

PRODUCT INNOVATION

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Abstract

Based on the scheme of the innovative product creation and its competitiveness "K" after taking into account the innovation coefficient from information system I_K , for which the following applies: ($I_K = K$), the following will apply for arbitrary innovative product:

The following will apply for the four innovation levels:

- The first innovation level ($I_K > 1,1$),
- The second innovation level ($I_K = 1,1$),
- The third innovation level ($1,1 > I_K > 1$)
- The fourth innovation level ($I_K \leq 1$)

Key words: *innovation, innovative product, quality of innovation, innovation coefficient, competitiveness.*

Introduction

The author of the term innovation is the economist Joseph A. Schumpeter (1889 - 1950). He analysed the business conditions in which a company has interest or may realize "the new combinations of developmental changes" – the innovations. These result from developmental changes in production and in the market and lead to an enlarged reproduction of the production process.

Despite varying views on social systems, public and private companies will exist for a very long time, if not forever. As they will exist, there will also be an effort to improve their results.

The aim of our study was to replace spontaneous competition by planned innovation in the process of product innovation, which should be some time ahead of spontaneous competition.

Based on a simplified model of the food products innovation and defined levels of innovation, modify the innovation process schema for any product and determine when it is necessary to innovate the product as well as the related technologies, depending on the " I_K ".

Development of the mechanical-technological equipment and its impact on product innovation

There were several factors influencing the development of the new technologies and equipment, derived from the state of the art in science disciplines and also from the experience. In particular, food chemistry, food physics, economics, sociology, engineering sciences and technical disciplines.

Whatever the original intent of the innovation, we necessarily hammer out the innovative product by following up a comprehensive approach of the innovation process. In particular:

- by application of new and improved unit operations in the proposed technology (process),
- by application of advanced principles in the design of machines and their functional parts or complete production lines (technologies),
- by application of modern forms of direct control of the production process, i.e. operation of individual machines or complete lines with control elements (control),
- by improving organizational, sales and marketing operations.

There are various definitions of innovation:

* Innovation is a new or significantly improved product (or service) introduced to the market, or a company introduced a new or significantly improved process. (Statistical Office of the SR, 2012)

* **Product innovation is the introduction of a new product or service to the market, or a product or service with significantly improved properties, such as improved software, user acceptability, components or subsystems.** (Statistical Office of the SR, 2012)

* Innovation is a specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service. (Peter Drucker „Innovation & Entrepreneurship“, 1985)

* Industrial innovation includes the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment. (Chris Freeman „The Economics of Industrial Innovation“, 1982)

* „Innovation is a man-targeted and proposed change related to products, production processes, work and production organization and management methods.“ (www.ratsk.sk/inovcnepodnikanie/clanok.php 2012)

The simplest and most accurate definition of innovation was expressed by Cooper, **R. D. in 1998:**

* **“Innovation involves the use of knowledge for the generation and practical application of a new benefiting idea”..**

Competition and the effort to maximize benefit (profit) is not shown directly, but in private companies actually creates feedback that makes (in the case of the innovative) search for a new competitive solution. Any company that neglects this fact, either due to lack of funds or for other reasons, necessarily goes bankrupt. Fear of bankruptcy makes the most competitive companies continuously innovate products, or at least have a prepared project solution of the innovation that the company is able to make in a short time. Such feedback does not operate in state-owned enterprises – the state protects them by its regulatory actions instead of innovation. These regulatory mechanisms are primarily aimed at protecting the market from other competitors but also at protecting consumers, increasing employment and the planned economy suited for it etc.. Despite the many benefits of such companies, these have one big disadvantage – they don't have functional feedback to innovation - so self-regulation does not work in these companies - which leads to an intolerable waste of wages, energy and so on. The management of these companies is primarily interested in their own high wages and in participation in the redistribution of profit.

Innovation steps and economic benefiting

Prior knowledge and observations show the following for the innovation in government as well as private enterprises:

- The innovation management process should contain some element of its system. We labeled it "I_k" and called it the innovation coefficient, which reflects the innovation degree of the product.

- We have integrated the "I_k" element into the innovation process shown in Fig. 1 in such a way as to produce feedback indicating a need for a new innovation in the closed cycle.
- The innovation has to be managed by a qualified and interpersonally capable and responsible manager with a visionary outlook, zealous for the cause.

In search of the element "I_k" we now assume the most effective coercive element of innovation, which is the competitiveness of the innovative product against a previously produced (supplied) product. Let the competitiveness of innovative product be "K". And the approach defines it as follows:

$$K = \frac{\text{The price of a presently produced an unrivalled product}}{\text{The price of the innovative product}} \quad [1]$$

Suppose in both cases it is the same type of product of the same quality and the same unit of measurement and that the minimal price of an innovative product is equal to the sum of all costs incurred in connection with the innovation, production and distribution of the product to the consumer per one product (mainly the costs of: equipment –depreciation of machinery and equipment, energy, raw materials, wages, maintenance, fines for polluting the environment and some other environmental disturbances, payment of compensation for occupational diseases etc.), then for "K" this will apply:

$$K = \frac{\text{The price of a presently produced and unrivalled product}}{\text{The cost of one innovative product}} \quad [2]$$

For practical use it is necessary to further describe the cases where: $K = 1$, $K < 1$, $K > 1$.

