Advanced façade design and technology

Industry view and where to go with research

Prof. Dr.-Ing. Winfried Heusler SCHÜCO-International KG / Deutschland

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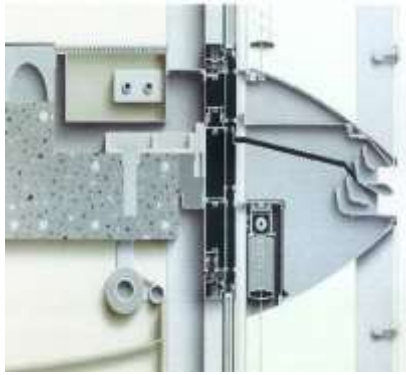
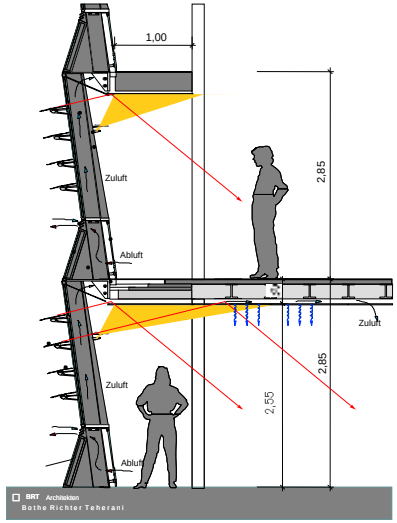
My Personal Past

… 33 years of „Façades“ and Lots of Excitement





1982: Gartner

1998: Schüco

1955 | 1965 | 1975 | 1985 | 1995 | 2005 | 2015

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Current Sphere of Activity

Senior Vice President of Global Building Excellence (since 2014)

… and honorary professor at the University of Applied Sciences OWL

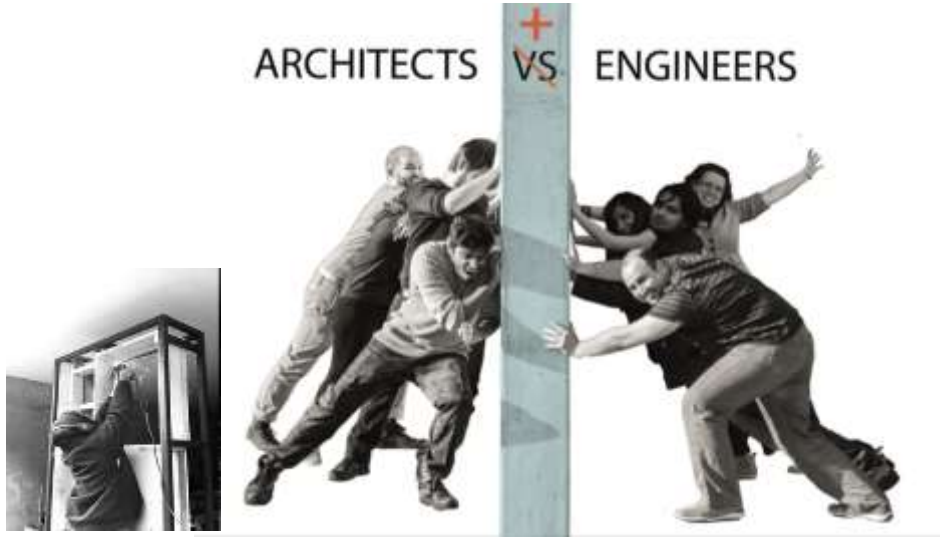
Hochschule Ostwestfalen-Lippe
University of Applied Sciences

Detmold School for Architecture und Interior Architecture / Faculty

31	Professors
50	staff members
1.300	students

- B. A. Architecture
- B. A. Interior Architecture
- B. A. Urban Planning
- M. A. Architecture
- M. A. Interior Architecture
- M. Sc. Urban Planning

- **M. Eng. IFDC**
- **M. Eng. MCDC**



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1. Introduction
2. Innovating out of the box
3. Functional optimization of buildings and façades
4. Functional and formal aspects of façades
5. Modular systems outside the box
6. Continuous digitalization of the process chain
7. Summary

