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## Stakeholder related fields of action for process optimization of nearly zero energy and plus energy buildings

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# Stakeholder related fields of action for process optimization of nearly zero energy and plus energy buildings

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**Abstract.** In order to be able to guarantee a regulated process in the design of nearly zero and plus energy buildings, it is important that all relevant stakeholders are involved from the beginning of the project. This is particularly important because disagreements and lack of communication between the stakeholders often lead to problems, which delay planning and implementation and lead to additional costs. In order to prevent the resulting barriers, it is essential that the previous processes for such an implementation are analysed and the individual steps are optimized to such an extent that a goal-oriented and cost-efficient cooperation is possible. This is focused in the thesis "Stakeholder related fields of action for process optimization of nearly zero energy and plus energy buildings". In this way, an attempt is made to achieve process optimization with the aid of various methods from management consultancy. In order to achieve this, the focus of every construction project, especially nearly zero energy and plus energy buildings, must be on integral planning. The individual action steps must therefore be optimized in such a way that it is clearly defined for all stakeholders when and with which partner to interact.

## 1. Introduction

As buildings account for almost 40% of total energy consumption and 36% of greenhouse gas emissions in Europe, the European Commission has adopted a directive aimed at reducing the total energy consumption of buildings [1].

By the year 2019, many researchers were already working on the topic of implementing nearly zero energy and plus energy buildings (nZEB and PEB) due to the greenhouse gas emissions already mentioned, which reduce the quality of life. In the various fields of research, the content usually concentrates only on a concrete view of a group of stakeholders. In this way, strategies have only ever been developed from a specific discipline, a specific field of study, in order to be able to successfully implement nZEB and PEB. The focus was often on architectural and technical details [2]. No matter which perspective was used for the research, the different perspectives usually have one aim in common. The necessary solutions for building optimization should be as cost-efficient as possible and have a positive influence on the life cycle of a building.

In addition, energy consumption should be reduced as far as possible in order not to pollute the environment further [3]. For this reason, research in the past concentrated to a large extent on the development of new technical concepts in implementation in order to be able to address these goals as quickly as possible. However, this is made more difficult because the lack of knowledge about new technologies and thus the lack of specialist know-how, the working methods of the commissioned project partners and the decision-makers are limited. Problems arise when life cycle costs are not considered in their entirety, but only the respective costs for individual sub-areas, in the planning and



implementation. The main reason for this is that it is unclear to many project participants that up to 40% of operating costs can be saved by using slightly higher construction costs (approx. 2%) [4]. Due to such misjudgements, existing potentials for cost reduction are often used only partially or not at all.

The term Integral Planning, through such misjudgements and problems in the transparency and cooperation of different stakeholders, achieves an important meaning in the planning and implementation of nZEB and PEB. This means the early integration of technical/functional aspects in order to additionally support the planning process. Methodological and technical aspects are an important focus for successful planning and implementation [5]. The core objective here is to highlight the different interests and perspectives of the stakeholders involved in order to optimize building quality as best as possible over the entire life cycle.

Of course, this aim should be pursued for all buildings, regardless of the requirements. However, it is particularly important for nZEBs and PEBs, as this approach is essential for the success of the project.

