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Article

Architectural Professionals' Needs and Preferences for Sustainable Building Guidelines in Korea

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Abstract: The issue of sustainability has become one of the major concerns among architectural professionals throughout the world. As a way of providing information, many countries have developed and distributed sustainable building guidelines. This paper aims to investigate architectural professionals' needs and preferences with regard to sustainable building guidelines in Korea, with a specific focus on various guideline attributes. We conducted a review of existing sustainable building guidelines in many countries and undertook a questionnaire survey among professionals in Korea to gain insight about their opinions. Forty guidelines were examined and characterized by their attributes, including main purpose, target building type, communication format, hierarchy of the information, and information type. As the main purposes of guidelines, professionals identified "to provide education on the significance of sustainable buildings and promote a better understanding of sustainable principles" and "to provide comprehensive and detailed information on sustainable building design strategies and technologies". Cost, financial information, as well as comprehensive implementation methods were found to be crucial information types for professionals.

Keywords: sustainable building; energy efficient building; guideline; architectural professionals; questionnaire

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1. Introduction

The concept of sustainable development has spread around the world with the need for energy efficiency and environmental protection. Many efforts have been made to address the sustainability issue in the building sector. Various design strategies and technologies have been developed to mitigate the environmental impact of buildings. The environmental performance of buildings has strongly captured the attention of architectural professionals across the world [1,2]. Since carbon emissions from fossil fuel use are known to be a major cause of global warming, most countries have set up national targets to minimize energy consumption and environmental impacts in the building sector. A variety of policies and long-term strategies have already been established and implemented to move buildings towards more energy efficient and sustainable levels. Policies related to sustainable and energy efficient buildings typically include various measures, such as codes and regulations, mandatory or voluntary certification schemes, financial programs, education and training activities, and communication and information activities [3–10].

Among these measures, communication and information activities are very important for promoting the demand for sustainable buildings, as well as convincing the public and building experts of the necessity of such buildings. Previous research [4–13] has identified lack of knowledge as one of the major barriers for more sustainable and energy efficient buildings and communities. The Building Performance Institute of Europe (BPIE) survey [6] also identified that there are many barriers related to knowledge and technical expertise. Professionals are now faced with the task of understanding new sustainable technologies and of translating strategic sustainability objectives into concrete action at project-specific levels [11,12]. This has proved to be a very challenging task due to a lack of structured methodology and information at various hierarchical levels [11,12]. From this point of view, the International Energy Agency Energy Conservation in Buildings and Community Systems Program (IEA ECBCS) has suggested the improvement of information mechanisms as well as the development of tools for integrated sustainable design, construction, and management [13] as future research and development (R&D) strategic goals. It is very important to provide easy-to-find and easy-to-understand information in order to enhance clients' and professionals' awareness and interest in sustainable buildings, and to promote sustainable building practices.

As a way of providing information, many countries have developed and distributed sustainable building guidelines for various stakeholders including professionals, policy makers, and consumers [4,12–14]. These guidelines also cover many areas such as general sustainable building concepts and principles, detailed design strategies, available technologies, recommendations, relevant standards, checklists, and lessons learned through case studies. One of the most important points for improving information mechanisms is the need for information to be provided in people's own language [13]. Without the country's own sustainable building guidelines, architectural professionals have to overcome language and technological barriers, as well as reinterpret foreign recommendations and standards from the viewpoint of local climatic conditions and peculiarities [4,10]. Therefore, it is necessary for each country to develop its own sustainable building guidelines for the planning, design, construction, and operation of a more sustainable built environment that is suitable for local conditions. In Korea, a brief sustainable building guideline was developed by the government in 1999, but it has not been used recently because of its out-of-date contents as well as its antiquated document format which does not

contain any figures or design details. Therefore, we are now faced with the need for the development of new sustainable building guidelines which include useful information at the present status.

In this context, the main aim of this research is to analyze architectural professionals' needs and preferences on sustainable building guidelines in Korea, with a specific focus on various guideline attributes. Critical attributes include guideline purposes, target buildings, communication formats, hierarchy of information, and information types. For this purpose, we conducted a brief overview and analysis of existing sustainable building guidelines to create the framework for analyzing professionals' preferences, and then conducted a questionnaire survey among professionals in Korea to gain insight into their opinions.

2. Analysis of Existing Sustainable Building Guidelines

To achieve the sustainable building goals and requirements in design and construction, an integrated design process is needed to connect as many stakeholders as possible: owners, architects, engineers, and builders. There is also an increasing demand for comprehensive guidelines that provide information on newly developed sustainable building technologies. To meet this demand, a growing number of sustainable building guidelines have been developed by various types of organizations, including national/federal government departments or agencies, local administrations and councils, public research institutes, universities, and non-profit academic or industrial associations. Most of the guidelines were produced through collaboration between two or more developers, with the technical and empirical support provided by building industry professionals.

In order to set the overall framework for the questionnaire, we conducted a brief overview of the categories, formats, and contents of guidelines based on the investigation of current sustainable building guidelines. Even though there are a growing number of sustainable building guidelines all over the world [15–17], this study focuses on guidelines developed in North America, Europe, and Oceania due to the limitation of language. The search for guidelines is focused especially on those developed by public sectors since the result of this study will be used to establish the developmental direction and strategies of sustainable building guidelines for the public sector. The guidelines were selected according to the types of developers: national level, state or county level, and city level of government of each country. In the case of the USA, guidelines developed by public associations such as USGBC and ASHRAE were also included.

From these criteria, 40 sustainable building guidelines were selected and compiled. Selected guidelines were examined and characterized by their attributes—main purpose, target building type, communication format, hierarchy of the information, and information type—as shown in Table 1. Whist this study only focused on the guidelines of a few countries in North America, Europe, and Oceania due to the limitation of language, it was considered to provide enough information to develop questions for surveying professionals' needs and preferences.

