Innovation as the final result of R&D projects

Abstract: R&D projects are the types of projects which can be a source of innovation. The complexities and unpredictability of R&D projects mean that companies need to continuously review projects' assumptions to attain success. In order to establish a system of indicators, metrics and forecasts to measure the project results, a division of R&D works must be carried out: basic research, applied research, experimental development. The method of accounting for income and expenses incurred in the research activities differs due to the division for these different types of research. Only properly recognized types of R&D projects will give project managers appropriate information to assess expenditures and monitor project progress.

Keywords: innovation, project, research and development, R&D costs

Introduction

Research and technology development has become one of the key success factor for growth and development for organisations. Nowadays, innovations are the domain, not only of research organisations such as universities or research institutes, but also of companies operating in different branches. These investments are important for companies to remain competitive.

Research and development projects (R&D projects) are characterized by uncertainty over their future results. The R&D project outcome (innovation) may not be understood, it may be resisted by competitive forces or it may be mismanaged through poor research into the process of innovation\(^1\).

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The complexities and unpredictability of R&D projects mean that companies need to continuously review projects’ assumptions to attain success. Organisations implement more sophisticated tools and techniques in project management which can improve effectiveness in managing multidisciplinary activities. Traditional project management methods may be inadequate for a R&D project. Obtaining better project control is among the top priorities of project managers implementing R&D ideas.

R&D project versus innovation

To improve competitiveness an organisation can implement various types of change in its methods of work or its use of factors of production. Developing new products or processes as a result of R&D projects is one of the ways by which the organisation can experience future growth. Research and experimental development (R&D) comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including human knowledge, culture and society, and the use of this stock of knowledge to devise new applications\(^2\). According to the Oslo Manual innovation activities include all scientific, technological, organisational, financial and commercial steps which actually, or are intended, to lead to the implementation of technologically new or improved products and processes\(^3\). Research and development is one of these innovation activities. Other forms of innovative activities are: acquisition of knowledge as patents or licences and tools of acquisition necessary to develop new or improved products or processes\(^4\). Frascati Manual of R&D projects may be implemented at different phases of the innovation process and may act not only as the original source of inventive ideas but also as a means of problem solving which can be called upon at any point up to implementation\(^5\).

Literature examines innovation from many and various perspectives. It is difficult to find one definition of innovation agreed on. The classical approach to innovation is represented by Joseph Schumpeter. He is accepted as the first economist to underline the relevance of innovation. He argued that economic development is driven by innovation through a dynamic process in which new technologies replace the old. Schumpeter proposed five types of innovation: the introduction of new products, the introduction of new methods of production, opening new markets, development of new sources of supply for raw materials or other inputs and the creation of new market structures in an industry\(^6\). He defined innovation as a product, a process and as organizational changes which may use already existing technologies or their applications in a new con-
text (not necessarily arising from new scientific discoveries). He noticed that entrepreneurs innovate by introducing new products, new means of production and new forms of organization.

The authors of this paper adopted the definition of the Oslo Manual published by OECD in 2005. According to the Oslo Manual an innovation is the implementation of a new or significantly improved product (goods or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. The implemented innovation may be new to the company, new to the market or new to the world.

The Oslo Manual distinguished four types of innovation: product innovation, process innovation, marketing innovation and organisational innovation. A product innovation is the introduction of goods or service that is new or significantly improved with respect to its characteristics or intended uses. It utilise new knowledge or technologies, or can be based on new uses or combinations of existing knowledge or technologies. Improvements should be introduced in such areas as technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics. A process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Process innovation can be intended to decrease unit costs of production or delivery, to increase quality, or to produce, or deliver new or significantly improved products. A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovation is aimed at better addressing customer needs, opening up new markets, or newly positioning a firm’s product on the market, with the objective of increasing the firm’s sales. An organisational innovation is the implementation of a new organisational method in the firm’s business practices, workplace organisation or external relations. Organisational innovation can be intended to increase a firm’s performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labour productivity), gaining access to non tradable assets (such as non-codified external knowledge) or reducing the cost of supplies.

The main interest of this paper are R&D projects implemented by organisations, therefore, it is important to underline that innovation term is a broader term than R&D and comprises a number of activities that are not included in R&D. Such activities may include later phases of development for preproduction, production and distribution, development activities with a lesser degree of novelty, support activities such as training and market preparation, development and implementation activities for innovations such as new marketing.

