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DEFINITION OF PRODUCT PROFILE BASED ON INNOVATION MANAGEMENT

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Abstract: Due to globalization and increase of product complexity requirements, as well as with a customer tendency to prefer more simple and profitable solutions, design engineers must use up to date management tools, methods and systems in their practice in order to be competitive in the market. The education of design engineers has to react to these new professional requirements and excellence in management competence must be generated. This is especially important in area of innovations management as innovative products drive the company success. The education of mechanical engineering students in machine design can make a decisive contribution in obtaining technique and management skills necessary for later professional success.

This paper presents the definition of product profile based on innovation management, used in education process of design engineers at Mechanical Engineering Faculty, University of Nis.

Key words: innovation management, new education model, industrial product development

1. INTRODUCTION

Nowadays, there are two tendencies in the world market [1]: domination of customers' demands and market globalization.

Modern products must satisfy the customers' expectations and needs, down to the level of their individual requirements, which raises product differentiation and permanent innovation.

Increased competition in globalised market very important to quickly launch various quality products.

In the last decade, product delivery time was reduced by 60%, demands regarding product quality and functionality were increased by 50%, with a parallel increase of competition in the market (by approximately 50%), which in some cases radically reduced product cost. Within this period, the products lifetime was reduced by around 20% [2].

Nowadays, it is necessary to consider market needs, customer wishes, competition, enterprise development and manufacturing capabilities and draw conclusions from these considerations in order to define the proper product profile.

It is established that only 15% of product flops were caused by technical weak points of the product. The main reason for market flop (85%) was lack of orientation towards the market (wrong target system) i.e. improperly defined product profile. So it is clear that the proper product profile definition has a decisive role on product success.

In era when development and survival of an enterprise depends on productivity, quality, flexibility, monitoring the speed of innovation and success of the project, there should not be lack of understanding the terms such as "Invention and Innovation".

Invention relates to the creation of a new product. On the other hand, innovation involves the use of knowledge and

therefore is an efficient and economical use of invention. Innovation means successful new products, processes, services and organizational solutions. The study of Berth [3] (Fig.1) shows that the percent of success in development of innovative products, processes and services, is actually very low.

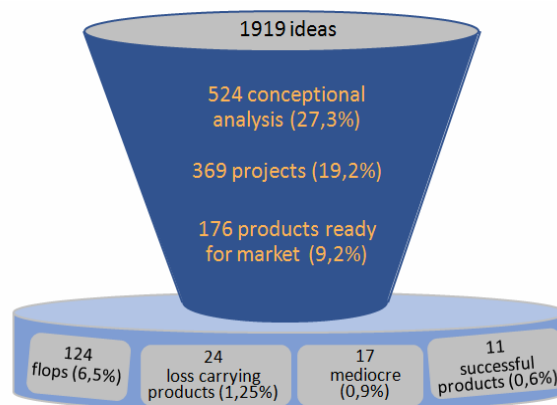


Fig.1. Less than 1% of ideas become innovation

Doctor Reinhold Bauer, historian of technology, found that innovation fails due to technical problems, the specific competitive situation, a misunderstanding of the potential users, and level of invention that is too high and unfavorable timing.

The aim of innovation management is to achieve a better understanding of product features, get successful products on fast, safe and economical way. New products guarantee a future benefit. Requirements presented to a future product cause an increase of prices and risks, challenging demands of development engineers and entrepreneurs.

Design engineers are not usually trained in innovations management, but due to reasons mentioned above it is

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necessary to implement such education into current curriculums. Paper presents innovation management implemented into product development curriculum in Mechanical Engineering Faculty, University of Nis and summaries experiences of the education results.

2. SITUATION ANALYSIS

The introduction of innovative products, processes and services is very complex and demands application of integrated development approaches, which rely on up-to-date development methods, processes and systems.

Implemented innovation management at Mechanical Engineering Faculty, University of Nis focuses on definition of product profile, as a critical point in product development process.

Beside the market analysis students are learnt to analyze their own enterprise (capacity, division of labor and workflow), the product (features, supporting services and profits), project management, as well as entrepreneurs themselves (their experiences, intentions and goals).

2.1. Company analysis

Each company should introduce various levels of competence analysis, which includes targets (enterprises, requirements and characteristics of the target market), planning (guidelines and regulations, planning, production and sales), process (flow work production process and the administration flow work) and results (circumstances, facts and situations).

