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EVALUATION OF INNOVATION PROCESSES

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Abstract

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In present, innovations are spoken as an engine of the world economy because the innovations are transforming not only business entities but the whole industries. The innovations have become a necessity for business entities in order to survive on floating challenging markets. This way, innovations are driving force of companies' performance. The problem which arises here is a question of measurement innovation's effect on the financial performance of company or selection between two or more possible variants of innovation's realization.

Various authors which are focused on innovations processes are divided into two groups in their attitudes towards the question of influence of innovations on financial performance of companies. One group of the authors present the idea that any reliable measurement is not possible or efficient. The second group of authors present some methods theoretically applicable on this measurement but they base their approaches mostly on the methods of measurement of investments effectiveness or they suggest employment of indicators or ratios which wouldn't be clearly connected with the outcome of innovation process.

The aim of submitted article is to compare different approaches to evaluation of the innovation processes. The authors compare various approaches here and by use of analysis and synthesis, they determine their own method how to measure outcome of innovation process.

barriers to innovation processes, effectiveness, efficiency, financial performance, innovation

Currently, innovations represent even critical mechanism by which business entities reserve and maintain their place in the market (Van de Ven, 1986). In literature, it is possible to find a range of different definitions of innovation as well as a range of innovations' classifications. Common element of all of them which is concurrently usually marked at the first place is that innovation would have to create a new value. In so far, companies invest great figures of their resources with expectation of future benefits (Patterson, 2009). Significant amounts which are spent for innovation on both, on micro-level as well as on macro-level, inevitably lead to questions about efficiency of these expenditures then (Synek, 2007). Taking into account that innovation is possible to be seen as an investment on one side, but on the other side it is very specific "investment", then evaluation of innovation efficiency objectively requires much more than just an application of some of the established and well known methods of investment effectiveness evaluation.

In general, efficiency or also productivity presents relation between resources spent and benefits reached from them. This way, it is some ratio of inputs and outputs of a given operation or a process. Then, efficiency could be pointed out as a state when inputs are minimized at stable level of outputs, or when outputs are maximized at stable level of inputs. From the managerial point of view, these are the outputs of a production process and the amount of tangible and intangible resources which have been spent in this production process.

Innovation process can be objectively considered as such a production process. This way, in connection to the innovation process, it is also possible to speak about efficiency and also about effectiveness that presents an ability to generate desired benefits, while this term is used mostly in relation to evaluation of this ability. Then, not only in the context of innovation processes, the Ducker's statement is in place: "Efficiency I doing things

right; effectiveness is doing the right things."[1] For purposes of this work, the authors use generally the term effectiveness.

OBJECTIVES AND METHODS

Evaluation of innovation processes and their effectiveness is regarded from various points of view. The objective of this article is to compare existing approaches to evaluation of the innovation processes and to provide their synthesis. In this work that is based on qualitative secondary research, the authors compare various approaches to evaluation of innovation processes mainly at application of the methods of analysis and synthesis. Authors divide these approaches in two basic directions which are managerial hand and economic hand. Subsequently, the authors are focused mainly on the economic approaches to evaluation of innovation processes while they submit and propose their own approach to this problem, i.e. to determination of influence of innovation processes on financial performance of a business entity.

Managerial approaches to evaluation of innovation processes

Evaluation of innovation processes is connected just with formulation of both, their efficiency and effectiveness. The level of effectiveness as well as the level of efficiency of innovation process is reflected in performance of a business entity. Performance of an enterprise is often defined in relation to productivity while there are to determining factors which are:

- Percentage of a resource employment;
- Production speed of a resource (Skorkovský, 2005).

It is also often connected to decrease in cost of production unit, especially from the managerial point of view.

A resource or a generator of innovations in a business entity is undoubtedly the human capital. Then, this is possibly the reason of the fact that the most of existing studies on innovation effectiveness are dedicated to management, e.g. in a sense of creation of such conditions which enforce and encourage innovation processes in companies.

Approaches to evaluation of innovation processes which are inscribed as managerial are characteristic with their outcomes. The outcomes of these approaches are mostly not in a form of quantified metric that would define an effect of realized innovation, but these approaches are mainly directed to creation of conditions in a company leading to successful innovation process. This way, these approaches are usually based on non-financial indicators enabling to cover up also the factors which support innovation processes, i.e. mainly the characteristics of organizational quality. On the other hand, if there is any numerical outcome, its measurement is built on subjective basis.

