

Article

Environmental Assessments in Architectural Competitions in Poland in the Years 2018–2022

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Abstract: This paper discusses environmental and energy-saving factors in architectural competition procedures. The final assessment of sustainability and environmental aspects of a building is a derivative of the decisions taken during the entire project execution process, especially those taken at the initial stage. Notifications concerning architectural competitions, both in Poland and other European countries, as well as in the United States and Canada, increasingly often list sustainability as a necessary criterion. Aspects such as the use of renewable energy sources, energy efficiency solutions or reducing a building's occupancy costs most often appear as guidelines. In this paper, the authors discuss the essence of solutions in architectural competition procedures announced in Poland in the years 2018–2022, using 154 cases as an example and setting them against the background of Europe. The types and level of detail of the selected criteria and their frequency of occurrence were examined. The study unveiled the absence of comprehensive guidelines in the processes of nationwide architectural competitions that take sustainability into account. The lack of definitions for environmental and energy objectives has a significant impact on their integration into competition designs, and reduces the chances of adapting and adopting these aspects at a further stage. Based on the analysis, a range of recommendations were formulated for implementation in competition procedures.

Keywords: architecture; sustainability; architectural competitions; sustainable development; green building; green factors; Poland



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1. Introduction

Studies show that the construction sector is responsible for 40% of carbon dioxide emissions into the atmosphere, including 27% of emissions related to the day-to-day use of buildings, and for 50% of extracted materials [1]. Over the past decades, it has been proven that the over-consumption of natural resources exceeds their recovery time, resulting in a scenario that is out of balance with human needs and activity and their adaptation in the environment [2]. Thus, over the last several decades, architectural design and construction has been at the centre of the broadly understood discourse on sustainability, decarbonisation or global warming which poses new challenges for the architectural profession [2]. This is an extremely heated topic in both academic, business and social circles—there arises the question as to what sustainability means and how it inspires specific architectural solutions [3].

On the real estate development market, there is an increasing number of novel solutions that stimulate the emergence of sustainable architecture. In addition, guidelines for new buildings also change, such as zero-energy architecture or a building's thermal balance requirements, which entails limiting heat transfer through a building's envelope. The research in the field of sustainable architecture and innovative solutions are constantly being developed on a regular basis. Among these are tools that support the thermal characterization of building envelopes, such as the temperature-based method (TBM), the heat

flux meter (HFM) approaches and the impact of incorrectly positioned exterior sensors on the precision of measurements [4]. In the face of these changes, design and real estate development procedures are also being modified, including, among others, architectural competition organisation procedures, which are the subject of this study. Despite the importance of competitions in optimising the quality of public buildings [5], the issue has some shortcomings, particularly in terms of applying effective and objective criteria for the qualitative evaluation of designs.

1.1. Literature Review

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [6]. This is the most quoted and up-to-date definition of sustainable development we can come across, and which encapsulates the essence of this movement in a single sentence and is referred to as its first-ever written definition. At the same time, the first events that led to the emergence of definitions and concepts of sustainable development appeared as early as the late 1940s and early 1950s [7], for instance in the form of establishing The International Union for the Protection of Nature (the present-day International Union for Conservation of Nature, IUCN) in 1948, the first international organisation to be focused on environmental concerns and which describes itself as the only institution that unifies governments and society to accelerate sustainable development and create a world that appreciates and protects nature [8].

Since this event, there have been countless national and international conferences, congresses, reports, commissions or other such events that have directly or indirectly influenced the issue under discussion. Milestones here include The United Nations Conference on the Human Environment, which took place in Stockholm in 1972 and resulted, among other things, in the founding of the United Nations Environment Programme. Thus, for the first time, the (initial) concept of sustainability was stated to be in the form of a vision that recognises the interconnectedness of social, economic and environmental problems [7,9]. The second extremely important milestone is the aforementioned Our Common Future report of the World Commission on Environment and Development [6], which contributed to the popularisation of the term ‘sustainability’. Furthermore, the sustainability statutes of the UCLA Sustainability Committee underline that sustainable practices support ‘ecological, human, and economic health and vitality’ and assume that the resources at our disposal are limited and should be used in a conservative and regulated manner with consideration of long-term priorities and expected consequences [10].

Sustainability is being addressed increasingly frequently, by a constantly growing number of people and communities, with new planes for discussion opening almost every day. One extremely important plane is the construction sector [11], where key decisions that affect the environmental aspect of a building (including the construction–environmental relationship and the impact of a building’s occupancy later on) are made already at an early stage of a project, where both the architect and the client play a significant role. It is the latter’s decisions that determine the basic guidelines for a particular development project, which the architect takes into account when developing the design. There are several routes that lead to the establishment of client–designer cooperation:

- the client’s selection of a design firm on the basis of, among other things, its portfolio, followed by cooperation and commissioning of the design;
- commissioning several design offices to develop conceptual proposals and then selecting one and continuing to work with that firm;
- closed competitions aimed at selected design firms (procedures by invitation);
- open competitions (open procedures) or restricted procedures open to all those who meet pre-selection criteria.

In each of these processes, guidelines are defined at the stage of formulating the building’s use programme and crystallising the multi-discipline functional and spatial concept, including, among others, those that relate to environmental factors or the impact

of the construction and operation of the facility on the health and comfort of its user. This paper focuses primarily on verifying environmental factors that are taken into account in the preparation and conduct of competition procedures used to select designs for primarily public, but also commercial, buildings.

This matter has been an object of research for many years, one excellent example being Canada, where publications on sustainable aspects in competition procedures for public buildings appeared as early as 2011 [12].

There are also organisations around the world that are dedicated to the professional certification of both existing and newly planned buildings. Here, a distinction can be made between systems such as: BREEAM (Building Research Establishment Environmental Assessment Method) [13], LEED (Leadership in Energy and Environmental Design) [14], HQE (High Quality Environmental Standard, Haute Qualité Environnementale) [15], GBS (Green Building Solutions) [16], DGNB (German Sustainable Building Council, Deutsche Gesellschaft für Nachhaltiges Bauen) [17] and WELL (WELL Building Standard) [18], which play a significant role in setting architectural trends that are consistent with sustainability. Each is guided by criteria such as how energy is sourced, generated, processed and saved, how water is saved and recovered or how air quality is controlled. Some of them also take into account aspects such as user comfort and safety or the quality of the indoor environment [19]. These actions are separate from competition procedures, but often in the terms and conditions of competitions it can be found that obtaining one of these certificates is a requirement.

1.2. General Overview

1.2.1. European Recommendations and Legislations

In Europe, a number of measures have been taken to establish guidelines for architectural competitions. The foundational document here is a guide by the UIA International Competition Commission (ICC) acting on behalf of The International Union of Architects (UIA) as an interpretation and implementation of regulations developed by the UNESCO 'Standard Regulations for International Competitions in Architecture and Town-Planning' [20]. These guidelines were written up and adopted by the 130th Council in Seoul in March 2017, and further supplemented and revised by the 131st Council in Kuala Lumpur in July 2017, and the 139th Council in Rio de Janeiro in January 2020. The creation of this document consisted of an in-depth analysis of the regulations created over the last sixty years for the conduct of competitions and was not only a response to the need to adapt the regulations to increasingly complex and diverse projects, but most importantly, the previous objectives were confronted with current trends in sustainable design and the threats posed by climate change [20].

In 2002, a global organisation was established that does not directly participate in the creation of new competition procedures but is involved in defining recommendations for newly designed buildings and carries out extensive research and initiatives in the area of sustainability. This organisation is the World Green Building Council (WGBC) [21], whose branch now combines more than twenty green building associations of European countries, The Europe Regional Network (ERN) [22]. The WGBC's mission is to pursue the transformation of the building sector through three key strategies: climate action; health, equity and resilience; and resources and circularity [11], which aim, among other things, to decarbonise the built environment by 2050 [23], create a healthy built environment, resilient buildings and society, and an environment that supports the regeneration of natural resources while maintaining a circular economy [11]. In addition, the vast majority of European countries regulate competition guidelines individually, with varying degrees of consideration of pro-environmental guidelines and considerations. Examples here include Switzerland, where competition guidelines are regulated by the SIA 142 'Regulation of architecture and engineering competitions' [24] and Finland, where SAFA (the Finnish Architects Association) is responsible for organising architectural competitions [25]. Poland has also decided to create its own custom guidelines and recommendations for architectural competitions.