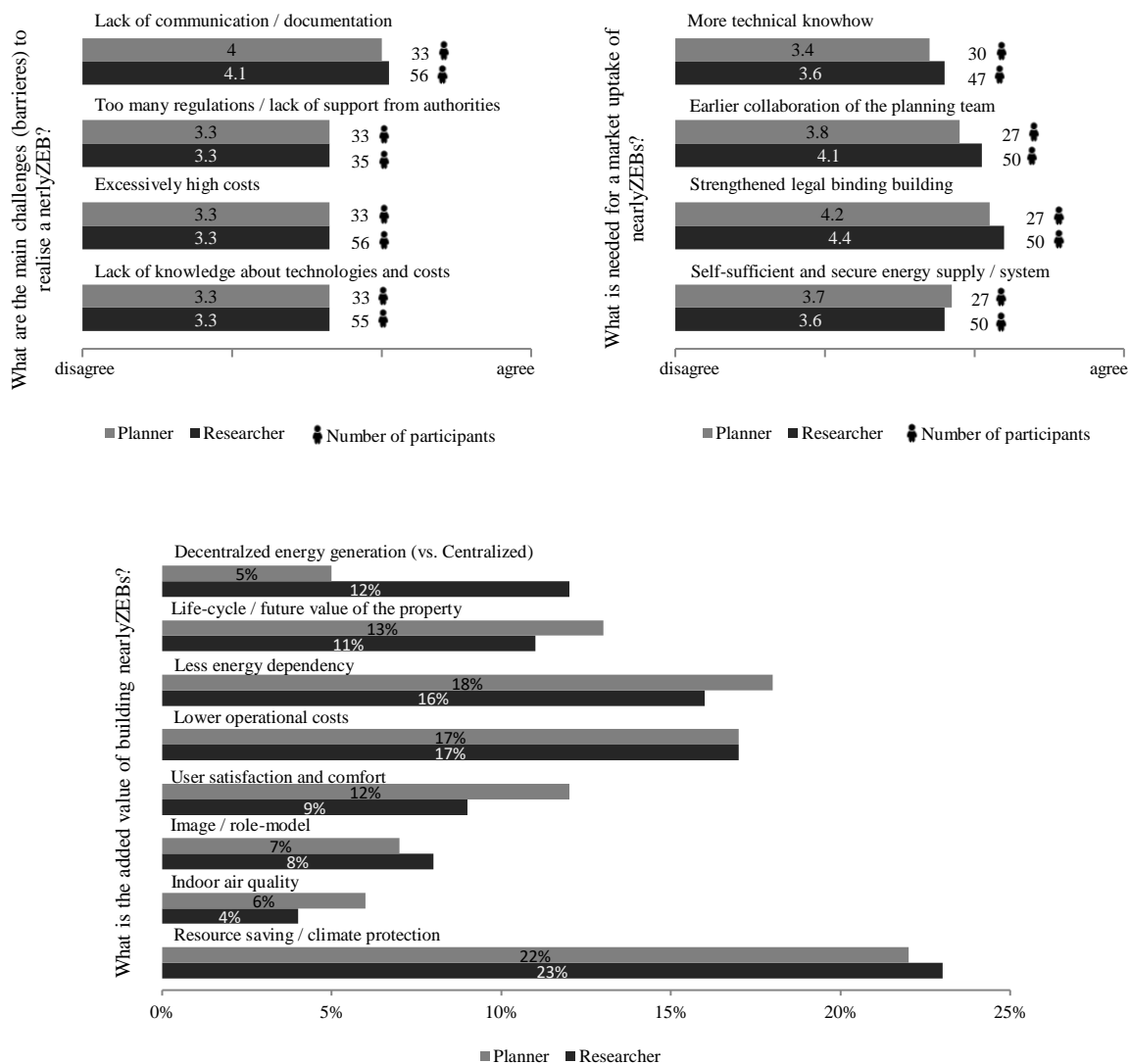
In order to ensure the quality of buildings, a passive house construction method has been aimed since the beginning of the 21st century and the associated integral planning in the building industry [6]. This is due in particular to the far greater scope for influencing the quality of a building at the beginning of a construction project, compared with the constantly changing views of various actors, which must be integrated into the planning. For this reason, it makes sense to involve all participants from the outset in order to be able to represent all opinions in the best possible way and to prevent emerging conflicts in the future. In addition, the more the project progresses, the greater the change effort and costs required.

## **2. Problem identification and challenges in the implementation of nZEB and PEB**

The implementation of projects with a high energy standard is currently often carried out using the same procedures as projects with lower requirements. This is a result of the fact that these processes have been tried and tested. This procedure, however, involves risks, as it is often not considered that the standardized processes cannot offer the best solution for the implementation of nZEB and PEB. Such procedures often generate additional costs in planning and implementation, although the high costs only become apparent very late and countermeasures can therefore only be taken late. For this reason, previous processes should be analysed and their sequence reconsidered in order to achieve the desired standards as quickly and as effectively as possible [7].

Previous projects and works dedicated to these themes usually only refer to parts or individual actors of a design project. This complicates the cooperation of all participants, since the different approaches and focal aspects are often not recognized and for this reason the required cooperation does not work out. It is therefore important to create a decisive overview for all actors involved in the project planning and implementation of nZEB and PEB.

Based on this necessity to implement integral planning, barriers were filtered out using the online survey tool Mentimeter [8] as well as the results of the CRAVEzero project of the research institute AEE INTEC, which complicate the planning and implementation of nearly zero and plus energy buildings. In the survey conducted during the ISAC Conference 2018 in Graz, Austria, 102 stakeholders participated, who, although coming from different professional groups, largely agreed on the influence of individual parameters on the planning and implementation of nZEBs. This is also shown by the research project CRAVEzero. The results of the survey can be seen in the graph below. According to the survey and the CRAVEzero project, the biggest deficits are too high costs [9], a lack of support from politicians, poor communication among themselves and a lack of knowledge about new technologies [10]. In addition, misjudgements are often made in demand planning [9] and no clearly defined minimum target values are given.



**Figure 1.** Results of the Mentimeter survey on the challenges, marketability and added value of nZEB and PEB (own illustration)

All these challenges are difficulties for the design and establishment of nZEB and PEB. In order to be able to handle them in the best possible way and thus guarantee error-free and time-efficient work, it is essential to clearly define which stakeholders are primarily responsible for which actions.

### 3. Methodology

In order to be able to carry out a successful optimisation of individual project processes, in addition to defining the circumstances causing the problems, it must be filtered out which stakeholder is responsible for which action and with which participants should be collaborated and communicated in order to promote constructive work. For this purpose, the filtered actions are divided into different project phases, prioritised and assigned to the stakeholders. In addition, the various dependencies of the actions dealt with are analysed.

By early recognition of interrelations between the individual actions, the actors can react quickly to changes and in the best case achieve a reduction in costs. However, the time savings that can be achieved in this way can also significantly influence the success of a project.

