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CLASSIFICATIONS OF INNOVATIONS: APPROACHES AND CONSEQUENCES

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Abstract

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Currently, innovations are perceived as a life blood of businesses. The inevitable fact is that even if the innovations have a potential to transform the companies or all the industries, the innovations are high risky. Even though, the second fact is that in order to companies' development and their survival on the markets, the innovations have become the necessity.

In the theory, it is rather difficult to find a comprehensive definition of innovation, and to settle down a general definition of innovation becomes more and more difficult with the growing number of domains where the innovations, or possible innovations start to appear in a form of added value to something that already exist. Definition of innovation has come through a long process of development; from early definition of Schumpeter who has connected innovation especially with changes in products or production processes, to recent definitions based on the added value for a society. One of possible approaches to define the content of innovation is to base the definition on classification of innovation.

In the article, the authors provide the analysis of existing classifications of innovations in order to find, respectively in order to define the general content of innovation that would confirm (or reject) their definition of innovation derived in the frame of their previous work where they state that innovation is a change that leads to gaining profit for an individual, for business entity, or for society, while the profit is not only the accounting one, but it is the economic profit.

The article is based especially on the secondary research while the authors employ the method of analysis with the aim to confront various classification-based definitions of innovation. Then the methods used are especially comparison, analysis and synthesis.

added value, classification of innovations, competitive advantage, definition of innovation, innovation

In present which is characterised with a strong competition on both, national and international level, the innovations became a necessity for maintenance of economic development and competitiveness of companies. One of the oldest definition of the term innovation states that innovation is a successful exploitation of new ideas (Harbour and Blackman, 2006). But it is obvious that this definition does not meet concurrent perceptions of innovation's content in many perspectives. In literature, it is possible to find a range of various definitions while almost every author works with his/her own definition of innovation (see Tabas, Beranová and Polák, 2010).

Innovation is not a separate activity but it is a process, respectively processes (e.g. Greve, 2003; Whitfield, 1975) while in order to meet the core of innovation every partial process has to be finished successfully. Historically, the first definitions of innovation (Schumpeter, 1934) consider especially the changes connected with products of production processes. Only later the changes in organization of work or in managerial methods, but only on the company level at that time are implicated in the content of innovation. The extension of innovations' impact out of a business entity is considered afterwards. These and other aspects create a framework or frameworks of possible classifications of innova-

tions when some of them emphasize a multi-disciplinarity of innovations and innovation processes more, and some emphasize it less (Trienekens *et al.*, 2008). Even if definitions of innovation's content are often based on various principles, it is possible to find there common items; some definitions are base on a requirement of novelty, the others work with an increase in value for customer or for society as a whole.

On the most general level, an innovation may be also spoken as something that adds value to nearly anything. But in order to be allowed to speak about innovation, the condition of successful implementation in practice or realization on a market has to be fulfilled at the same time. A range of definitions of innovation is also base on classifications of innovations while it is possible to find a lot of taxonomies classifying innovations according to various criteria in the literature. An evolution in perceptions of innovation is clearly visible in these classifications systems where the oldest classifications are strictly focused on the product innovations classification. Any classification system has to function as a mean to an end and ton and end in itself. A good classification has to serve some useful purpose which should be clear and tangible (Onkvisit and Shaw, 1989).

METHODS AND RESOURCES

A comprehensive definition or description of what is possible to consider as an innovation is more complicated than it seems to be. That is why some authors (e.g. Mahdjoubi, 2009) use classifications of innovations at defining content of the term. In theory and in practice, there exist various types of innovations and various approaches to innovations. In addition to the technical innovations which are based especially on a research, it goes about non-technical types of innovations as well, i.e. for example innovations of organizational processes and management, innovations of business models, innovations of market etc.