The target level of company competence falls under subjective assessment, while planning and process levels can be assessed by objectivising methods. The results, falls under objective assessment. Students are learned that product planning starts with the target level. The direction company analysis is from bottom to top (from results to targets), while direction of operation of modifications is performed from top to down (Fig. 2).

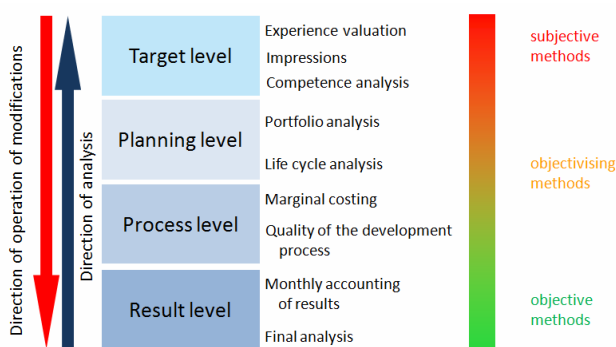


Fig.2. Company competence levels

The company analysis is performed via the competence star of the company (Fig. 3). Competence star is a tool for assessing tangible and intangible assets or chances of a company. Competence star is based on the principles of the competence level, competencies division in internal and external issues, and subjective evaluation.

The purpose of the stars competence is to have control over the complex structure of the company and its visualization features.

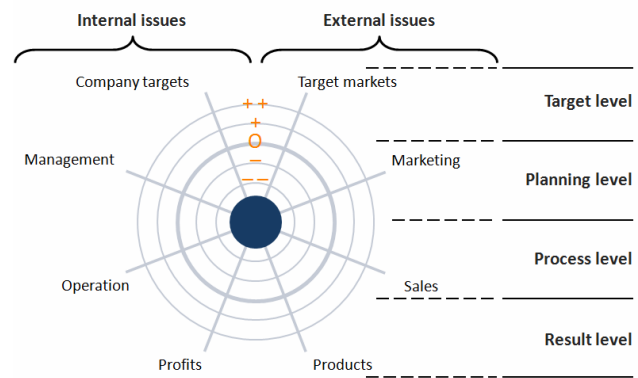


Fig.3. Competence star of the company

2.2. Product analysis

For successful realization of product it is necessary to analyze the product costs and its life cycle. Cost analysis includes cost estimate, which may be individual costs, overhead costs and special individual costs.

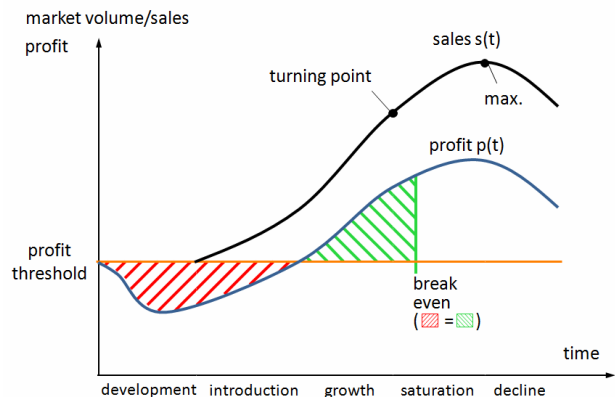


Fig.4. Product lifecycle

Life cycle analysis (Fig. 4) allows the conclusion signs of aging turnover rate of products. The course of the product life cycle depends on many factors such as: investment planning, development, production start, market introduction, planning start, duration of development, delays, market volume, market demands of the marketing efforts, product, pricing, communication, distribution behavior of competitors, market share, competitors' products, etc.

Analysis of total turnover leads to the portfolio analysis. Portfolio analysis is an instrument of strategic planning. Results are displayed in a simple graphic representation of complex mutual relations. During the course in product development students are trained in following analysing dimensions:

- Market growth rate towards relative market share (Boston Consulting Group),
- Market attractiveness towards relative competitive advantage (McKinsey)
- Competitive position towards phase of the product life cycle (Arthur D. Little)

