

Innovation Project Performance Measurement: Selected Shortcomings

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Abstract

This paper presents an overview of studies that describe the emergence of innovation project performance measurement. It is dedicated to the issue of economic indicators and focuses on the metrics that can be employed to evaluate a single innovation project. These metrics are divided into two groups, financial and non-financial. Comparisons are made between these indicators using methods of analysis and synthesis. This includes the establishment of their pros and cons, and a discussion on the revealed shortcomings. The main findings of the paper refer to the importance of innovation project performance measurement within the framework of a corporation. However, a one size fits all solution does not exist. Every innovation project is unique and specific. This paper should therefore motivate researchers to conduct more large scale studies into the area of innovation project performance measurement in different business sector and areas.

Keywords: innovation, innovation project, performance measurement, management control, financial indicators, non-financial indicators

Introduction

Innovation is the basis for the sustainable growth of a business corporation. However, no matter how high the investment in innovation might be, there is no guarantee that the resources committed to it are spent efficiently. It is therefore necessary to innovate wisely and with focus. Such activity requires companies to be capable of the continuous evaluation of ongoing innovation projects and to use this data to make decisions on whether to continue or not.

In order to assess the success of innovations it is necessary to select criteria by which the assessment can be made. Hauschildt and Salomo (2011) recommend the following three types of criteria to measure innovation success: technical; economic; and others. This paper is intended to assess the economic performance of innovation projects.

The range of options for expressing innovation project performance through economic indicators has also been investigated by Valenta (2001). In his last publication, he concludes that in general terms the improved economic performance of a company i.e. a change in a company's economic behaviour towards its environment, is not only the

result of innovative measures in the manufacturing field, but also a product of non-manufacturing innovations expressed through management and service activities. In addition, it is also intensively influenced by the external environment e.g. by changes in the price of purchased components and investment goods, as well as by the company's success or otherwise in achieving the volumes and prices ideally counted on in the sale of its products when the decision was taken to move forward with a particular innovation project (Valenta, 2001). Valenta's theory was expanded on by Vlček (2008) with a study into innovation value, the effect of which is the growth, or rather, the maximization of value for the customer with a simultaneous growth in the value of a company.

Methods for economic analysis are currently the most diffused methods for the evaluation of innovation projects (e.g. Ryan & Ryan, 2002). Although existing methods largely differ in their implementation, they all share a common principle, that is, the capital budgeting approach for calculating the economic return of a project as a sequence of discounted cash flows (Chiesa & Frattini, 2009).

Materials and Methods

The scientific aim of this paper is to gain knowledge and analyse the present status of innovation projects and their performance measurement as published in Czech and foreign professional literature by leading experts from the past and the present. The objective of the article rests in the summarization and presentation of the results of a literature review of the relationship between innovations and performance measurement. In addition, the paper is also important in terms of innovation management, which is a field of science, and its related disciplines, specifically strategic management.

The systematic approach of analysis, comparison and synthesis was applied to this paper. Analysis was used as the method for acquiring new knowledge and for the interpretation thereof. When processing secondary data, the secondary analysis method was used. Professional literature, in particular foreign resources, was the source of secondary data. Comparisons were then made of the various pros and cons of the various approaches to innovation performance measurement.

Results

Well managed innovations successfully commercialized in the market are a tool with which companies can win competitive advantages that will allow them to prosper and grow over the long term. Many studies show that the growth of a company does not occur at random as is not independent of its size. Since Schumpeter (1950) suggested that large enterprises are more likely to innovate than their smaller counterparts, researchers have investigated the relationship between innovation, performance, and enterprise size (Rosenbusch et al., 2011). Large companies, it is argued, are in a better position to carry out the necessary R&D for innovation and may also be better placed to exploit the market potential of each innovation (Love & Roper, 1999). In addition, these companies are also in a better position to employ professional managers and technical experts, and to protect innovations against competition, strong marketing, etc. (Rogers, 2003).

