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Prof. Dr.-Ing. V. Grienitz

Scenarios for the engineering design of new products – product scenarios with evolutionary algorithm

Topic 7: “Engineering Design”

Manufacturing based corporations often find themselves confronted with complexities of increased pressures to innovate in order to ensure their comparative market positions. In order to react to various exogenous changes corporations need to develop strategies that match their manufacturing resources as well as products with the markets requirements.

The success of tomorrow based on the balanced respect of market and technologies to reach sustainable competitive edge (figure 1). That means: **Market Pull** describes the ecological and social developments with the focus on market and line of business developments. **Technology Push** focuses on technological devilmments, for example new substitute manufacturing technologies or improvements, new materials which allows the use of new technologies, which are often seen as enabler [1].

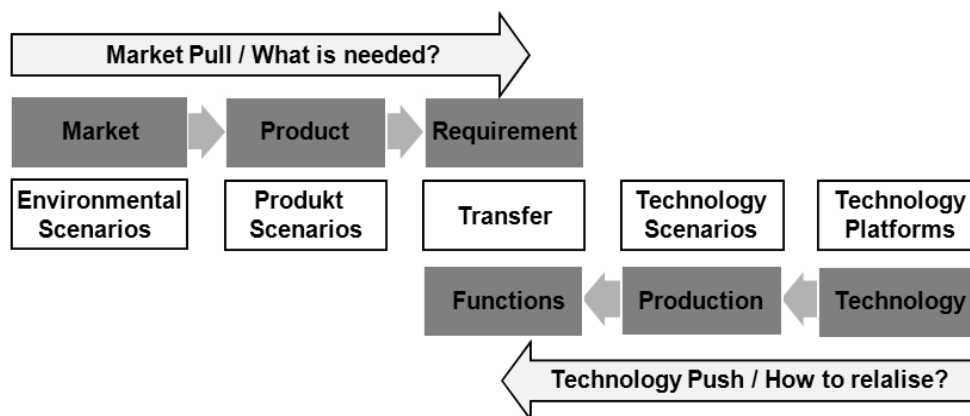


Figure 1: Interaction between Technology Push and Market Pull to anticipate future options [1]

Product scenarios represent a holistic approach for managing innovation processes and technologies efficiently. The process of developing Product Scenarios is structured into the following three phases: Scenario field analysis, scenario prognostic and scenario creation.

The starting point (scenario field analysis) is the product structure like a morphologic matrix (fig. 2). The second step (scenario prognostic) identifies characteristics to each

product structure element. At this point should not use only well known solutions, more interesting are thinkable characteristic values.

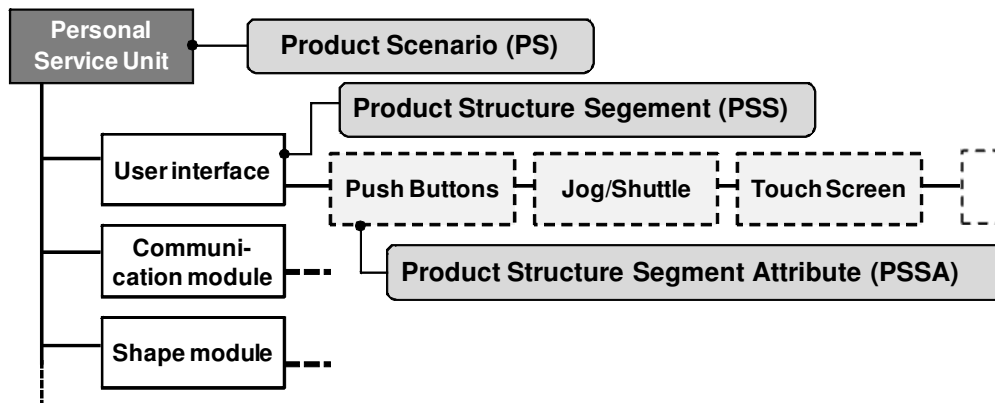


Figure 2: Structure of Product Scenarios like a morphologic box

The last step (scenario creation) is the creation of product scenarios. A multi goal optimisation is needed. The best way is to use nature analogue algorithm like evolutionary algorithm [2], [1] (figure 3).

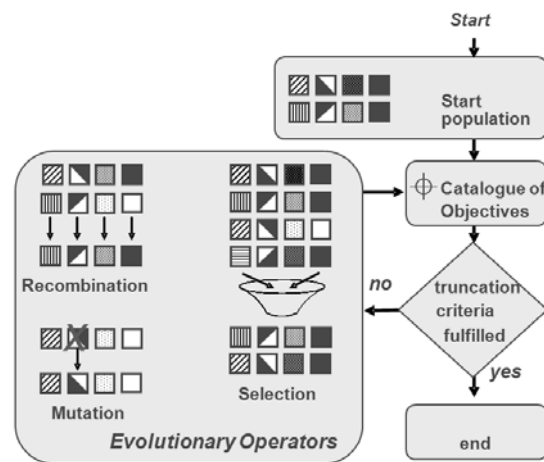


Figure 3: Sequence of evolutionary generation of solutions [1], [3]

The mechatronic product – the personal service unit of aircrafts, so called PSU is a complex but also understandable example of use for product scenarios. The product structure could be divided into e.g.: Shape module, communication module and user interface. The different product scenarios describe a range from clear separated module (electronics and mechanics) up to a full function integrated mechatronic module.

Conclusion: The essay gives an overview of the development of product scenarios with evolutionary algorithms.

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