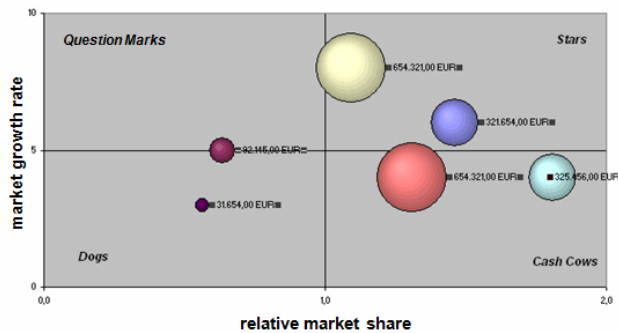


Fig.5. Boston Consulting Group portfolio analysis

Portfolio analysis should define product position on the market. Assess of the product status means to analyze the appeal of applied technology, the position of the competition, the appeal/market growth. The assessment is based on objectivity, the reference for sale, reference profit, a measure of objectification, a comparison of product characteristics. Visualization of product assessment is performed in portfolio matrix (Fig. 6).

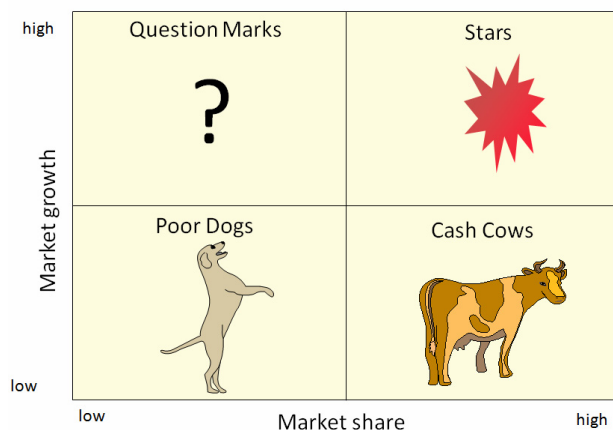


Fig.6. Portfolio matrix

As it can be seen from Fig. 6 there are four fields in the portfolio matrix:

1. **Question-Marks:** new products with weak position and strongly growing activity
2. **Stars:** great market growth, important market share. The revenues still must be re-invested for extending the capacity
3. **Cash-Cows:** develop from stars in case of decreasing market attractiveness. Growth investments are no longer required; profits can be used for financing new products
4. **Poor Dogs:** develop from unsuccessful question-marks, failing stars or old cash-cows. Low market share, low market attractiveness, low profits → strategy: withdraw!

Based on product position in the portfolio matrix there are several possible strategies for determination of product future, i.e. should it be withdrawn (Poor Dogs), kept (Cash-Cows), promoted (Stars) or selected (Question marks). Product portfolio matrix corresponds to product

lifecycle. As a matter of standard a product passes the portfolio fields from Question marks over the Star and Cash-Cows field to Poor Dogs. The company success relies on Question marks and Stars because if there are only cash-cows in portfolio matrix, the successors are missing after these products have been discontinued.

Product analysis is performed not only the abovementioned criterions, but product competences are evaluated also. Again the competence star (Fig. 7) is used again in order to locate the product strong and weak points. The competence star of products is a “subset” of the competence star of the company. As far as emphasizing the product competences is concerned the same is applicable as referring the company competences.