Research into innovation in SMEs is more recent (Audretsch & Lehmann, 2005) and, although the evidence of a strong correlation between innovation and SME performance is overwhelming (e.g. Baldwin & Gellatly, 2003; Mansury & Love, 2008), the dynamics of this relationship remain ambiguous (Gronun et al., 2012). Studies prove that SMEs tend to grow faster than larger enterprises in most sectors (Falk, 2008; Fiala & Hedija, 2015). The better management of the innovation process by smaller companies could be one of the reasons for their faster growth. The main innovation advantage which small companies are suggested to have is that of entrepreneurial dynamics and flexibility. The dynamics and flexibility are mostly derived from a simpler, flatter organisational structure which translates into a significantly more flexible response to, and faster capitalisation of, market opportunities (Bhattacharya & Bloch, 2004; Link & Rees, 1990; Rothwell, 1989).

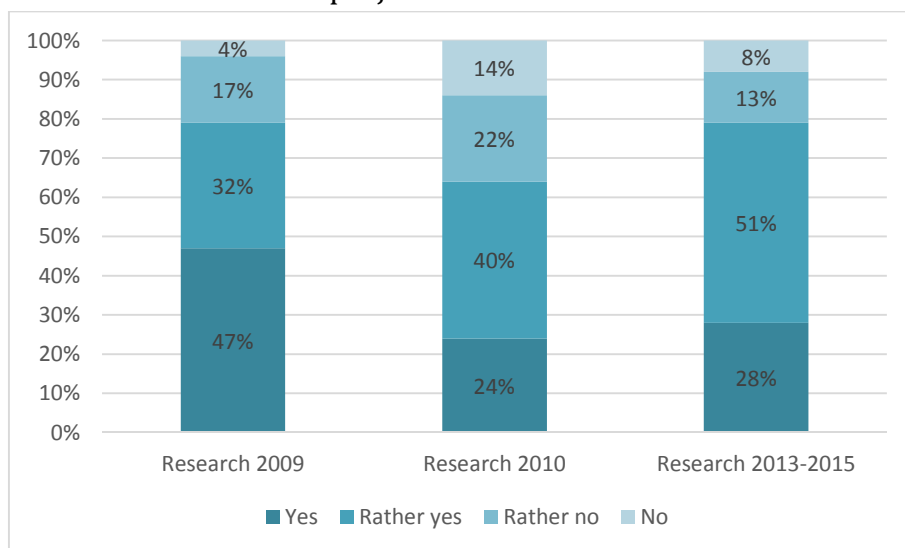
When considering the commercial success of innovation, it is very important to evaluate the effect of the business opportunity, both in terms of incremental innovation and radical innovation. The financial evaluation of an incremental innovation requires a project management perspective. This involves:

- estimating (setting up) future cash flows;
- calculating return on invested resources;
- calculating financial indicators;
- comparing the calculated values with predefined criterion.

The evaluation of the potential effect of a radical innovation in preparation should help a company to find out whether practical research will bring sufficient progress and whether there is a market in which that radical innovation can be successful. Furthermore, it must answer the question of what will be the costs of production of the relevant technology or product and what amount of capital will be required (Gault 2013; Van Merkerk & Smits, 2008). For every aspect, performance must be evaluated during each phase on the basis of economic criteria – from the inception of an idea to its final commercialisation. In other words, this means that the evaluation for each period of time considers whether the potential revenue and/or cost savings expected from the innovation are likely to be greater than the fixed and variable costs of the mobilised resources, given the strategy, the business model and the organisation.

To measure or not to measure the performance of innovations remains an open question. The majority of people would affirm the need to measure, however results of primary research conducted in Czech manufacturing companies (Žižlavský, 2015; Žižlavský & Bartoš, 2010; Žižlavský 2009) indicates that the surveyed managers were not so quick to respond in this way. When asked whether the companies had evaluated the implemented innovation projects, the vast majority answered affirmatively in all the periods under consideration, 79%, 64%, and 79% of respondents, respectively. What is disquieting is the fact that this area is neglected by 21%, 36%, and 21% of the respondents even though innovations were implemented by them (see Figure 1).

