Planning Guide
Future Industrial Building
Research at the Technische Universität Braunschweig

Brief report

"Holistic integration and optimization of the planning and implementation process for advanced and sustainable industrial buildings"

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1 Objective of the research project

1.1 General conditions

The Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) supports scientific research projects in the structural engineering sector serving the goals mentioned in the tender of the program and being of public interest. The goal of the research initiative "Future Building" is to strengthen the competitiveness of German construction engineering in the European Single Market and to eliminate existing deficits, especially in the field of technical, building cultural and organizational innovations.

In this context the research work "Holistic integration and optimization of the planning and implementation process for advanced and sustainable industrial buildings", short title "Planning Guide Future Building", has been funded by the research initiative "Future Building" of the Federal Office for Building and Regional Planning.

1.2 Objective

Constantly changing conditions in a globalized industry will pose new challenges to industrial establishments. Some examples of changes in the company environment are shortening product life cycles, modified customer demands and a turbulent market environment.

In this context factory building becomes a relevant competitive factor as it is mainly responsible for several important decisions like the way of reacting towards changing requirements, necessary investments and the associated life cycle costs of a building.

The first main goal of this research project is the holistic integration of all disciplines involved in the planning and implementation process. By means of an improved coordination of numerous interfaces of an industrial building project higher utilization qualities should be reached and an improved sustainability of the planning result should be guaranteed. Furthermore, necessary investments should be minimized by an improved use of constructional resources.

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The integration of planning periods into a holistic systematics is the second main goal of the research project. The systematics aims at enabling a future-oriented solution by means of an early determination and evaluation of different scenarios. Both main goals are reached by developing an application-oriented, validated methodology in the form of a planning guide. At the same time, the whole research project always focuses on the future-oriented design and implementation of an industrial building.

2 Realization of the research project

Right from the start the coordination of interfaces in the research project has been supported by an interdisciplinary composition of the research team. Apart from architects and facility planners of the Technische Universität Braunschweig numerous industry representatives have been working on the topic. Altogether seven meetings of the industrial association took place, which served to work on the work packages and to check the results with reference to their praxis relevance. Concerning specific problems institutes of the universities in Braunschweig, Paderborn, Stuttgart and Kassel have been consulted.

2.1 Scenario management in industrial building

The formulation of possible future requirements provides a basis for a draft of a planning guide for future industrial building. For this the established and scientifically recognized method of scenario management was chosen. By means of this method several scenarios have been derived within the scope of the research project. As future requirements cannot be predicted exactly and determinately due to uncertain dynamic conditions a so called multiple future is developed, which includes three scenarios. The three scenarios are depicted in figure 1. Scenario 1 shows a positive picture of the future, while scenario 2 is a standard scenario and scenario 3 a negative trend scenario.

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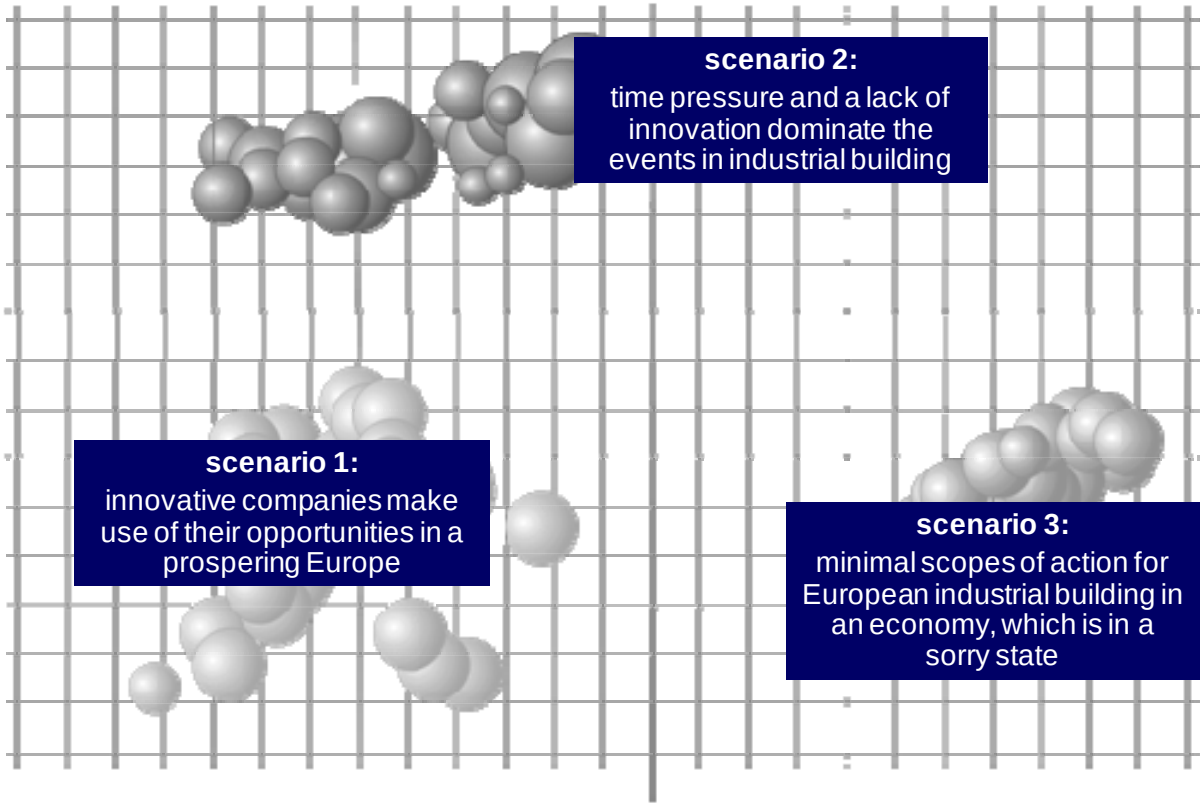