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methods or new organisational methods which are not product and process innovations or acquisition of external knowledge or capital goods\(^9\).

**Characteristics of R&D projects**

Projects are recognized as major components of business activities of present day organizations. A project can be defined as a sequence of activities to accomplish a temporary endeavour to create a unique product or service. Each project is unique in some aspect and introduces some novelty. The implementation of R&D projects leads to the development of new or an improvement in existing products or processes, new marketing methods, or new organisational methods knowledge and skills. R&D projects are the type of project which can be a source of innovation.

R&D projects can vary from other types of projects. The outcome may be difficult to define and long-term and difficult to measure. The relevance of the project may change rapidly as a result of an unstable, changing research environment. All the above mentioned characteristics mean that R&D projects are high risk as they may have several sources of uncertainty: the cost and time of development, the level of market requirement, technological performance; and the payoff market\(^10\).

The average innovation management proficiency level among European SMEs is not sufficient to be considered globally competitive\(^11\). Polish organizations operating in the field of R&D rarely use project management methodologies or any formal management support systems\(^12\). Universal methodologies and standards proposed by different organizations promoting project management practices and techniques such as PMI (Project Management Institute), IPMA (International Project Management Association or Prince2 (Project in Controlled Environment) may not be sufficient enough in the case of a R&D project. Methodologies developed by industry-specific organizations may include specific circumstances of the branches but depends on the level of knowledge and skills of those organizations. Organization-specific methodologies may be applied but their area of application is usually limited to the organization for which they were developed.

Characteristics of R&D projects reinforce the need for effective project management especially for ongoing monitoring and reviewing project assumptions by\(^13\):

- developing a system of indicators, metrics and forecasts;
- informal meetings or formal reviews of the project status;

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Innovation as the final result of R&D projects

Innovation as the last step of R&D activities - financial framework

As mentioned in the Oslo Manual, it is not enough to invent, describe or develop an idea in order to name it ‘innovation’. Only implemented (or proved possibility to implement) might be described as innovation. Into activities that are aimed at innovation implementation, the Frascati Manual includes research and experimental development (R&D), that is defined as ‘work undertaken on a systematic basis in order to increase the stock of knowledge, including human knowledge, culture and society and the use of this stock of knowledge to devise new applications’[^14]. The main reason to undertake a R&D activity is acquiring new knowledge and creating a situation where its implementation as an innovation will be possible.

Innovation is the very first application of a new idea or knowledge, but first R&D action (formal or informal) must be undertaken. In order to establish a system of indicators, metrics and forecasts to measure the project results, a division of R&D work must be done:
- basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. This research is relatively rare in the business sector (but very often conducted at research institutions), because it does not result in knowledge possible to directly apply to a business activity,
- applied research is also an original investigation undertaken in order to acquire new knowledge, but is directed primarily towards a specific practical aim or objective (developing new products, processes or services or implement substantial improvement into already existing products, processes or services),
- experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed at producing new materials, products or devices, to install new processes, systems and services, or to improve substantially those already produced or installed.

In light of the above, the method of accounting for income and expenses incurred in the research activities differs due to the division for these different types of research. Both research and experimental development should be considered a type of investment, which results in business’s intention for future profit, but increasing the company’s assets is possible only as a result of experimental development.

The distinction between research activities and its results which are possible for commercial use is underlined in International Accounting Standard 38 Intangible Assets. Research is defined as an original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge.

and understanding\textsuperscript{15}. In the research phase of an internal project, an entity cannot demonstrate that an intangible asset exists that will generate probable future economic benefits. Therefore, this expenditure is recognised as an expense when it is incurred\textsuperscript{16}. This becomes particularly important if a business conducts R&D activities in an occasional way and will result in a distortion of the profit and loss account because of higher costs. A solution might be to account R&D costs as short-term prepayments. When starting a R&D activity a business counts on the results in the form of new solutions, which is known after finishing R&D. That is why a business may treat costs as a current cost only when there is a certainty that they cannot result in creating an intangible asset\textsuperscript{17}.