In the frame of managerial approaches, mainly organizational circumstances in which innovation process takes place are though out and untwisted. These circumstances either support the innovation process or retard, or even forbid the innovation process. The second are those which are usually called as barriers to innovations. Then, managerial approaches consist in observations whether these barriers exist or not, and if some barriers are identified, these methods deal with how to minimize or even eliminate these barriers in order to make the innovation process effective (Synek *et al.*, 2007). The substance of innovations is just overcoming all of barriers which existence has roots in oncoming change that is inevitably connected with every innovation. Innovation itself makes the business entity facing to the risk which is more or less weighty (Madrid-Guijarro *et al.*, 2009; Genus & Coles, 2006). According to Borgelt & Falk (2007), negative effects of risks might be very serious barrier to innovations in companies. In the opposite, projects characteristic with none, respectively less powerful barriers have higher probability to be effective. This way, the problem of the innovation effectiveness is transformed into the problem of barriers observation and elimination or minimization because the premise that the less barriers to innovation realization the higher effectiveness of innovation exist there.

Barriers to innovation are generally classified as external (exogenous) which cannot be efficiently influenced from the side of business entity and internal (endogenous) which are possible to be more or less efficiently influenced in a company. Then, Hadjimanolis (1999) classifies external barriers to innovation as those connected with supply, connected with demand and those connected with general environment. Internal barriers which are the subject of observations and discussions within the managerial approaches to innovation effectiveness evaluation, can be sub-classified as those connected with resources, e.g. lack of internal resources, technical and technological possibilities, lack of time etc., those connected with corporate culture and systems, e.g. obsolete managerial systems, and those connected with human factors, e.g. managers' attitude towards risk or employees' perceptions of changes (Hadjimanolis, 1999; Rush & Bessant, 1992). Another classification of innovation barriers into internal and external that is also quite usual is sub-classification according to Madrid-Guijarro *et al.* (2009) who classify internal barriers as lack of financial resources and weak financial

1 Elaborated based on Management mania. Efektivnost. (17.11.2011) [On-line] available from: http://managementmania.com/efektivnost

position, incompetent staff, high costs and high risk. As external barriers the turbulent environment, insufficient cooperation opportunities, lack of informant and insufficient government support are considered then.

In various studies (e.g. Madrid-Guijarro *et al.*, 2009; Tiwari & Buse, 2007; Hewitt-Dundas, 2006; Rammer *et al.*, 2006) the organizational barriers are discussed very often. Klein & Sorra (1996) solve these barriers in the sense of innovation effectiveness. These authors, in consequence of previous studies (e.g. Klein & Ralls, 1996; Reger, 1994) consider the organizational failures in the process of innovation implementation as the main reason of lower benefits than have been expected. This way, they pose their approach to evaluation of innovation on a grade of creation of such environment that would support implementation of innovations even more that creation of innovations. Processes of implementation of innovations are also the point of interest of Humphreys *et al.* (2005). They have been returning to the environment and innovation area in a business entity where especially innovation culture, innovation technologies and innovation management are stressed while they define tight relations to customers and mounting to customers as one of the key area of creation of innovations.

Orientation to customers, respectively market orientation in relation to the five competitive forces according to Porter (1994) in connection to the innovation effectiveness of small and medium sized entities is observed by Henández-Espallardo & Delgado-Ballester (2009). Their work is based on two facts which have been already discussed in previous work of authors of this article (see Tabas, Beranová & Vavřina, 2011). These facts are as follows:

It is not possible to clearly identify which size of business entity is more suitable for innovation potential development;

Small and medium sized entities have barriers to innovations and characteristics which are substantially different from those in big companies.

Profitability of small and medium sized entities, respectively their financial performance is influence with external environment much more than profitability of big companies which have stronger position on the market. Then, these are specially negotiating power of suppliers and customers, threat of substitutes, barriers to entering the branch and intensity of overall competitiveness in the branch. In this context, Porter (1994) himself stresses direct impacts of these factors on company's profitability. Subsequently, if Cooper's (1984) definition of innovation that innovation is the way how to adapt to environment is taken, then it means that business entities which have to face stronger pressure of these factors have also to show greater effort to adapt to the environment, so innovations are de facto the must for them (by Henández-Espallardo & Delgado-Ballester, 2009). This way, the turbulent can be considered as an incentive to innovations, but on the other side, it is often mentioned among barriers to innovations. The way how to overcome this barrier is just the market orientation of small and medium sized enterprises.

