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Position evaluation in industrial product life-cycles

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Abstract

The importance of the clarification of the objectives in the early stages of product development is often stressed in the scientific literature. It is primarily focused on the target search. Until today, methodological approaches were not the subject of consideration, which aim to determine the status quo of a product with regard to various aspects, i.e. to evaluate the exact position of the product. This paper focuses on the methodological support of the position evaluation in product development; the results of such a position evaluation should in the scope of the product development methodology result in a search for objectives on a higher and more informed level of information. Both, the current work of the authors in the industrial product development as well as several retrospective analyses point to a clear need for a deeper and wider positioning. Important emphasis of the developed methodological approaches is the stimulation of abstraction in the case of existing products in order to avoid solution fixations in function and feature options. As a novel aspect the focus on optimal functional performance and optimal characteristics is proposed. Another main aspect is the inclusion of field experience and quality problems. Basically, qualitative and quantitative analyzes of the existing product are used as a basis, wherein, when possible, a quantification with respect to the monetary impact is attempted. As one key driver of cost and complexity the product variance is taken into consideration. The approaches have been developed and verified using the example of a compressor for the air supply for braking systems of rail vehicles and are explained on this example.

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1. Importance of position evaluation

The importance of position evaluation is emphasized in many areas of human life. Edmund Phelps, a well-known economist and the winner of the 2006 Nobel Memorial Prize in Economic Sciences, points out that each country should evaluate its position first in order to assess its innovative capabilities [1]. An industrial example, within which aspects of inadequate position evaluation have played a role, is described by Weule [2]. The company AEG Olympia was one of the pioneers in the development of inkjet printers. At a relatively early stage, however, the decision was made not to pursue this technology but to focus on mechanical printing systems; this decision can be seen as central to the subsequent decline of the company. Thus, during the decline of AEG Olympia the technology position of mechanical pressure

systems was misjudged and the development of the inkjet printer was missed. Lindemann [3] also points out that the discontinuation of development activities in the field of electronics was an entrepreneurial false decision; also at this point insufficient position evaluation can be assumed, among others, as one cause for this false decision.

A recent example provides the cell phone manufacturer Nokia (Graf & Schröder [4]). Nokia was one of the market leaders in mobile phones, but focused at the time of development of the first Apple iPhone on mobile phones with separate mechanical keyboards as opposed to a pure virtual keyboard on a smartphone. Thus, in the company Nokia the technical position of mobile phones with separate keyboards was misjudged and the development of the smart phone market was neglected. Even Sony has probably misjudged the position of its product "Walkman". Krames [5] reported that

Sony focused purely on selling music players and missed the integration of an online music marketplace, which Apple could offer. As a consequence, the market share of Sony in music players was reduced to 10%.

Examples in engineering can, for example, be found in the research results of Frankenberger [6]. He found that a high quality of target decisions is an important influencing factor for the functional performance of products. It can at least be assumed that an implicitly or explicitly performed position evaluation is a necessary basis for an informed target decision. In the development process of a medical device, which was examined in detail by Blessing [7], numerous changes in all phases could be observed which can be partly attributed to insufficient objective clarification. Again, it can be assumed that a position evaluation would reduce those iterations.

2. Placement in the product development process

In the area of product development today different methodologies are available, which are extensively described in literature (see review in Feldhusen & Grothe [8]). In the area of "clarification of the task" the different methodologies are in good agreement, they propose lists of requirements, checklists for the "clarification of the task" up to complete methodologies for requirements management. Basically, the particular importance of the early stage of product development is emphasized. Ehrlenspiel [9] also emphasizes the importance of an information backflow from previous, similar products. In many cases benchmarking is recommended to clarify the starting point of a new product. In this phase of the product development process, an explicit analysis and visualization of the starting position of a product or a product range would be appropriate; it is however not directly proposed and described in detail. A special role plays the method Quality Function Deployment (QFD - e.g. Brüggemann & Bremer [10]) because it includes some elements of a comprehensive position evaluation. Customer requirements, for instance, integrate a market point of view, while also aspects of benchmarking are part of a comprehensive QFD. Likewise, product characteristics are assessed with regards to the effort necessary to realize them. However, a real abstraction, for example, on a functional level is not carried out during a QFD process. Additionally, the customer requirements are only present-oriented and no methodological support that supports the consideration of new customer requirements, new product features or new technologies is present in QFD. In summary, it can be said that so far no consistent methodological support for the position evaluation of development projects and products is available.

Ponn [11] compares the product development with the navigation of a ship; in this context he interpreted the concept of navigation as follows: "First, the actual orientation is carried out in terms of positioning, i.e. the analysis of the process and the situation in which the developer is currently located. By "site" the point in the process model under consideration is meant which is applicable to the current process (the current situation)". In contrast to the navigation of a ship, the current position is often not sufficiently clarified in

industrial product development. Rather often only singular, situation-specific perceptions of individuals or reports are available which do not fully describe the complex nature of a starting position.

The special significance of the position evaluation results in particular from the fact that this is essential for a substantiated definition of realistic and meaningful goals (Figure 1).

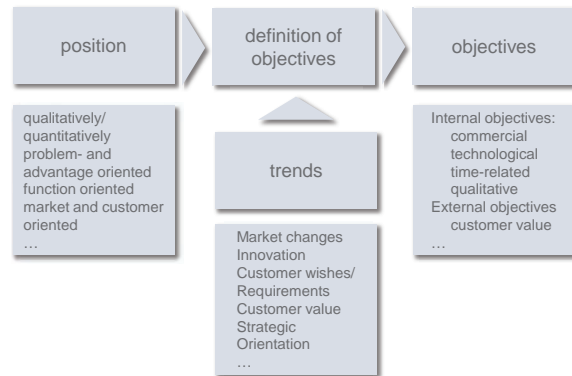


Fig. 1. Position evaluation and subsequent process

A detailed and "honest" position evaluation is the foundation to question the boundaries of a product or the limits permitted by any organization. The position evaluation thus creates the basis to be aware of the own strengths and weaknesses in order to be able to respond to both market trends and customer requirements and to develop innovative solutions.

3. Fundamentals of methodical position evaluation

The evaluation of the position includes the qualitative and quantitative determination of the position, i.e. the coordinates of a product. One way to determine the coordinates of the product is to quantify the degree of fulfillment of product functions. Other aspects relate to direct and indirect product characteristics and product quality. It is of central importance to determine realistic evaluation criteria. The following section examines aspects of the position evaluation in industrial products in detail and provides methodological approaches which take these aspects into account.

3.1. Product and process oriented position evaluation

Many key aspects of the position evaluation are aimed at strengths and weaknesses of the product or the products under consideration. In the consideration of these issues ideally known product characteristics, market experience, service experience and quality problems are integrated and lead in particular in serial projects to a clear determination of the product position in the current and future competition. In addition, the position evaluation offers an additional, process-oriented point of view. This view questions at which time and in which particular position as regards to content a conception, development or problem-solving project currently is

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