Phases of Product Evaluation Process

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Abstract: - The paper presents some considerations regarding the evaluation issue in the general approach process of engineering product development. Starting with evaluation definition as a significant stage in the life-cycle of a product, the content of the paper valorises some achievements of the author's research and some selected information from references in the field. Proposals for an evaluation procedure are introduced.
As referring point of view, a proposed methodology titled Functional-Technological Engineering is briefly argued and, based on it, some considerations regarding the evaluation using functional and technological criteria for different stages of the engineering approach are developed.
The new elements of the paper are in close relation with the actual tendency in the life-cycle approach to continuously scale the development progress.

Keywords: - evaluation process, technical feasibility, development phases.

1 Introduction

After product strategy has created a vision of what kind of product should be developed, a formal development project is started. The PEP - as the master process model for such projects is commonly structured in three main phases: During the initial phase, the technical and economical feasibility of the project is clarified, which is concretized over the concept phase to a consistent set of targets. The task of the series development phase is then to realize the product so that it can be produced by a manufacturing plant. Not a distinct phase of the PEP but also a model related design task is post-launch series support and further development
In the engineering approach of product evaluation could be considered not only a distinctive but also an integrated stage. Decision-making represents an essential act in any process including the engineering approach. Having a procedure for quantitative and qualitative evaluation is a great advantage for the quality of the decision making process [3].

Because engineering approach of products is a complex and evaluative process the concern for introducing and completing evaluation has been present at many authors or researchers. Many methods and techniques were proposed as practices in the process, containing very different ways of procedure in a distinctive or integrated manner [2], [8], [9], [10].
Depending on the proposed aims of different proposals, evaluation could be generally differentiated as technical [4], [5], or economical [7].
During the initial phase, the product profiles coming out of product strategy are concretized towards a consistent target framework from which the technical and economic feasibility of a product project as a whole can be evaluated. The target framework must be plausible, prioritized and its conflicts resolved.
Some examples of evaluation aims and in the same time proposed evaluation techniques are synthesised in Table 1. It is obvious that relevant criteria are differentiated but the final goal is the correct and efficient decision.

Table 1 Evaluation aims.

Techniques applied when economic goals are considered	Techniques applied when technical goals are considered
Cost comparison	*QFD*
Profitability	Decision tree
Break-even analysis	Expert systems
Benefit-cost analysis	Concept selection techniques
Cost versus performance index	Weighting factors
Value analysis	Finite –Element Modelling

2 Aspects of development products

It is very difficult to appreciate when technical or economic evaluation is more appropriate to a particular case. This difficulty could be solved within an integral and unitary methodological approach like Functional-Technological Engineering (FTE) proposed as a new and general methodology in which evaluation sequences were considered as stages of the engineering approach [1]. FTE is a unitary methodology because it proposes a new approach through the philosophy of life-cycle engineering management by considering both functional and technological aspects as determinative ones for the whole life-cycle evolution of a product [1].

The methodology allows the efficient view on the product life through design, development and continuous monitoring of the product evolution and its related information's associated to correspondent life stages. FTE could solve some of the shortcomings of the sequential approach by this integration of functional and technological levels approach [7].

The terms used in the definition of FTE deserve some explanations:

Functional means all aspects related to the usage value, including functional requirements, functional implications of the requirements (functional performance, utility), list of functions for certain product, functional modelling, functional decomposition

Technological means all aspects related to the transfer of conception's idea to be brought to a concrete stage considering the entire life of a product, including diverse ways for the conversion of materials, energy or information's input into physical form**.**

A logical structure with main methodological steps is presented as proposals of FTE. The evaluation stage of the engineering approach is detailed into methodology's components with three main different ways approaches: functional evaluation, technological evaluation and economic evaluation. Logical models regarding functional, technological and economic aspects can be seen in figures 1, 2 and 3.

Regarding functional aspects, FTE methodology considers an algorithm that allows the elaboration of decisions strictly related to functions of the product completing the engineering evaluation in primary conceptual stage of the approach [11].

Particularly regarding the technological aspects, FTE methodology proposes an approach containing several levels. First level is concerning to the qualitative approach and presumes consideration of a set of general technological criteria for a global qualitative evaluation using a goodness function.

Second level attempts a quantitative evaluation corresponding to two different levels, product or detailed structure on elements of a product. For product level evaluation uses a set of technological indices which can estimate the quality of engineering process regarding technology for a product as entire. For detailed level on components of the physical structure of products that means that conceptual process is more advanced and details corresponding to elementary level of an element are known.