In 2020, the New European Bauhaus (NEB) initiative was launched by the European Commission with the overarching aim of reflecting the European ambition to create beautiful yet sustainable and inclusive spaces. The NEB takes a multi-level approach to transformation—from global to local. According to the initiative’s creators, the key to tackling the effects of climate change lies in changes made from the bottom up and implemented around the world. The NEB builds on the strength of the community that is growing around its activities [26].

1.2.2. Polish Recommendations and Legislations

In Polish law, the following legal acts and recommendations of individual bodies can be distinguished, which define the methodology of organising architectural competitions in the country:

- The Competition Code drafted by the Association of Polish Architects, adopted by SARP General Board Resolution No. 46 of 28 March 2009, which includes: Regulations for architectural, urban and architectural, and urban planning competitions; The SARP guideline for organisers of architectural, urban and architectural, and urban planning competitions; Document templates recommended by the SARP; The list of SARP Competition Judges; Regulations of Architectural and Urban Planning Competitions of the Association of Polish Architects [27];
- The ‘New model competition’ Recommendations of the President of the Public Procurement Office regarding competitions in the architectural sector: List of key issues necessary for the proper preparation and conduct of a limited two-stage competition and the preparation of the competition regulations [28];
- Act of 11 September 2019, Public Procurement Law concerning projects executed with public funds covered by this law [29];
- Competition regulations for individual architectural competitions, whether organised by public institutions or private parties.

The first three documents do not include sustainability aspects in their provisions, this issue is entirely left to the discretion of project sponsors or those who draw up the rules of the competition in question.

In addition, it is worth emphasising that solutions that have attempted to introduce changes in this area have already appeared, but these have not been successfully translated into modifications of the existing provisions. Thus, the Association of Polish Architects set up the SARP Expert Team for Sustainable Development in 2014, whose main statutory task is to provide expertise in the field of sustainable development in architecture and urban planning [30]. Despite this, the team did not influence the modification of the general guidelines for the competitions organised in Poland. A team from the Warsaw branch of the SARP has also developed an evaluation of the guidelines for the Architectural Award of the President of the City of Warsaw competition, which was presented at the ACPS international academic conference: Architecture, City, People, Structure, which took place on 21 May 2021 [31]. At the same time, various bottom-up initiatives to define pro-environmental guidelines, such as public consultations, are also taking place. Another organisation active in Poland is the Polish Green Building Association [32], which is part of the World Green Building Council—the world’s largest organisation of local associations.

1.3. Aim of the Research

Due to the increasing interest and concern for the level of sustainability of both new and renovated buildings, and the importance of architectural competitions in the process of providing guidelines for building design, a detailed analysis of the current state of affairs, including the available literature, was carried out (Figure 1). This study showed that there is a lack of detailed procedures, common to all the competitions held, concerning pro-environmental aspects. Furthermore, existing scientific studies cover other geographical areas or only discuss phenomena within a given country. Consequently, a research gap has been identified in this field, leading to a thorough analysis of the rules and regulations

of the various competitions. Thus, the aim of this study was to verify to what extent sustainability aspects are taken into account in architectural competition procedures and how high a priority they are given. The situation in a given country was also assessed and assumptions and recommendations were formulated which, in the authors' opinion, should be taken into account in developing the procedures for the competitions under study, which could contribute to objectivising submission evaluations in terms of the optimality of their environmental solutions.

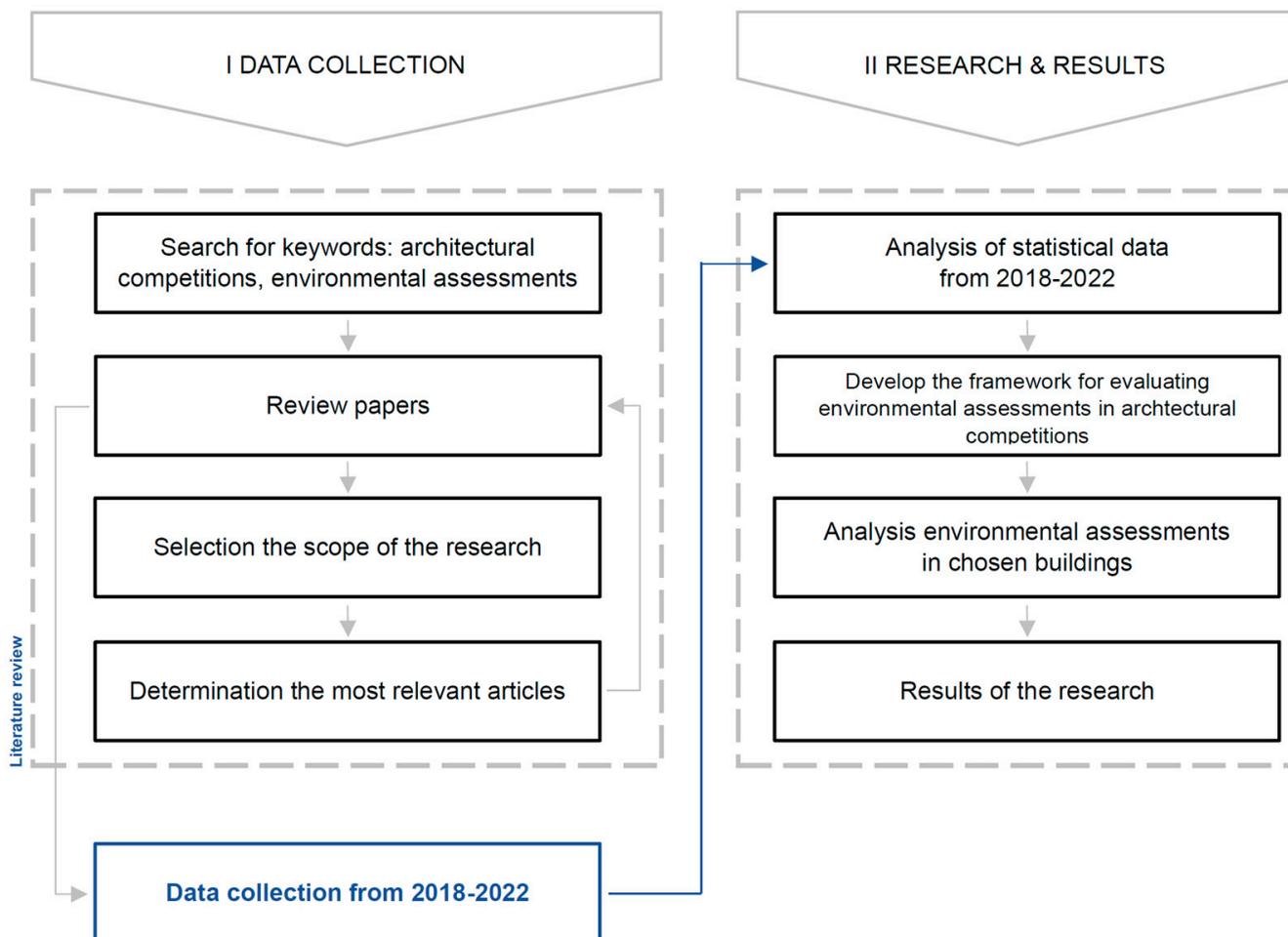


Figure 1. Research methodology. Source: original work.

2. Materials and Methods

Due to the extensiveness of the issue in terms of procedures, guidelines and legal acts that define the course of architectural competitions in Poland, it was decided to focus the study on open and limited competitions dedicated to professionals, and whose objective was procuring building designs. The fact that the vast majority of such buildings are public buildings and that there is full access to information on the competition procedure, guidelines and results were also an important consideration. The entire issue was presented in a European context. In Poland, there are also competitions that follow a restricted procedure and that are classified (and were not included in this study). These involve private project sponsors, who invite design firms, often specialised in the design and construction of a particular type of building, take part in a competition (procedures by invitation). Such competitions are not publicly announced; most often, one can only find information on their outcome. Based on interviews with architects and design firm representatives, it can be seen that the subjects of these competitions are mostly office

buildings and that one of the key requirements in the guidelines is accreditation for a specific certificate.

