

RESEARCH AND DEVELOPMENT EXPENDITURE AND ITS ECONOMIC EVALUATION

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Abstract

Expenditure on research and development are unique as its results are generally intangible, but it is also very difficult to estimate its future benefits. Given the current demands on enhancing competitiveness and innovation, it comes to the increase of expenditure on research and development. Great emphasis is therefore placed on monitoring and reporting needs of stakeholders for which such information is used to support their decision-making processes. Expenditure on research and development has in a range of key enterprises significant value and affect the results of operations and financial situation many times in the years ahead. Their impact on the economic and financial situation is difficult to estimate, expending funds may be associated with high future profits and can contribute to the sustainable growth of the company. The article focuses on spending on research and development in general means. After that, attention is focused on their economic evaluation. The aim is to demonstrate in a case study approach the evaluation of these expenses based on the methods to evaluate investments efficiency.

Key words: research and development, research and development expenditure, economic evaluation

JEL Code: M21, M16, M11

Introduction

Research and development (hereinafter “R&D”) expenditures are as unique as their results are generally intangible. It is also very difficult to estimate the associated future benefits (Gill and Lopéz, 2014). Therefore, the increase of intangible assets in balance sheets connected with R&D, create requirements for their accurate and true representation. R&D expenditures leave room for the "management adjustments" and can be an opportunity for "profit alteration" (Cazavan - Jeny et al., 2011). Reducing R&D can instantly improve annual performance in accounting terms (Bushee, 1998; Mande et al., 2000); therefore, some companies tend to use

R&D for the 'fine-tuning' of profits (Oswald and Zarowin, 2007). R&D reduction may, on the other hand significantly change strategic developments and profits in the long term period. The issue of evaluation of R&D expenditure is closely linked to the accounting principles as they relate to financial reporting; where both forms, cost capitalization and accounting costs in the current financial period are allowed. The question, is whether managers should be entitled to decide whether or not to capitalize on these costs or charge them directly is further discussed in the literature available (Ahmed and Falk, 2006).

In comparison with fixed assets investment, R&D planning can be very problematic. R&D outputs can bring huge profits (Zhang and He, 2013) and can also lead to the growth of cash flow (Eberhart et al., 2004). Zhang and He (2013) therefore recommend to compare R&D funding with long-term investment plans, and to evaluate it accordingly. The aim of this paper is to provide an approach of appropriate economic evaluation considering R&D expenses as a long term investment in a case study.

1 Materials and Methods

Knowledge and ability to innovate is a crucial resource for maintaining long-term competitive advantage (Papalexandris et al., 2005), competitiveness is tied to new technologies and knowledge, which are not available for other companies. These intangible assets cause difficulties with both definition and evaluation. Mařík et al. (2003) name problematic issues in the evaluation process, it is recommended to consider carefully period during which the technical solution is actual (after this period of time it may become obsolete) and also recommended to pay a special attention regarding risk analysis. If revenues connected to the particular technology or knowledge can be forecasted, the income approach can be implemented, the given intangible assets is then evaluated according to the financial plan and cash flow forecast (Mařík et al., 2003). Valach et al. (2005) recommend primarily analysis of discounted cash flow for investment evaluation and also preparing several cash flow scenarios to show the sensitivity of cash flow on various factors, such as total turnover or a key cost item. To deliver the above mentioned objective and demonstrate an effective way of R&D expenditure management a method of discounted cash flow (net present value and internal rate of return) was selected according to Valach et al. (2005). Case study method allows to describe interactions in business (Langfield-Smith, 1997) and it is often used to evaluation of a specific management tool, therefore a case study method was outlined in a selected medium size company Z.

The core business of company Z is providing expert advice and related services composting of units. Company Z is currently developing a research project focused on a new technology of composting animal waste and food waste. Present composting technologies cannot compost these items in an effective way to meet the legislative standards for biological waste treatment. The new technology shall bring revenues from the license fees and from associated advisory services. While preparing this project, the aforementioned Company Z is considering cost specified in the following table:

Tab. 1: Total project budget

Item	Note	Amount in ths. CZK
Personnel costs	key staff salaries (project management, research activities), salaries for technical personnel (testing);	2 700
Expert services	ensuring the protection of intellectual property, certification of compost, laboratory analyzes	400
Material costs	nonwovens, measuring sonde for performing experiments	100
Travel costs	connected to carrying out experiments in the field	50
Total		3 250

Source: own

The above mentioned cost structure indicates that, according to the accounting cost categories the company Z will not make any investments. The analyzed project incurs only operating costs (staff cost, services etc.) However, for the purpose of economic evaluation the total costs will be considered as an investment in the acquisition of know-how and technology, and thus will be treated as such in the cash flow analysis.

2 Results of the Research

As suggested by Mařík et. al. (2003) and Valach et. al. (2005) cash flow analysis was used to evaluate R&D project of Company Z. The forecast of revenues and expenses was based on the following premises:

- A period of 5 years will be considered as a period, when the new technology keeps the advantage, after the 5 year period we can expect that better technologies will be

developed, the proposed revenues decline dramatically to almost zero in 8th year; the financial plan is therefore provided for the period of 8 years.