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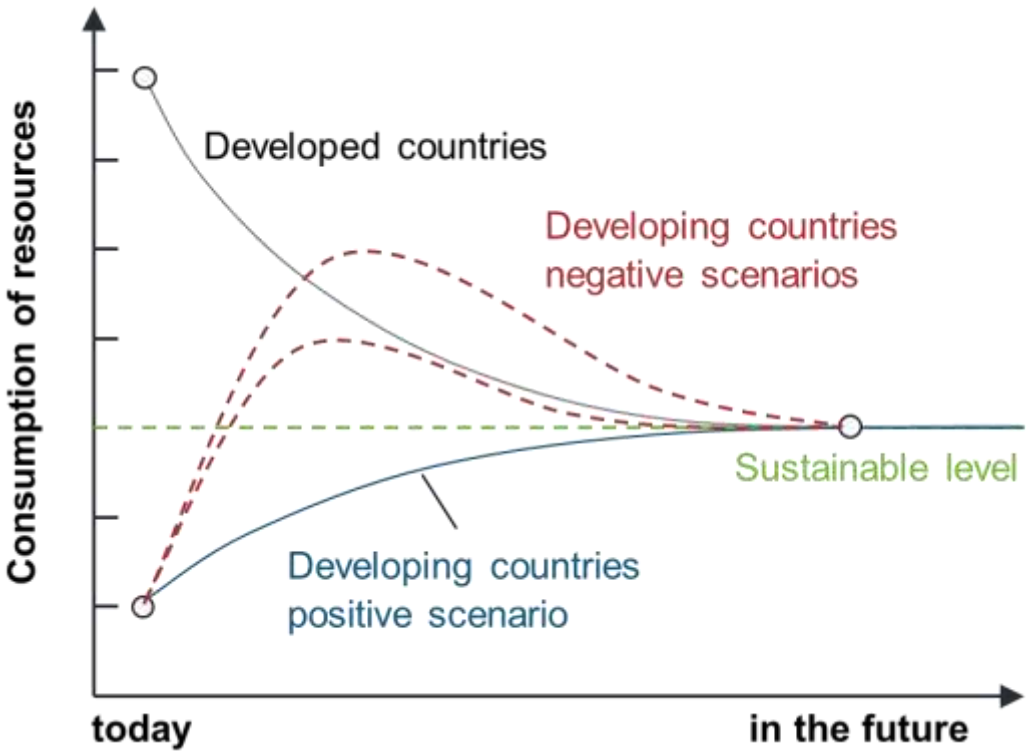
Introduction



- In the new millennium social systems, living arrangements and working patterns have changed faster and more radically than ever before.
- The unstoppable desire of people to live comfortably takes a heavy toll on the environment.
- The well-documented climate change has mutated to a global challenge.
- The digital transformation both offers opportunities and challenges.

What has to change to enable 9.5 bn people to live on earth in 2050?

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Innovating out of the box

Thomas Edison (late 19th century)

- great ideas do not pop fully formed out of brilliant minds
- the starting point is understanding customer needs
- the lone genius inventor is a myth
- the best approach to technological innovation is large-scale teamwork in a research laboratory (linking basic research to applied science)

… it is fruitless to simply invent for invention's sake

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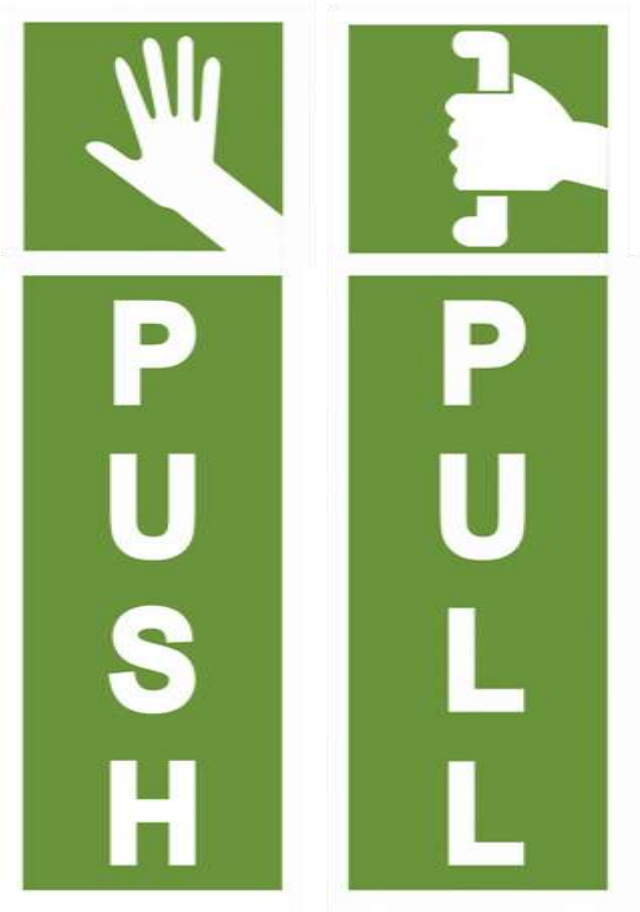
Innovating out of the box