Objective of the submitted paper is to compare the approaches to classification of innovations and to discuss suitability and consequences of such a classification. The authors are focused especially on finding similarities and common items in various classifications and approaches to classification of innovations. Then the authors compare existing taxonomies, concepts of categorisation and classification of innovations that the literature works with. Then the paper is based mainly on the secondary research when the authors employ the methods of comparison, analysis and synthesis. The outcome and contribution of the paper is especially systemization of various approaches to the problem of innovations classifications from the viewpoint of particular business branches and consequent synthesis of these approaches. This comprehensive perspective on the classifications of innovations should be used as a basis for evaluation of innovation potential of small and medium-sized enterprises in the Czech Republic when determination of a concrete type of innovation is a key ground of assessment of factors influencing the innovation potential of companies while it is possible to assume that these factors would differ among particular types of innovations.

RESULTS AND DISCUSSION

Actually, categorisation of innovations is possible to regard as an enlargement of their definitions. Innovations are likely to classify according to many criteria, and there exist various classifications of innovations in both, in the theory and in practice as well. In the context of history, absolute majority of innovations classifications is linked to product innovations (Subramaniam and Youndt, 2005). Classifications connected to the innovations of product as the oldest are currently supposed only as the subclassification of the basic categorisation system of innovations which distinguishes between two types of innovation. These are:

- Product innovations.
- Process innovations.

Currently, this classification may be superodinate to categorisation of innovations into incremental and radical which is connected only to product innovations in the oldest studies. E.g. Marquis & Myers (1969) introduce three types of innovations as follow:

- Radical innovations.
- Incremental innovations.
- System innovations.

In principle, the system innovations within this categorisation represent an analogy to that is introduced as process innovations in current terminology. Gradually, based on the innovations categorisation according to Marquis and Myers (1969) the fundamental classification into product and process innovations has been originated while both, product innovations as well as process innovations are subsequently divided into incremental and radical. It means that every product innovation can be incremental or radical just as the innovation of process. As of the ratio of innovations classifications occurrence, in the literature the product innovation classifications are still prevailing.

Innovations of products are consequently elaborated by Onkvisit and Shaw (1989) who add the effect of innovation on consumer habits or behaviour into the sub-classification of innovations. In accordance with this criterion, the classify innovations into:

- Continuous.
- Dynamically continuos.
- Discontinuous.

Probability of disrupting customers' habits is the lowest at the continuous innovations because these innovations are represented by a relatively minor, "cosmetic" change in a product. More disrupting effect is characteristic for the dynamically continuous innovations because the change in a product is more

related to its function. Third, discontinuous innovations are perceived as a completely new product with completely new functions that results in the development of new consumers' patterns of consumption (Onkvisit and Shaw, 1989).

It is obvious that this classification has some inadequacies mentioned also by its authors. The reason lies especially in that this categorisation not every innovation is clearly classable[1].

So, the primary categorisation of innovations mentioned above speaks on the incremental and radical innovations. Radical innovations bear a significant, pulse and far-reaching transformation of attributes of innovated subject. In the opposite, incremental innovations represent a continual process of changes in single attributes of an innovated subject. This way, the categorisation of innovations into incremental and radical follows a rate of change in an innovated object.

Another way of innovations' classification in accordance with the rate of change in innovated object is represented by the approach of Valenta (2001) who elaborates the primary two-group categorisation into nine innovations degrees. Valenta (2001) divides these nine degrees of innovations into two phases then; the first phase consists in prevention and elimination of production losses and damages or in purposeful exploitation of existing elements of a production entity. To the first phase belong following innovations degrees:

- 0th degree: Regeneration – complying with standards of a technology.
- 1st degree: Intensity – higher employment of some agents.
- 2nd degree: Reorganisation – transition of operations/materials at a workplace (Valenta, 2001).

The first phase is an initial point of innovation management that brings effects without any expense while every company member should participate on it. Without the first phase innovations it is not possible to realize the innovations of the second phase (Valenta, 2001).