These positive effects are achieved, for example, when the thermal quality is coordinated with the heat output, since the heating system is often over dimensioned and therefore not economically viable. If, however, an early coordination between the responsible actors is aimed at, optimisations can be made in this area. Thus it becomes clear that these two parameters are interrelated and consequently influence each other.

These procedures are usually known in theory, but many of these steps are often circumvented in practice. This causes delays and errors in communication and processes. For this reason, it is necessary to sensitize and subsequently optimize in this respect.

In order to propose a process optimization, various existing optimization methods must be analysed and applied to construction projects. For this purpose, particular attention is paid to Business Process Reengineering, Total Quality Management, Lean Management and Artificial Intelligence since these methods of process optimization promise fast and targeted action with future-oriented solutions.

- **Business Process Reengineering (BPR):** This method pursues the approach of radically redesigning current business models or completely replacing them [11]. Thus every core process is questioned without considering the existing structures. The goal of this method is to achieve 30% of the four targets: Optimize quality, time, costs and service [12].

This approach uses four process steps [13]:

1. Uncover core processes
2. Locate and identify vulnerabilities
3. Radical restructuring of existing processes
4. Adapt corporate structures

The most important factors for the implementation of such projects are motivated and competent project partners, a systematic approach and clear guidelines to achieve the project goal.

- **Total Quality Management (TQM):** The aim here is to achieve an increase in processes. The satisfaction and motivation of the players are particularly important. The essential component, which is aimed at with the help of this method, is the increase of the execution quality. In particular, the active and independent action of all actors involved is assumed [14]. This is also made clear by Deming's 14 points on the characterisation of TQM [15]:

- |   |  |
|---|--|
| - The will to continuous improvement            | - Open organization                      |
| - Creating awareness for quality                | - Elimination of organizational barriers |
| - Preventive quality assurance                  | - Understandable goals and procedures    |
| - Check offers and pay attention to total costs | - Qualitative target agreements          |
| - Continuous process improvement                | - Identification with own activity       |
| - Modern training methods                       | - Continuing education                   |
| - Cooperative management style                  | - Create action plan                     |

- **Lean management:** This involves organisational processes that aim to conserve resources and keep costs as low as possible. The focus is particularly on the "value-adding" processes. These

are meant to identify waste and value-adding activities in order to save unnecessary processes and promote efficient procedures. The Lean Management method thus offers analysis possibilities for identifying non-value-adding activities and eliminating them [16]. When implementing lean management processes, it is important that all employees are involved in the new concept. The result is a new corporate philosophy that promotes cooperation and communication between all those involved [17]. The following objectives are decisive for the successful application of this method [11]:

- Process-oriented corporate management
  - Highest possible efficiency
  - Clearly defined processes and procedures
  - Clearly distributed responsibilities and logical communication among each other
- Artificial intelligence: The fields of machine learning and artificial intelligence are expanding very rapidly and affect almost all technological aspects of society. One exception is the building sector [18]. Problems occurring in this area frequently require the use of optimization methods that enable the minimization or maximization of certain target functions. However, these problems cannot be solved precisely in most cases. For this reason, an approach is often more effective than a concrete solution to the problem at hand [19].

This approach is particularly helpful in optimising the building sector. Intelligent systems can reduce the energy consumption of a building. This method is needed in order not to neglect not only energy savings but also the comfort of users [20].

The individual methods have their own character and rarely build on each other. This is because, depending on the method of optimization, there is a different focus on it. In TQM, for example, the focus is on independent action, while Lean Management is designed to promote communication among the participants. A more modern method is artificial intelligence, because it combines many factors, which are mostly considered individually in the planning, and shows how they can influence each other.

#### **4. Results and Discussion**

In the course of this research work, individual actions, which have a high priority especially for nearly zero and plus energy buildings, were analysed, assigned to responsible stakeholders and integrated into the already tested and known process flows. In this way, a clarity is created which should help all participants to integrate themselves into the processes. In this way, each participant sees by when which action must be completed and with whom he must contact in order to achieve this goal. This is important, because only together these often occurring problems can be tackled. In this way, the stakeholders involved are able to avoid problems at an early stage or solve them on their own.

These actions lay the foundation for the planning and implementation of nZEBs and PEBs. However, this does not eliminate the problems that have arisen so far. Here the methods for process optimization, which have already been explained in Methodology, are used. By the different approaches of the optimization methods best possible solutions can be found for the respective challenges. This corresponds to a learning process, which certainly takes a lot of time, but the knowledge gained in this way can significantly shape the future for the implementation of nearly zero and plus energy buildings.

## 5. Conclusion

Although the procedures for planning and implementing nearly zero and plus energy buildings are mostly known, individual steps are often skipped or only taken at a later stage. This has temporal, qualitative as well as financial consequences, since set goals are often delayed or not reached at all. In order to ensure the smooth planning and construction of almost energy free and energy efficient buildings, integral planning is indispensable for these reasons and should therefore be aimed at the very beginning of a project. In this way, initial communication difficulties can be avoided from the outset, as close cooperation already takes place between all parties involved.

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