ClimaDesign Competition:
Sustainability in architecture competitions

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ABSTRACT: Preliminary design influences at most the life cycle performance of buildings and of urban projects. Therefore the issue of sustainable development is increasingly entering the architecture competitions. The optimized framework and the specific methodology for all stages of the competition makes it possible to base the jury decision on appropriate information and with appreciation for the workload of the participants. The paper presents the results of a completed research project [1] and an ongoing PhD.
Keywords: Architecture, Competition, Sustainability

INTRODUCTION

Sustainable architecture has its own architectural vocabulary and expressions that have developed from biological and climate principles, the local building traditions, and innovations. Architectural competitions are an established evaluation method for initial design of construction and development projects. Competitions have a long-standing history of traditions and success stories. The approach that architectural competitions take, allows for applying them to the full spectrum of typologies of buildings, space usage, and urban planning projects. In such competitions, an experienced committee usually ranks the best proposals after thorough examination and discussion. Ideally, a proposal with an exceptionally aesthetic, functional, and realisable design, that meets all project goals as stated in the competition brief is best awarded.

Sustainability has become part of the worldwide discussion about buildings and its cultural issue. It is thus only natural that ecologic and economic aspects of sustainability are catching up with the already established socio-cultural aspects and are more and more appearing in the brief requirements of architectural competitions. In addition, architectural competitions meet exactly those phases of the project development that determine the building's shape, orientation and the design of the envelope. Consequently, this phase has the largest impact on the life-cycle performance of the finished product. For this reason, it is extremely important to consider aspects of sustainability in architectural competitions.

Implementing aspects of energy efficiency or sustainability with all its impacts in architectural competitions still regularly leads to heated discussions, especially because established processes do not provide satisfying means for evaluating those aspects and requirements stated in the call for proposal are often overloaded and out of proportion.

METHODOLOGY

This paper summarises the completed research project „ClimaDesign Competition“ [1] and an ongoing dissertation with the preliminary title "Evaluation criteria for aspects of sustainability in architectural competitions". The goal of this research effort is to extend the existing evaluation criteria and to methodically adjust competition processes so that architectural competitions will continue to be an effective decision tool for aesthetic sustainable buildings.

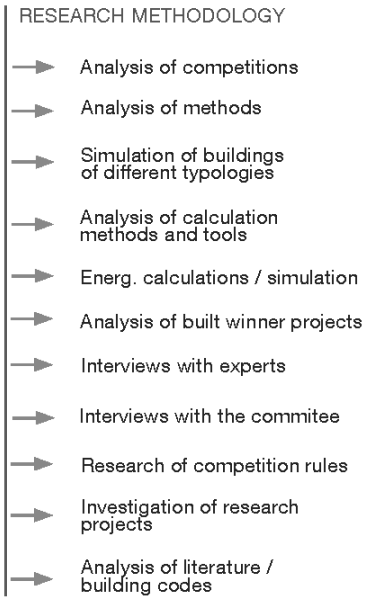

Figure 1: Research Resources and Methodologies

RESULTS: CONCEPT PHASE

Prior to publishing a competition brief, the project initiator and their competition advisors, as well as all other involved parties, must decide on formal and process agreements, and technical requirements and goals. This initial concept phase of the competition is gaining more and more importance. Similar to the initial design phases of a building, that are so crucial for the later performance of the finished product and the success of the project, the concept phase bears the largest potential for laying the groundwork to a successful competition. The main steps of the conceptual workload are described bellow.

Definition of Goals and Participants. As part of the discussion, the project initiators' ideas and expectations must be outlined and examined for plausibility, because the owner may not have sufficient expertise to make informed decisions. This includes planning laws and building typologies in regards to the anticipated future use of the building, as well as site-specific characteristics and requirements. All the participants' different points of view tie into one holistic take on the project. It may be beneficial – depending on the scope and project-specific challenges – to include technical experts into the early discussions.