At the same time, Poland lacks clearly defined guidelines for the organisation of architectural competitions that take into account aspects of sustainability, such as a project's impact on the environment and the surroundings, or a building's adaptation to the challenges of the 21st century, such as waste management, non-renewable energy sources or global warming. As such, this area remains under-investigated and was chosen as the focus of the study.

3. Results

3.1. Survey Competitions

This research focuses on the analysis of competitions that were mostly carried out according to the guidelines of the Association of Polish Architects (SARP), out of which 154 competitions announced in Poland in the years 2018–2022 were identified (Figure 2a). There was a noticeable decrease in the number of competitions in 2019 (the number of these competitions represents 61% of the number of competitions announced in 2018). The cause is difficult to identify, and there appeared to be no noticeable link to the pandemic, which started in November 2019, while the first cases of infection in Poland were reported in 2020. In contrast, the downward trend in subsequent years can be linked to the global economic situation. Depending on the actors who carry out the procedure in question, a distinction can be made between three types:

- 81 competitions organised or co-organised by the SARP;
- 52 competitions organised by public institutions;
- 21 competitions organised by private companies (Figure 2b).

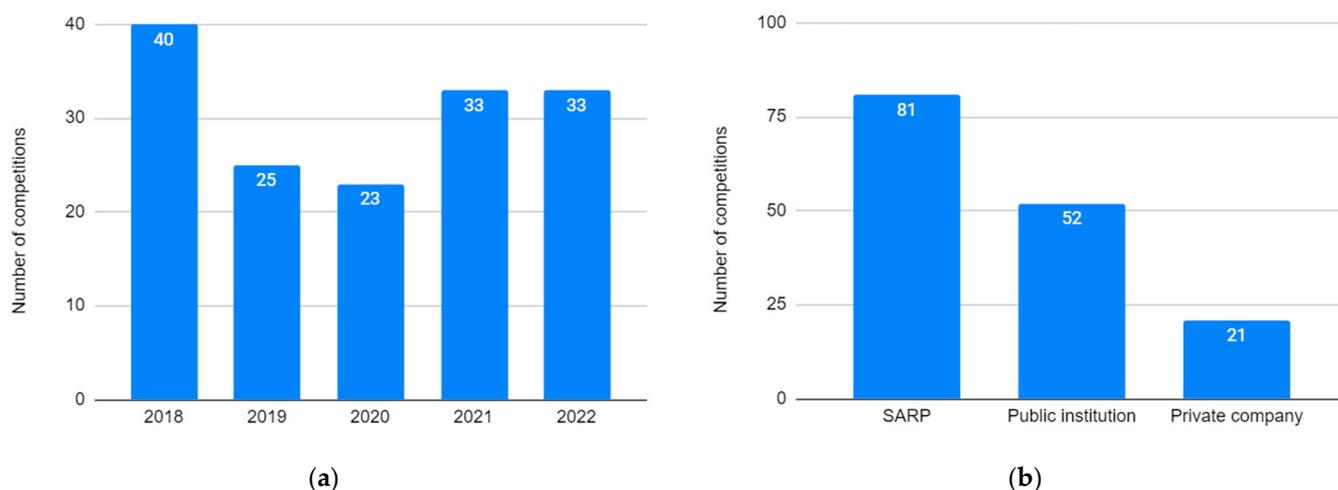


Figure 2. (a) Year of the competition. Source: original work based on this research; (b) Organiser of the competition. Source: original work based on this research.

Of the competitions in question, the vast majority (35%) of the buildings they concerned were located in the Masovian Voivodeship (including the capital city of Warsaw) (Figure 3). The largest proportion (81.8%) of the buildings subject to competitions are public buildings (126), including: culture (47), sports and recreation (16), science and academia (14), education (13), administration and communications (11), health and social services (8), office (7), communications (5), hotel and tourism (2), retail and services (2), fire, police and penal services (1). In addition, there are still distinguished residential buildings, of which 28 were recorded (Figure 4).



2 Polish nationwide competitions

Figure 3. Number of competitions per voivodeship. The darker the fill on the map, the greater the number of competitions organized in the voivodeship. 2 competitions were nationwide, therefore they were not added to any voivodeship. Source: original work based on this research.

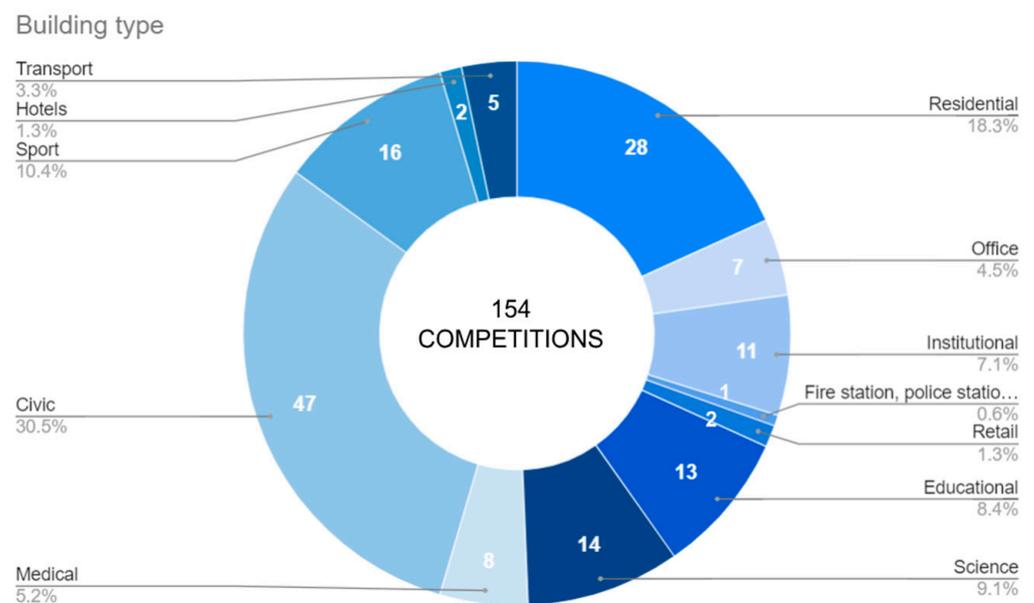


Figure 4. Building type. Source: original work based on this research.

3.2. Architectural Competition Procedure

The competitions investigated can be divided into different types by procedure (Figures 5 and 6a), the number of stages (Figure 6b), building executability (Figure 6c) or complexity level (Figure 6d). The competitions analysed were carried out using:

1. Open procedures—there were no participation restriction criteria;
2. Restricted procedures—eligibility for participation was conditional on meeting professional qualification criteria and proving experience [20], (Figure 6a).

