be the main inducing factor. The topic of education is extremely context dependent, yet based on the results of this review, a foundational knowledge and understanding of all three pillars of sustainability and principles of SIAD—both in theory and in practice—is lacking. Despite a general interest among students toward the idea of sustainability [78], the lack of appropriate education may in turn affect the students' awareness regarding SIAD, and influence their behavior and attitude toward its adoption in practice. Moreover, IAD is a profession that requires lifelong learning in view of the evolving context of the interior environment and human behavior [81]. Thus, the lack of continuous professional development programs provided by professional bodies, may further increase the divide between industry and academia.

In addition, the economic related deterrents identified in this review are generally similar to other sustainable practices within the construction industry as far as the premium and upfront higher cost is concerned [2]. However, the indirect costs (i.e., the additional required time) are significantly more concerning within the IAD field. Interior architects/designers usually get involved at later stages of a project, which leaves them with less time for the research and development of sustainable strategies. The other stakeholders may apply pressure and assume tight schedules believing the scope is insignificant, further instigating prompt action from designers. Moreover, interior architects/designers who lack relevant fundamental knowledge face an even greater challenge diving into an ocean

of information that they are unfamiliar with. Considering the above, it is not surprising that the lack of available information regarding the state-of-the-art SIAD practices, successful examples, and local sustainable material databases are regarded as crucial deterrents. However, recent studies on the designers' information processing preferences reported that designers do not fully utilize all research strategies and rarely use findings of academic research [82]. Consequently, the importance of appropriate education and training—in this case with respect to research strategies—is further amplified.

Government related deterrents are among the least widely reported obstacles. This may be due to the current low adoption rate of SIAD, especially in developing countries [26,83]. Perhaps a wider adoption and more awareness among clients, designers, and stakeholders would provide the driving force for governments and professional bodies to develop and establish comprehensive regulatory frameworks. Government policies directly affect the performance of market as well. For instance, import regulations (i.e., taxation, customs, etc.) for materials or commodities that have similar locally produced counterparts, together with additional incentives for encouraging the usage of local materials are among the strategies put forward in the literature [54]. Furthermore, while it has been reported that within the construction industry, clients generally prefer instant savings rather than long-term economic benefits, government incentives (i.e., tax reductions, discounts in procedural costs, etc.) are regarded as useful tools for responding to this issue [19]. Without these incentives, demand may not grow as much, competition in the market may not significantly increase, and high premium costs may remain.

One of the major aspects of sustainability that was only briefly discussed in a few articles [53,54,84,85] is the social pillar. Numerous authors have warned about the disproportionate attention given to the three pillars of sustainability [71,86,87]. Ignorance toward the social aspect of sustainability is also reported in the general assessment criteria of the sustainability rating schemes within the construction industry [88]. Concepts such as "user-centered design" and "universal/inclusive design" give considerations to the needs of all (physical and psychological) and ruminate the impacts of design decisions on occupants' wellbeing as well as the community as a whole [89,90]. Nonetheless, these concepts are often isolated from sustainable approaches and discussed separately. Thus, there is a need for the scientific community to amend the current definition of SIAD and formulate a universal definition that constitutes such concepts.

As outlined in the introduction section of this review article, deterrents influencing the practice of SIAD must first be identified in order to pave the way for the subsequent quest for finding appropriate solutions. However, the results have revealed there is still a lack of rigorous empirical studies focusing on the state of SIAD practice and its deterrents in different contextual settings. Moreover, when compared with other domains within the built environment, the number of studies focusing specifically on deterrents to SIAD practice is alarmingly low. It seems that the 'sustainability gap' is still relevant and there is a significant disconnect between the focus of academia and the dire needs of industry for practical solutions. It is hoped that in the future, better collaborations can be formed among industry, academia, and professional bodies in order to advance research in this area. Such collaborations could assist in better identification of deterrents, proposing practical solutions and empirically testing them, as well as objectively examining the implications of such solutions for the advancements within the field.

Having said the above, it is also notable to mention the recommendations that have been put forward by the examined articles to overcome some of these deterrents. Recommendations are primarily concerned with topics such as education, practice, and policy. With respect to education within the IAD field, the recommendations include: (1) incorporation of all three pillars of sustainability within the IDA curriculums [28,50,64,70]; (2) bridging the gap between theoretical and practical understanding of students through transfer of skills by industry experts [63,68,69]; (3) focusing on integrating cultural, traditional, and vernacular values of the local context into studio projects [26,54,83,84]; as

well as (4) improving students' social skills and psycho-behavioral awareness to encourage sustainable practices and persuading other stakeholders to adopt SIAD [62,67,85].