The competition advisors should have a good basic understanding of all aspects of the project in order to be able to call on interdisciplinary experienced experts for the jury. The advisors contribute their professional expertise to point out synergies, correlations, and dependencies. In addition, they should act as organizers and coordinators that run the competition as an initially non-solution-driven and amendable process.

Depending on the project definition there are different types of competitions and competition processes to choose from. A clear definition of goals and the choice of a suitable type of competition fundamentally influence the quality of the proposals later on. Making the right choices at this stage is fully the responsibility of the project initiators and owners.

All expectations and requirements for the competition and its results must be appraised thoroughly during the collaborative discussion in the concept phase in terms of organisational issues and expected content and level of detail. Expectations must be reconciled with the characteristics and purpose of an architectural competition. In order to receive meaningful proposals, all decisions concerning the scope and goals of the project must be made by the organising committee rather than leaving them up to the participating architects.

Data collection. Feasibility studies often serve as primary tool for verifying the feasibility of the project vision prior to running the competition. They are often interdisciplinary consulting services that include primary analysis and data collection on e.g. the technical infrastructure and the energy related potential on-site. In this respect, feasibility studies are an extremely useful tool, especially when defining the energy performance goals for the finished building.

A preliminary energy concept can be developed based on the extracted data and serves as a basis for the requirements of the call for proposals. Based on the preliminary concept objectives and constraints can be formulated, such as not to use any active cooling systems, implementing natural ventilation of office spaces, preferred heating system, required space for technical units, etc.

Clearly defined goals help the participating architects in finding optimised architectural and urban planning solutions while at the same time optimising the technical building concept. Only with such clearly outlined preliminary works does it remain possible to conduct successful competition without the help of additional experts.

COMPETITION BRIEF

There are a number of factors that ensure the adequacy of a competition process: selecting the right type of competition and competition process; defining deliverables, project goals, requirements, and assessment criteria clearly and disambiguously; and selecting of jury members thoughtful. The competition participants must understand what is expected of them, what will be assessed in the preliminary review, and what criteria the jury will apply when deciding on the ranking of proposals. All of this information should be summarised in the competition brief. A transparent competition process can only be achieved if all of these aspects are considered.

Specification and Additional Information. The analysis of numerous competition processes shows that sustainable construction is often only loosely included in the briefs of architecture competitions. Instead of providing informative guidelines these briefs list non-quantifiable objective rather than target constraints. Sustainability is often an important issue for the project owner. However, due to imprecise definitions of requirements and a lack of genuine intent projects often do not live up to their intended potential. On the part of the designers, the statements made in the drafts and designs are often presented somewhat vaguely and do not provide a reliable basis for evaluation. Another important principle of communicating specifications and additional information is a clear comprehensibility of the brief especially in terms of communicating the data collected in the pre-liminary research stages. It is important to provide neither too much nor too little information to the participants. The amount and level of

detail of data and information provided should correspond to the project requirements and goals.

Deliverables. The scope and types of deliverables should be corresponding to the architects capabilities and the early stage of the project design. Additionally to the drawings in scale 1:100 or 1:200 the assessment of many aspects of the criteria Summer Comfort, Usage of Daylight, Quality of Details, Technical Interior Concept and Functional Quality is based on the scale 1:50. In this scale drawings of room section, view and ground plan of a standard room with corridor are very helpful to evaluate the comfort quality potential in standard rooms. A loose definition of deliverables without any references to a general form of drawing presentation causes confusion and discrepancies. A large variance in the forms of presentation can develop due to the large freedom of interpretation, for example in terms of extensive written reports and schematic figures for explaining the technical side of building technologies. The problem that arises is that a lot of effort has to be put into confirming and comparing the proposals, because the variance in depth of the provided information and the quality thereof often prevents a direct comparability from one proposal to the other.