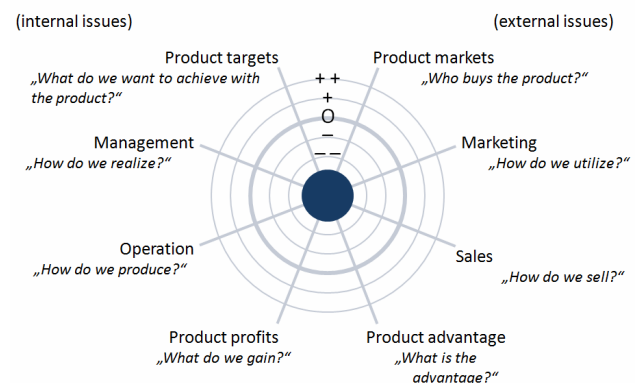


Fig.7. Product competence star

2.3. Planning of turnover and product competence

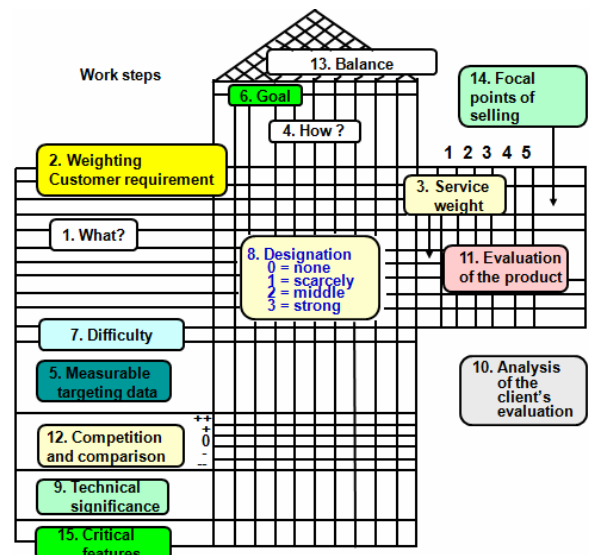


Fig.8. The House of Quality

One of the most important thing students are learnt is that it is necessary to set innovative goals and strategies. From the previous analysis stages they must be able to define what is to be achieved/ gained with a new product. Only the introduction of new products on has a market-medium-term effect on turnover. The long-term effect on turnover is achieved by venturing in a new business area-

In product planning One of the methods of product planning students are trained in is Conjoint analysis. The Conjoint Analysis shows, which combination of attributes a product must have in order to maximize the customers advantage. It enables the optimisation and modulation of product profile even in saturated and new markets.

A useful tool implemented at Mechanical Engineering Faculty, University of Nis is Quality Function Deployment as it enables deduction of product requirements from the customers' requirements.

The House of Quality is the first matrix in a four-phase QFD (Quality Function Deployment) process. It's called the House of Quality because of the correlation matrix that is roof shaped and sits on top of the main body of the matrix. The correlation matrix evaluates how the defined product specifications optimize or sub-optimize each other.

Target positions rival portfolio (Fig. 9) is used to position own products compared to the ones of competitors and to complete the actual presentation by expected future positions.

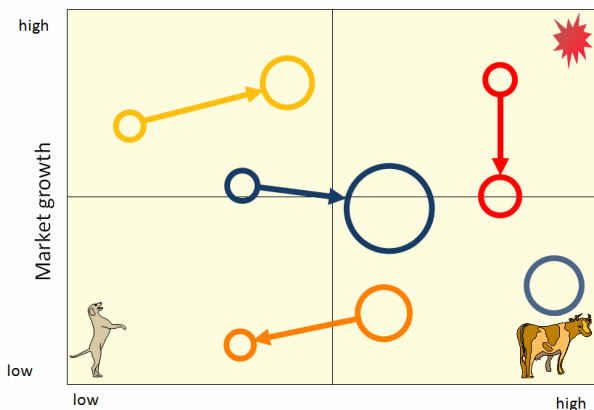


Fig.9. Targeted portfolio matrix

Beside targeted portfolio matrix, students use the targeted competence star in order to plan the targeted product competences. Target competences are abilities, knowledge, means which are required for reaching the innovation targets. In that process it is necessary to pay attention to how the competences are linked up, as they usually depend on each other mutually. Competence mix must be and stay in harmony; isolated improvement of single competence characteristics does not make sense. So students than start with the weak product points when making improvements, as those competences, which are the most unpleasant, form the bottleneck.

3. DEFINITION OF PRODUCT PROFILE

Innovation directives are answering to main question in product profile definition - what directives does product have to fulfill in order to secure the economic survival of the company. They naturally include the target system definition, which in turn contains the requirements to supplier and customer value. In addition, they also define includes sales and profitability targets, investment and schedule as well as the innovation framework.

In definition of product profile it is uttermost important to orientate the in regard to internal (technology) and external (market) factors.

Orientation in planning at Mechanical Engineering Faculty, University of Nis is performed by Orientation matrix (Fig. 10).

Orientation matrix divides the „innovation world“ into 9 fields. The more distant the product profile from the origin is, the bigger are the risks.

Incremental innovation occurs in adjacent areas of an orientation and constitutes around 15% of all innovation.

Radical innovations occur in remote areas of an orientation matrix on totally new market and a complete new technology They include 5% of all innovation, but they are accompanied by total risk. Radical innovation can cause innovation/progress, meet the requirements of customers who were not so far or have not been met because of technical reasons.