Innovation strategies



- Technology push strategy

  … to identify technological trends

  (e.g. the “Internet of Things and Services”)

- Market pull strategy

  … to identify currently inadequate satisfaction of customer needs

  … anticipating the customer's needs

  (the method of scenario thinking creates more probable “futures”).

… successful innovations often rely on
the targeted combination of market pull and technology push activities

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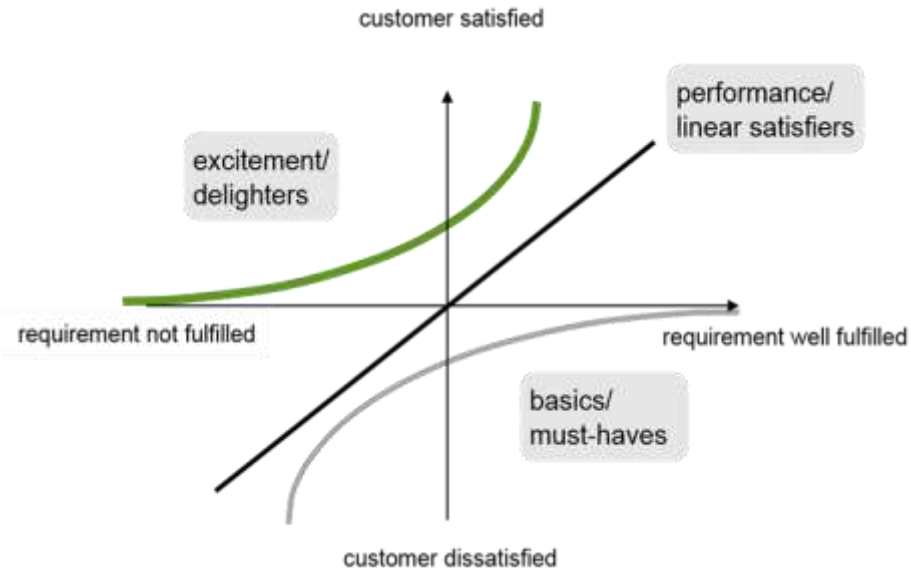
Innovating out of the box
Clustering customer needs