A definition of deliverables that is excessively large and that exceeds the competencies of the participants does not result in better proposal qualities. Rather, the usable information content of the proposals decrease and proposals become too imprecise for a reliable evaluation. Detailed information that goes beyond the current design phase, for example detailed energy demand calculations will not be comparable amongst proposals due the different approaches each proposal chose and their degree of precision. Standardised calculations made by the involved evaluating experts usually provide a means for a rough numerical confirmation and may be used as plausibility checks for estimated qualitative and quantitative evaluations. But results should be analysed attentively and double-checked for order of magnitude and proportionality. Empirical data shows that – apart from non-characteristic outliers – calculated demand values provided in proposals often do not differ much from one proposal to another. The difference is often only a few kilowatt-hours. Nevertheless, proposals are often categorised as “good”, “medium”, and “weak” based on their calculated demand values. Compared to the amount of work that goes into this part of the evaluation the actual informative value is unproportionally low.

Criteria for evaluating - New Construction. Criteria for evaluating sustainable planning in the preliminary concept and design stages are a frequent topic of current research projects [1, 3, 4, 5]. Generally speaking, it has been found that reducing the amount of criteria leads to better results [1, 3]. The initial conceptual design of the building, as well as the state of the draft of a competition process, must conform to work phase 1, 2 or 3 of the HOAI (German regulation for “Official Scale of Fees for Services by Architects and Engineers”). This stage is characterized by defining the vision of the project. The sustainability criteria are therefore referring to the design aspects and indicators of the building draft (Fig. 2). The main factors in terms of the building design were identified as the following: the building shape, orientation, the proportionality of transparent to opaque elements in the façade, and the layout of the floor plan. In comparison, building physics aspects, such as the thermal conductivity of the building envelope, only have a marginally small relevance for the design. In the next step, aesthetic aspects were examined in terms of their impact on the overall energy and resource efficiency, as well as economic viability. Here, use-specific values were compared, energy input and outputs were estimated using simple calculation tools and simulation software, and material properties and comfort requirements were analysed.

The competition assessment consists of judging the potential for sustainable design on the basis of the submitted illustrated architecture drawings and the relevant design parameters. Such a methodical approach increases the transparency of the evaluation process and the comparability of the results. The assessment criteria for economic and ecological dimension are described briefly below:

Space efficiency. Appraisal: quantitative. Space efficiency is among the most important criteria for evaluating building concepts for their economic aspects of sustainability. It is usually quantified using the ratio of the main floor space to the gross floor space. Besides the economical aspects this ratio impacts the resource efficiency, material consumption and urban area consumption, as well as the energy demand for heating, cooling, and lighting.

Functional quality. Appraisal: qualitative. The functional quality is another important criteria in the economic dimension. It examines how well the requirements for flexibility and long-term usability of the proposed floor plans, the building structure, and building technologies are met. Another aspect is the feasibility and ease of the integration of regenerative systems, for example photovoltaics and solar thermal, in the overall concept.

Summer comfort. Appraisal: quantitative. This criterion describes the potential of the proposal to provide adequate protection with overheating in the summer with passive cooling strategies, i.e. without necessitating the use of energy intensive active cooling

techniques. An important factor is the reduction of external thermal loads. Other factors include: the glazing fraction, the availability of thermal storage mass, and adequate shading devices properly positioned regarding to the orientation of the proposed interior use. Site-specific parameters are for example the orientation and shading through adjacent structures. A reduction of internal loads is usually not a design parameter in this early design stadium.

ceiling height and the depth of the room, and unintended shading through the building geometry or fixed façade elements. The evaluation of the daylight potential takes place on the basis of ability to look outside, regularity of daylight supply throughout a floor and the size of the area that is illuminated by daylight.