If $K < 1$, - The innovation is not suitable. Production of the innovative product should be stopped immediately (if already started) and the innovation cycle repeated.

If $K = 1$, - The innovation only compensates the previous product. It is a waste of time, it is necessary to immediately repeat the innovation cycle (find a better solution).

If $K > 1$, - The innovation is appropriate - it brings a net income (profit) for the company that has implemented it. Instant replay of the innovation cycle is not required.

By such a division we get four levels of innovation. In this "K" definition, profit is not used. However, it is important to achieve a profit, because it will be used in the future to invest in further innovations. No manufacturer or dealer does publish how much of the profit is included in the product. It is possible to calculate it for a state company, but it may be distorted by paid salaries and remuneration, which we can cut in the case of bad results. In general, as a reasonable profit is considered about 10% of the product price. Such income will give us the re-investment funds necessary in the innovation process and therefore if we want it to succeed, we must reckon with it.

For the innovation steps will then apply:

- The first innovation level ($K > 1,1$)
- The second innovation level ($K = 1,1$)
- The third innovation level ($K < 1,1$)

The objective of the economic policy of each company is to achieve and surpass the most advanced companies. This means that we have to approach the local as well as global perspective of the coefficient "K". Therefore we need to divide the case when $K < 1,1$ into two parts from the local perspective:

- The first innovation level ($K > 1,1$)

- The second innovation level ($K = 1,1$)
- The third innovation level ($1,1 > K > 1$)
- The fourth innovation level ($K \leq 1$)

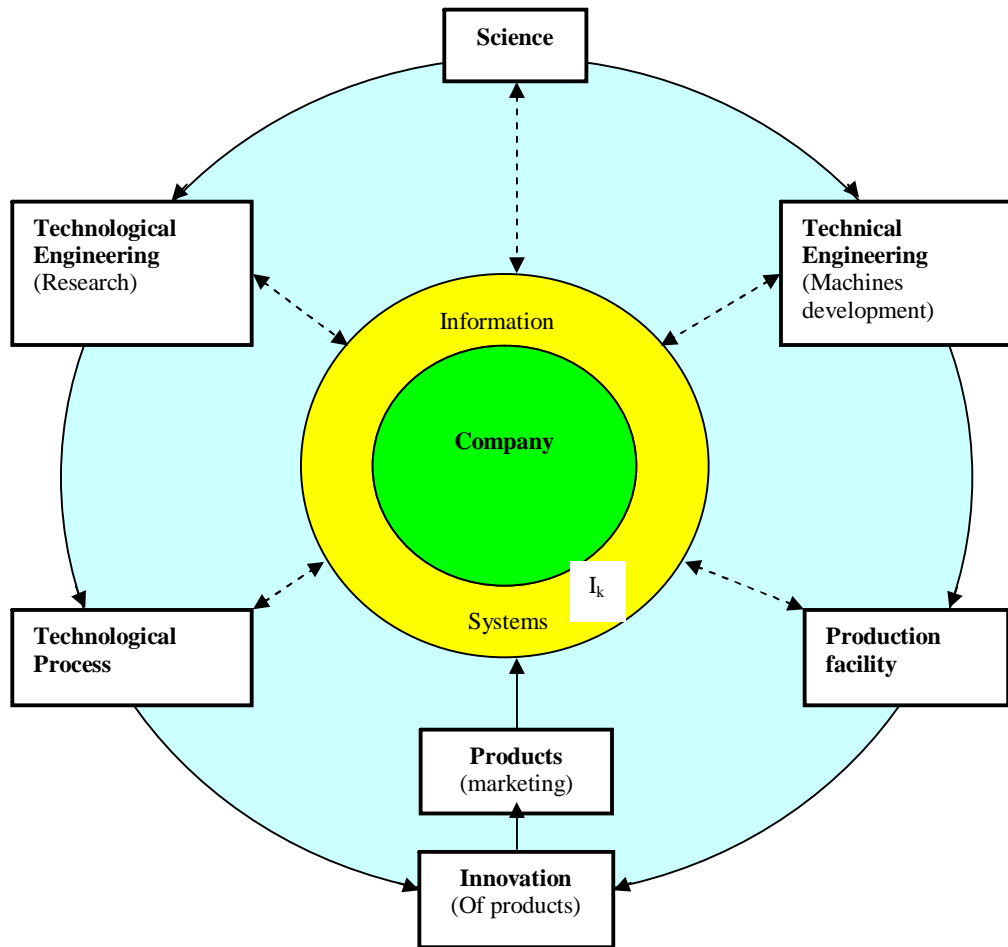
According to this classification we will know exactly what the level of our innovation is, and what advantages and disadvantages can be expected from its implementation. Moreover, we know exactly who has participated in this innovation and by how much (beginning with companies - science, research, development and manufacture, and ending with individuals). So we know exactly how to retrospectively split all the advantages of the profit or disadvantages of the loss associated with the innovation. The innovation is always related to a particular product, regardless of whether it is the innovation of a process, technology, organization, sales, marketing, or combinations thereof. It is common practice that the cost of the research, the development and the production of the new technology are included in the price of the new technology, which is indirectly projected into the innovation's product price in the form of depreciation. Other costs are directly included in the price of the product for the final consumer (user).