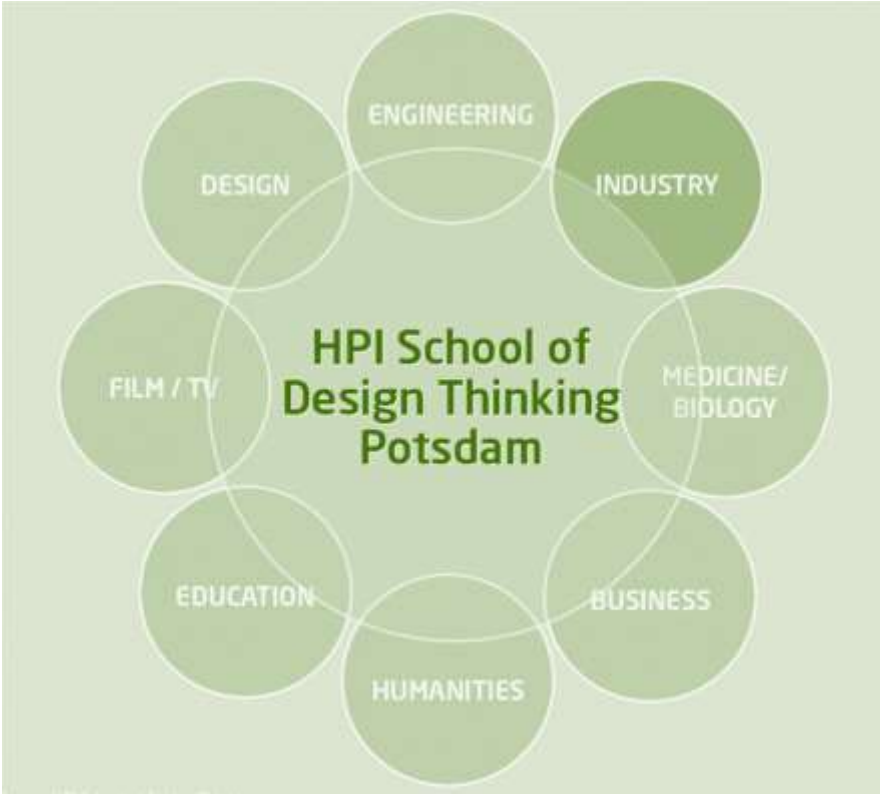


- “performance factors”: specified in detail;
  if well developed, it results in corresponding level of satisfaction.
- “must-haves”: not generally expressed;
  if missing, it results in extreme dissatisfaction.
- “excitement factors”: unspoken;
  if they meet customer needs, it is the really differentiating feature

…satisfaction and dissatisfaction of customer needs (Kano 1984)

Innovating out of the box

The method of “design thinking”



Source: HPI School of Design Thinking (Potsdam / Germany)

- matching people’s needs
- with what is technologically feasible
- developing a viable business strategy

… converting an idea into customer value and market opportunity

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Functional optimization of buildings and façades

- passive building concept: passive façade components seal off the interior from external factors as far as possible (contemporary building technology ensures a comfortable interior environment).
- active building concept: dynamic façade components respond specifically to changing internal and external conditions (the aim is to minimize the use of mechanical systems).
- cognitive building concept: the façade and mechanical-system components are connected to each other through an intelligent building automation system (adaptive components of the building skin are capable of reacting to non-continuous, changing external and internal conditions).

… which one is the appropriate concept for the specific project ?

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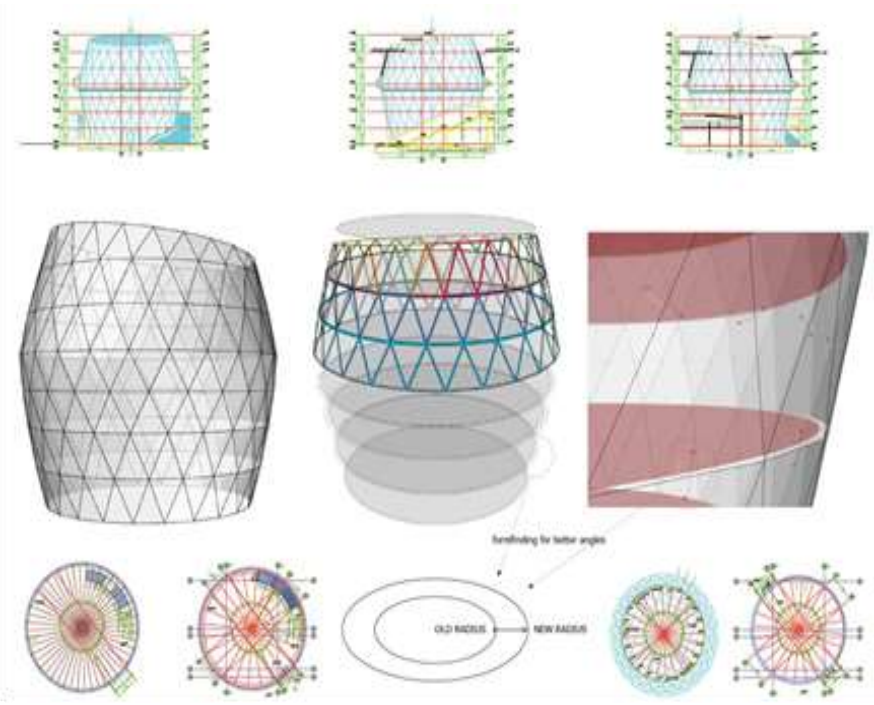
High tech or low tech concept ?