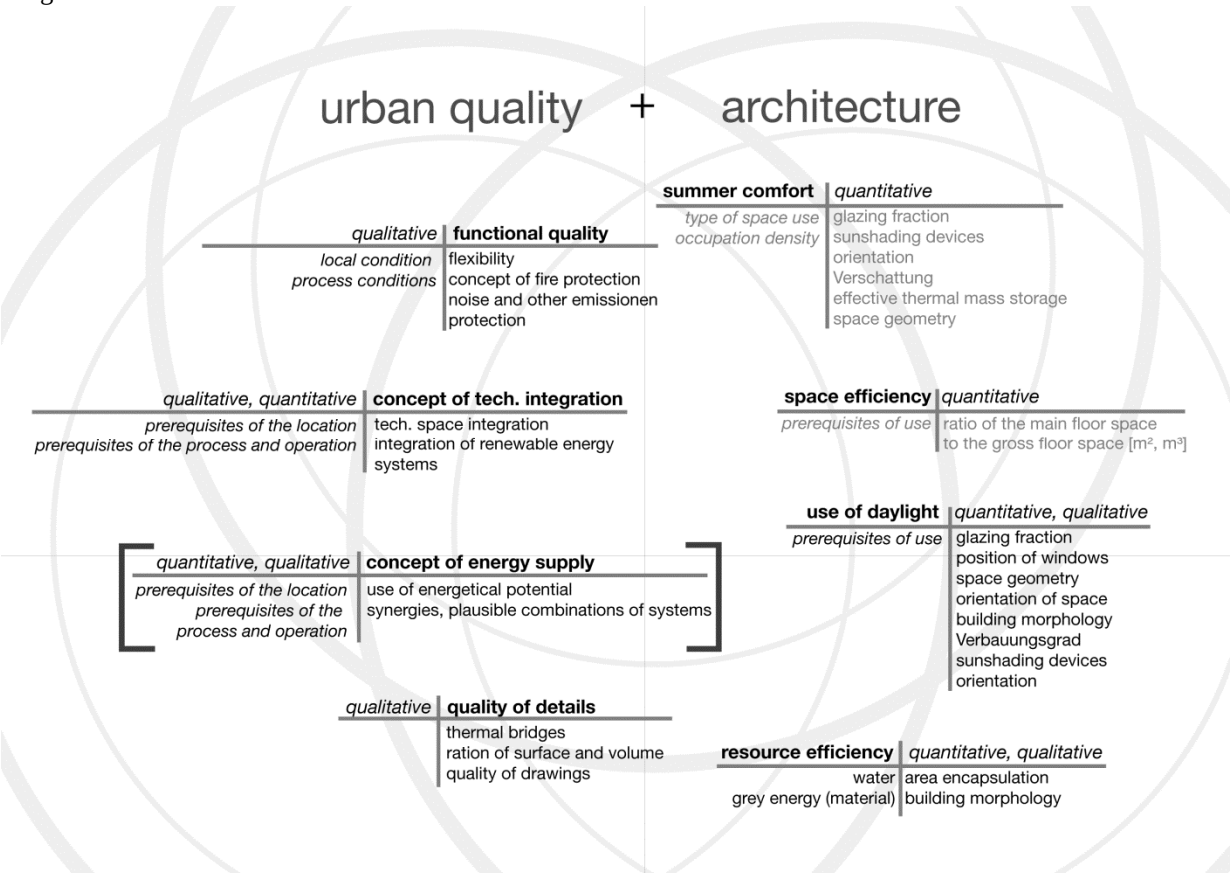

Figure 2: Assessment criteria and design indicators

Quality of details. Appraisal: qualitative. Based on the general building concept and the quality of planning, it must be estimated whether the targeted energetic standard can be achieved. Here, the building envelope plays an especially important role because thermal bridges, the location of the thermal insulation pane, and the compactness of the chosen building shape in combination with the intensity of use have a large impact on the energy efficiency and durability of the design.

Daylight concept. Appraisal: quantitative, qualitative. This criterion describes the potential of the proposal regarding the usage of daylight, which is an important factor for comfort and energy efficiency. The relevant proposal aspects are the size and positioning of windows and glazing, the interior geometry such as the

Concept of technical integration. Appraisal: qualitative. This criterion observes the integral approach of the proposal on an ambient level. The proposal relevance is caused in the consideration of essential areas and volumes for installations.