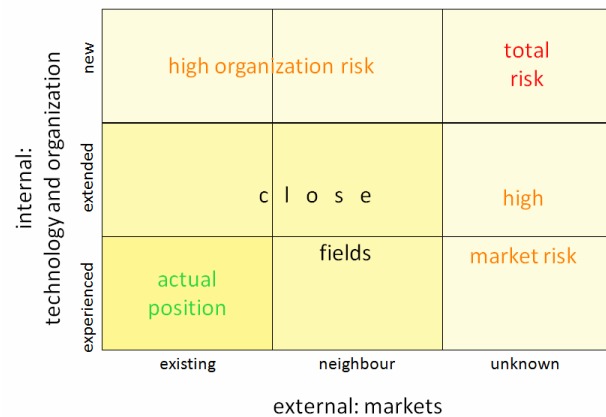


Fig.10. Orientation matrix

Orientation decision for new product is not difficult as decision is already narrowed down by risk values in orientation matrix. It is important to emphasis that in product profile definition a technical solution is not yet required. Innovation strategy results from the decision for one of the 9 fields in and depends on:

- innovation targets,
- innovation directives,
- innovation competences

Besides previously described tools and methods for successful definition of product profile, by innovation management approach, students are trained in creativity techniques, elaboration potential and social competences in order to improve their competence profile prepare them for realistic industrial environment.

3.1. New educational model implementation experiences

Since winter semester 2006/07, Mechanical Engineering Faculty in Nis implemented innovation management into design engineer's education curriculum. An integral part of the course is a realistic development project defined by a regional industry.

One of the tasks of the project is to define the new product profile, which was performed by application of tools and methods of innovation management.

The project work, which is an integral part of education model, produced patentable product developments, while the product presentations were to a professional standard.



Fig.11. Student team WAFIPO and CFS prototype

It is observed that graduates of this subject, who carry out their Diploma work in industrial companies, are able to translate their knowledge directly and successfully as the relevant feedback shows. Also the initial evaluation discussions with Graduates of this module showed a very good acceptance by all kinds of industrial companies.

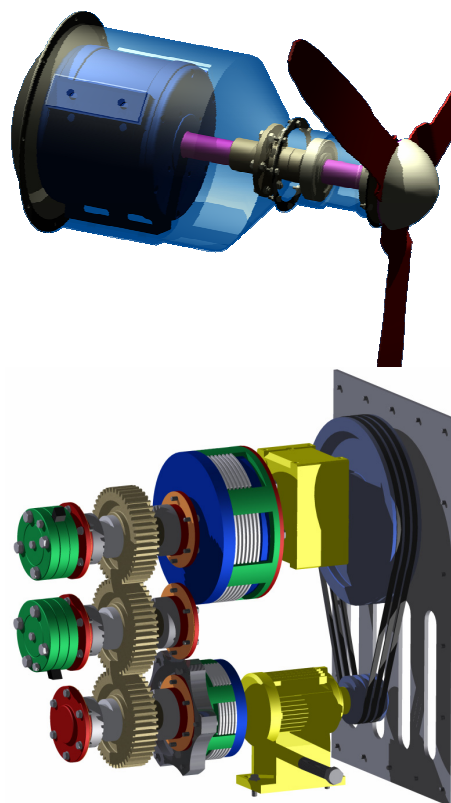


Fig.12. Student teams The Future Team and ABM products

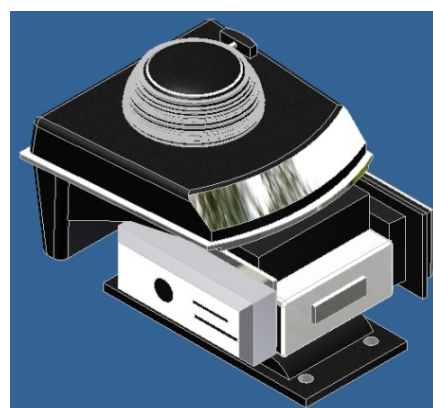


Fig.13. Student team The Innovators product

4. CONCLUSION

Based on previous it can be concluded that innovation management provides a systematic approach to definition of product profile. Such approach decreases the risk of market flop as most of the market flops are related to poorly defined product profile. Such approach was also implemented into education of design engineers at Mechanical Engineering Faculty, University of Nis. Integration of innovation management into curriculum increased the success rate of development projects performed by students in the course of Integrated Product Development.

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