Source: P. Günther (Schüco International KG / Germany)

- cost-efficiency (investment, operating and maintenance costs)
- energy requirements (heating, cooling, ventilating, lighting etc.)
- environmental and room comfort (thermal, visual, acoustic etc.)
- across the entire lifecycle (design, planning and construction, operation and usage, updating and upgrading, demolition with possible reuse or recycling)

Minimize complexity: use only as much technology as really necessary

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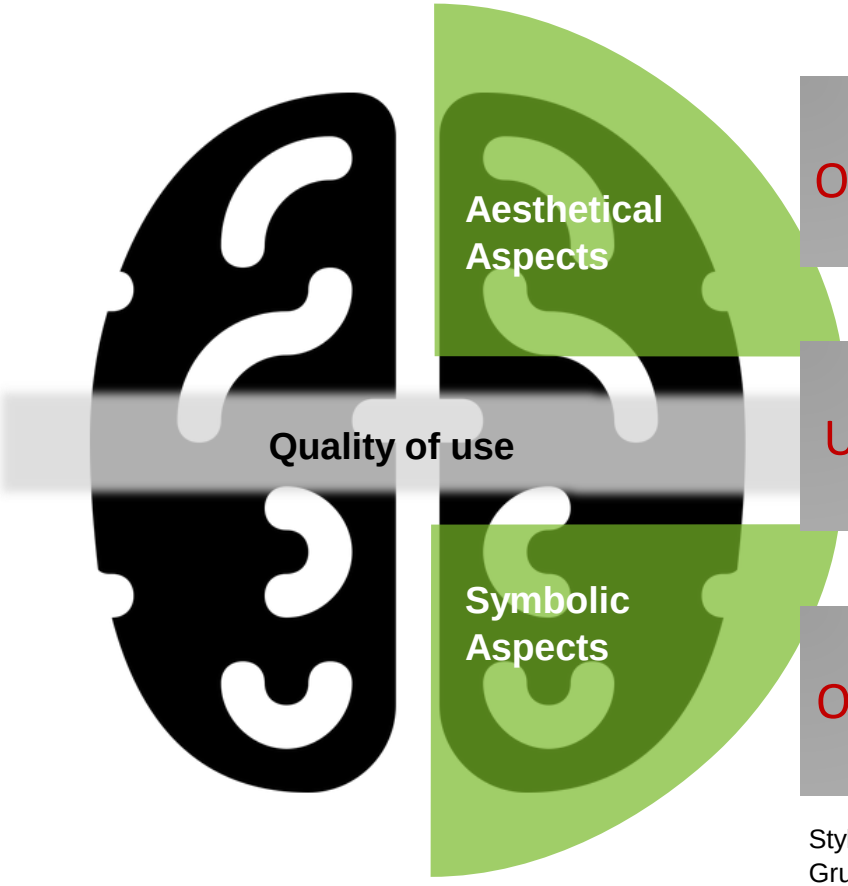
Formal aspects of façades



Observer	Product properties (form, structure…) and grammar of product language
User	Product feature that show what the product should be used for and how
Owner	… refer to social, cultural, historic, and ecological backgrounds

Styled after: „Offenbacher Ansatz“
Grundlagen des Industriedesign (Design als Teil der systematischen Produktentwicklung)