Table 1. List of sustainable building guidelines studied and their developers.

Country	Title of guideline	Developer */ Region	Type of Developer						
			Administrative Organization			Public Organization			
			Nation	State/ County	City	Association	Research Institute	Private Company	University
Korea	Sustainable building design guide	MOLIT	■						
U.S.	Sustainable Building Technical Manual	DOE/EPA	■			■		■	
	Greening Federal Facilities	DOE	■					■	
	Sustainable Design, Construction and Land Development	ORNL	■				■		
	Whole Building Design Guide	NIBS	■				■	■	■
	Minnesota Sustainable Building Guidelines	Minnesota		■					■
	Minnesota Green Affordable Housing Guide	Minnesota		■					■
	Guidelines for Creating High-Performance Green Buildings	Pennsylvania		■				■	■
	Guidelines for Sustainable Building Design	Hawaii		■					
	Multifamily Green Building Guidelines	Alameda		■				■	
	New Home Construction—Green Building Guidelines	Alameda		■				■	
	Home Remodeling-Green Building Guidelines	Alameda		■				■	
	San Mateo Countywide Guide—Sustainable Buildings	San Mateo		■				■	
	New Home Construction—Green Building Guidelines	Sonoma		■					
	New Home Construction—Green Building Guidelines	San Ramon		■					
	Home Remodeling—Green Building Guidelines	San Ramon		■					
	Santa Barbara County—Green Building Guidelines	Santa Barbara		■					
	High Performance Building Guidelines	New York			■				
	Sustainable Building Source Book	Austin			■				
	SeaGreen—Greening Seattle's Affordable Housing	Seattle			■			■	
	Green Portland's Affordable Housing	Portland			■				
	Santa Monica Residential—Green Building Guide	Santa Monica			■				
	Green Building Design and Construction Guidelines	Santa Monica			■			■	
	Sustainable Building Guidebook	Los Angeles			■				

Table 1. *Cont.*

Country	Title of guideline	Developer */ Region	Type of Developer						
			Administrative Organization				Public Organization		
			Nation	State/ County	City	Association	Research Institute	Private Company	University
	Green-It-Yourself	San jose			■				
U.S.	Oakland Sustainable Design Guide	Oakland			■				■
	LEED Reference Guide Series *	USGBC				■			
	REGREEN−Residential Remodeling Guidelines	USGBC				■			
	ASHRAE Green Guide	ASHRAE				■			
	NAHB Model Green Home Building Guidelines	NAHB				■			
EU	PRESCO Recommendations	PRESCO-net.				■			
U.K.	Sustainable Housing Design Guide for Scotland	Scotland		■					
	Sustainable Design Guide	Edinburgh			■				
	Designing for Sustainability in the Highlands	Highland			■				
Germany	Guideline for Sustainable Building	MTBH	■						
Australia	Your Home Technical Manual	DEWHA	■						
	Environmentally Sustainable Design and Construction	Victoria		■					
	Sustainable Design Guideline Series	Yarra			■				
New Zealand	Smarter Homes	ME/DBH	■				■	■	
	The Residential Design Guide	Auckland			■			■	

Notes: * Abbreviation for guideline developers: MOLIT (Ministry of Land, Infrastructure, and Transportation); DOE (Deptartment of Energy); EPA (Environmental Protection Agency); ORNL (Oak Ridge National Laboratory); NIBS (National Institute of Building Science); USGBC (U.S. Green Building Council); ASHRAE (American Society of Heating, Refrigerating, and Air-conditioning Engineers); NAHB (National Association of Home Builders); CMHC (Canadian Mortgage and Housing Corporation); MTBH (Ministry of Transport, Building and Housing); DEWHA (Department of the Environment, Water, Heritage and the Arts); ME (Ministry for the Environment); DBH (Department of Building and Housing); ■ stands for the type of developer of each guideline.

The ultimate goal of sustainable building guidelines is to raise awareness and to encourage the spread of sustainable building practices by providing information to building professionals as well as to the public. Even though most of the guidelines examined here are designed and produced for this common goal, each guideline also has its own main purposes and proscriptions targeting the needs of various users and developers. Main purposes were classified according to the following issues:

- To educate on the significance of sustainable buildings and promote a better understanding of sustainable building principles;
- To provide comprehensive and detailed information on sustainable building design strategies and technologies;
- To support the decision-making process in the building design, construction, operation, and remodeling phase;
- To assist building professionals by checking compliance with code and standards or by specially addressing point attainment of sustainable building certification systems.

The type, depth, and hierarchy of information addressed may vary greatly depending on the main purposes of the guidelines—from a brief guide to a detailed manual. For example, in the "City of Yarra Sustainable Design Guidelines" [18], 20 pages briefly introduce basic and commonsense sustainable building design principles to residents, planners, builders and architects. At the same time, hundreds of pages of the "Multifamily Green Building Guidelines" [19] and the web-based "Your Home Technical Manual" [20] provide the building industry with a variety of detailed points of information, including design strategies, technical information, implementation methods, construction best practices, code considerations, costs and benefits, and references to additional resources. Since the main purpose of a guideline affects its overall content and hierarchy, it is very important to define the purpose clearly in the process of developing a sustainable building guideline.

The sustainable building guidelines examined here can be organized into the following categories by building type: residential buildings (42.5%), commercial buildings (15%), public facilities (12.5%), and buildings without any specific target type (30%). These guidelines are usually divided into more detailed construction types. For example, in the case of Alameda County, CA in the USA, guidelines for residential buildings can even be sub-divided into three different construction types: new homes [21], new multifamily residential buildings [19], and home remodeling [22]. Customized guidelines for public facilities [23–26] are also being developed as more government authorities make it mandatory to achieve more sustainable outcomes in the design and construction of public sector projects [27].