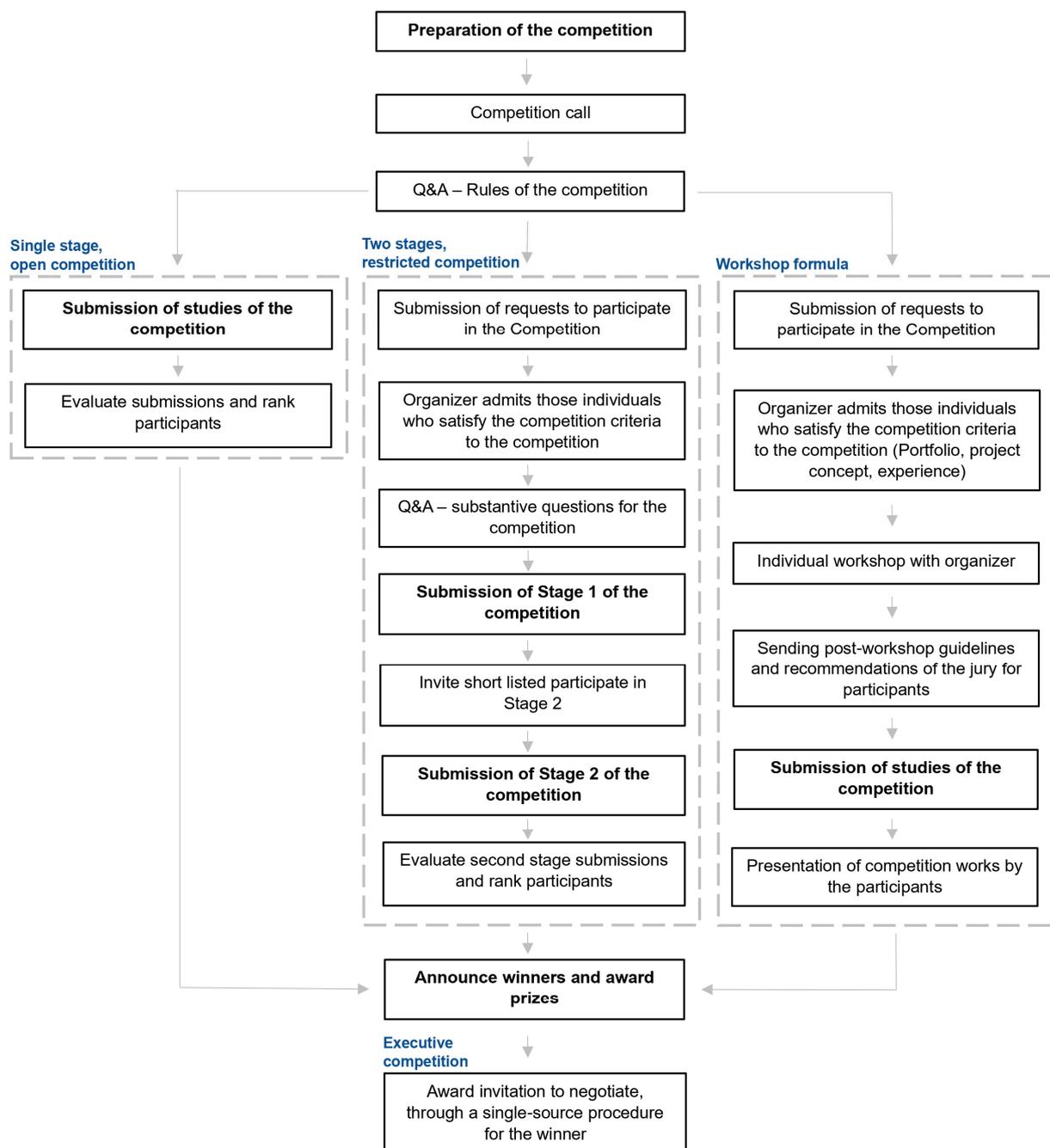


Figure 5. Competition procedure. Source: original work based on this research.

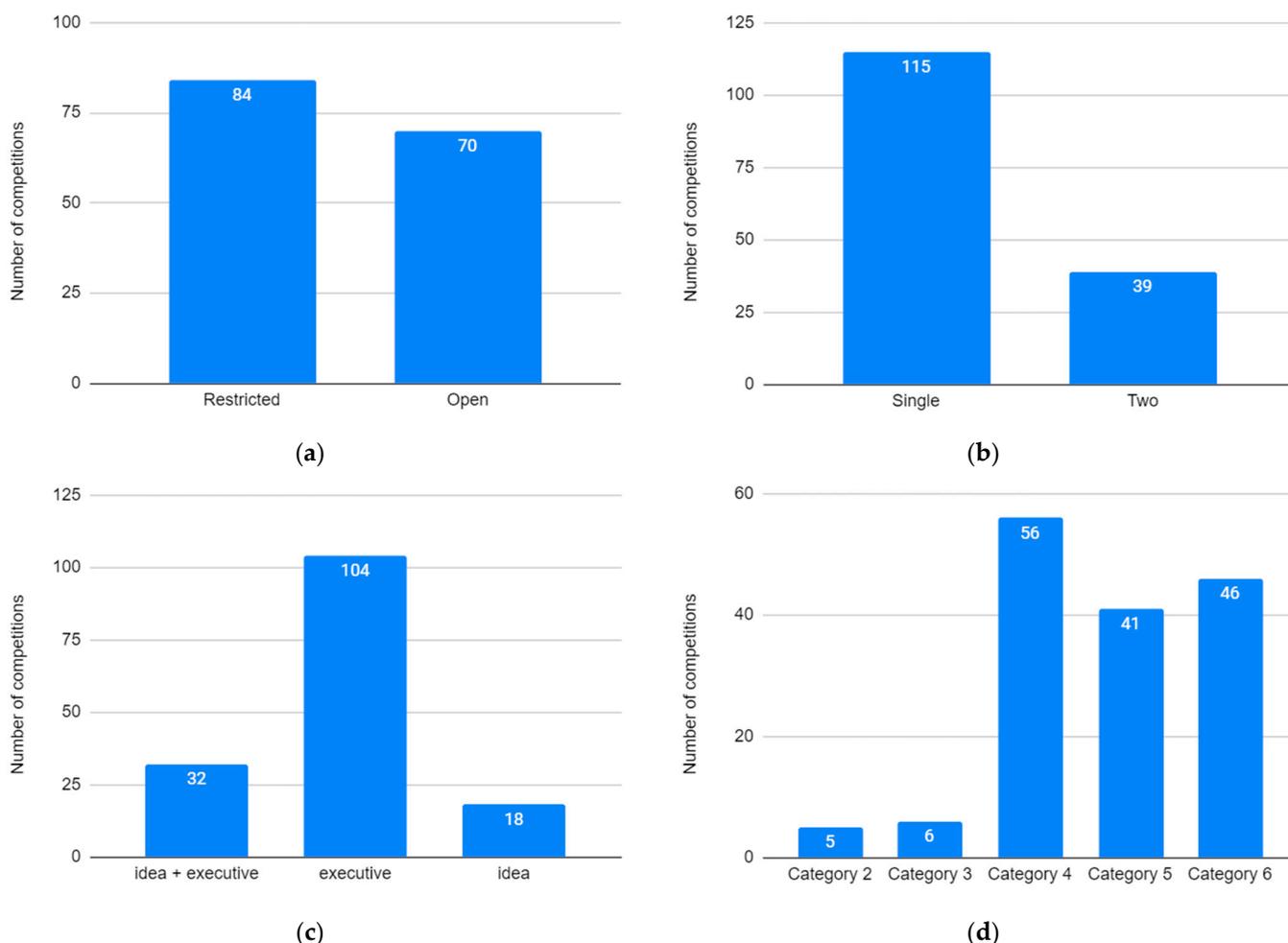


Figure 6. (a) Procedure type. Source: original work based on this research; (b) Competition stages. Source: original work based on this research; (c) Competition types. Source: original work based on this research; (d) Complexity as per SARP classification. Source: original work based on this research.

It should also be noted that workshop procedures were also found to be used in a few cases of large housing projects. It can be considered an open, two-stage formula in which the organiser, after an initial selection of submitted portfolios, organises individual workshops for selected participants. Their outcome is the drafting of recommendations and design guidelines for participants in the second stage of the competition (Figure 6b).

Depending on the potential for design implementation, a distinction can be made between three types of competitions, as reflected in the literature:

- ideas competitions [20,33];
- project competitions [20,33];
- ideas and project competitions—a combination of the above two (Figure 5).

Project competitions accounted for the vast majority of announcements (104), which is related to the exclusive participation of professionals (Figure 6c). The ideas and project competitions (32) and the ideas competitions (18) were much less popular with organisers. It is natural that a much higher proportion of ideas competitions could be observed in student competitions, but this is not the focus of this analysis.

Among the competitions assessed, there are two modes: one- and two-stage competitions (Figure 6b). The organisation of a two-stage competition was, in the vast majority of cases, dictated by the size and complexity of the site and the more detailed evaluation of the competition entries. In this type, the possibility to change the requirements between stages and to make better use of the potential and workload of the participants, by selecting

no more than ten authors for the next stage, is an important aspect. Two-stage competitions are recommended by the SARP due to their quality-related benefits [33].