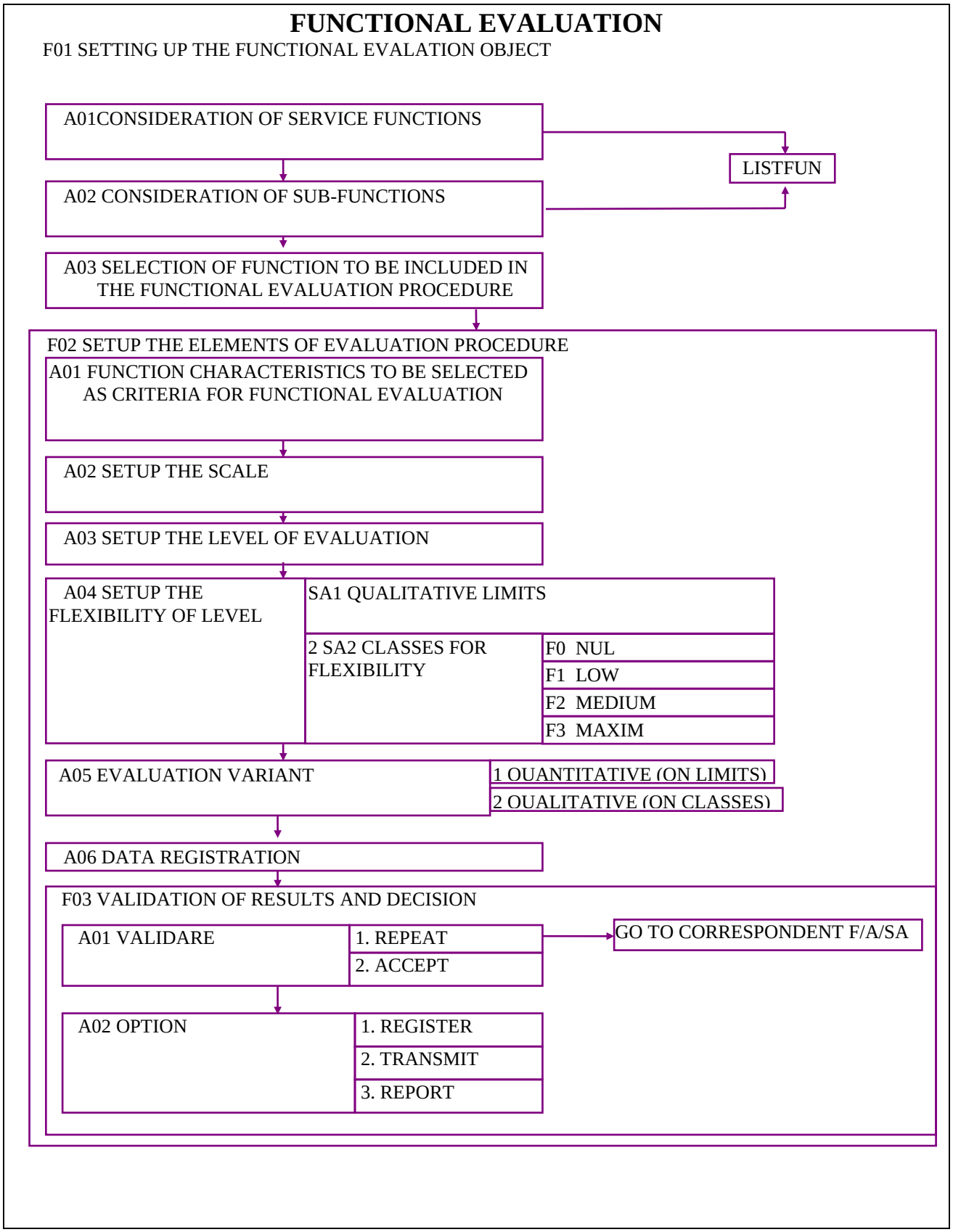

Fig.1 Functional evaluation

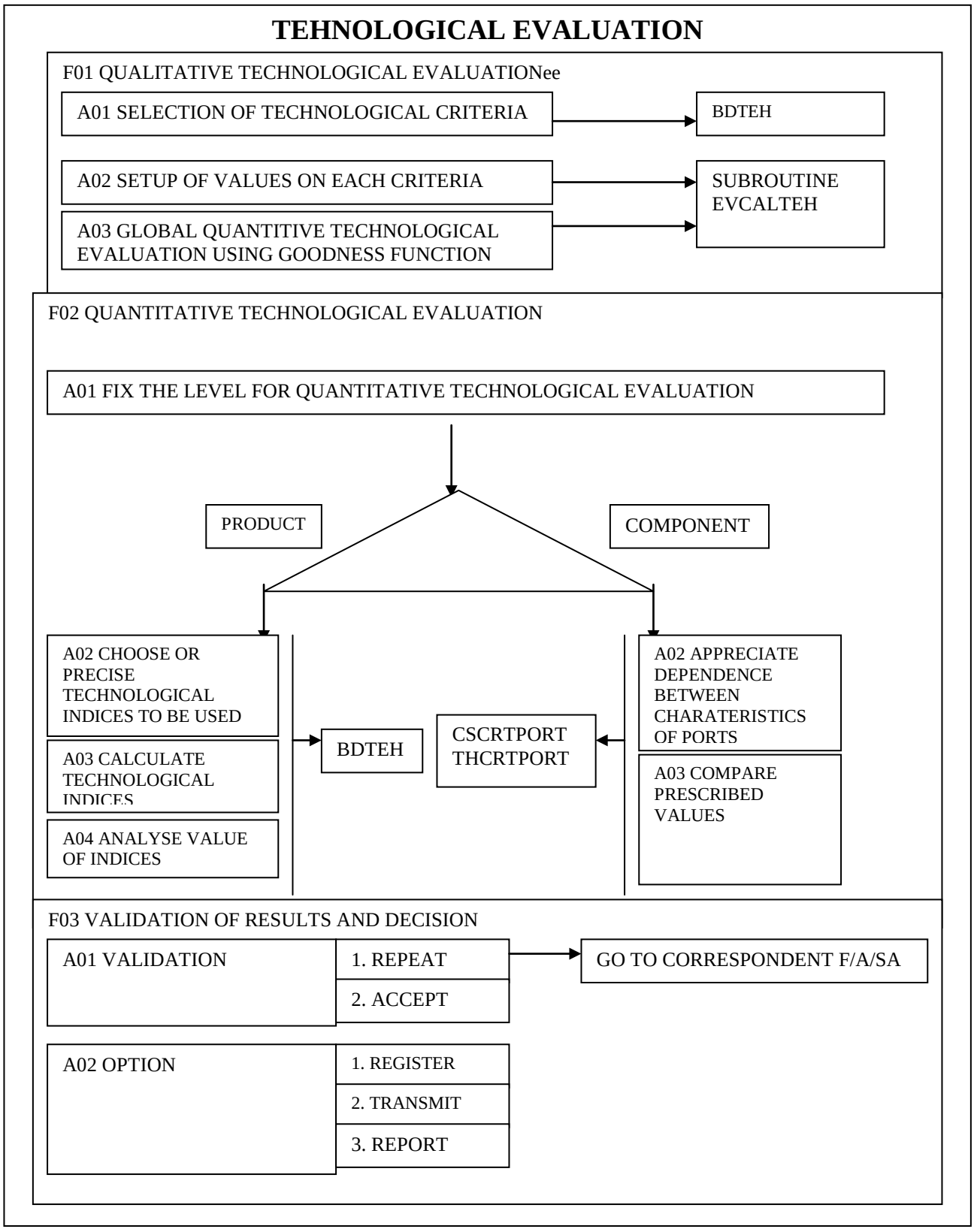

Fig.2Technological evaluation

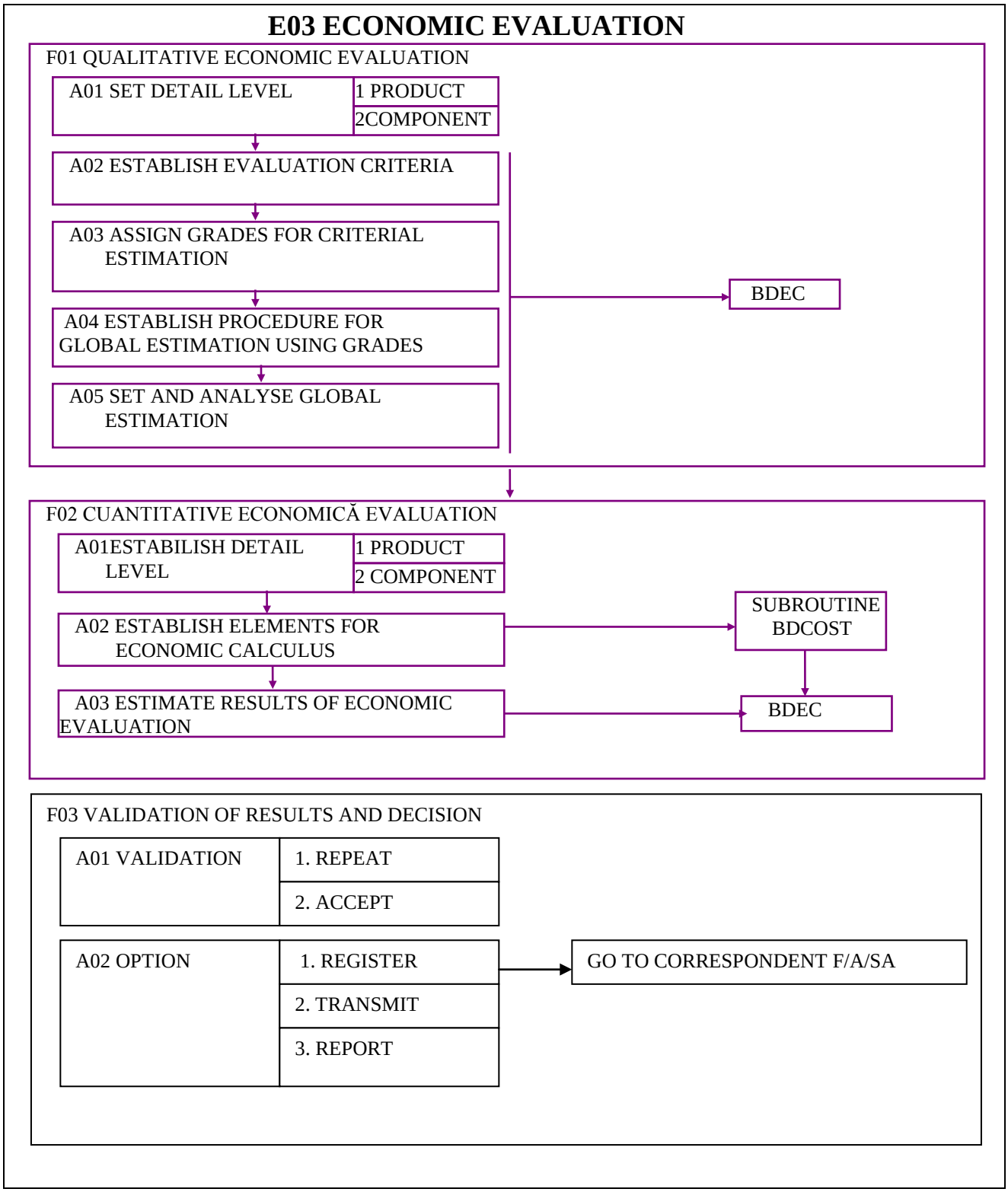

Fig.3 Economical evaluation.

For detailed level on components of the physical structure of products that means that conceptual process is more advanced and details corresponding to elementary level of an element are known. The concept of elementary port is considered and concrete prescribed technological characteristics might be estimated.

The evaluation stage can continue on a third level that considers strictly economic aspects also using a qualitative or a quantitative procedure. The qualitative phase is based on general economic criteria and could use an assignment procedure on several grades. The quantitative phase assumes already the availability of a lot of economic operational data. So the analyst could be able to go further with the evaluation stage until the detailed analyse on cost components or cost indices.

A general study of evaluation techniques and methods has conducted to the conclusion that a universal procedure does not exist.

As normal for the actual development of engineering tools, the entire methodology of FTE was implemented in a software medium able to aid the whole application subject.

For both functional and technological aspects a set of evaluation criteria could be considered as starting examples (Tab.1).

Table 1. Evaluation criteria for functional and technological evaluation.

Functional Criteria	**Technological Criteria**	**Economic Criteria**
Relative thickness Temperature stability Wear resistance Dimensional stability Relative weight	Simplicity Execution speed Technological processes involved Capacity used	Material costs General costs Man power costs Profit

3 Conclusions

The goal of the paper is to state the importance of evaluation in the engineering approach of products. Only an integral computer aided design process methodology can succeed, having as final result more efficient and rational decisions.

FTE's utility as a method was already proved by its capabilities in educational field and work is going on in order to complete registered data and to extend operational capability.

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