According to the communication format, guidelines can be divided into the following categories: online, downloadable document file; printed document; software tool; and website. Most of the document files (75%) were not only available for download from the websites of the developers, but also distributed in the form of printed documents such as brochures, books, and manuals. For example, the government of Australia adopted several formats with two information levels based on extensive audience research. In the first instance, "Your Home Buyer's Guide" [28] was developed as a glossy magazine to avoid information overload, whereas "Your Home Technical Manual" [20] was designed as a printed manual for designers, builders, and students to explain the concept and possible solutions related to environmental impacts. These guides and manuals were also reproduced on the website [29] and available as a downloadable file for the quickly growing computer literate audience [30].

Sustainable building guidelines cover different construction phases, and take different issues and measures into account. Guidelines are also used by a variety of groups, including building owners and building professionals (architects, engineers, and constructors). A well-designed information hierarchy is very important to guide users through the content according to importance and need. Therefore, we examined how the guidelines were organized into parts and sections. Table 2 shows the criteria used

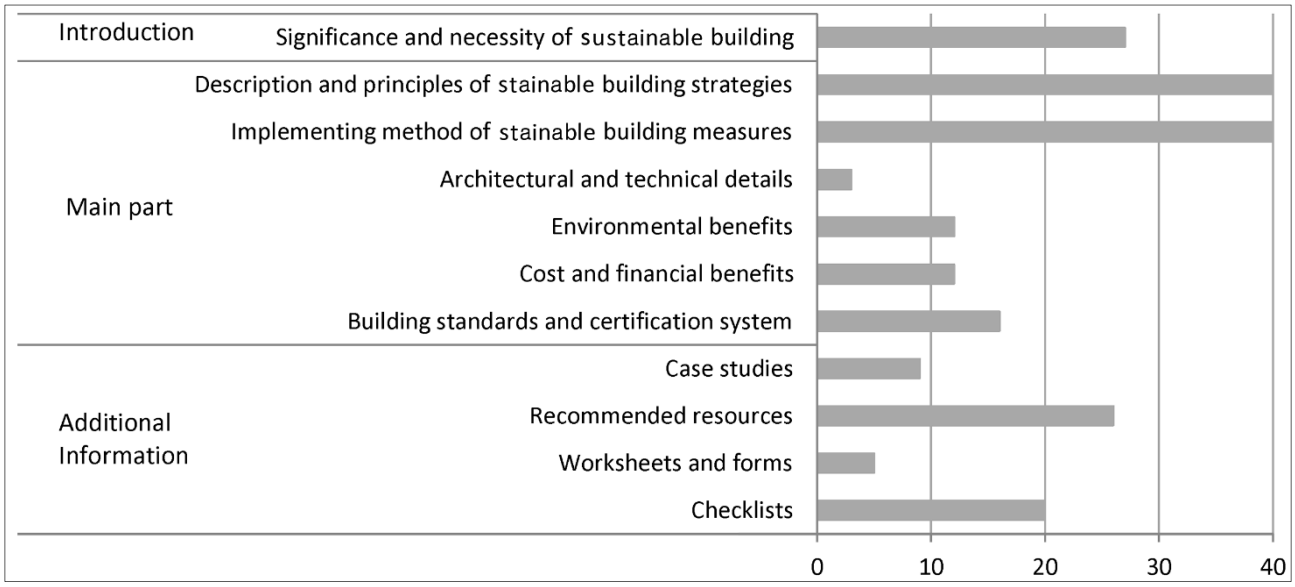
for categorizing the content of guidelines. In 60% of the guidelines, main chapters were arranged according to the "sustainable building issues", and then the content was categorized into sub-chapters according to "detailed measures". In 33% of cases, main chapters and sub-chapters were divided according to "building components/products" and "detailed measures", respectively. There were also cases where the chapters were organized in the following ways: "construction phases" (main chapters) and "detailed measures" (sub-chapters); "construction phases" (main chapters) and "building components/products" (sub-chapters); and finally, "users" (main chapters) and "building components/products" (sub-chapters). There was no case in which "detailed measures" was selected as the criteria for dividing main chapters.

Table 2. Criteria for categorizing the content into sections and parts.

Criteria	Examples
Sustainable building issues	Sustainable site/Energy conservation/Water conservation/ Materials and resources/Indoor environmental quality/ Waste reduction/Operation and maintenance, *etc*.
Detailed measures	Water-efficient fixtures/High-performance windows/Cool roof/ High-efficiency lighting/Renewable energy/Grey water reuse, *etc*.
Building components/products	Structure/Envelope/Finish and furnishing/Window/Heating system/ Hot water system/Ventilation system, *etc*.
Construction phases	Master planning/Schematic design/Design development/ Construction/Operation and maintenance, *etc*.
Users	Building owners/Architects/Builders, *etc*.

The guidelines should meet the diverse information needs of users, from general information about sustainable building to more technical issues. In general, the introductory part of a guideline not only provides an overview of its purpose, format, and application but also addresses the significance and necessity of sustainable buildings. The main sections of most guidelines provide detailed information and useful practices that can be readily introduced into new construction and renovation projects through description and basic principles of sustainable building strategies, implementation methods of sustainable building measures, architectural and technical details, environmental benefits, cost and financial benefits, as well as building standards and certification systems. Furthermore, additional supporting information was also included, usually in appendices such as case studies, recommended resources, worksheets and forms, and checklists. Figure 1 shows the total number of occurrences by the information type.

Figure 1. Total number of occurrences by the information type.



3. Method of Questionnaire Survey

The questionnaire survey was conducted to assess architectural professionals' needs for the sustainable building guidelines and to analyze their viewpoints and opinions on the attributes of the guidelines to be developed in Korea. One-to-one based in-depth interviews, focus group interviews, and questionnaires can all be used to analyze professionals' opinions in this type of study. Generally, in-depth interviews or focus group interviews can provide more valid responses if we want to identify why something has occurred. On the other hand, questionnaires are sufficient and reasonably effective at obtaining data about what issues are of importance and what people do in a particular situation. In addition, since questionnaires consist of a set of questions which all participants are asked to complete, they can be delivered to a large number of participants with little effort and time once the questionnaire has been created [31,32]. Therefore, in this study, a questionnaire survey was selected as the most appropriate methodology since we intended to investigate as many professionals' opinions as possible with various working experience and careers.