The SARP building type classification was used to divide the buildings to be designed by complexity. This classification describes complexity categories ranging from 1 to 6, where Category 1 buildings are the simplest, while those in Category 6 have the greatest degree of functional, utility and technological complexity [34], (Figure 6d). The analysis confirmed the assumption that complex sites represented by Categories 4 to 6 were the most numerous group in the competitions.

3.3. Assessment Tools

Based on the analysis of the 154 architectural competition regulations, ten main evaluation criteria were identified:

- architectural aspects—Criterion 1;
- urban aspects—Criterion 2;
- functional and utility aspects—Criterion 3;
- sustainable solutions—Criterion 4;
- rationality of adopted solutions—Criterion 5;
- flexibility of solutions and/or staging—Criterion 6;
- originality and relevance—Criterion 7;
- estimated cost of the project—Criterion 8;
- estimated construction cost—Criterion 9;
- cost of operation and maintenance of the facility—Criterion 10.

The most frequent evaluation criteria were architectural aspects (154), and functional and utility value (148). Given the type, nature and theme of the competitions, this result was expected. The next most frequent aspects were criteria relating to estimated operating costs (126) and urban solutions (117). Similar values were recorded for the criteria of sustainable solutions (70), solution rationality (71) and estimated construction costs (67). Criteria relating to the novelty and originality of solutions (45), design documentation cost (20) and project flexibility and staging (14) were less common (Table 1).

Table 1. General criteria for evaluating competition entries. Source: original work based on this research.

Criterion Number	Criterion	Number of Competitions ¹
1	architectural aspects	154
2	urban aspects	117
3	functional and utility aspects	148
4	sustainable solutions	70
5	rationality of adopted solutions	71
6	flexibility of solutions and/or staging	14
7	originality and relevance	45
8	estimated cost of the project	20
9	estimated construction cost	67
10	cost of operation and maintenance of the facility	126

¹ The maximum number of competitions is 154.

3.4. Sustainability Factors

This study focused specifically on the occurrence of pro-environmental and energy-saving criteria in the competition guidelines. Depending on the extent of their occurrence, we can distinguish four categories:

1. no information and recommendations on pro-environmental and energy-efficient solutions;
2. general application of pro-environmental solutions;
3. general application of energy-efficient solutions;
4. detailed application of pro-environmental and energy-efficient solutions (Figure 7).

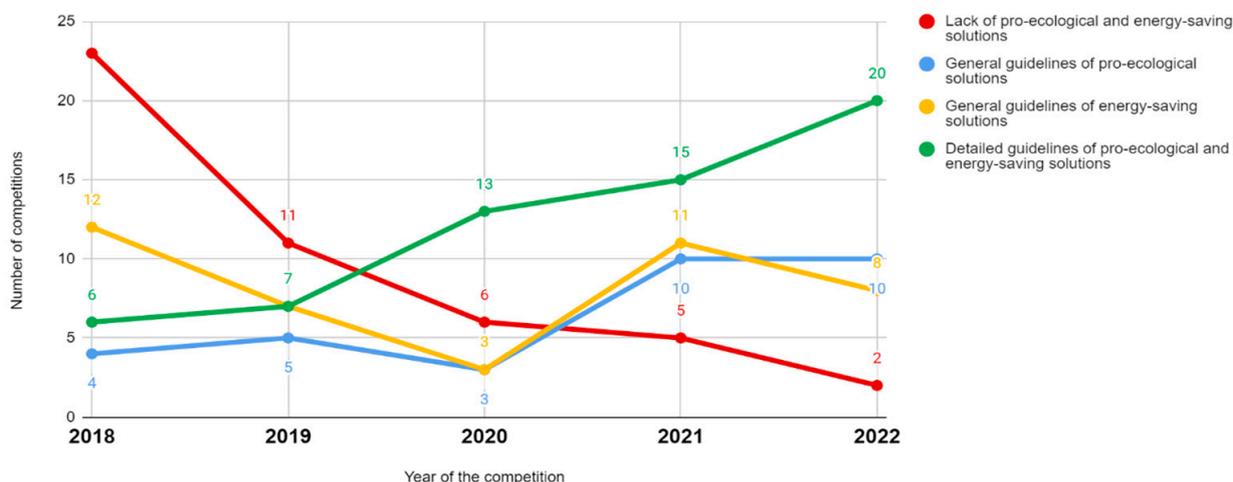


Figure 7. Pro-environmental and energy-efficient solutions in competitions. Source: original work based on this research.

Looking at the graph above, it can be seen that, with each passing year, the number of competitions with no indication of pro-environmental criteria decreased, while the number of competitions with a specific indication increased. The number of competitions with general pro-environmental and energy-efficiency guidelines remained at a similar level.

It should also be emphasised that in the competitions in question, where pro-environmental guidelines were present, we can distinguish different degrees of detail. On the one hand, there were regulations that explicitly stipulated the necessity for such measures without much specificity, while on the other, a large proportion of them specified pro-environmental guidelines such as climate neutrality, energy efficiency, greenery or water retention in detail. The last type of competition refers to existing documents that specify solutions in a highly detailed way, such as certificates (BREEAM, WELL and others) or the recommendations of the Polish Green Building Council (PLGBC). At the same time, the latter account for the smallest percentage of all competitions that contained pro-environmental criteria.

The next stage featured an analysis of competitions whose project sponsors may be described as ‘environmentally conscious’, as pro-environmental criteria were defined in detail. We identified 61 such competitions. We can divide the environmental factors identified into four categories: ecology; comfort, safety and mobility; resources and technologies; economy and management. Within the above categories, additional sub-categories were formulated, as indicated in the table below (Table 2).

Table 2. Detailed guidelines of pro-environmental and energy-efficient solutions. Source: original work based on this research.

Criterion Category	Criterion	Number of Competitions ¹
Ecology	Rainwater management	32
	Greenery and green roofs	18
	Protection of biodiversity	10
	Reduced carbon footprint and climate neutrality	22
	Renewable energy sources	47

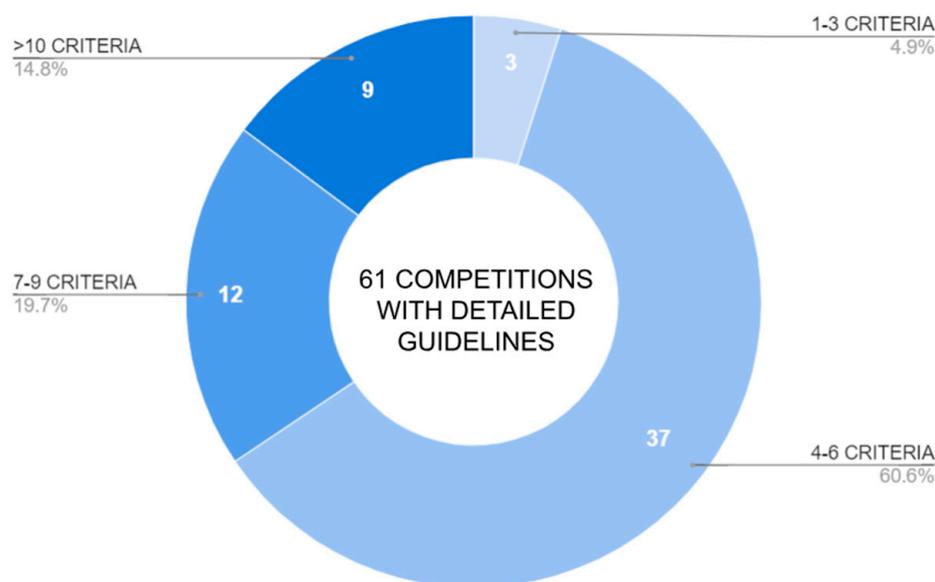
Table 2. Cont.

Criterion Category	Criterion	Number of Competitions ¹
Comfort, safety and mobility	Circulation solutions	5
	Good daylight conditions	12
	High quality of indoor air and sound insulation	10
Resources and technologies	Passive solutions—compact building shape, high airtightness and thermal insulation	7
	Material and technical solutions that limit heat loss and overheating	29
	Highly efficient utility systems with heat recovery	13
	BMS	17
	Durability of materials in the life cycle	10
	Use of greywater	16
Economy and management	Energy-efficient solutions	49
	Educational aspect	3
	Building certification	6
	Estimated construction cost	25
	Cost of operation and maintenance of the facility	53

¹ The maximum number of competitions is 61.