The fact that environmental dynamics and competitiveness emulate the innovations effectiveness in the sense of their financial performance is mentioned in a range of studies of various authors (e.g. Jansen *et al.*, 2006; Lewin *et al.*, 1999; Levinthal & March, 1993). Jansen *et al.* (2006) investigates these aspects in consequences of their effects on performance of innovations while they distinguish between explorative and exploitative innovations, respectively between radical and incremental innovation. At the same time, they firstly deal with organizational background of innovations, i.e. especially with organizational culture, and after with factors of external environment as well, i.e. with above mentioned dynamics of environment and intensity of competition. Contrary to the other authors, Jansen *et al.* (2006) take the way of investigation of influence of these factors on financial performance of innovation processes. In the frame of their research, they have proved that strong social relations and corporate culture based on these relations positively influence both, creation of explorative as well as of exploitative innovations. Moreover, according to them dynamics of the environment positively influences the relation between explorative innovations and financial performance but negatively influence the relation between exploitative innovations and financial performance. As of the factor of intensity of competition, it positively influences both, the relation between explorative innovation and financial performance and between exploitative innovation and financial performance as well. Nevertheless, if these authors speak about the innovation performance as about the dependent variable, it has to be taken into account how this performance was measured. Here, they have used the measure of *profitability achieved* that is the rate of profitability and target profitability (Tsai, 2001). In order to set the measures of explorative and exploitative innovations, Jansen *et al.* (2006) have used the seven-point scale where the measure for explorative innovations represents the level in which an item differs from existing knowledge and pursue the innovations for new customers, and the measure of exploitative innovations is the level in which this item builds on existing knowledge and fulfils the needs of existing customers. The measurement itself but has been based on interviews with managers that leads to the inevitable consequence that this measurement is more or less subjective again event these measures entail more criteria.

Nevertheless, for all the approaches to innovation processes evaluation is common that individual measures are insufficient and misguided in principle. The complex view is an objective necessity it means that application of systems of interconnected measures is needed. When speaking

about managerial approaches to evaluation of innovation processes, the substantial disadvantage of metrics used in managerial indicators systems is that these indicators are mostly not measurable objectively and then different judges could formulate different results. The most difficult question is which measures for innovation process evaluation and consequently for the business entity's performance to select. Bartoš & Žižlavský (2010) have for example stated that a settlement of innovation process outcomes measures is usually rather easy. As examples of such measure they name e.g. number of new products and services introduced on the marked or number of trade agreements during past period. But these measures are possible to use only in connection to relatively small group of innovations which are innovations of products. For these innovations, it is also not very difficult to settle the input parameters.

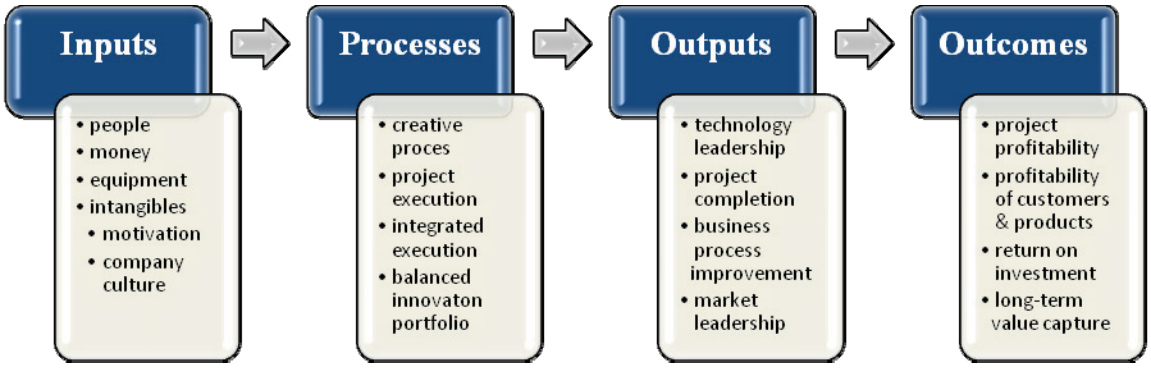
One of the complex systems of enterprise performance measurement is the Balanced Scorecard that translates the enterprise's vision and strategy into the complex set of indicators of company's overall performance. This performance is measure from the viewpoint of four perspectives which are:

- Financial perspective;
- Customers' perspective;
- Perspective of internal processes;
- Perspective of education and knowledge (Kaplan & Norton, 2007).