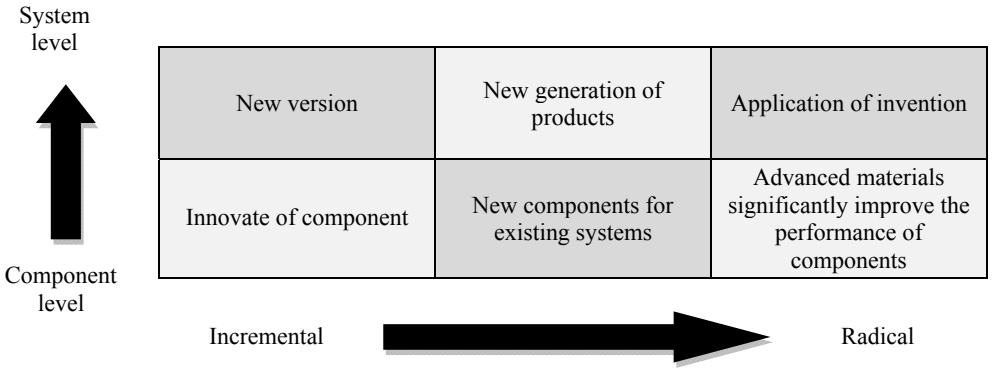
The second phase of innovations is based on detection, creation and exploitation of the inside and outside company reserves possible, and on achievement of increase in productivity and prosperity, i.e. the maximization of the value for customer. The second phase of innovations covers the innovations degrees as follow:

- 3rd degree: Change in volume.
- 4th degree: Qualitative conversion – change in an external quality.
- 5th degree: New variant – change in one or more functions of technological process.
- 6th degree: New generation – change in all functions.
- 7th degree: New category – change in a conception.
- 8th degree: New race – change in principle (e.g. exploitation of new materials).
- 9th degree: New strain – chance in an approach to the nature (e.g. nanotechnology).

Innovation of the second phase are prepared and realized by specialists and managers on each level of management. Here the investment expenditures are inevitable while in some situations these investments are of indispensable amounts spent (Valenta, 2001). Categorisation of innovations into their degrees is important from the managerial practice point of view as well while every innovation may be subsequently classified as positive innovation or negative innovation in words of its impact on the innovating subject or its surroundings (Konečný, 1999).

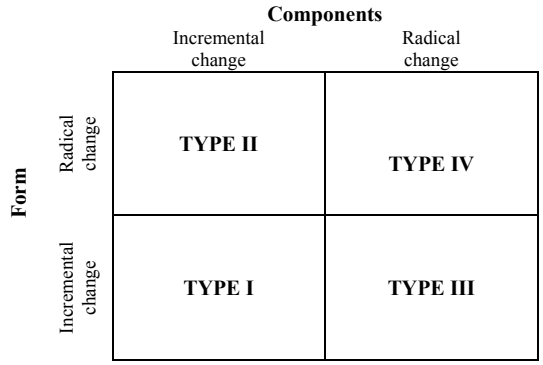
Analogy to the innovations degrees according to Valenta (2001) is possible to be found in dimensions of innovations according to Tidd et al. (2007). These dimensions are presented at the Fig. 1.

A rate of change brought by an innovation and a rate of innovation impact on consumer is synthesised in the matrix system of innovations classifica-



1: *Dimensions of innovation*

1 E.g. if the product is modified substantially it is quite unclear whether it is only an extension of the existing or it is something completely new.



2: *Matrix system of classification of product innovation*

tion (Harbour & Blackman, 2006). This system (see Fig. 2) distinguishes changes in form and changes in components while both are subsequently categorized into incremental and radical changes.

Based on the matrix it is visible that innovations of the type I represent only minor changes in form and in components. This type of innovations has only minimal influence on the purchasing habits of consumers. Innovations of the type II are based on radical change in form but only elementary change in internal components. Relatively small change in form can have disproportional impact on the consumers' habits. Type III is characterized by substantial change in components but only by a minor change in form while Henderson and Clark (1990) call this type of innovations as modular innovations. Innovations of type III require a substantial change in concept and knowledge. Then, type III innovations have a real potential to interrupt existing market substantially and they also represent significant threats and/or challenges to established entities. With regard to a possible impact of the type III innovations on the whole market, relative high probability of a change in consumers' habits exists there. Innovations of the type IV which is commonly called radical innovations in the literature is described with both radicals, radical change in form as well as the significant change in components. This type of innovation creates completely new markets or it may have very negative influence on existing markets (Harbour and Blackman, 2006). Tidd *et al.* (2007) work with rather similar classification. These categorisations both follow the foregone classification of innovations used by Abernathy *et al.* (1983). In this context, they classify innovations into four groups which are:

- Architectural innovations.
- Market niche innovations.
- Regular innovations.
- Revolutionary innovations.