… an attempt of comprehensive evaluation of design quality

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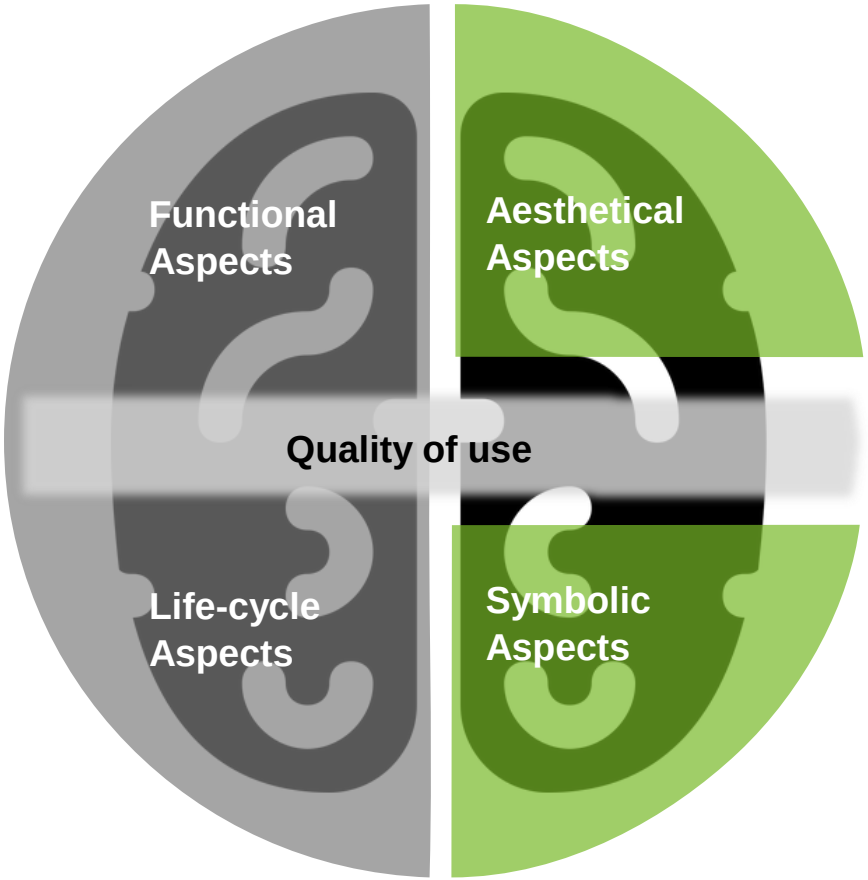
Practical and formal aspects of façades

practical aspects

formal aspects



… an attempt of comprehensive evaluation of façades

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The principle of convergence

- The merging of trades as well as the blurring of existing lines, within which enterprises used to position themselves
- Different trades` competences are necessary for the successful solution of this cross-disciplinary challenge

Convergence represents the next evolutionary step towards value-added solutions for the building's life cycle

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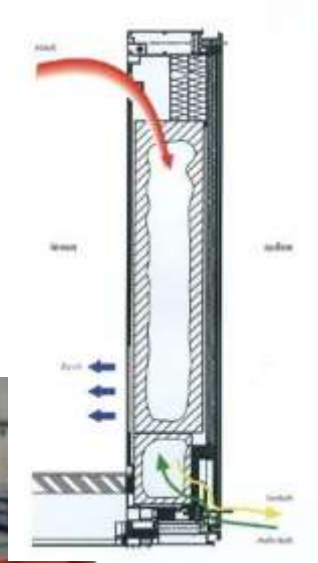
Convergence and modular systems

Integrated and scalable functional groups for the different trades



- a flexible cooperation between the functional groups through optimized interfaces
- interoperable components lead to easier integration efforts
- with standardized functional principles and carry-over parts across several series
- with system-specific construction characteristics as well as typical joining details and connection technologies.

…even complex project specific solutions can be planned and executed more efficiently and with a higher quality