This section addresses information about the survey conducted, as well as the design and content of the questionnaire. A survey questionnaire, split into three parts, was designed for architectural professionals. Table 3 summarizes the content and design of the questionnaire. The first part asked about respondents' levels of interest and their task relevance with regard to sustainable buildings. The second part asked what their current sources were for obtaining relevant information and their needs for sustainable building guidelines. This part is intended to identify the problem areas in using information sources in sustainability practice. In the final part, respondents were requested to answer questions about their preferences and opinions concerning the purpose and format of guidelines, the target buildings, and the hierarchy and type of information. To give respondents the opportunity to express views not covered elsewhere in the questionnaire, one optional open-ended question asked respondents to add any comments on what they consider necessary for developing guidelines.

Table 3. Parts and contents of the questionnaire.

Parts	Contents	Question type
Interest and task relevance with sustainable buildings	Q1. Interest in recent technical trends in sustainable buildings	Likert scales
	Q2. Task relevance with sustainable buildings	Likert scales
Current information sources and needs for the guidelines	Q3. Current most frequently used sources to obtain sustainable building information	Rank (1st, 2nd)
	Q4. Satisfaction with current information sources	Likert scales
	Q5. Reasons for the inconvenience of information sources	Choice
	Q6. Experiences in using foreign guidelines	Yes/No
	Q7. Needs for sustainable building guidelines in Korea	Likert scales
Preferences and opinions on the attributes of the guidelines to be developed	Q8. Purpose of the guideline	Choice
	Q9. Target building	Rank (1st, 2nd)
	Q10. Communication format	Choice
	Q11. Hierarchy of information	Choice
	Q12. Information type	Likert scales

To ensure an adequate sample and to reduce bias, we asked 22 architectural planning and design companies with three different size groups to participate in the survey : six large sized companies (more than 300 employees), six middle sized companies (50–300 employees), and 10 small sized companies (less than 50 employees). The respondents were responsible for architectural planning and design development, and all of them voluntarily participated in the survey. We selected the samples in a way that they would be evenly distributed according to the size of company: 30.4% from large sized companies, 37.4% from middle sized companies, and 32.2% from small sized companies. In total, 171 professionals from different firms voluntarily participated in the survey. An appointment at respondents' offices was scheduled and the questionnaire survey methods were properly explained to the interviewees.

We observed the following distribution in terms of respondents' work experience in the industry: 88 (51.5%) had less than 5 years' experience, 56 (32.7%) had 5–10 years' experience and 27 (15.8%) had more than 10 years of experience. Further analysis of respondents' personal data revealed that 81 (47.4%) individuals had been mainly involved in designing and consulting on residential building practices in the past three years; 77 (45.0%) had been involved in commercial building practices, and the remaining 13 (7.6%) had experience in other types of building practices. According to the Korean statistics, the building permits consist of 45.5% of residential buildings, 37.7% of commercial buildings, 13.4% of industrial buildings, and 3.3% of institutional buildings in the last 10 years. Therefore, most of them seem to have been mainly involved in designing and consulting on residential building and commercial building practice.

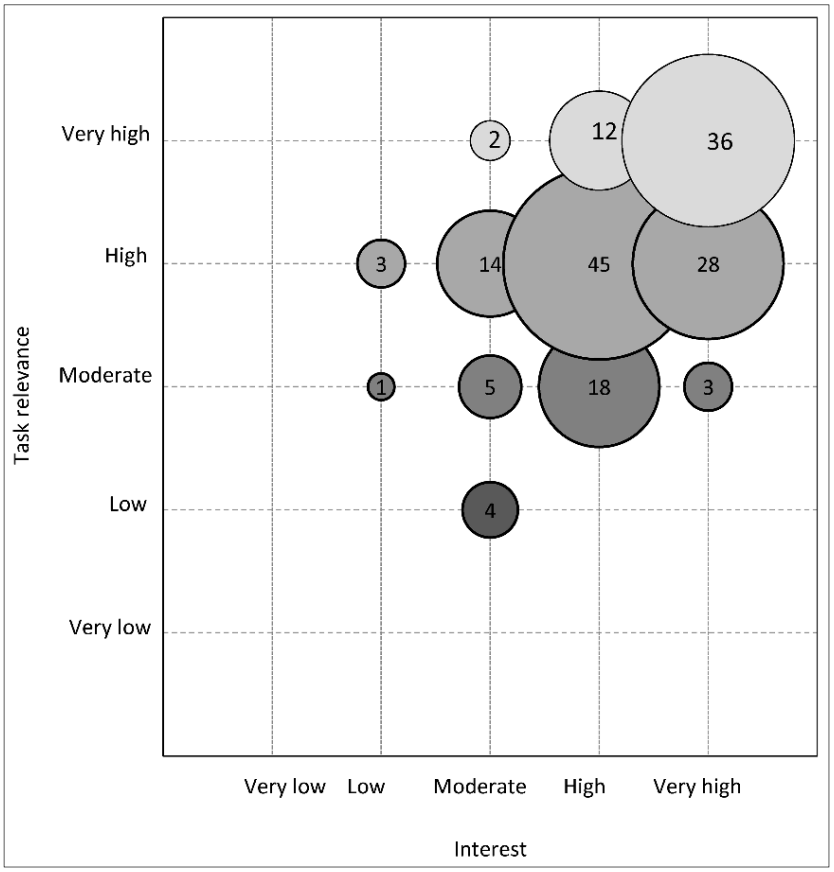
4. Results & Discussion

4.1. Interest in Sustainable Building Design and Task Relevance

The questions centered on how much interest respondents had in sustainable building design and how relevant it was to their task. They were asked to indicate the level of interest and task relevance on a five-point Likert scale (1: very low; 5: very high). Among respondents, 29% and 53% indicated

"very high" and "high" interest, respectively. In terms of the relevance of sustainable building design to their task, the percentages of respondents who gave a rating of "very high" and "high" reached up to 39% and 44%, respectively. The results in Figure 2 show a relation between level of task relevance and interest. As expected, professionals with higher task relevancy were in general more interested in sustainable buildings.