A division into R&D and development research when there are no strict criteria is very subjective, but it is extremely important that business understands the different nature of research (basic and applied) and experimental development aimed at commercialization of research results. This distinction is important because of the fact that experimental development (when finished) might be classified as intangible assets if fulfilling the following criteria\textsuperscript{18}:

- product or technology production is strictly defined and the related costs of experimental development are reliably identified,
- the technical suitability of the product or technology has been properly documented by the business and on this basis the business has decided to manufacture these products or the use of technology,
- documentation concerning experimental development shows that development costs will be covered by the expected income from the sale of these products or the use of technology.

If the above criteria cannot be fulfilled, the business can classify expenses when they occur and attribute them to other operating costs due to the fact that the company cannot link research activities to the probability of future income. It is worth mentioning that experimental development does not include routine or periodic changes made to products, production lines, manufacturing processes, existing services and other operations in progress, even if such changes may represent improvements\textsuperscript{19}. Very often these improvements are actually attributed by businesses as R&D activities – 55.6\% of respondents asked by Deloitte during a survey ‘Research and development in Poland 2014’ defined their understanding of R&D as ‘changes/improvements of existing products/processes/services leading to better performance/characteristics of products/processes/services’. ‘Development of new products/processes/services’ as a R&D activity was selected by 48.6\% (down from 78.0\% in 2013).

\textsuperscript{15}\textit{International Accounting Standard 38 Intangible Assets}, par. 8.
\textsuperscript{16}\textit{International Accounting Standard 38 Intangible Assets}, par. 55.
\textsuperscript{18} Ustawa z dnia 15 lutego 1992 o podatku dochodowym od osób prawnych (Dz.U. 1992 No 21 poz. 86, as amended), art. 16b par. 2.3., Ustawa z dnia 29 września 1994 o rachunkowości (Dz.U. 1994 No 121 poz. 591, as amended), art.33 par.2.
\textsuperscript{19} Ustawa z dnia 30 kwietnia 2010 o zasadach finansowania nauki (Dz.U. 2010 No 96 poz. 615, as amended), art. 2 par. 4.
Joint realization of research projects aimed at improvement or development of new products / processes / services with other capital group entities / companies, declare 29.2% or survey participants (a significant decrease from 70.7% in 2013)\(^{20}\). It is sometimes extremely difficult to attribute research activities to one of the R&D phases, then Technology Readiness Levels (TRL) description (a type of measurement system used to assess the maturity level of a particular technology) might be helpful. There is no clear division of costs occurring in each R&D phase, although some are rather attributed to experimental development, for example:

- the design, construction and testing of pre-production or pre-use prototypes and models,
- the design of tools, jigs, moulds and dies involving new technology,
- the design, construction and operation of a pilot plant that is not of a scale economically feasible for commercial production; and
- the design, construction and testing of a chosen alternative for new or improved materials, devices, products, processes, systems or services\(^{21}\).

Each business must implement a clear definition of experimental development and directly implement it into its accounting policy, because only if fulfilled the criteria for capitalisation research activities lead to the creation of (intangible) assets. It is easier in the case of a project financed by the EU grants division into different research categories, because they must be declared before the project starts in an application or business plan.

**A comprehensive research programme aimed at commercialization of research results – a case study in SME**

The ‘NN company’ is present on the market since 2007 and since this time is driven by innovation-seeking approach. One of the company’s strategic goals was to gain competitive advantage by investing in personnel and ongoing development of know-how based on new technologies, as well as by ensuring a high quality of its services, therefore the company has grown rapidly. In order to expand the business and enter new markets (but also as a result of continuous monitoring of market needs and competitors’ offers) the ‘NN company’ decided to launch a series of projects aimed at gaining substantial competitive advantage.

