

Design for Sustainable Solutions: The Need for Action Beyond Green Design

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Problem and Current Understanding:

Design is a strategic and creative discipline with far-reaching consequences for the entire life cycle of a product or service. It is a major part of industrial production processes and consumption patterns and ultimately influences the sustainability of manufactured products: Design is in the majority of cases part of complex correlations - but there is often not enough knowledge about these correlations in innovation management. There is a broad consensus on the need to integrate design activities in innovation processes, especially in the early phases. As general conditions, such as global product development and consumption, are rapidly changing, a detailed analysis of all the influences between design, its implementation in innovation processes and sustainability is required to adapt the discipline of design to these challenges. Far beyond *Green Product Development*, which is based heavily on content and methods of traditional product development processes, a better understanding of the impact of design-decisions on sustainability is necessary. The present study provides a contribution to this.

Research questions and Research design:

Which parameters within the product or service life cycle influence most its sustainability? And how can design-decisions make a maximum contribution to sustainability? In addition to the technology-centered aspects of *Green Product Development*, this survey focusses on the holistic view of economic, environmental and social aspects of sustainability, that are influenced by design-decisions. Answering the question, which conceptual and operational changes are necessary in order to achieve *sustainability by design*, is a challenge: for the discipline of product design as well as for the management of innovations.

At first a multitude of sources was spotted and checked for success factors in the course of a literature research. As part of the following primary study, qualitative interviews with experts in the fields of product life cycle, climate change, science, society and consumption (n=23) were conducted. The semi-structured interviews were translated into individual cognitive maps. The captured mental concepts of the experts were evaluated using software and the importance of the success factors was identified. In addition, semi-structured interviews were conducted with designers (n=8) and also documented and evaluated.

Findings, Contributions and Implications:

The survey is reflecting the great influence of design-decisions on the sustainability of products and services, but it is also highlighting the phases of product and service life cycles where design is increasingly helpless and without influence. Therefore, to really contribute to sustainability, the discipline of design must change conceptually. In this respect, the study provides indications of conceptual development in the field of product design. *Design for sustainable solutions* is still not sufficiently anchored in the mindset of innovators and there is an obvious need for action concerning the implementation of design in innovation processes beyond *Green Design*.

For the management of innovations, for entrepreneurs - and most of all for the design-education - the results provide important clues for the future of design and sustainable innovations.