The criteria that appeared the most often were: reduced of operation and maintenance costs (54 competitions), energy-efficient solutions (49 competitions) and the use of renewable energy sources (47 competitions). In contrast, the least frequent criteria were: planned certification (6 competitions), transport solutions and traffic intensity (5 competitions) and educational activities (3 competitions). The results imply that the most important elements are related to economic conditions, which may suggest lower ecological awareness among investors and a desire to generate savings. A significantly lower number of competitions are related the methods and technologies that should be used. On the one hand, this gives designers a free hand to propose optimal solutions, but on the other hand, it may suggest a lack of knowledge and experience in this area among organizers and investors. Ecological issues are used selectively, with the predominance of the use of renewable energy sources and rainwater management. Again, this may be related to the desire to reduce the consumption of resources in the form of electricity and water, and not necessarily directly with pro-environmental reasons. The least frequently chosen category is “Comfort, safety and mobility”, which may be surprising considering that these are extremely important elements of people’s functioning in urban environments and buildings. This may indicate too much focus on the building itself without taking into account the presence of future users.

In each of the competitions, the number of criteria indicated to be met varied, as shown in the pie chart below. The largest number of competitions specifying between 4 and 6 criteria (37 competitions) and the smallest between 1 and 3 criteria (3 competitions) (Figure 8).



THE MAXIMUM NUMBER OF CRITERIA TO BE MET IS 19

Figure 8. Detailed guidelines of pro-environmental and energy-efficient solutions. Source: original work based on this research.

3.5. Sample Competition Entries That Included Detailed Pro-Environmental and Energy Efficiency Aspects

This chapter presents four winning projects for one international competition from California and three competitions from Poland. The purpose of this comparison is to show the results of well-organized competitions whose regulations meet over 10 criteria guidelines of pro-environmental and energy-efficient solutions (Table 2). The California competition is not the subject of the research in Section 3.1, but it is an important guide on how to define the regulations for future organizers. The examples are described in detail due to the nature of the buildings and the pro-ecological solutions used. Each description is enriched with a visualization that helps to orientate oneself in the building's space, and drawings such as plans or sections illustrating issues related to energy efficiency and ecology.

Californian architectural competitions can serve as a very good example for organisers in European countries. One of these is the recurring Architecture At Zero competition, organised since 2011 by the Pacific Gas and Electric Company (PG&E) and The American Institute of Architects California (AIA CA), whose main mission is to promote innovative architectural and technological solutions based on sustainability and zero-energy strategies. California, as a global leader in green building transformation, introduced strategies (California's Long Term Energy Efficiency Strategic Plan) [35] that clearly set out building efficiency targets for 2030 as early as 2008. Such ambitious goals must be closely linked to the education of architects and students, which is why architectural competitions have proved to be an element of this development. One characteristic feature of competition regulations are well-defined objectives and expected results for environmental solutions. The final design always consists of two main parts, the architectural and functional part and the technical part, where the energy efficiency assumptions must be proven with the help of specialised software. In the 2020 Architecture At Zero competition, the theme was to design a zero-energy library in Hollister, California.

Over 150 submissions from all over the world entered the competition. In the professionals category, the design called The Book Garden by Jensen Architects from San Francisco was rated the highest. The jury decided that it met all the goals of the competition and was an excellent fit for a place like Hollister. The architects designed a building fragmented into several cascading volumes, sunk one storey below ground level, which made it possible

to significantly increase the volume and create the expected—representative—character (Figure 9). Due to these measures, combined with the use of large, glazed surfaces and a timber structural system, a friendly space with a human scale could be created. Due to an inventive interior layout, the space of the library was naturally divided into zones. All these qualities, when combined with greenery, created an attractive place for gatherings, peace and quiet, as well as learning and entertainment [36]. The architects also proved the validity of their assumptions in the technical part of the design and presented a broad range of their building’s sustainable advantages (Figure 10). The competition was included in the work to show an international example of good organization and clearly defined requirements for pro-ecological and energy-saving solutions in architectural competitions.



Figure 9. The entrance area of the library—“The Book Garden” project—visualisation. Source: [37].

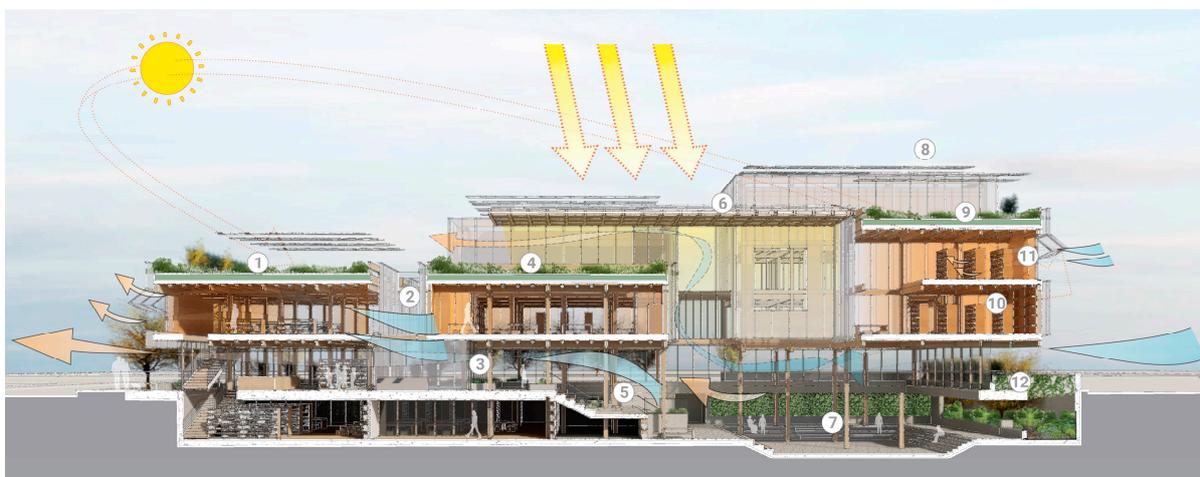


Figure 10. Section of the library- “The Book Garden” project—section. (1) Roof garden; (2) Natural light; (3) Natural ventilation; (4) Solar shading; (5) Diversity of uses; (6) Photovoltaic infrastructure; (7) Green wall; (8) Heat island reduction; (9) Roof top farm; (10) FSC Certified wood; (11) Operable windows; (12) Rain garden. Source: [37].

In Poland, on the other hand, procedures differ significantly from those in California—most importantly, the objectives and expected results are defined to different degrees from competition to competition. Architectural competitions are characterised by different ways of evaluating specific issues, with a tendency towards an increase in the importance of pro-environmental criteria. An increasing number of competitions use detailed guidelines on sustainable design issues, but these do not guarantee their correct application in the winning entries. However, by assessing this phenomenon more broadly, it definitely increases the likelihood of desirable solutions being applied. This also broadens the knowledge of the entrants, which in turn is expected to result in increased awareness among project sponsors and the public. Three competitions from Poland that demonstrate the positive direction of environmental aspects are presented below (Table 3).

Table 3. Surveyed competition designs.

Project Code	Building Type	Location
P-01	Library and kindergarten	Józefów
P-02	Kindergarten	Michałowice
P-03	University building	Warsaw

3.5.1. Competition for an Architectural Conceptual Proposal of a Library and Kindergarten Building and Site Development at Asnyka Street in Józefów [38]

In September 2020, a competition was announced for the design of a library and kindergarten building with site development to be located in Jozefów, Masovian Voivodeship. The facility, with an estimated floor area of 2000 m², was to be located on a distinctive plot of land predominantly covered by woodland. The winning entry, by Regio sp. Z o.o. from Warsaw [39], proposed dividing the two main uses into two separate buildings, which resulted in adapting the scale of the buildings to the surrounding development and zoning the various educational and cultural spaces (Figure 11).