Figure 1: Scenarios for future industrial building

Every single scenario was used to derive future requirements for industrial construction and planning processes, which form the basis for the guideline.

2.2 Life cycle considerations in industrial building

In order to ensure a future-oriented design of industrial buildings it is insufficient to consider only the investments in and the conditions of the building at the moment of launch. The development of the building during the whole life cycle and the resulting life cycle costs are more important than just the temporary target state. The life cycle concept describes the stages from the design to the recycling of a building.

While normally only the life cycle of a unique product is considered, the planning and implementation process of an industrial building takes into account both the life cycle of a building and the life cycle of the production inside the building. As depicted in figure 2 the future-oriented industrial building has to be able to facilitate as many life cycles of production as possible, while at the same time keeping a high utility value.

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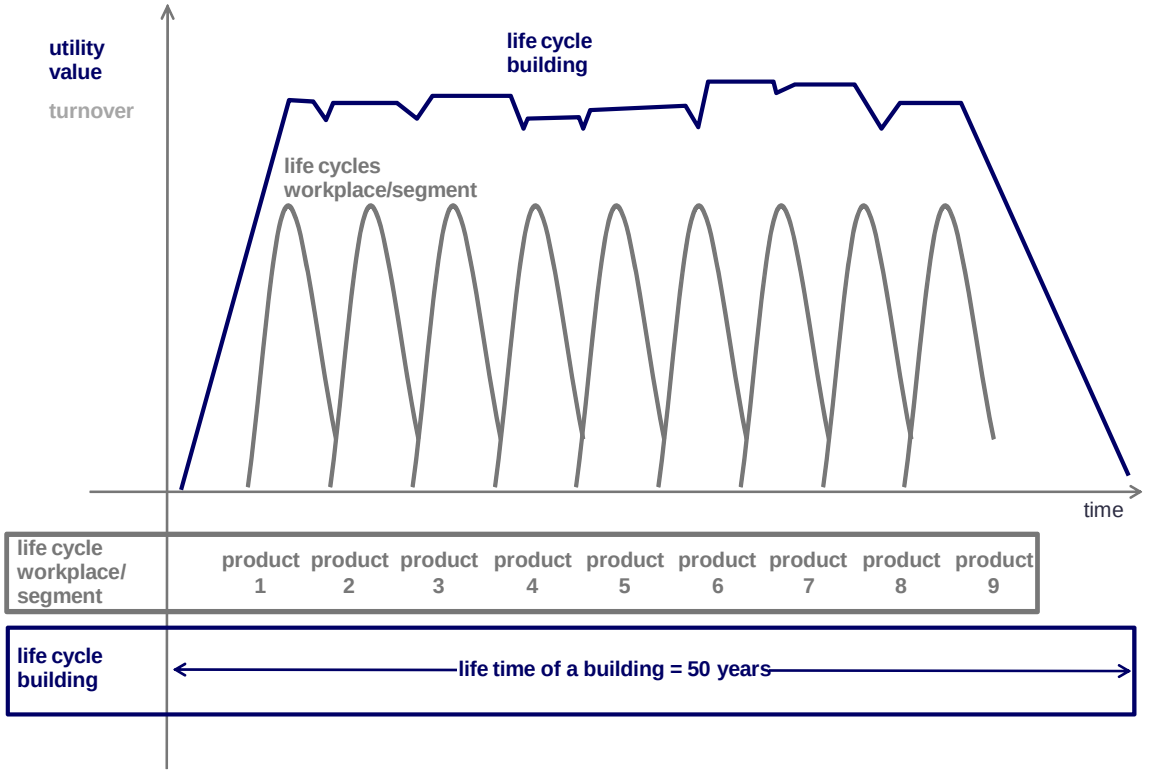