- As mentioned above the technology shall bring revenues from the license fees and from advisory services, staff costs and also a certain amount of expert costs will be incurred.
- 4% interest rate is calculated as standard in the given country¹ as recommended by (Mařík et. al, 2003)

Estimated revenues and expenses, financial plan and cash flow analysis are shown in Table 2.

Tab. 2: Financial plan

Period	2017	2018	2019	2020	2021	2022	2023	2024
License fee	600	600	550	550	400	50	30	20
Advisory services	650	650	650	600	250	100	40	30
TOTAL REVENUES	1 250	1 250	1 200	1 150	650	150	70	50
Staff costs / expenses	65	60	55	50	50	50	50	50
Expert costs / expenses	60	50	45	40				
TOTAL EXPENSES	125	110	100	90	50	50	50	50
CASH FLOW	1 125	1 140	1 100	1 060	600	100	20	0
DISCOUNTED CASH FLOW	1 082	1 054	978	906	493	79	15	0

Source: own

Profitability ratios are calculated in Table 3.

Tab. 3: Profitability ratio

Profitability ratio	
Net present value	1 357 thousands CZK
Internal rate of return	18,63 %

Source: own

The table above shows that the project generates a positive net present value, and achieves also a satisfactory level of internal rate of return.

¹ 4% is used in the evaluation of R&D project in Cost Benefit analysis in the EU operational programme such as OP Entrepreneurship Innovation Competiveness (Ministry of Industry and Trade, 2016).

Two other alternatives were provided for the risk analysis according to Valach et al. (2005). Both alternatives assumes lower turnover. The first estimates 14% decrease in the total estimated income and assumes the same development of revenues (the decrease in the 6th year). The second alternative assumes double decrease of revenues (27% in total) and it estimates a cut in turnover earlier, in the 4th years. This scenario therefore suppose only a three year period, while the technology will maintain its competitive advantage and therefore significant turnover decrease. Financial plans are provided in Annex, the following table shows net present values only.

Tab. 4: Net present value – Alternative 1 and 2

Alternative	1	2
Net present value	649 thousands CZK	12 thousands CZK

Source: own

The table above indicates that if the lower turnover decreases by only 14 % the net present value falls by more than 50%. In the case of 27% fall, the net present value adjoins zero level.

Conclusion

Costs incurred for research and development might bring revenues and profit but usually in a longer period than one fiscal year. Therefore evaluation of costs as long term investments and performance management based on cash flow analysis and payback period might bring more accurate picture than a pure accounting assessment as shows the provided case study. Company Z spent 3, 2 mil CZK on R&D project mainly by paying employees and experts. Although this costs have a negative impact on the fiscal profit in the given year, the total amount of 3,2 mil CZK where invested in a new technology and might bring over 1,3 mil. CZK in a 8 years period of time and shall be managed and evaluated accordingly. The provided risk scenarios indicate that the period in which the technology will maintain its competitive advantage is of a crucial importance for cash flow and presents main risk factor.

The provided evaluation has assessed the viability of the project based on financial forecasts of income and expenditure related to the new created technology. The literature however presents an opportunity to evaluate the benefits of technical knowledge from the perspective either from the perspective of the entire company or a combination of quantitative

and qualitative evaluation (Malý, 2007); these might be a vital topic for future research. Valach et al. (2005) recommend more elaborated risk analysis, that can also be further examined in R&D investment analysis.

Since the beginning of the new millennium there have been more notable efforts to maintain a stable ratio of public support and also to create an efficient combination of direct and indirect public support to enhance private investment in R&D projects. Elschner et al. (2011) chart the development of R&D tax support in the private sector in EU countries) and used a model of the tax incentives impact to measure the average tax burden for a hypothetical company in a 10 year life cycle. Elschner et al. (2011) have compiled results stating that the third highest tax relief is offered by the Czech Republic as the construction of additional deduction from the tax base. This means that the R&D expenses are deducted from the tax bases twice - firstly as a regular expense (cost) and secondly as a tax allowance. Future research should examine the impact of tax rules to R&D investment in the Czech Republic.

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Annex

Financial plan Alternative 1

Period	2017	2018	2019	2020	2021	2022	2023	2024
License fee	600	500	400	400	300	20	10	10
Advisory services	600	600	550	550	250	100	40	30
TOTAL REVENUES	1 200	1 100	950	950	550	120	50	40
Staff costs / expenses	65	60	55	50	50	50	50	50
Expert costs / expenses	60	50	45	40				
TOTAL EXPENSES	125	110	100	90	50	50	50	50
CASH FLOW	1 075	990	850	860	500	70	0	-10
DISCOUNTED CASH FLOW	1 034	915	756	735	411	55	0	-7

Source: own

Financial plan Alternative 2

Period	2017	2018	2019	2020	2021	2022	2023	2024
License fee	600	500	400	200	80	20	15	10
Advisory services	600	600	550	250	220	100	30	30
TOTAL REVENUES	1 200	1 100	950	450	300	120	45	40
Staff costs / expenses	65	60	55	50	50	50	50	50
Expert costs / expenses	60	50	45	40				
TOTAL EXPENSES	125	110	100	90	50	50	50	50
CASH FLOW	1 075	990	850	360	250	70	-5	-10
DISCOUNTED CASH FLOW	1 034	915	756	308	205	55	-4	-7

Source: own