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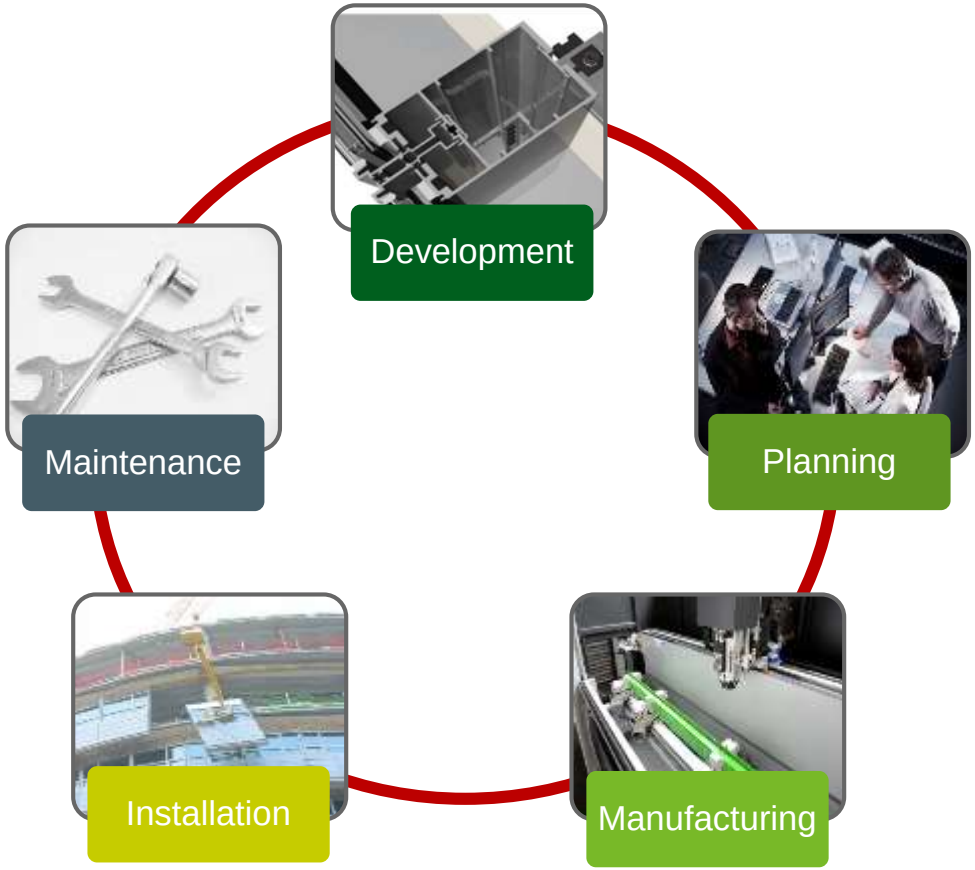
Continuous digitalization of the process chain



Connecting all involved parties:

- architects and engineers
- main contractors, system suppliers, façade and maintenance companies

To build and operate the whole building twice:
First of all virtually (by means of augmented reality) and finally in reality

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The introduction of cyber-physical systems (CPS)

- Smart machines, storage systems, production facilities and building site terminals capable of autonomously exchanging information, triggering actions and controlling each other independently.

- Smart assistance systems (e.g. cyber glasses) release workers and maintenance staff from extensive and sophisticated product manuals and from having to perform routine tasks, enabling them to focus on creative, value-added activities.

CPS will radically transform the principles of operation of all involved parties

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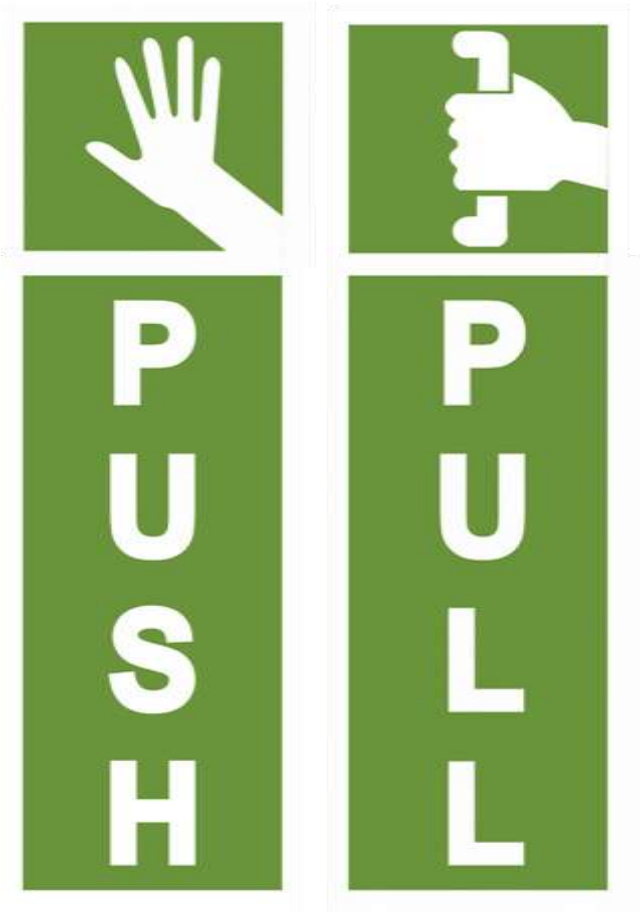