Figure 2. Respondents' interest in sustainable building design and task relevance.



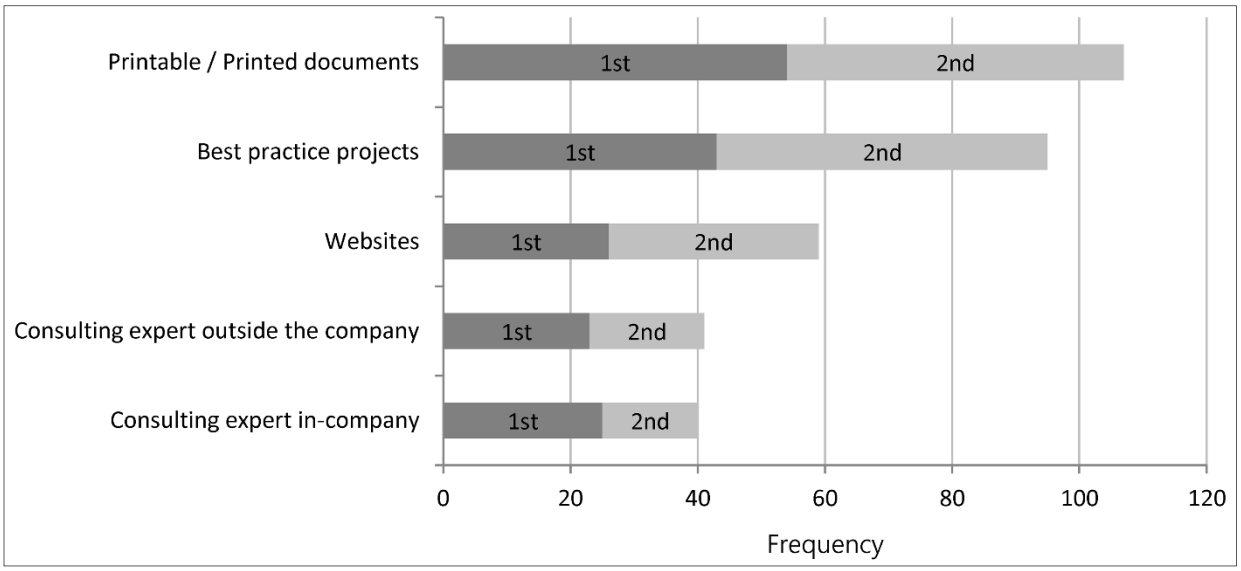
4.2. Current Information Sources and Needs for the Guidelines

A list of information sources was presented to the respondents as shown in Figure 3. Respondents were asked about the two most frequently used sources for their building design process. In total, the most frequently used information source was downloadable or printed documents (31.3%), followed by best practice projects (27.8%), websites (17.3%), expert consultants outside the company (12.0%), and in-company expert consultants (11.7%). Strictly speaking, websites seem to be the least utilized information source, if we do not distinguish between outside and in-company expert consultants. Reardon and Marker [30] observed that designers and builders were reluctant to access internet or other electronic sources in their work practice, with their preferred media being the printed document. The results of this survey were in good agreement with this previous research.

Respondents were then asked to present their satisfaction with the current information sources mentioned above. A Likert-type scale was used with five choices ranging from "very satisfied" to "very dissatisfied". Only 23.4% of the 171 respondents were very satisfied (2.9%) or satisfied (20.5%) with the current mechanism for obtaining information on sustainable building design. The mean

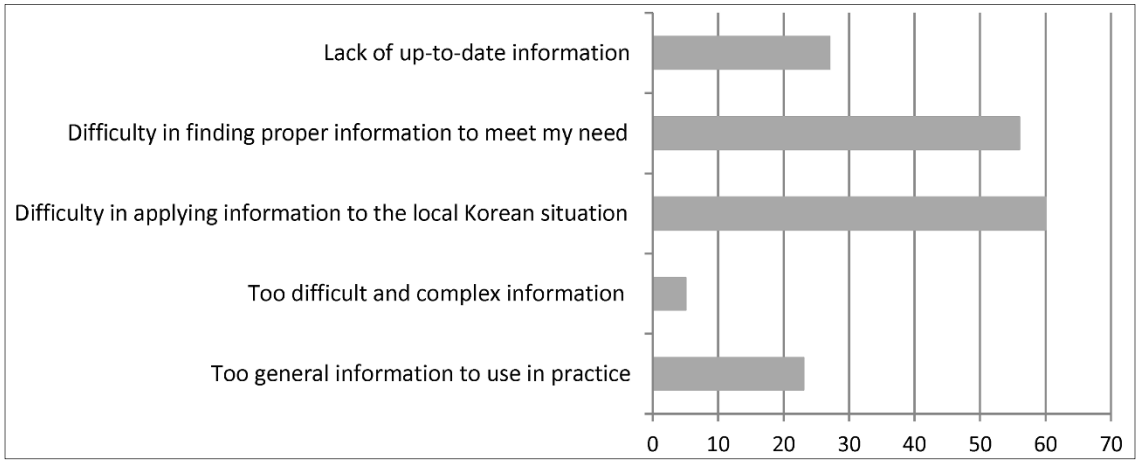
score was 3.05, which indicated that the professionals were neither satisfied nor dissatisfied with the current sources.