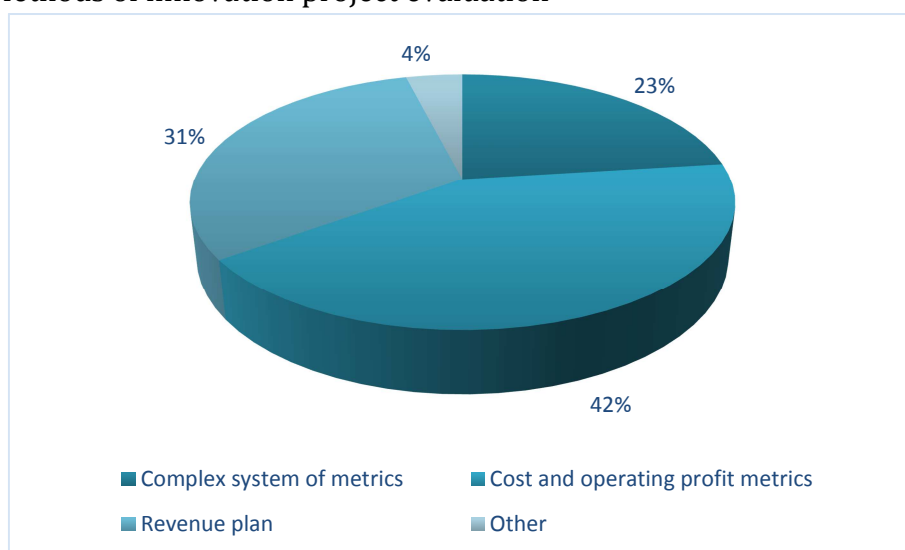
Figure 1: Evaluation of innovation projects



Source: Žižlavský (2015)

For companies which responded affirmatively to the above question, the method of evaluating the innovations has been examined. The results are shown in the Figure 2. The prevailing approach is to monitor financial indicators or, more precisely, to monitor costs with respect to operating profit and the fulfilment of turnover based on the sales plan. Other data and indicators were not considered essential by the surveyed companies. Only 23% of respondents transformed the objectives and strategies of innovations into a comprehensive system of measurable financial and non-financial indicators. It should be noted that after overcoming the initial barriers and the reluctance of managers to communicate more detailed information about their systems of innovation evaluation, these systems often proved to be inappropriate and biased in favour of financial indicators.

Figure 2: Methods of innovation project evaluation



Source: (Žižlavský & Bartoš, 2010)

In follow-up research (Žižlavský, 2015) respondents were asked to indicate the evaluation techniques they use within innovation projects to provide the information they require for decision-making and control. The measurement tools were divided into two groups - financial and non-financial tools.

Table 1. Performance measurement methods (n=354)

Category (Number of employees)		Micro (1-9)	Small (10-49)	Medium (50-249)	Large (>250)
Financial tools	Balanced Scorecard	0.00%	2.38%	10.95%	33.91%
	Budget	67.45%	72.46%	84.27%	100.00%
	Cost accounting (with cost centres)	11.33%	19.31%	35.13%	42.67%
	Cost accounting (without cost centres)	20.38%	25.19%	22.54%	14.17%
	EBITDA, EBIT	28.16%	30.45%	36.19%	34.85%
	Economic value added EVA	0.00%	2.14%	17.50%	20.15%
	Payback period	3.15%	17.23%	24.49%	36.84%
	Profitability (ROI, ROE, ROA, ROS)	23.70%	20.13%	13.52%	7.92%
	Revenues from innovation	59.19%	74.28%	83.45%	100.00%
Non-financial tools	Cannibalization of existing products by innovation	4.12%	5.26%	6.43%	16.24%
	Customer satisfaction indicators	23.45%	17.33%	22.50%	26.67%
	Growth of market share	8.69%	13.17%	18.36%	36.13%
	Innovativeness	2.70%	2.56%	7.12%	13.41%
	Number of new customers	34.33%	32.73%	47.20%	52.48%
	Patents	7.81%	10.47%	28.49%	36.96%
	Productivity and quality indicators (lead time, etc.)	3.43%	6.81%	15.70%	32.76%

Source: (Žižlavský, 2015)

Financial indicators

Table 1 demonstrates that financial indicators are more frequently adopted than non-financial indicators. Since this study concentrates on Czech manufacturing i.e. the for-profit sector, innovation evaluation must always be based on a group of logically

interrelated financial indicators. The financial indicators can be divided into three elementary groups.