Within the Balanced Scorecard, the innovations are supposed as even critical internal process. In accordance with Balanced Scorecard, this process consists in two parts which are proposal and development. For the innovation area an address system of indicator has been set. This system is called as Innovation Scorecard, and it is based on the model of innovation management which consists in inputs, processes, outputs and outcomes. The inputs represent all the resources spent within the innovations efforts, human resources and financial resources included. Then, the processes combine and transform these resources while there are the real time measures tracking the progress toward creation of outputs, and which can be used in order to keep company's ability in innovation activities. The outputs are the results of innovation efforts then. The measures of outputs describe what the innovation efforts have brought to a company. While these measures of outputs describe quality, quantity and timelines, the outcomes present creation of value. The value measures entail how the innovation efforts have transformed the outputs into value for the company and the net amount of value contribution. This contribution is often measured on the principle of the residual profit, it basically means on the principle of the economic value added (Davila *et al.*, 2006). Consequently, this business model requires explicitly determined what resources are needed, how these resources are combined in order to create innovation and how the specific innovation is projected to business value.

Graphically, this model can be presented as a value chain. From the viewpoint of value creation, the innovation process in company is the source of continual increase in company's value. This way, innovations are the source of maintenance and growth of financial performance of company. This implies that such a long-term resource is much more important and has much higher potential than short-term operating cycle (Niven, 2005).

On the other side, the Balanced Scorecard has many critics for its limitations. In 2005, for example Voelpel *et al.* (2005) have published their study *The Tyranny of Balanced Scorecard in Innovation Economy* where they criticize this system especially because of its orientation on a single business entity only which means that it is insufficient in the context of global economy and global companies operating within this economy. From the innovation point of view, according to the critics, the elementary limit Balanced Scorecard is that it still takes some traditional logic of innovations with their resource in R&D proceeded in "internal labs" where the innovations are worked from the beginning to the end. Nevertheless, the times when innovations were really limited with R&D and evaluation of a potential of every new idea was relatively easy because innovation has been addressed to known market with known customers, are over. In the



1: *Innovation Value Chain*

21st century, the substance of innovations changes from incremental to more and more dynamic, from closed to open while the innovations are realized at cooperation within groups of companies. Concurrent entrepreneurial reality covers non-linear and interactive activities considering the whole system, not only discrete, direct, visible and tangible factors but also those which influence the environment but which are latent for the Balanced Scorecard (Voelpel *et al.*, 2005).

Economic approaches to evaluation of innovation processes

In order to measure economic effectiveness of innovations a range of various authors suggest employment of the same methods which are used for evaluation of investments effectiveness, such as net present value (NPV), internal rate of return (IRR) etc. On one side, the truth is that evaluation of the innovations effectiveness has the common points with effectiveness of innovations but at the same time, the measurement of innovations effectiveness has a number of specifics. The most significant is that the innovations have intangible character until a certain moment and some of the innovation would never have material substance. Then it stands on reason, and is prove by practice that innovations of different degrees would have different effect on their performance.

The effect of innovation was already the point of interest of Schumpeter's first work (1934). He developed the idea of an innovation profit which basis consists in the decrease in cost of production because of "new combinations" of production factors. But this innovation profit is limited and is declining while these "new combinations" are imitated by the other entities.

Practical possibility and relevance of quantification of innovation effects is given by a depth of the innovation. Possibilities of innovation effectiveness measurement are the point of interest for example of Valenta (2001) who subsequently introduce the conclusion that better results of business activities, respectively in general point of view, a change in economic behaviour toward to environment is on only an outcome of production innovations but also the result of non-production innovations, i.e. managerial and service activities in a company. Then this change is also inevitably joined with changes in the general environment of a company, e.g. changes in prices. Moreover, various accounting operations in costs and revenues could lead to both, overestimation and undervaluation of this economic effect. That is the reason why Valenta (2001) concludes his work like that real economic effects of innovation are factually not possible to measure.