Figure 3. Most frequently utilized information sources.



The next question was intended to examine the reasons behind the perceived inconvenience of using current information sources. Respondents were asked to choose the largest source of inconvenience from the list of options shown in Figure 4. The five reasons in the list were established through interviews with building professionals in the pilot study [33]. As depicted in Figure 4, the questionnaire results revealed that "difficulty in applying information to the local Korean situation" (35.1%) and "difficulty in finding proper information to meet my need" (32.7%) were considered to be the main barriers. On the other hand, most respondents seem to have had less difficulty understanding information provided by the sources. The results demonstrated that in developing sustainable building guidelines, it is very important to consider carefully how the latest up-to-date technologies or successful foreign sustainable building practices can be adapted to suit Korean national and regional climatic conditions, codes and regulations, social and cultural contexts, and technology levels. The guidelines should also be designed to provide decision support in the sustainable building design process.

Figure 4. Reasons for inconvenience in using current information sources.



In response to the question concerning experience using foreign sustainable building guidelines, 57.9% of the respondents indicated that they have attempted to obtain information from the guidelines of other countries, which implies the potential necessity of guidelines. Subsequently, they were asked if they require sustainable building guidelines in Korea. In total, 93.0% responded that they recognized the need for the guidelines to assist them during the design process to create sustainable buildings. Only one respondent expressed no need, and 6.4% of respondents had no idea.

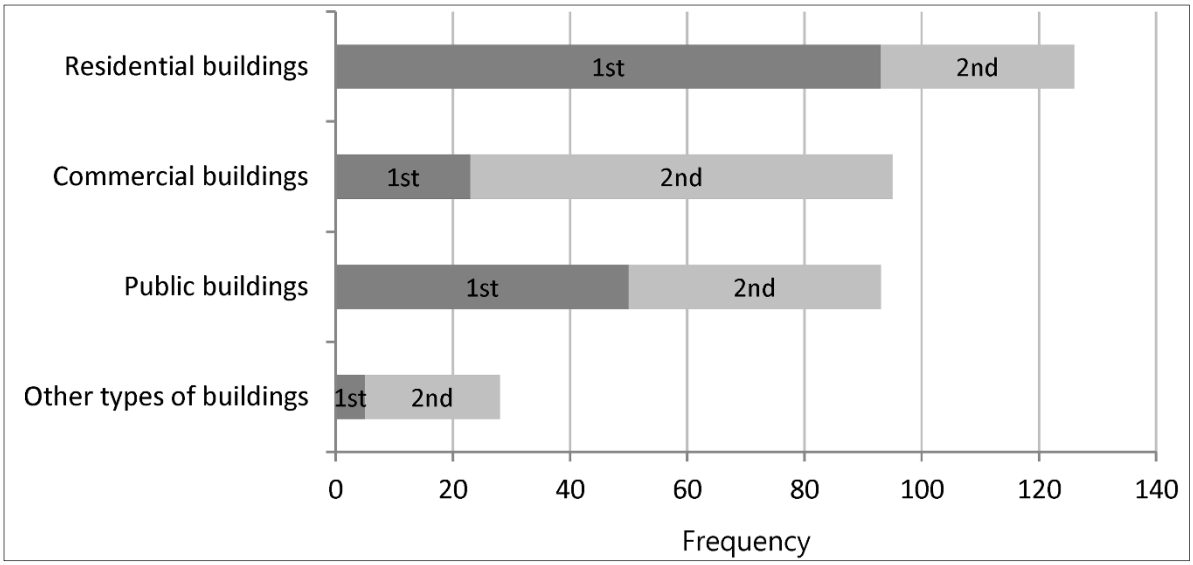
To summarize the results of this part of the questionnaire, respondents obtain information on sustainable design mainly from printable or printed documents, and from best practice projects. However, the level of satisfaction in using these information sources is relatively low due to difficulty encountered in applying this information to the local Korean situation, as well as in finding proper information to meet their needs. A comparatively high percentage of respondents have referred to guidelines published in other countries. The results indicate that there is a significant demand among professionals for information in the form of well-designed national or local guidelines. It was evaluated that 93% of respondents support the development of sustainable building guidelines in Korea, implying that government or local authorities need to help develop such guidelines, as well as encourage a strong movement towards sustainable building and sustainable development.

4.3. Opinions on the Attributes of Guidelines

Guidelines' purposes would be best fulfilled with a focus on their user groups [30,34]. To investigate professionals' opinions regarding the main purpose of the guidelines to be developed, we presented them with a list of specific issues, which were identified through the analysis of existing guidelines in Section 2. The highest rated main purpose of the guidelines was "to provide education on the significance of sustainable buildings and promote a better understanding of sustainable building principles" (35.7%), closely followed by "to provide comprehensive and detailed information on sustainable building design strategies and technologies" (31.0%). Also, there were requirements for the guidelines "to assist building professionals by checking compliance with code and standards or by specially addressing point attainment of sustainable building certification systems" (19.3%) and "to support the decision making process in the building design, construction, operation, and remodeling phase" (14%).

As the second question for this part of the questionnaire, respondents were asked to select and rank, in order of necessity, two target building types among residential buildings, commercial buildings, public buildings, and other types of buildings. Additional space was included at the end of this question to provide specifications on the "other types of buildings". As shown in Figure 5, there seems to be an urgent need for new guidelines for residential buildings, followed by commercial buildings, and public buildings. Respondents ranked public buildings (29.2%) higher than commercial buildings (13.5%) as their first choice. However, commercial buildings were valued highest (42.1%) as their second choice. In total, 28% of respondents answered the combination of "residential buildings" as the first choice and "commercial buildings" as the second choice. In response to the open-ended question for the "other types of buildings", most respondents (93%) indicated that a guideline for "educational buildings" is necessary.