Figure 2: Comparison of life cycles workplace/building

2.3 Planning systematics

The analysis of existing deficits and future requirements for planning and construction of industrial buildings serves as starting point for the development of the systematics. Intensive involvement of experts as well as extensive literature research prove the need for new strategies, but also their potential and possible approaches. In many cases the sustainability of industrial buildings is restricted, especially because life cycles are not taken into consideration, structures lack adaptability and quality criteria are only defined partially. At the same time the fragmentation of disciplines involved and a lack of know-how among the decision makers result in substantial frictional losses.

Besides the increase in sustainability of the buildings the improvement of the process quality during planning and construction is the main objective of the development of the systematics. In this regard the planning systematics claims to offer a holistic, application-oriented and practical guideline for constructor, planner and draftsman.

In order to reach these goals a structure of fields of actions and topics specifying industrial building has been developed. The fields of action (fig. 3) treat all questions

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concerning WHAT (definition of the planning object) and HOW (definition of the planning and construction process). In doing so the fields of action are rather linked than developing parallel and independently. The field of action WHAT is described by the objectives quality, costs and time with regard to the existing laws/ standards/ regulations. The topic quality is subdivided into the factors requirements, adaptability, resources and socio-cultural factors. The field of action HOW evolves from the relation between the topics skills, constellations, communication and flexibility. In addition to general information the topics contain checklists related to their main tasks. The structure of the topics provides a basis for 27 methods and tools, which support the user in performing his main tasks.

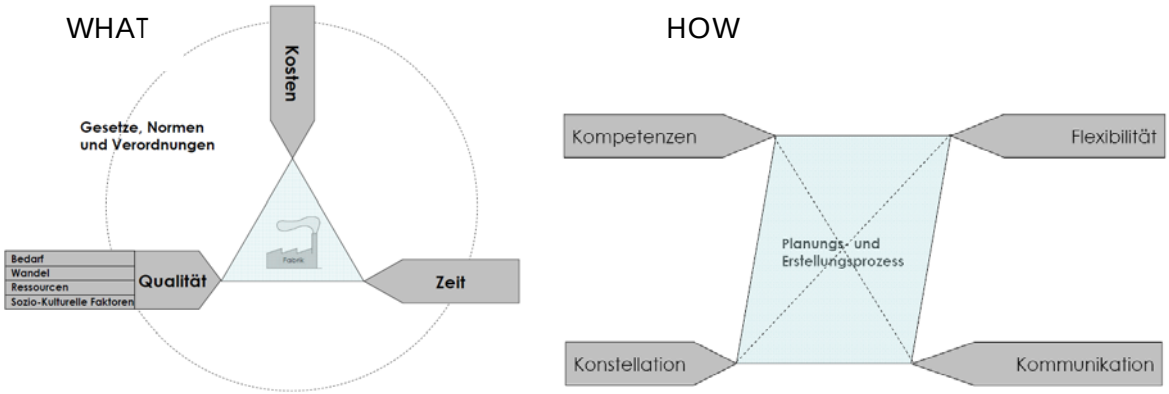

Fig. 3: Fields of action planning object industrial buildings and the planning and implementation process (Quelle: IIKE)

2.4 Structures of future-compliant industrial buildings

In addition to the planning systematics for future-oriented industrial buildings a strategy catalogue meant to lead to a future-oriented structure of industrial building has been developed. In order to reach this aim the report explains the significance of sustainability in industrial building, its additional value and constructional implementation as well as the way, how investments in future-compliant, planned and implemented industrial buildings pay off in the form of intrinsic value.