In the opposite, other authors (e.g. Dvořák, 2005; Hauschildt, 2004; Acs & Audretch, 1992) in their works suggest various criteria for innovation effectiveness measurements while the very important factor is if the measurement, respectively the evaluation should proceed ex-ante or ex-post. The ex-ante evaluation is relative fairly at innovations of revolutionary character but practically impossible at innovations of evolution character. At ex-ante evaluation, the is a discrepancy and deficiency in predictions of future incomes or benefits from innovation especially because of the fact that before starting or at starting the innovation process it is not possible to estimate all the consequences of this process which often leads to existence of synergies. For evaluation the effect of innovation ex-post e.g. Hauschildt (2004) suggests three groups of criteria which are technical, economical and others. Subsequently, the economic effects are divided into direct and indirect effect while the direct effects are derived especially from profit of from the contribution to fixed cost and profit covering. But these measures are confronted with the problems discussed by Valenta (2001) and which are seriously uncertain especially at the beginning of the innovation process and which are applicable only at product innovations in fact. At the process innovations, the effort is to observe if the innovation has led to decrease in costs. Then, indirect effects of innovations are mostly related especially to competitors.

Currently, two directions dealing with the effect of innovation exist. These are as follows:

- Evaluation of innovation effectiveness without explicit relation to the market while this approach employs the ratios such as e.g. return on sales, cash-flow to sales ratio, or productivity of work which have only limited evidence ability when regarding to the company's position on the market;
- Evaluation of innovation effectiveness with relation to the market, i.e. some expression of product's market success which employs the measures expressing the change, e.g. annual increase in sales, annual increase in profit, or a change of a product share on the market.

In frames of these approaches, various metrics are used in order to evaluate the effect of innovation. Nevertheless, these metrics could be the points of discussions; e.g. if the return on sales mentioned in the first point should be related only to the innovation how the incoming variables for this ratio are measured. The annual increase in profit, in the second point, uses the accounting variable which is relatively problematic and the annual increase in sales is directed only on one side, i.e. on revenues, and does not deal with potential change in costs.

Measurement of innovation effect with theoretical performance of business entity

In general, evaluation of any effect consists in comparison of outcomes reached with inputs spent. But at evaluation of innovation effectiveness, both, outcomes and inputs are not uniquely determined, respectively are not possible to be uniquely allocated in the company. From the viewpoint of theory and also from the viewpoint

of expectation of the practice, innovation would affect the financial performance of company. Before innovation realization, this financial performance has developed on some pattern and this way, after the innovation realization this pattern should be changed. With regard to the fact that every business activity, i.e. innovations included, induces some respond on a market, the authors tend toward application of measures which use the relation to market situation in order to evaluate the innovation effectiveness.

So as this change would have extensive relations, especially in the sense of development in external environment of the business entity, the authors suggest employment of a complex indicator of economic development, e.g. development of the national economy as a whole. This way, the change in financial performance of a company would be measured on only in connection to internal environment, i.e. internal changes in a business entity, but also in connection to external environment. Then these are the basis of the model which considers the economic effect of innovation as a deviation of financial performance reached from the theoretical financial performance. This theoretical financial performance is based on the perquisite that dependence between performance of business entity and performance of economy exists. Based on the known independent variable, i.e. performance of economy the theoretical financial performance, i.e. dependent variable is derived from the regression function. Abreast with this, it is supposed that innovation would case just the deviation of financial performance reached from its theoretical value. This deviation is suggested as a measure of economic effectiveness of the innovation.

The financial performance reached can measure in various ways; it is e.g. possible to use revenues as one of the generators of the company's value which is, unlike profit, more resistant to applied accounting methods. Nevertheless, with regard to the fact that the innovation can take effect of both, of increase in revenues as well as of decrease in costs the measure of financial performance should be related to the operating profit. But on the other side, as already mentioned above, profit might be seriously affected by applied accounting methods, e.g. by depreciation policy, policy of provisions of accounting adjustments or also with sales of tangible fixed assets and materials. If these items are eliminated from the operating profit the result basically presents the cash-flows from operating activities when all the sales are collected and all costs are paid. This approach to calculation of operating cash-flows is common in long-term financial planning. Another measure of financial performance of business entity for this purpose would be also the indicator of economic value added (EVA) which represents an economic profit and belong to the group of so called modern measures of financial performance. Moreover, this measure is already mentioned in this paper in relation to the Innovation Scorecard. Nevertheless, employment of this measure in circumstances of the Czech Republic is complicated by concurrent accounting legislation. With regard to this fact, when measuring the performance of business entity in order to quantify the effect of innovation, the authors prefer the variant of cash-flows from operating activities.