Resource efficiency: water. Appraisal: quantitative. This criterion considers the fact, that water is the most important resource for life. The degree to which the proposed design of exterior space renders surfaces impermeable is an important factor in evaluating the resource efficiency for the resource water. A low space consumption an degree of sealing permeable soil greatly influences the location's microclimate and thus impacts the comfort within the building.

Resource efficiency: material. Appraisal: quantitative, qualitative. The amount of embodied energy that goes into the structural components greatly depends on the type of structure, the shape, the façade and the glazing fraction and type of glazing. If desired, the energy required for digging construction pit and other construction facilities on site can be included in the evaluation of embodied energy. The criterion could also be considered qualitatively under the phrase "special solution approaches".

Criteria for Evaluating - Energy Retrofits. When it comes to evaluating actual competition contributions sustainability considerations are on the rise. Efforts are particularly moving to finding better solutions for public buildings such as schools, gymnasia, and administrative buildings from the 1970s and 1980s. When designing com-petitions for such projects even more emphasis should be put on getting the initial preparation phase for the competition right. An in-depth analysis of the existing structure and the installed building technologies are essential for providing the participants with a reliable basis. Naturally the assessment criteria must be adjusted according to the individual project requirements and its particular challenges. For instance, embodied energy is far less important in retrofitting projects than in new construction. It is possible to assess proposals based on floor area specific and building component specific values in terms of how they propose to handle existing structures and how sophisticated their proposed use of new materials and buildings components is.

The deciding criteria, however, remains a holistic evaluation of all energy related aspects of the retrofitted building, while still allowing an evaluation based on the regular scope of work. Due to the particular thematic of retrofitting existing buildings it may often be required to provide drawings at a higher level of detail. The thereby caused additional effort would usually be compensated for example by not having to include in-depth considerations in the urban context. [5]

Criteria for Evaluating - Urban-Planning Concepts. Sustainable urban development, too, is playing an increasingly important role in urban-planning and neighbourhood development competitions. There are a number of parameters for urban-planning designs that should be favoured in energy efficient implementation of neighbourhoods and the use of renewable energies. In neighbourhoods with very compact buildings and dense urban patterns, for example, optimising individual buildings for solar gains is of minor importance. The design focus should much rather lie on optimising solar gains through adequate building orientation and shape, mindfully stacking the different user units, and optimising floor plans depending on the building type and in response to the existing urban context.

In order to be able to successfully implement centralised supply mechanism using renewable energies available on site, compact building and urban-scale patterns, mixed-use arrangements, and mixed building types should be evaluated positively from an energy and economic perspective.

Including renewable energies in urban planning processes is especially important if zero-energy and plus/active house standards apply. Energy efficiency and urban planning qualities can be combined by balancing energy-related and urban planning aspects. Ecological aspects in terms of efficient use of space and water add another dimension to the above considerations. [2]

WORKING PHASE

During the development of the proposals, project meeting with all participants should be held to answer any questions that may have arisen. Answers to these questions must fairly be communicated to all participants alike.

PRELIMINARY ASSESSMENT

Practical experience from having participated in numerous architectural competitions shows that including experts into the competition process from a very early stage on has a positive impact throughout the course of the competition and especially its outcomes. Experts in the area of sustainable construction are already being employed as consultants during the conceptional phases of the competition, thereby ensuring an uninterrupted flow of information throughout all phases of the competition.

It has also proven beneficial to mutually agree on criteria and evaluation methods as well as the preferred means of communication proir to the competition itself. For a visually well structured and easily legible evaluation matrix, automated templates are available.

The presentation of results of the preliminary review published in the preliminary report should avoid extensive texts and written explanations. These would often go unconsidered by the jury during the preliminary stage of the jury meeting due to its tight schedule. Evaluating project proposals by using an overall mark or colour coding, for example using the traffic light colours red, yellow, and green, is not advisable because it is not apparent how the rating was decided upon and how the individual criteria were evaluated and weighted. The developed circular graphic in fig. 3 displays the different criteria as individual segments. Each segments shows the associated potential as "low potential", "potential existing", and "high potential". The higher the potential

within a criterion, the more rings are coloured within that segment. The circular graphic, the overall rating (Fig 3) and possibly a short written explanation are all part of the preliminary review.