Figure 11. The entrance area of the library and kindergarten building in Józefów (P-01)—visualisation. Source: [38].

The masses allow for passive heat gains and the maximisation of rainwater retention through the use of green roofs. The use of renewable energy sources, high-efficiency heat pumps and partly recycled building materials reduces the carbon footprint and negative environmental impact. Of particular note is the special care taken to preserve biodiversity and respect the existing stand of trees in the project area (Figure 12).



Figure 12. Ground floor plan of the library and kindergarten building in Józefów (P-01). Source: [38].

3.5.2. Project Competition for the Development of a Conceptual Proposal for an Energy-efficient Kindergarten with Site Development in Michałowice [40]

Another competition with a wide range of eco-friendly solutions was organised for an energy-efficient kindergarten in Michałowice, near Warsaw, announced in August 2020. Of the 56 teams that entered the competition, none received first prize, while an equal second prize was won by 2PM (authors: Michał Adamczyk, Szymon Chwazik, Piotr Musiałowski, Karol Perkowski) [41]. The proposed building was a simple two-storey mass with an area of 1650 m² (Figure 13).

It takes advantage of its orientation in relation to the sun, accumulating heat gains in the winter months through south-facing glazing and massive walls with a high thermal storage capacity. In the summer months, user comfort was to be ensured by a system of louvres and a green roof acting as a thermal buffer. It also forms an important part of the rainwater retention system used for watering plants and for domestic purposes as greywater. The building was designed to use a ground heat exchanger system paired with a heat pump, floor heating and cooling in the ceiling zone (Figure 14). The building was planned to have high energy efficiency—a usable energy requirement of no more than 15 kWh/m²/a. At the detailed design stage, the proposed solutions were modified by the client to be less energy-efficient.



Figure 13. Aerial view of the kindergarten building in Michałowice—visualisation (P-02). Source: [40].

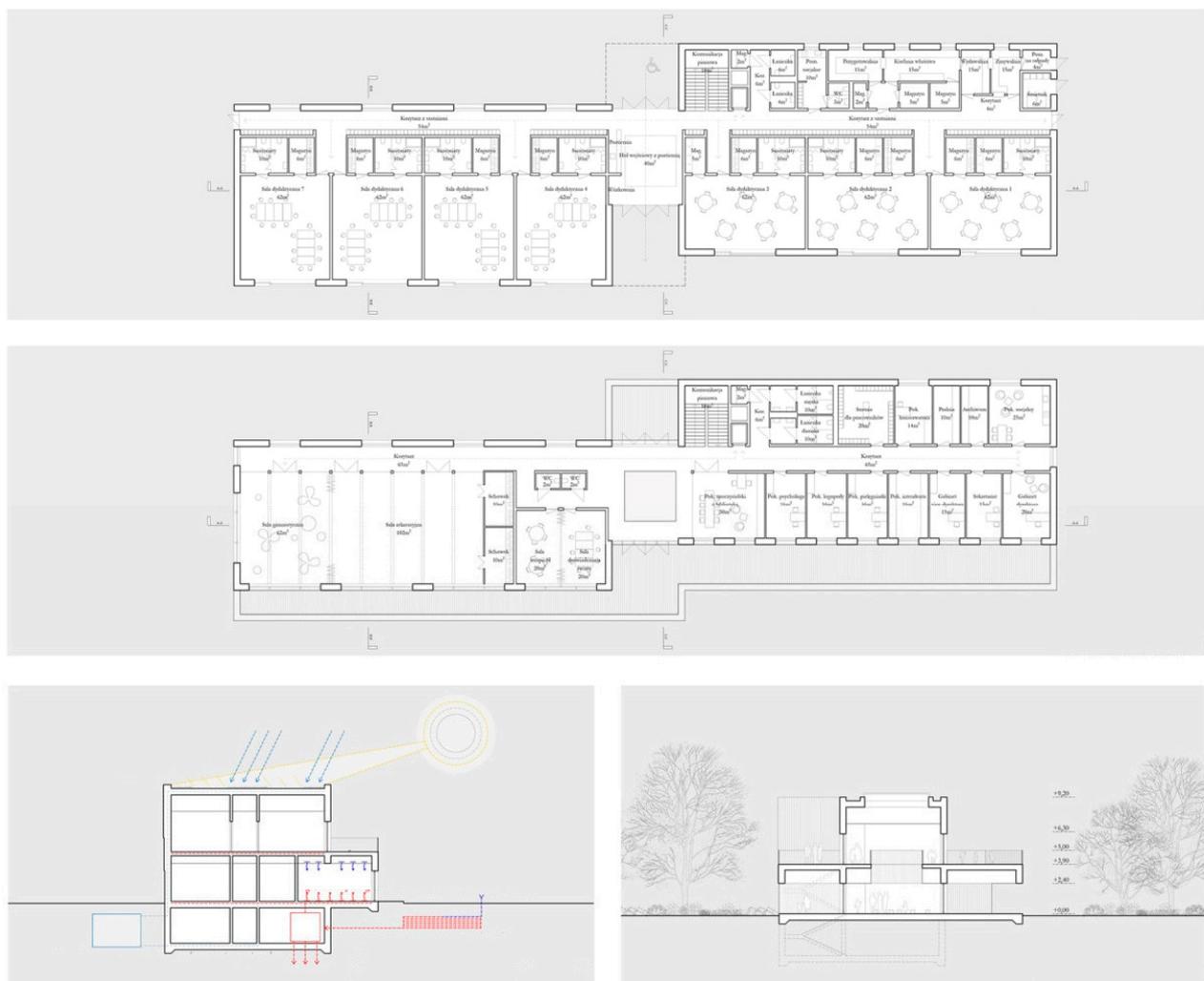


Figure 14. Floor plans and sections of the kindergarten building in Michałowice—(P-02). Source: [40].

3.5.3. One-Stage Architectural and Urban Planning Competition for the Development of an Architectural Conceptual Proposal and Site Plan for the Project Entitled ‘Construction of a Research and Teaching Building at Furmańska Street (Social Sciences)’, Executed as a Part of the Multi-Year Programme Entitled ‘Warsaw University 2016–2025’

The competition for a research and teaching building for the University of Warsaw was characterised by an extensive and detailed list of environmental and energy efficiency requirements and guidelines. The four-storey building with a floor area of 7600 m², located at the intersection of Furmańska and Karowa streets in Warsaw, was a challenge that was tackled the best by Bujnowski Architekci (authors: Piotr Bujnowski, Katarzyna Magdzik, Maciej Koczocik, Dominika Dydyszko, Ewa Grządka, Paula Wróblewska, Małgorzata Łysik, Krzysztof Makowski) [42]. The modularity of the structural system and the versatility of the solutions used allowed a very high degree of functional flexibility, which, combined with the wide range of sustainable solutions, exemplarily fulfilled all the competition criteria. The building was designed with consideration for applying for BREEAM or WELL certification (Figure 15).



Figure 15. Entrance area of the university building at Furmańska Street in Warsaw—visualisation. Source: [43].

One important element was the optimisation of the building, reducing construction and operating costs while retaining the very high quality of the materials and solutions used. Maximising daylight while controlling access through shading devices ensures adequate user comfort. The use of greenery on the roof and the careful selection of plants in public spaces was to improve the microclimate. The building was designed to allow for natural ventilation supported by high-efficiency mechanical systems (Figure 16). The facility was planned to be equipped with greywater retention systems and a ground heat exchanger.

3.5.4. Comparison of Surveyed Competition Designs

Below is a table showing the analysis of the occurrence of detailed guidelines of pro-environmental and energy-efficient in competition statutes (Table 4). The results do not evaluate the actual design solutions introduced at the implementation stage, they only concern the competition procedure. This shows the mechanism and method of assessing all competitions subject to research. The total quantitative results for 61 competitions are presented in Table 2. The competition regulations in California were additionally developed as an external comparative element. The presented Polish competitions have 10 or 11 detailed guidelines (out of 19 possible), but in different categories. In the library and kindergarten in Józefów, the greatest emphasis is placed on the ‘‘Resources and technologies’’ category, which may indicate the desire to save energy and materials as much as possible. The competition for the kindergarten in Michałowice is focused mainly on ecological and environmentally friendly issues, but also on socio-economic ones. The latest competition for a

university building in Warsaw had balanced results in each criterion, which may suggest an attempt to maintain balance and rationally select the most advantageous elements. The examples clearly show that the model competition in California takes a much more comprehensive approach to creating pro-ecological guidelines, which may constitute a model for the future for organizers in Poland.