CONCLUSION

Currently, the primary goal of innovation is supposed to be the creation of value for customer. This customer is not only a customer in the sense of buyer but it goes about creation of value for customers defined in a wide context. It means that it is the value for both, for external as well as for internal customers. In this connection, if the value is inflected than this value should be measured. It means that the effect of innovation is necessary to be evaluated. Regarding to the fact that innovations are created in order to gain a competitive advantage for the business entity and to gain position on a market than the effect of innovation has to be reflected in the value of enterprise which is given by its future perspectives and financial position and performance. As great amount are spent for innovations, solution of the problem of the innovation effectiveness measurement is the necessity.

Objective of this article was to compare existing approaches to of the innovation processes and to provide their synthesis. It is possible to make a primary division of these approaches into two groups which consist in managerial approaches and economic approaches. Managerial approaches are focused on investigation how to eliminate the barriers to innovation processes in business entities. Outcomes of these approaches are common for their ambiguousity because they are mostly based on subjective measures. On the other hand, the economic approaches are mostly based on the methods of evaluation of investment effectiveness. However application of these methods has been relevant in the past when the view on innovation had rather narrow sense than currently has. Even if the innovation processes can be view as investments from a certain point of view, they are insufficient for concurrent dynamic concept of innovations.

The approach to quantification of the innovation effects that is presented in this paper is the approach of ex-post evaluation. This approach is based on close relation between business entity and its environment because an enterprise is not sole isolated entity. Of course, future research of the authors has to be focused on proving the relevance of suggested model and on observation of it limits.

Evaluation of innovations ex-ante that would be a decision making basis of realization of an innovation is almost unreal especially because present days are characterized by increasing dynamics. So, if a company develops some

innovation, at the moment of decision about the innovation realization it is factually impossible to know to what market and to what customers this innovation would be addressed because these elements are changing dynamically as well as the overall environment. Then, decision making about innovation is maximally based on intuition, sense and complex approach which are possible to gain only from experiences based on ex-post evaluation of innovations realized. This is just the reason why the innovations are always connected with high level of risk. But on the other side, in concurrent competitive environment, the innovations are the must for company's survival on a market.

SUMMARY

The significant amounts spent for innovation on both, the micro-level as well as on the macro-level require a demonstration of effectiveness of these expenses. In general, when speaking about effectiveness some ratio of inputs and outputs of a process is meant. In various studies, effectiveness of innovation processes is regarded basically from two angles which can be marked as managerial hand and economic hand.

Objective of this paper was to compare existing approaches to evaluation of innovation processes and to provide their synthesis. Based on the secondary research, the authors have divided the approaches observed into two groups as mentioned above; the managerial approaches and the economic or financial approaches. The main point of interest of the authors is especially the economic evaluation of innovation processes. Subsequently, the authors suggest their own approach to the innovation effectiveness measurement, respectively to quantification of innovation's effect on financial performance of a business entity.

Approaches to evaluation of innovation processes which are marked as managerial approaches are specific for their outcomes. The outcomes of these approaches are mostly not in a quantified form but these approaches are mainly focused on creation of such conditions in within a company that would lead to successful innovation process. Then, generally barriers to innovation are discussed and evaluated in order to eliminate them. If any of these approaches leads to a numerical outcome, its measurement is built on a subjective basis.

Economic measurement of innovation's effects is mostly mentioned in relation to the standard methods of investment effectiveness evaluation, i.e. especially net present value and internal rate of return. Even if these methods have been suitable in the past when innovations were regarded in rather narrow sense than currently are, these methods are factually not applicable any more within concurrent dynamic perceptions of innovations. The effects of innovation have necessarily to be evaluated in relation to the market because the primary goal of innovation is supposed to by the creation of value for a customer. Then, in order to measure the effectiveness of innovation processes, the authors suggest the model of theoretical financial performance. This theoretical performance is linked to the general environment of a business entity, i.e. to the development of whole economy while it is supposed that statistical dependence between financial performance of a business entity and performance of economy exists. It is also supposed that realized innovation leads to a change in current development of company's performance. This way, the effect of innovation would be describes as a deviation between theoretical performance which is calculated based on the regression function and the real performance reached. From the authors' point of view, a relevant measure of company's performance would be the cash-flows from operating activities. Currently, this model is in the stage of theoretical suppositions and the future research will be focused on its relevance and limitations.

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