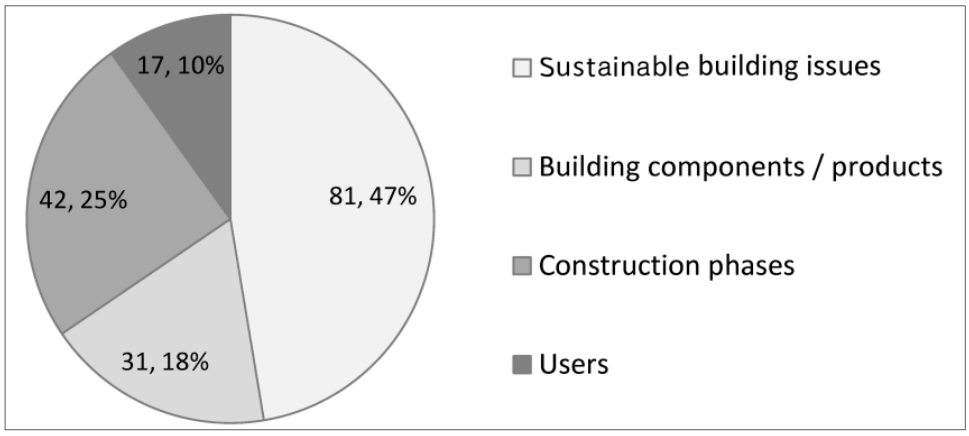
Figure 5. Professionals' needs by target building types.



As for the communication format, the order of the preferred format was document file/printed document (62%), website (23%), and software tool (15%). Although websites have advantages in terms of enabling users to access the most up-to-date information compared to other formats, the questionnaire results show that printed or file-type documents were the preferred media form, which has previously been acknowledged [30].

In order to decide how to organize the guidelines, we asked respondents to point out the preferred criteria for categorizing the content into main parts. Among the criteria in Table 2, "detailed measures" was excluded from the answer choices because there was no case in which it was used as a criterion for dividing main chapters. As shown in Figure 6, almost half of the respondents showed a high preference for "sustainable building issues", which was in good agreement with the overview result in Section 2, which showed that main chapters were arranged this way in 60% of the guidelines investigated here. Secondly, "construction phases" was preferred, whereas "users" attracted a low preference.

Figure 6. Professionals' preference on hierarchy of information.



Existing guidelines include various information types, as shown in Figure 1. Respondents were asked to rank, in order of importance, the information types to be included in the main part of the

guidelines. Figure 7 shows the rankings of six information types. "Description and principles of sustainable building strategies" was valued highest, having been selected by 29.8% of the respondents as their first choice, followed by "implementing method of sustainable building measures" (18.1%). "Architectural and technical details", "cost and financial benefits", and "building standards and certification system" were valued by the same percentage of respondents (13.5%) as their first choice, while "environmental benefits" was ranked lowest by 11.5% of respondents.

Figure 7. Rankings of the information types.

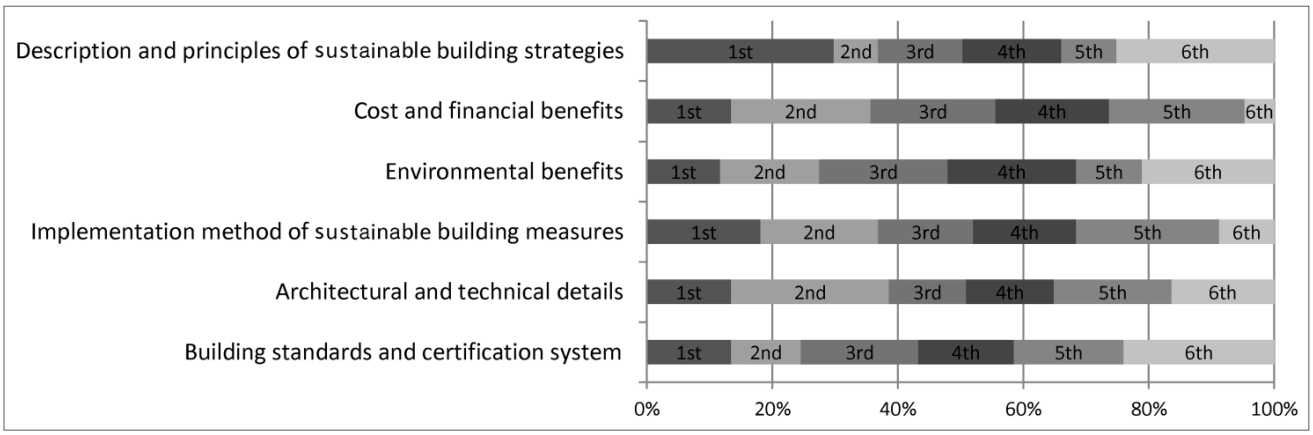


Table 4 shows the ranking of each information type based on their mean ranking, which was established by placing the type with the highest rank first, and that with the lowest rank sixth. Unlike its lower ranking as the respondents' first choice, "cost and financial benefits" was found to be the most important information type to be included in guidelines. "Implementation method of sustainable building measures" came in second, equal to the result in the first choice. "Description and principles of sustainable building strategies" was ranked as the third most important information type. The reason why its rank (according to the ranking mean) was lower than in the first choice seems to be that it was also valued highest (25%) as their last choice, as shown in Figure 7.

Table 4. Ranking of each information type in order of importance.

Information type	Ranking	Ranking mean
Cost and financial benefits	1	3.26
Implementation method of sustainable building measures	2	3.33
Description and principles of sustainable building strategies	3	3.42
Architectural and technical details	4	3.49
Environmental benefits	5	3.65
Sustainable building standards and certification system	6	3.84

This result revealed that there are varying levels of expertise and understanding, even in professional groups. For example, more detailed and technical information would be preferred to "description and principles of sustainable building strategies" by the respondents who were generally more aware of the basic principles, but lacked specific skills and information to implement them [30]. This suggests that guidelines should be developed with two more levels of detail of information. Overall, there is a need

for developers of future guidelines to focus more on cost and financial information, as well as comprehensive implementing methods for each sustainable building measure.