The use of an analysis technique intends to depict all aspects of the building structure, which are relevant in terms of sustainability and to identify practical strategies for implementation. For this purpose typical innovative industrial buildings are examined so that they are applicable to industrial building projects in general by means of case-specific illustrations as well as general strategy catalogues. The classification of

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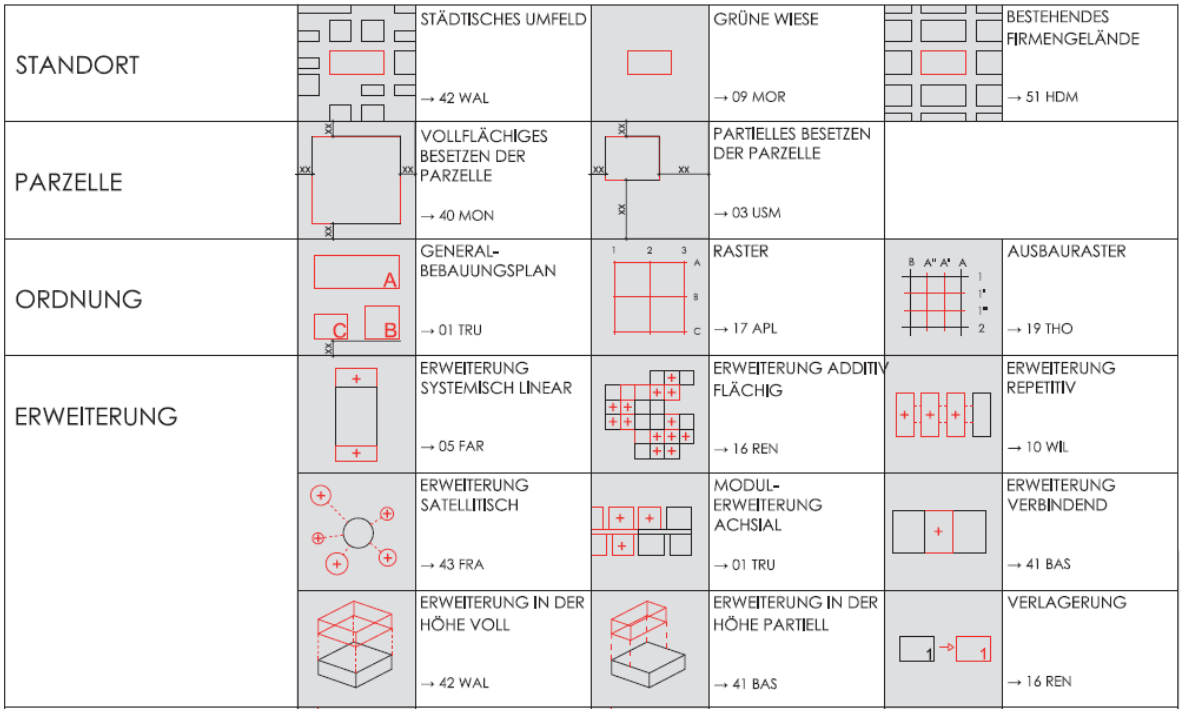
the single strategies in the superior strategy catalogue identifies typologies of future-compliant industrial buildings. Figure 4 depicts an extract from the strategy catalogue.



Picture 3: Extract from the strategy catalogue

During the first stage of the development of the strategy catalogue a research field is defined. It is based on the requirements catalogue for sustainability and the system levels of industrial building. In stage two the research field is used for the evaluation of case studies, which represent the practical part. For this, 23 industrial building projects are examined and the data collected from location, utilization and construction is used to realize a building analysis. According to the criteria of the requirements catalogue from the first stage the project- specific data is evaluated and used to develop case-specific requirement profiles. In stage three the case-specific conclusions are turned into a structure typology and a strategy catalogue for future-compliant industrial buildings.

3 Conclusion

By means of the planning guide the research project has been able to contribute to an improvement of the planning and implementation of industrial buildings. The par-

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ticular consideration of the three scenarios developed for industrial buildings and the differentiated view of the whole life cycle of a building as well as of the production inside the building can be seen as innovation. Already during the planning phase the planning systematics accounts for the versatile influences and goals emerging during the life cycle of an industrial building. The user can choose between numerous methods, which contribute to reaching the prioritized areas of interest. The strategy catalogue enables the user to take into account the different ways of implementation, which are classified by means of case-studies.

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