In the opposite, e.g. Ross (2009) employs only three types of innovations which are incremental innovations, architectural innovations and radical innovations while he describes each group by four characteristics defining changes in components, in functions, in principles and in value.

Li *et al.* (2010) are focused on the incremental and radical classification of innovations in their work as well, but they call the incremental innovations as exploitative and radical innovations as exploratory. Exploitative innovations are designed to improve existing situation while companies' exploitative innovations mostly improve standing design, broaden existing knowledge, extend and enhance available product lines, increase the efficiency of existing distribution channels and provide existing customers with better service. Radical, exploratory innovations here are implemented in order to overcome existing limits. Exploratory innovations offer new design, create new markets and/or market segments, develop new distribution channels and provide new customers with services. Exploratory innovations tend to gaining and creation completely new knowledge and lead to depart from existing knowledge.

Both, exploratory and exploitative innovations improve the performance of company but each in different aspects. Exploitative innovations increase company's performance in short-term perspective and make current revenues higher. Exploratory innovations have a long-term effect in the sense of increase in company's competitiveness and therefore an increase in long-term income or potential added value for the society as a whole (March, 2001).

Currently, among a range of various classifications of innovations, the most frequent and adopted generally on the international level it the classification of innovation according to OECD and Eurostat (2005) which specifies product innovations, process innovations organizational innovations and marketing innovations. Product innovations are concerned with goods or services which are new or substantially improved in their technical parameters, component and/or materials, implemented software and other functional characteristics. Process innovations include new or improved production approaches and technologies, approaches to supply etc. while it should be a substantial change in technology. Marketing innovations represented by marketing methods aggregate a substantial change in product design and its package, in product establishment on a market, or in price policy. Organizational innovations then represent new methods of organization of business activities, organization of external relations and ordering of working place as well. Both the description of marketing innovation and description of organizational innovation inevitably lead to a conclusion that these two types are closely connected, respectively are the partials of process innovations. Then the authors regard this detach of them separately as controversial.

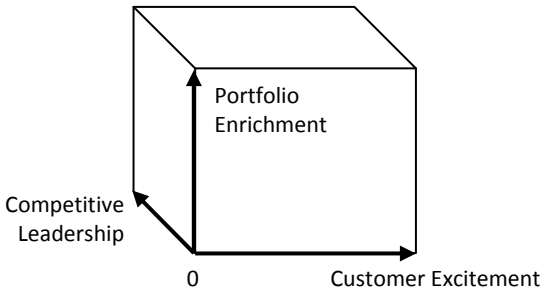
Hollander (2002) defines the content of each type of innovations in accordance with the OECD and Eurostat mentioned above in such a way where he conform each type of innovation to a necessity of answering customers demand. As of the logic of innovations categorisation into incremental and radi-

cal, this point of view may be applicable almost only on the incremental type of innovations. If there is an incremental innovation, then a customer knows the innovated object and therefore he/she is able to demand its change somehow. In the opposite, radical innovations are mostly based on application of a new idea on a market. That is why it is necessary to face a probability that such an innovation would not be accepted by this market, i.e. this innovation does not reflect an existing demand. It is also necessary to assume that if a completely new product, process, market or organization is submitted, it is almost sure that without a broaden awareness of it, a demand for it would not exist.

As a consequence, a need of demand reflection in an innovation it is not possible to agree entirely. Nevertheless, a possible classification of innovations comes out from the relation to a consumer. This classification system is based on the innovation strategies according to Bowonder et al. (2010) who work with three strategic dimensions of innovations which are as follows:

- Customer excitement.
- Competitive leadership.
- Portfolio enrichment.

This way, the three-dimensional space is created where the infinite of points representing the infinite of combinations of a rate of these strategic dimensions exist. Therefore the theoretical infinite of innovations' types may be followed here. This innovation space is shown at the Fig. 3.