"K" is actually information about the economic performance of our product production, which varies depending on the change of values in the relation (2). Since the individual variables in the relation (2) change their values over time, "K" will also change its value over time. This means that in order to accurately control the innovation upgrade, we need to constantly monitor the value of "K". It is apparent that for the job of monotonous tracking of "K", it is appropriate use an information-computing system, which is still ever more expanding the mental capacity of the human society. Include "K" into the information system and denote the selected information about "K" from the information system as " I_K " and name its value the innovation coefficient. **Therefore the following will apply:**

- The first innovation level ($I_K > 1,1$)
- The second innovation level ($I_K = 1,1$)
- The third innovation level ($1,1 > I_K > 1$)
- The fourth innovation level ($I_K \leq 1$)

Based on the above, we can schematically illustrate the innovation of any product as follows:

Figure 1: Scheme of an arbitrary product innovation process



Note that the definition of " I_k " was based purely on economic terms - that means that all the advantages and disadvantages must also be expressed in economic terms, to be appropriately redistributed to subjects involved in the product innovation process. This means that in order to integrate e.g. the ecology into the innovation management process, firstly we have to translate its requirements to a known language used by economics – e.g. disturbances in ecology have to be expressed in the costs needed to remedy these defects. Similarly, the adverse effects of the innovation on human health must be expressed in terms of the costs of: - treating occupational diseases, - sick leave, - permanent disability, - and so on, and then they can be considered as a cost item in the product price.

The ideal case is when the demands of sociology and ecology are zero, but this can occur only in the case that the innovations produces no waste and that workers are not in direct contact with raw materials, products, waste and so on. Thus the innovation should not only be without waste, but it should be also fully automated. Often we are faced with the fact that for the producer of the ecological disturbances it is easier to pay a fine than to make the innovation - but if it is in a conflict with the interests of the public society, the society is not prevented from making new social laws and measures to increase the penalty to the extent that it is more convenient for the producer to make the innovation.

Therefore it follows that it will be economical tools that will indirectly serve as basic management of the innovation process and thus of the development of the machine equipment. The

" I_K " coefficient will therefore serve as feedback with an economic consequence, forcing everyone involved in the innovation to approach the innovation in highest quality, because the profit will be redistributed for quality in the case that $I_K > 1$, in the case $I_K = 1$ - nothing and in the case $I_K < 1$, 1 - the extra costs will be redistributed in the form of financial penalties - which can lead to the liquidation of the company.

Conclusions

In History, a seven years innovation cycle had been used. If the product has not undergone the innovation during the period, it had been placed in a lower category, which also leads to a reduction in the product price. Currently in the Slovak Republic innovations are evaluated biennially (in accordance with the guideline of OSLO international methodology). The innovation cycle is more and more reduced and it is quite reasonable to ask what the innovation cycle should be and whether it will continue to shorten, and what should be the stimulus for innovation in the case that the previous innovation was already of the first level?

In accordance with the scheme of the innovation process, it can run continuously, but due to cost optimization it should be implemented when the new information knowledge impulse related to the production and innovative cycle occurs. The impulse can occur anywhere in the innovation process; in science, research, production, organization, business, and marketing, or in the consumer sector of the society. However the strategic management department of the manufacturer decides if the innovation impulse will be implemented into the production.

In accordance with the definition of innovation (Cooper, R. D., 1998): "the use of knowledge for the generation and practical application of a new benefiting idea", the fourth level can be modified because for $I_K \leq 1$ the benefit is uncertain. Therefore the following will apply:

- The first innovation level ($I_K > 1,1$)
- The second innovation level ($I_K = 1,1$)
- The third innovation level ($1,1 > I_K > 1$)

i.e., the levels of innovation are not dependent on the environment in which they originated (e.g. in research, development or manufacturing, etc.), but on the benefits they bring. The producer primarily determines the distribution of benefits - as investor and implementer of the innovation - it depends on the producer how much of the benefit is left to the end user of the product, how much is dedicated to science, research and development, and if the manufacturer is not also the supplier of the product to the end user, how much it redistributes to traders and possibly to the other participants in the innovation process.

In search of " I_K " we have expressed the requirement: "The innovation has to be managed by a qualified and interpersonally capable and responsible manager with a visionary outlook, zealous for the cause".

In private companies, when the manager (owner) does not have these properties, the market will solve it. The market will remain only the most able.

State-owned enterprises need to achieve a similar effect on managers as is applied on managers in private companies, i.e.: "The liability for the negative results of the company in the required amount of the own assets." The manager's results should be evaluated on a regular basis, at least once a year, and if he does not have the desired results - it should be operationally changed and he should pay potential damages.

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