JURY

After the first round of project evaluations, design proposals that do not meet the architectural and urban planning expectations are usually eliminated. This causes the ecological and economic dimensions of sustainability to be of minor importance in this phase of the jury meeting. Practically, detailed presentations of projects through the experts (preliminary review) in this first stage of the jury are associated with an immense time consumption due to the complete number of proposals remaining in the assessment process. Additionally due to the number and variety of proposals the resulting extends and depth of information often exceeds the time capacity and cognitive interest of the jury members. Therefore the scope of information provided should match the current expertise of the jury. Especially during the initial information phase it is sufficient to communicate the overall strengths and weakness of each project proposal as well as comparatively across all proposals. This could be achieved using graphical evaluation methods such as the developed circular graphic (Fig. 3) Extensive reports and detailed statements concerning individual criteria and higher-level correlations are of relevance after the number of remaining proposals is far reduced and the jury is discussing the awards.

The evaluation of the awarded proposals consolidated by the experts of sustainability and the jury members should be included in the written evaluation. This underlines the importance and relevance of the requirements published in the initial competition announcement and honours the participants achievements.

CONCLUSION

The primary goal of architecture and urban planning is to create aesthetic and usable spaces – be it a large or small scale context, or on a building or room sized scale. The most essential phase for the design must not be excessively restricted by stringent requirements and inadequate criteria and skew the design. In conclusion, in order to introduce sustainability issues into the evaluation discussions of a competition, sustainability must be included in every phase of the competition process. However, over-instrumentalising the topic of sustainability is not supportive of a successful project. The goal should be to implement a competition process that is adequate for the special project requirements to maintain a practical and holistic evaluation system. The time and monetary expenses that all participants contribute to the competition should be reasonable in relation to the scope of the competition and the project itself. The introduced practical methodology for competition process is complemented by the development of a software-based tool [1]. The software ClimaDesign Competition was designed specifically for simplifying data collection and evaluation, and for creating the final evaluation charts. It is planned to extend the ClimaDesign Competition software (PhD) by implementing additional functionality that can support the competition process, starting with drafting the call for proposals all the way to the preliminary assessment and jury.

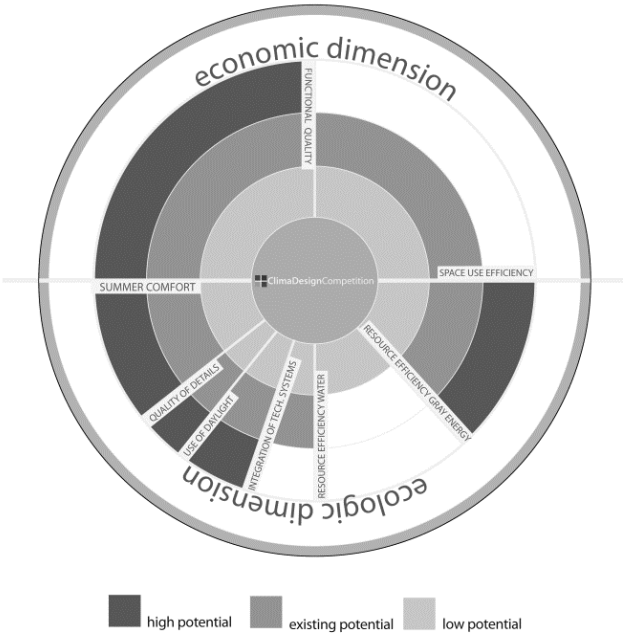

Figure 3: Graphical display of project´s preliminary assessment. The graphic shows an assessment example of a project with high, existing and low potential in different criteria

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