3: *Three basic dimensions of innovation*

Even if this approach to innovations' classification containing the infinite types of innovations is not very common, and the strategic dimensions have primarily not been established for a purpose of innovation classification and Bowonder *et al.* (2010) use them in order to determine the innovations strategies, this concept is basically applicable on the innovations categorisation as well. At the same time, it is clear that this approach corresponds with the first classification of innovations into incremental and radical innovations; i.e. incremental innovations are placed closer to the origin of coordinates while the radical innovation would represent a maximization of the illustrated dimensions (axis). This approach also markedly covers division of innovations into product and process innovation while it is possible to place the marketing and organizational innovations there as well.

Other multidimensional model of innovations' classification includes innovations of product – process, incremental – radical innovations, administrative – technological innovations (Eris and Saatcioglu, 2006). This model basically creates the three-dimensional space as well, and within this space it is also possible to mark (to place or to find) any innovation, of any form or type. The illustration of this space would be similar to the space determination of innovations' type presented above (see Fig. 3). Even if this model does not bring any new categorisation of innovations, respectively it works only with the classifications mentioned in the previous sections of this paper which are established in both theory and practice, this multidimensional classification model can be supposed as quite simple but highly suitable especially because it covers each level of innovation within all single categories of basic innovations taxonomies.

CONCLUSION

There is a continuous development of classification of innovation since inception of innovation management. This development starts from one dimensions of segmentation of innovations where innovations were divided into incremental and radical. This historical segmentation has been related to innovations of product only at the beginning. Over the course of years, innovation of process has been added to innovation of product. It means that segmentation of innovations developed from one-dimensional segmentation to two-dimensional space. When a classification of innovation was connected to impact of innovations on recipient of innovations, the three-dimensional space for classification of innovation has been established.

Different authors adjusted the classifications of innovation to their needs over time. But in detailed study of their work it could be concluded that in most cases it was only change or modification of terminology and basis of all taxonomies is the same. All authors have working more or less with basic categorisation of innovation into the incremental and radical innovation and to the product and process innovation in which they add more and more subgroups.

In terms of continuous development it seems to be possible to build the classification of innovation based on three-dimensional space as the most suitable in which it is possible to place almost any innovation. It does not matter if it is going to be incremental or radical innovation, or to what extent it is going to be product or process innovation and to what extent concerns to recipient of innovation (customer) and his established customs and procedures.

SUMMARY

In present, innovations are the necessary precondition to maintain the competitiveness of a company at all the levels. Despite of the importance of innovations, there basically does not any comprehensive definition of this term exist. As well as everything in the world, the apprehension of a content of innovation is passed through evolution. Historically the oldest definitions of innovation are connected especially to a product. By a progressive development of the term innovation, other aspects of business activities have started to be taken into account, e.g. production management, organization of work, managerial methods. A range of innovations' definitions is based on a classification of innovations which are not integrated as the uniform definition of innovation does not exist. In literature, it is possible to find a number of various classifications of innovations.

Objective of this paper is to compare various approaches to innovations' classifications. The authors provide the systemization and comparison of different approaches to categorisations of innovations while they base their work especially on the secondary research at employing the logic methods of analysis and synthesis.

In the evolution of approaches to classification of innovations it is possible to find an analogy to the evolution of the content of the term innovation. One of the first taxonomies classifies the innovations as incremental and radical while both types are tied only to a product at the beginning. By the course of time, this division into incremental and radical innovation has been subordinated to the categorisation of innovations into product innovations and process innovations. In the frame of the OECD and Eurostat's innovations classification which is currently perceived as a worldwide accepted, the marketing innovations and organizational innovations are detached to separate types. But from the authors' point of view, this isolation of innovations of marketing and organization is not without any reserve. Both the definition of marketing innovation and the definition of organizational innovation are possible to determine as the innovations of processes, respectively as an extension of definition of a process innovation.

The newest approaches to innovations' classifications add to the innovations of product and process and their sub-classification into incremental and radical innovations also another, third dimension which is represented with various forms of relation to innovation recipients. This way the three-dimensional space is established, and in principle, it is possible to place any innovation into this space. In terms of current theory, the authors consider this approach as the most suitable.

At using this new three-dimensional approach to classification of innovations it is possible to determine the type of innovation properly and therefore to determine key factors influencing the innovation potential of small and medium-sized enterprises in the Czech Republic.

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