- The first group of indicators serve to evaluate the contribution of innovations to the increase in the competitiveness of the entire company. The most frequently used indicators in this category include production power, return on sales, liquidity and indebtedness.
- The second group of indicators serve to evaluate how the innovation plan is reflected in the economic results of the company. These include profitability indicators such as ROCE, ROI and ROE.
- The third group of indicators serve to evaluate the financial effects of innovative activities. These include working capital turnover ratio, profit ratio and the total rate of return (Pitra, 2006).

Other popular innovation performance metrics in industry include the percentage of revenues from new products, percentage of growth in new products, and overall profits generated by new products (Cooper et al., 2004).

"An innovation is successful if it positively contributes to the profits and return of a company." (Gemünden & Littkermann, 2007; Pitra 2006; Thomaschewski & Tarlatt, 2010)

In this regard it is difficult to state what the optimal length of the planning period is. Some innovations require a significantly longer market introduction and acceptance period, whereas others generate a rapid payback (Thomaschewski & Tarlatt, 2010). An ideal amortization period needs to compensate for the invested capital e.g. costs for R&D, production, market launch and marketing as well as the cost of capital.

This brings up the issue of comparing the achieved results with a reference value during and at the end of the project implementation process. The question is, what the obtained data will be compared with i.e. how is the baseline for the comparison set. One option is to compare it with the existing situation – at the time of measuring e.g. the degree of progress in technical parameters, growth rate or increase in economic parameters such as the amount of profit, sales, contribution margin and market share. It is subsequently useful to compare the individual parameters with pre-defined goals, subject to them having been set realistically, and simultaneously, with sufficient stringency.

Comparisons on the basis of benchmarking seem to be the most appropriate method. Such comparisons can be made against a competing company but also against an "ideal" or normative model. Examples of such performance related comparisons include the Malcolm Baldrige Award in the US, the Deming Prize in Japan and the Quality Award in Europe. The growing use of the Internet has also led to numerous web portals offering interactive systems for evaluating the innovation performance of companies.

Non-financial indicators

Economic assessment is an integral part of every project and is the preferred approach of company owners. It should be borne in mind that the owners have invested in the company with the prospect of achieving a return. From the owners' perspective, the company is a "money-making-machine". If it fails in this role, the owners see the root

cause in incompetent management – and rightly so from their perspective. Financial indicators are indispensable for evaluating performance. They alone can inform managers whether the company is generating value and whether the measures adopted by them have contributed to value generation.

How do we objectively assess the rate of return on invested efforts and time? Purely assessing the results of a project in terms of its economic benefits may not always be the most advantageous way because it may also result in the rejection of projects in which the qualitative benefits significantly exceed the potential costs associated with project implementation.

The development and improvement of measurement systems has therefore led to financial indicators being supplemented by many other non-financial indicators used by companies seeking to measure and evaluate the development of basic success factors in their respective strategic areas (Ittner & Larcker, 1998; Kaplan & Norton, 1992; Nanni et al., 1992; Neuman et al., 2008; Palmer 1992; Vaivio, 1999). It has been clear for some time that the traditional systems for measuring performance could not succeed in the ever changing conditions associated with global business (Johnson & Kaplan, 1987).

Non-financial indicators are not a new concept but they have enjoyed huge interest among the professional public since the 1980's. The integration of non-financial metrics into systems for measuring performance allows managers to better understand the relations between various strategic innovation targets, communicate the linking of these targets with workers' activities and, subject to the defined targets, to formulate priorities and allocate resources (Kaplan & Norton 2001). The results of an international study have confirmed that there is a strong association between the use of non-financial indicators and strategies oriented towards innovation and quality (Said et al. 2003).