Additionally, when it comes to the practitioners, recommendations include: (1) gaining a thorough understanding of clients' preferences, needs, cultural or personal beliefs, and values to develop suitable strategies considering the contextual settings in order to embrace the social aspect of sustainability [28,49,55]; (2) ensuring the usage of sustainable and/or locally produced materials [17,49]; as well as (3) making efforts toward expanding knowledge, and developing clients' awareness of the significance of SIAD and encouraging them to adopt SIAD [76,86]. Finally, with respect to the policies, recommendations include: (1) introduction of rigorous regulatory standards concerning both practice and education that are in line with SIAD and actively enforcing them [26,28]; and (2) increasing government promotion and support for SIAD, and introducing regulatory frameworks together with monetary incentives for all stakeholders involved [19,26,42].

Research Implications

The present review paper provides a number of practical and academic implications. First, considering the lack of a systematic review of literature on the topic, this work provides a complete list of deterrents towards the practice of SIAD, establishing a foundation for future researchers to build upon. In addition, the findings of this review provide valuable insights for designers, educators, stakeholders, governments, and professional bodies which could steer their efforts toward understanding and addressing these deterrents in order to fully embrace sustainable development. The results also imply that scholars must recognize the reality of practice, and dive deeper into the investigation of the imbalance between theory and practice of SIAD. Moreover, the findings of this review revealed the need for the academic community to amend the definition of SIAD, and introduce a universal definition that encompasses not only all three pillars of sustainability, but also universal/inclusive design, and user-centered design approaches. Finally, there is a dire need for constructive collaborations among academy and industry towards achieving the mutual goal of sustainable development.

6. Limitations and Future Research Directions

As mentioned earlier, there are a very limited number of studies concerning this topic. To this end, much consideration was given to ensuring maximum coverage of all publications related to this topic (i.e., the inclusion of conference proceedings, book chapters, etc.), though there may have been other publications overlooked in the process. Future work could perhaps further narrow down and investigate the practice of SIAD within specialized sectors (i.e., healthcare, hospitality, etc.). On the other hand, certain concepts that are fundamentally associated with the social aspect of sustainability (i.e., universal/inclusive design, user-centered design, etc.) are not usually discussed in relation to sustainability. Perhaps in the future, other SLRs can be carried out on the mentioned topics with a particular focus on their adoption, practice, and applications within the interior environments.

In addition, not all the identified articles in this study have benefited from meticulous methodologies and/or have been rigorously peer reviewed. Besides, these publications represent findings from numerous diverse contexts. Thus, researchers are advised to refine the list of deterrents outlined in this review article with consideration to the contextual settings of where their study is taking place. This can be achieved by adopting prominent methodologies that involve participation of experts in the field. Furthermore, future research must analyze individual deterrents, focus on prioritizing them, investigate the potential cause and effect relationships among them, and finally, offer possible solutions to overcome them.

Considering that much of the early works on the topic have been carried out in developed countries, and less deterrents are being reported, future research should put more focus on developing countries. Simultaneously, comparative studies among different

developed and developing countries can be conducted with an emphasis on regulatory frameworks, educational frameworks, market and technology, and the current state of SIAD practice. Such studies can expand the knowledge on the issue, form collaborations, and possibly assist in implementing best strategies for a wider adoption and practice of SIAD.

7. Conclusions

Although the importance of SIAD and its positive impacts on the interior environment—the place where we live, work, and play—is recognized, its practice is still faced with numerous deterrents. The first step towards facilitating a more extensive practice of SIAD is to identify its deterrents. However, the existing literature lacks a systematic review on this topic. To this end, a comprehensive systematic review of literature was carried out and a pool of 158 publications (from 2000 to 2021) were retrieved. The pool was further refined by examining the abstracts and entire body of the manuscripts. Additionally, a number of publications with significant contributions were identified by inspecting the list of references of the initial documents. As a result, a total of 51 articles were selected and through utilization of a scientometric analysis, a distribution of publications by year, journal, and country was found and reported. Moreover, through investigation of co-citation of sources and co-occurrence of keywords, influential journals and keywords were identified using the VOSviewer software. Finally, a total of 61 deterrents were identified and further classified under five main categories: (1) economic; (2) attitude, knowledge and awareness; (3) market, information and technology; (4) education and training; as well as (5) government and professional bodies. On the other hand, potential recommendations to overcome deterrents that were put forward by the examined articles, particularly concerning education, practice, and policy, were also discussed. Based on the results of this review, several future research directions are proposed, including: (1) investigation of the practice of SIAD within specialized fields (i.e., hospitality, healthcare, etc.); (2) adoption, practice, and application of concepts such as universal/inclusive design and user-centered design within the interior environments; (3) analyzing individual deterrents, prioritizing them, identifying underlying causes, and offering practical solutions; as well as (4) conducting comparative studies concerning regulations, educational standards, and the state of practice among developed versus developing countries with respect to deterrents to the practice of SIAD. Finally, the findings of this review provide a building block for future scholars to build upon, and provide valuable insights for stakeholders, assisting them in steering their efforts toward achieving the SDGs.

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