4.4. Open-Ended Comments on Further Considerations for the Guidelines

Many respondents actively suggested their opinions on further considerations for the guidelines. Table 5 shows major recurrent topics in open-ended comments received by respondents, and specifies the frequency, in percentage, of comments (out of the total number 117 of comments received). Many respondents identified practical, specific, and detailed information directly applicable to design and construction practice as one of the main considerations for developing the guidelines. Out of all respondents, 12.8% suggested the inclusion of detailed analysis of existing sustainable building case studies. Other suggestions regarding information included background data on financial and environmental benefits in order to support stakeholders' decision making, and considerations for Korea's situation and current sustainable building policies. In terms of the development process and format of the guidelines, there are three types of opinions expressed: "step-by-step development of guidelines for various building types", "regular update of information", and "accessible and user-friendly guidelines". Some of the respondents also pointed out their need for supporting documents aimed at persuading clients that sustainable buildings can be very significant and cost-effective solutions.

Table 5. Major topics and frequency in open-ended comments.

Topics	Frequency
Practical information directly applicable to design and construction practice	16.2%
Specific and detailed information	13.7%
Detailed analysis of sustainable building case studies	12.8%
Background data for financial and environmental benefits	11.1%
Consideration of the Korean situation	9.4%
Accessible and user-friendly guidelines	8.5%
Information connected with current sustainable building policies	7.7%
Step-by-step development of guidelines for various building types	5.1%
Supporting documents for persuading clients of the need for sustainable buildings	5.1%
Consideration for overseas construction market	4.3%
Regular update of information	4.3%
Education program for guideline users	1.7%

5. Next Steps

In Korea, the government enacted a new "Green Building Construction Assistant Act" in February, 2013 to promote and support sustainable building design, construction, and management for the public and private building sector. A new "Green Architecture Division" was also created as part of the Ministry of Land, Infrastructure, and Transportation which is in charge of sustainable building policy and promotion of sustainable buildings. Various types of tools and guidelines are currently under development to provide information for clients and professionals as well as to support professionals' sustainable building practices. The results of this research are being used as reference to make a framework of these guidelines and tools in terms of stakeholders' interest in sustainable building

issues, preferences of communication format, *etc*. For example, a passive building design guideline was recently developed by the Presidential Commission on Architectural Policy for providing information especially focused on reducing building energy demands and consumption. This guideline was not only available for download from the Korea national green building information website, but was also distributed in the form of a printed document. It covers residential building types and commercial building types as analyzed in the Section 4.3, and includes various information types including description, principles, implementation methods of passive design strategies, technical calculation details, building standards and certification systems, *etc*.

Among information types, "cost and financial benefits" was found to be the most important information type based on their mean ranking as shown in Table 4. Other text-based or graphic-based information types such as the second ranked "implementation method of sustainable building measures" and the third ranked "description and principles of sustainable building strategies" can be sufficiently and appropriately included in the professionals' preferred communication format of "document file or printed document". However, there is bound to be a limit to include up-to-date information on "cost and financial benefits" in the document type guidelines since the costs and financial conditions consistently vary over time with technology development and commercialization. Therefore, a large scale five-year R&D project has been planned and has begun this year to develop a support system that will help clients and professionals to design, operate, and retrofit their buildings in a sustainable and energy efficient manner. This R&D project includes the topics of a periodically updated cost database, LCC evaluation methods and decision making tools, a material and technology database directly applicable to design and construction practice, and a case study database with detailed analysis of sustainable building case studies. Different communication and dissemination approaches and formats for the support system will also be considered in detail based on this research.

6. Conclusions

The attitudes and perceptions of building professionals have a significant influence on sustainability in the building sector [35]. Especially, architectural professionals have a key role to play in future low energy sustainable buildings, since it is directly related to their decisions in the design phase [36]. In determining the development strategies of sustainable building guidelines in Korea from these professionals' perspectives, this paper analyzed existing guidelines and conducted a questionnaire survey in order to investigate their preferences and needs for guidelines. Current sustainable building guidelines were briefly overviewed in terms of their attributes, including their main purpose, target building type, communication format, hierarchy of information, and information type.

Based on the questionnaire survey results presented in this paper, we conclude that architectural professionals prefer printable or printed documents and best practice projects to obtain information on sustainable buildings, but they still encounter difficulties in applying these to the local Korean context. The results also indicate that there is a significant professional demand for well-designed national or local guidelines. In terms of guideline attributes, it was shown that the guidelines need to be developed with attention paid to advertising the significance of sustainable buildings and to promote a better understanding of sustainable building principles. Additionally, providing comprehensive and detailed information on sustainable building design strategies and technologies was also recommended as one

of the main purposes of guidelines. We also conclude that cost and financial information, as well as comprehensive implementation methods for each sustainable building measure, are crucial for architectural professionals and should be included in the guidelines. This study only focused on professionals' opinions in the Korean situation and there is an obvious need for surveys in other countries in order to develop their own guidelines. However, this paper also includes analysis of existing sustainable building guidelines in many countries and suggests a framework for a professionals' questionnaire survey based on it. This part can be generalized to international readers who are trying to develop their own sustainable building guidelines.

Sustainability has been growing as one of the main considerations across the construction industry in the past few decades. To implement sustainable building strategies and technologies in practice, well-organized and informative guidelines are required for professionals and other stakeholders. Our results can contribute to establishing the developmental direction and strategies of sustainable building guidelines.

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Author Contributions

Both authors have equally contributed to this research.

Conflicts of Interest

The authors declare no conflict of interest.

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