Discussion

Project management, as well as the process of measuring innovation performance as outlined above, are often used in practice. The first phase of the process i.e. the estimation of future cash flows, is problematic. The credibility of the specified benefits of a particular innovation, which directly depends on the depth of the innovation being implemented, is a weak spot in performance evaluation of the innovation process. Practical experience shows that companies are unable to estimate with sufficient accuracy the costs of developing and introducing an innovation, let alone the effects generated by that innovation. Since companies face considerable uncertainty regarding the results of their innovative activities – in introducing something new, previously unknown and untested – the calculation of the benefits of innovations tends to be inaccurate and incomplete because all possible applications are not estimated successfully at the time when the programme is first engaged.

What matters in the initial phase of the innovation project is to establish whether there has been a shift in knowledge, whether new findings have made it possible to develop new technologies and products which will be successful on the market, and whether they help reduce production costs. For the innovation itself, it is necessary to establish what economic benefits (sales, profit, etc.) a new product brings, or what savings can be

derived from process innovations and in what proportion these benefits stand to the costs expended (Kislingerová, 2008).

In order to evaluate the profitability of a project, it is first necessary to compile the required data i.e. determine the revenues and costs related to the innovation concerned. Basically, it is easier to measure costs than revenues.

A budget showing the costs of implementing an innovation project is an important underlying document for a company. It shows what costs must be expended in the course of implementing a project and specifies the purpose for which they will be used. In budgeting, a company must not restrict itself to the direct costs (materials, salaries and depreciation) related to the individual phases for bringing an innovation to life. In addition to direct costs, the budget must also reflect the costs of project development, integration and implementation, as well as overhead costs (such as laboratory fees and licence fees). As a rule, creative costs can be simply gathered through project control and management. Overhead costs are first recorded for the whole company. Capital expenses (CAPEX), operating expenses (OPEX) and the costs of innovation use and company operations are then recorded. These are generated by the need to cover the additional expenses of existing business because corporate performance must not decrease as a result of bringing an innovation to fruition. Residual costs are also important – the non-depreciated value of tangible assets divested by a company e.g. due to technology upgrades.

For incremental innovations, past purchasing and start-up costs can often be used. Measurement in the case of radical innovations is even more difficult since, depending on the case, this involves the use of completely new technologies for which no market prices exists in the present. In contrast, OPEX for incremental innovations as well as completely new technologies can often be measured with reference to past experiences. Sales, marketing, call centre, or service costs can be taken from existing business and adapted, whereby flat rate values are frequently used.

The next step is to compile, on the basis of the results of market research and the market placement plan in combination with the production plan, an overview of expected revenues for individual innovative products and future financial flows from collected revenues, including risk appraisal. However, the measurement of revenues presents the greatest risk due to the fact that they are only forecasts.

The marketing information system (e.g. Žižlavský, 2012) can be crucial in helping to forecast future revenues from individual customers. The system collects customers' business data. This allows past contracts to be used for forecasting future revenues from new products. Innovation-generated sales are among the most important revenue items. The difference between radical and incremental innovations also plays an important role. Existing and historic market data can be used to measure revenues from incremental innovations. For radical innovations on the other hand, customer surveys and market tests are often very difficult to use because users generally have little knowledge of new technology. This makes it impossible to achieve good quality forecasts for expected revenues. Simultaneously, this makes it more difficult to predict how willing customers will be to use and pay for the relevant innovation. One option for avoiding the use of surveys is to use comparable cases from other sectors or foreign markets.

Other revenues may result from the provision of consultancy services, the sale of licences or patents. Most revenues are generated only after costs are expended because innovation projects usually do not generate any revenues during the inception and innovation phases.

A forecast of the income tax rate subsequently makes it possible to specify the estimated net profits. Given the fact that it also includes costs that do not fall under expenses (such as depreciation), and that some expenses are not included (debt instalments, distribution of profits, increased demands for working capital), it is necessary to adjust net profits by these items to help determine the cash flow.

Managerial steering in this setting means to constantly monitor the development of the business case for an innovation in order to safeguard the payback from the innovation and to limit eventual losses. This can be accomplished via *ex ante* and *ex post* comparisons of the business case for an innovation at each critical decision phase.

