SCIENCE LITERATURE REVIEW EXAMPLE

SCIENTIFIC PRODUCT DESIGN

"The main task of the engineer is to apply engineering knowledge to the solution of technical problems and then to optimize these solutions within the requirements and constraints imposed by material, technological, economic, legal, environmental and human factors. Problems become specific tasks after engineers classify and define problems that need to be resolved to form new technical products (artifacts). This occurs during the individual work of engineers, as well as team work in order to achieve product development at an interdisciplinary level. Virtual design of a new product is a task of constructors and engineers working on product development, while physical product realization is the task of engineers in production" (Pahl, Beitz, Feldhusen, & Grote, 2007).

The pre-quote text emphasizes the basic guidelines that assert the responsibility of engineers as the main bearer of the product development process. At the same time, the relationship of the product is emphasized - an artefact that is produced because often in the literature the product is described as a technical artefact. Furthermore, there is also an emphasis on the interdisciplinary of engineering work. As an introduction to the product development, it is essential to classify the basic carriers of the product development process and the most important elements that make it "As regards the basic responsibilities of engineers who are in charge of the technical and value or economic features of the product, as well as the commercial

features of the time-consuming process of product development, it is important to define procedures that are design-based and that provide good solutions.

These procedures must be flexible and at the same time suitable for pre-planned, optimized and approved. Such procedures, however, cannot be realized if the engineers do not have the necessary knowledge in the domain that relates to that product, and if they do not have the capability to work in a systematic way. Furthermore, the use of such procedures should be encouraged and supported through the company or organizational body that orders the product or process of product development" (Pahl, Beitz, Feldhusen, & Grote, 2007, 9). The importance of an organization's organization is in the way it operates and the resources that are assumed in the individual activities or tasks of the project team or engineers. Therefore, indirectly through the organization of a company is defined the way the engineers will act, i.e. design team or teams. "The organization of the construction and development process depends primarily on the overall organization of the company. In companies with a product-oriented organization, the responsibility for product development and subsequent production is divided between separate departments in the company depending on the type of product ... " (Pahl, Beitz, Feldhusen, & Grote, 2007, 3). So when mentioning the organization of the product development process in companies that are focused on product, most often speaking about production companies. The role of teams and company structure is to develop a product according to the structure of product development and the organization of the same process. Apart from product orientation, there are other company structures that are problem-oriented or oriented to solve a particular problem, or to designing only modules and circuits, or other. It is important to conclude that the organization of companies in this regard directly affects the structure,

relationships and organization of the product development process. Working with computers, computing, presenting and collecting data and product information is present at all stages of the development process.

"The most important thing that happens in the field of product development and the activities of engineers comes in the form of data processing using a computer. Computer-assisted product development (CAD - Computer Aided Design) influences the design methods, the organizational structure, the division of labor, the activities of engineers who work on conceptualization and detailing, as well as the creative and mental processes that occur on an individual level. "Such a systematic approach design and the entire process of product development does not mean lack of creativity at the individual level (Hubka et al., 1988). This is especially evident in the development of variant product solutions that the authors anticipate that computers will fully take over that part of engineering activities, obligations and activities This leaves more time and other resources for engineers to develop products that are oriented to the needs of customers Absolutely all tasks in the field of product development, i.e. all activities of this process, are sought through computer and computer / IT tools.

Trends in the introduction of expert judgment expert systems that are complex computer systems for deciding, processing information and data managed so-called supercomputers and with the help of artificial intelligence, can be expected and is already present in this area. Once we have developed a picture of what the customer expects from the product, we create a model of what is the main function of the product to explain and begin the construction of the production architecture (Otto & Wood, 2001). Although the task of this paper does not define product requirements, they arise from the demand of the market, customers and others.