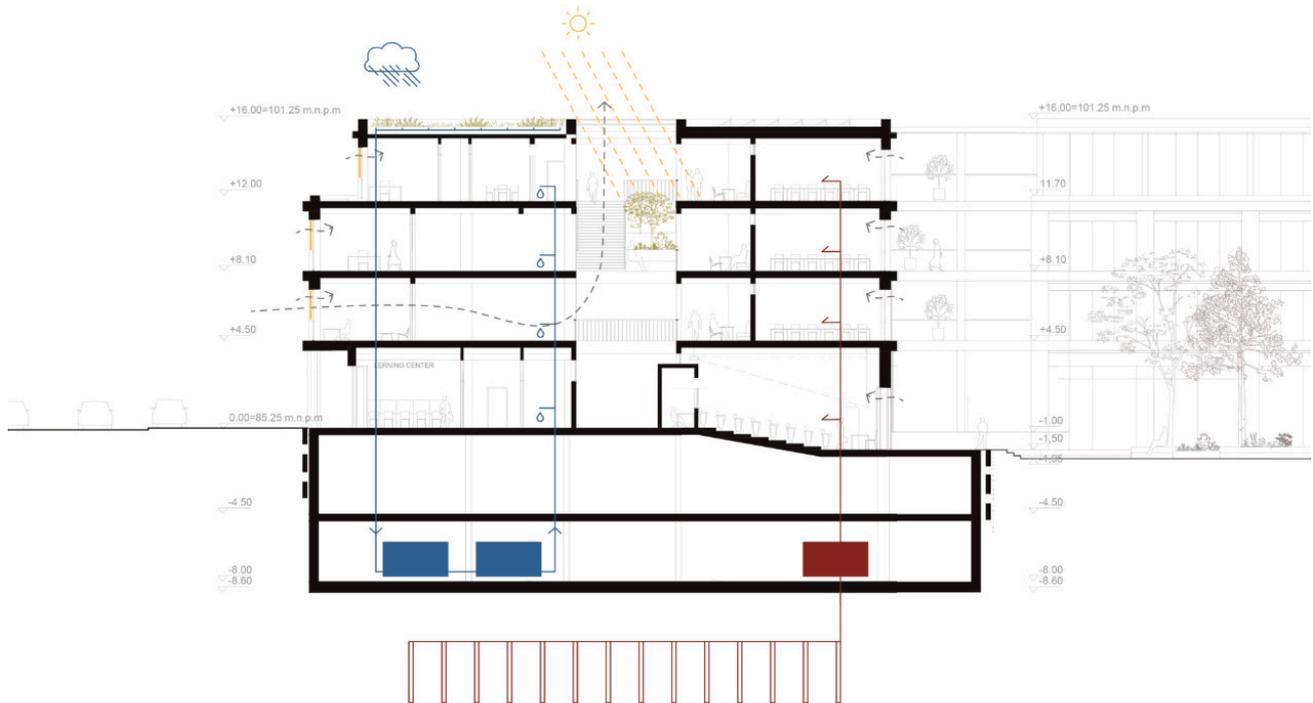


Figure 16. Cross-section of the university building at Furmańska Street in Warsaw (P-03). Source: [43].

Table 4. Detailed guidelines of pro-environmental and energy-efficient solutions shown on the examples of selected competitions. Source: original work based on this research.

Criterion Category	Criterion	Library in Hollister ¹	Library and Kindergarten—Józefów	Kindergarten—Michałowice	University Building—Warsaw
Ecology	Rainwater management	X		X	X
	Greenery and green roofs	X		X	
	Protection of biodiversity	X	X		X
	Reduced carbon footprint and climate neutrality	X		X	X
	Renewable energy sources	X	X	X	X
Comfort, safety and mobility	Circulation solutions				
	Good daylight conditions	X	X		X
	High quality of indoor air and sound insulation	X	X	X	X

Table 4. Cont.

Criterion Category	Criterion	Library in Hollister ¹	Library and Kindergarten—Józefów	Kindergarten—Michałowice	University Building—Warsaw
Resources and technologies	Passive solutions—compact building shape, high airtightness and thermal insulation	X	X		X
	Material and technical solutions that limit heat loss and overheating	X	X	X	X
	Highly efficient utility systems with heat recovery	X	X		
	BMS	X	X		X
	Durability of materials in the life cycle	X		X	
	Use of greywater	X			
Economy and management	Energy-efficient solutions	X	X	X	X
	Educational aspect	X		X	
	Building certification				
	Estimated construction cost				
	Cost of operation and maintenance of the facility		X	X	X

¹ International example of the competition—not included in the research analysis.

4. Conclusions

The manner and principles of organising architectural competitions play an essential role in the design and construction of buildings, especially public buildings. Upon analysing the pro-environmental criteria in the procedures in question, it can be seen that awareness is steadily growing, but despite this there is still a lack of comprehensive nationwide guidelines that take sustainability aspects into account. Projects implemented under the competition procedure, especially those involving public buildings in the context of pro-environmental solutions, differ significantly from projects implemented by private project sponsors (also under the competition procedure) in terms of standards. This is especially true for restricted competitions for green, certified office building projects. The number of pro-environmental criteria and their level of specificity has a decisive impact on the final design solutions applied and the quality of the resultant architecture. The lack of clear and realistic environmental and energy targets for each project reduces the chances of the proposed solutions being reasonably adapted and implemented during the execution phase. The study also showed that in the case of public buildings, obtaining certification is rarely set as a guideline, which often makes it difficult or even impossible to create a good set of desirable features and solutions.

On the basis of this research, conclusions were drawn, and recommendations and guidelines were proposed. They were intended to have a significant positive impact on the final design, which would form the basis for the construction of buildings that encompass the entire palette of sustainability recommendations—so that they can positively influence the environment, as a direct result of the pro-environmental architectural solutions applied, instead of merely coexisting with it.

Firstly, it is necessary to formulate nationwide guidelines for the organisation of architectural competitions in terms of pro-environmental solutions, which would cover all competitions and standardise their procedures. It is important to set out the main objectives in terms of new buildings and their impact on the environment, and the application of

solutions to achieve specific objectives for use in competition regulations. Certificates, whose structure and requirements have often taken years of work and extensive research to develop, can provide a very good model here. Another suitable example for consideration is the competition procedures implemented in California, as outlined in Section 3.5.4 (Table 4). The next step is the presentation of guidelines and standards for environmental issues, supported by energy calculations in an energy and carbon balance simulation programme that is freely available to prospective entrants. At the same time, this is an aspect that is inextricably linked to the education of the architectural community on sustainable and environmental issues, which is also essential. Another crucial aspect is the setting up of a nationwide database of competitions, e.g., in the form of an online platform with open access to information about the organisational mode of competitions. This would ensure an equal opportunity for all architects to participate, while potentially having a positive impact on the quality of the winning entries.

The conclusions and guidelines presented are highly relevant to the construction of public buildings, which directly correlates with the level of complexity of the issues in such buildings. They must fulfil their functions to the best possible extent—functions that are essential to the overall public good. In addition, architectural competitions determine how the most prestigious public buildings are built, which, in addition to their functional structure and unique architectural expression, should provide a tangible model for users on how to protect the environment and how to provide them with a comfortable and healthy environment. In these circumstances, the authors plan to carry out further research in this area in the future, including following up on the changes that have been made and extending their territorial scope.

The research focused specifically on architectural competitions was concentrated on competitions organised in open or restricted procedures, with the majority of them being for public buildings. The limitations of the study were directly related to restrictions on access to closed competitions. It was not feasible to establish the scope and nature of these procedures, and their documentation may affect the final results of the evaluations and comparisons undertaken.

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