Another important aspect lies in the allocation of costs and revenues to a specific innovation or innovation project. In this respect, a serious problem lies in the fact that accounting systems are not capable of sufficiently reflecting the costs and revenues of a specific innovation project. The innovation process occurs in phases and often takes a number of years. In contrast, accounting records do not operate with accumulated figures and accounting periods do not mirror the phases of the innovation process. Some intangible investment goods used in developing an innovation are also not subject to depreciation. For costs and effects to be allocated, it is therefore necessary that the innovation project be clearly defined from the very beginning in both substantive and temporal terms. However, this requirement often cannot be met in the initial phases of the innovation process when innovation proposals are generated and selected (Kislingerová, 2008). Without this future orientation, the assessment of innovation projects would always be negative, since the innovation sometimes does not generate revenues until some considerable time after the project has been completed (Gemünden & Littkemann, 2007).

The innovation type is also crucial to the allocation of costs and revenues. Costs can generally be allocated to innovations in methods, processes and infrastructure, as well as to product innovations. This applies equally to capital costs and all cost savings that can be achieved later through improvements. The division of overhead costs is the most difficult task. An overview and division by function significantly simplifies later structuring into innovation projects but it also entails increased costs. In addition to traditional overhead costs such as personnel costs, other costs can also take the form of overheads, especially where integrated products are concerned. If several products are based on a single innovation infrastructure, costs must be allocated to individual innovations (Erner & Presse, 2010).

Allocating revenues is even more difficult. Incremental innovations improve an already existing product, thereby increasing the value for customers and, simultaneously, sales of that product. However, it is difficult to determine whether and, even more importantly, to what extent the increase in revenues was in fact due to the relevant innovation. If sales are decreasing, the improvement in the product is deemed successful if it at least contributes to maintaining the existing level of sales. With radical innovations, the allocation issue is often far easier because radical innovations can be clearly identified as new benefits for customers. Radical innovations often lead to a

completely new range of products which makes it possible to clearly allocate the resulting revenues to the innovation in question. As mentioned above, not only the level of innovation but also its kind is important for allocation purposes. While revenues from a product innovation are relatively easy to allocate, this is not directly possible with process innovations where only theoretical constructs can be applied.

Conclusion

Innovations must be implemented prudently and in a targeted manner. Moreover, innovations are very costly and they tie a substantial part of a company's available resources for a significant period of time (Erner & Presse, 2010; Gaily, 2011; Huang et al., 2004; Patterson, 2009; Thomaschewski & Tarlatt, 2010). The effort and resources expended must be recouped if a company is to stand a chance of surviving in a strongly competitive environment. The need for a management control system is crucial for innovations.

Unfortunately, there are no uniform guidelines in the professional literature for measuring the performance of innovations (Adams et al., 2006). Every innovation is unique, specific, and intended to bring competitive advantage and company growth (Bonner et al., 2001). It brings a growth in revenues but also generates costs. From this point of view, the use of selected financial indicators appears to be a suitable approach to measuring the performance of innovation activities.

However, innovation performance measurement has its pitfalls. Traditional accounting information cannot reflect some of the indirect consequences of business decisions. Financial indicators are related to short-term goals and built on historic accounting data – as such they are not suitable for predicting future developments and for strategic planning; they are in fact lag indicators. Since they are mostly based on profitability and net profits, there is a risk of their being “embellished” through the manipulation of profit/loss figures (Kislingerová, 2008).

A well developed system of evaluation of innovation projects should therefore contain a suitable mix of quantitative financial and qualitative non-financial indicators. The former being best suited to capturing unmeasurable aspects, and the latter capable of reducing the subjectivity of the evaluation (Driva et al., 2000; Chiesa & Frattini, 2009; Werner & Souder, 1997). Furthermore, given that economic-financial indicators are often questionable because it is very difficult to evaluate intangible elements in monetary terms over time, as typically happens in innovation (Frattini et al., 2006), they are often integrated with non-financial indicators, which can be more easily estimated. Under such circumstances, the use of benchmarking to compare metrics with competitors or excellence models is beneficial.

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