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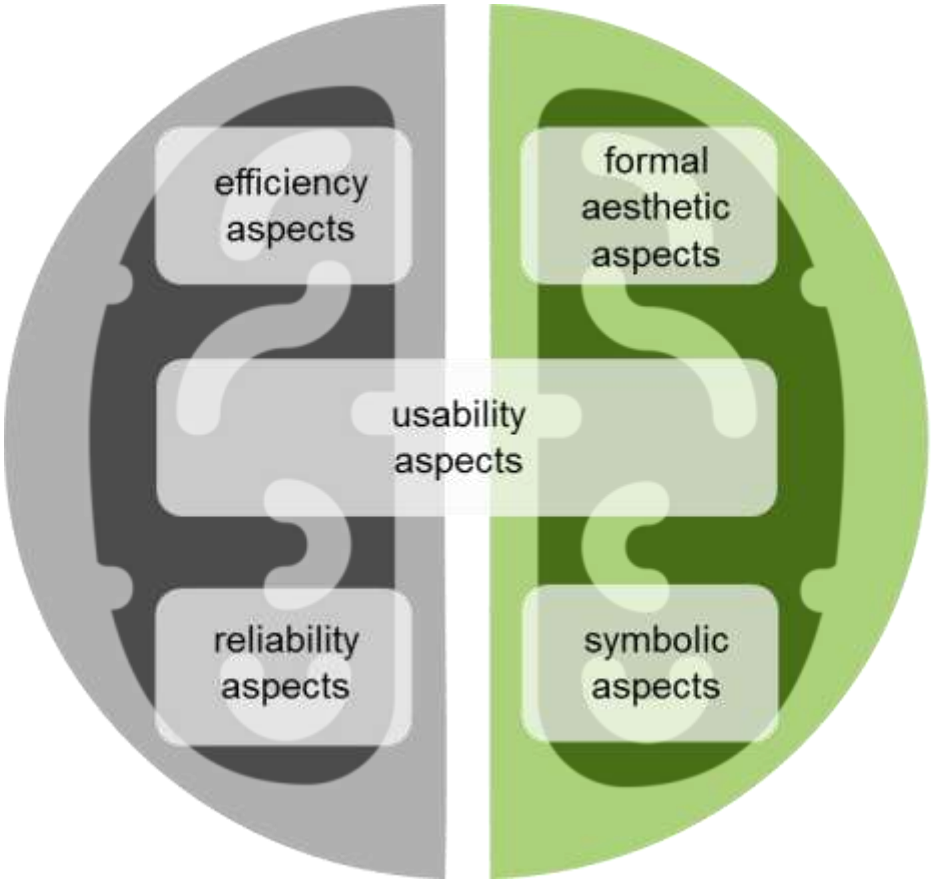

1. cost-efficiency (investment, operating and maintenance costs)
2. design considerations (functional, formal and symbolic aspects)
3. energy requirements (heating, cooling, ventilating, lighting etc.)
4. as well as room comfort (thermal, visual, hygienic, acoustic etc.).

… taking into account environmental, economical, social and cultural aspects

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Summary

- Modularly designed façades - with scalable functional groups having optimized interfaces and standardized functional principles - can be planned and executed efficiently and with a high quality.

- Continuous digitalization of the process chain, connecting architects and engineers as well as main contractors, system suppliers, façade and maintenance companies with their specific activities.

This will radically transform the competence profiles of all involved parties

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On our the way to a sustainable built environment

Sustainability			
	Aspects		
Strategies	**Ecology**	**Economy**	**Society**
Efficiency Reduce effort			
Consistency Reduce side effects			
Sufficiency Reduce demand			

… neither the high tech nor the low tech but the smart tech concept is the best one

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