To begin the development of any product, there must be clear and meaningful motivation in terms of cost-effectiveness, the ability of manufacturers and enterprises, etc. Suppose there is obvious interest, interest and economic background and approval for the development of a bicycle. In terms of where the development will move in terms of the variant later and the product is specialized in terms of the requirements of certain groups of bicycle markets and customer interests. It is necessary to foresee trends that direct the development of bicycles ... Basically, in the design phase, it should be assumed that the planning phase is finished, market research is done, customer needs analysis completed and goals, and the mission of the enterprise defined. There are two main factors: market demands (defined target group of users, estimated economic profit ...), and company opportunities (economic, product, enterprise resources, machines, tools ...) as well as in the enterprise itself (mode, human resources, company orientation ...) (Andreasen & Hein, 1987). As is the case for any product, at the very beginning, it is necessary to define a target group of customers and evaluate the market in the form of a quantitative number that is the business of marketing and economists who assess the cost-effectiveness of the project. When this planning phase is finished, it moves into the design phase, and this work is oriented towards the development and definition of a specific method that generates concepts at the component level based on the existing product structure and can serve for their development, which is later optimized and directed by other methods to selecting better solutions (constructive).

But, as is stated in the second part of the quotation, the functional analysis of the product must first be followed, in this case the bicycle. Methods of generating concepts are specifically approved within the constructor's team. The process from the demands of buyers to the

design of concrete construction solutions can be considered more art than the scientific method. Solutions arise from meaningful, engineering and practical experience because this is in the spirit of the engineering profession and otherwise it can result in an unrealistic, unprofitable or unrealistic product.

Any decision made in the design process must be substantiated and approved. According to Otto and Wood (2001), customer demands are considered criteria for evaluating concepts, not directly for evaluating the method of generating concepts. Customer requests cannot be explained or defined in any way different than their own preferences of customers and, ultimately, they are statistically regulated data. For example, in customer surveys, many factors decide on the results, i.e. requirements do not have to be explicitly what is in the interests of customers or the optimum product potential in terms of quality-price relationship-product characteristics. The reconciliation of these relationships can also be in the description of the work of the constructor, i.e. the design team. In order to solve a technical problem, a system with a clearly and easily defined relationship between inputs and outputs is required ... Such a relationship must always be planned, i.e. such that it meets product specifications. In order to describe and solve such a structural problem, it is useful to apply the term of functions to the default input and output relationship of a system whose purpose is to perform a certain task ... If the main task is defined, i.e. if the inputs and outputs are quantitatively involved and their features are known, then it is possible to specify the main function" (Pahl, Beitz, Feldhusen & Grote, 2007). Overall function is the main function and for the bike it reads - a bike ride. By definition, the function satisfies the "noun + verb" form. The combination of meaningful and appropriate combinations of auxiliary or subfunctions into a unique function results in the so-called functional structure.

Then, we create a block diagram in which the processes and subsystems are placed within the given block (black box) and are initially ignored. Each function can be achieved through a range of different solutions, and a specific solution for each function is selected. A function solution may be a subsystem consisting of multiple components or parts. Such components or parts are most commonly agreed upon in circuits, and one or more circuits constituting the function solution can be worked on.

Also, the function solution can also be in the form of a single component of a product or part. A set of all the solutions of the main functions makes the product structure. The product's grammar is a new methodology derived from grammar forms that were greatly assisted by MIT (Massachusetts Institute of Technology) professors George Stiny and James Gips. Grammar is part of linguistics or linguistics, a general discipline that studies the language. According to the "Great Vocabulary of Foreign Words", it is defined as: "grammatical (grammatical - alphabet; linguistic education) 1. The science of the system of a language and its characters (it can be descriptive, comparative, and historical); 2. A book that expounds the system and laws of a language; it is divided into phonetics, morphology, syntax, semantics, stylistics, etc. In mathematics, logic and computing, the notion of grammar is found in the form of formal grammar. For example, in computing, the syntax of each programming language is defined by formal grammar. The main goal of linguistic theory is to formulate and define formalisms that can describe, create, and define the language. In theoretical computing and similar disciplines, a large number of such formalizations have been developed (Gibbon, 1997), and formal grammar is one of them. Although in works before 1980, the grammar of forms was widely mentioned and studied (although only in the field of painting), to Stiny's work "designing with Froebel's building gifts" there was no useful explanation of the method.

References

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