A case study presented in this subsection concerns research project conducted in the years 2013-2014, financed by the Innovative Economy Operational Programme under the Priority Axis 1 – Research and development of state-of-art technologies, by the contracting authority – the National Centre for Research and Development (NCBiR). Funding (app.14 mln PLN) was provided to conduct industrial research focused on the creation of a laboratory prototype of a new product (the project’s operational aim) and after project completion—up-scaling the laboratory prototype into a production prototype and implement-

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\(^{21\}}\) International Accounting Standard 38 Intangible Assets, par. 59.
ing the product on the commercial market in two years (the project’s strategic aim). Only the reach of the operational goal (R&D phase) was financed by the NCBiR, however, the financial agreement signed between the NCBiR and the ‘NN company’ obliged the latter party contract to also reach the strategic aim (otherwise all financial contribution made by NCBiR must be returned). The business case developed before the start of the project made these two main goals inextricably linked and ordered the discontinuation of the project in case some external factors (e.g. new competitors with the same technology) or external factors (failure of the laboratory tests) occurred. The possibility of closing the project without the achievement of the operational goal was also entered into the financial agreement. The project was conducted in cooperation with 3 partners (one technical university, one small business and one research institution) and the ‘NN company’ as a leader.

The project was a highly innovative venture, with a huge impact on the firm’s competitiveness – the result of the project is a world novelty and will give a substantial competitive advantage. The project was implemented into an organisation that has no formal project management system and accepted methodologies, but in which accounting system allows precisely the allocated costs of each project (and furthermore, allows for breakdown of project cost into standard categories as salaries, materials, subcontracting, equipment, consumables and others but also into different categories tailored to the specifics of the project). Despite the lack of a formal project, programmes and portfolios management system project managers use project management practises and techniques, especially combined IPMA and Prince2.

The project budget was divided into 5 work packages (a group of activities with attributed scope, cost, duration, products and that which can be managed, monitored and estimated). Each work package was assigned to a different partner, 2 of them were managed by a R&D department in the ‘NN company’, that operated also as a coordinator for the whole project and was responsible for project success. Each work package covered the same cost categories: W (personnel), A (equipment), E (subcontracting), Op (consumables e.g. laboratory materials) and O (other costs such as managing, postage, telephones, travel etc.). O category covered overhead costs calculated as a percentage of W+A+E+Op costs. The cost breakdown was forced by the catalogue of eligible costs for the R&D phase – mandatory for all R&D projects in NCBiR but was helpful during project management and accounting.

In order to easily distinguish between R&D and experimental development costs, while preparing the project scope the ‘NN company’ described 4 work packages as applied research and 1 as experimental development. The costs of the applied research in the whole 4 packages were accounted as a current cost (accounting account group no 4 and 5), the last work package (no 5) covered experimental research and costs were accounted into accounting account group no 6. After achieving the operational project goal (developing a laboratory prototype) an up-scaling phase was conducted (developing a production prototype). The next step was to conduct further feasibility studies that proved that from the economic and technical point of view implementing a prototype into serial production is reasonable and will bring profit (NPV and IRR
was used as a main measure, also a market research was conducted) the costs of work package no 5 (and up-scaling phase) were accounted from accounts group no 6 to account no 020 ‘intangible assets’ (all criteria mentioned in art. 33 and its depreciation is accounted on account group no 4 and 5 for no longer than 5 years\textsuperscript{22}.

\begin{figure}
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\includegraphics[width=\textwidth]{cost_control_cube.png}
\caption{Cost control cube in ‘NN project’}
\end{figure}

At present the project is at the phase of the implementation of project results into production. Parameterization of the production line has been done, the production hall is being built and an assembly line has been ordered. The new product will not be implemented to the market until the end of 2016.

Summary

The implementation into businesses usual activities of innovative projects aimed at state-of-art technologies/products or other project outcomes seems to be a well-know method for gaining competitive advantage. To effectively manage R&D projects, managers must be aware of the necessity of a clear declaration whether planned (or in progress) research activities are actually in the process of research or at an experimental development. Only when properly recognized, will this give project managers the appropriate information to assess expenditure and monitor project progress. The most popular method

\textsuperscript{22} See more: E. Maćkowiak, Ujęcie nakładów na prace badawczo-rozwojowe według międzynarodowych standardów sprawozdawczości finansowej i ustawy o rachunkowości. Zeszyty Naukowe Uniwersytetu Szczecińskiego nr 757, „Finanse, Rynki Finansowe, Ubezpieczenia” nr 58, Szczecin 2013, pp. 95-96.
to monitor project progress as earned value is based on occurred costs and if the project manager is not aware of the differences in R&D costs and experimental development costs, he will never have a clear picture of where the project actually is in its life cycle. If the project will result in the creation of intangible assets (although it might not be the project’s aim) the business case should be reviewed because costs leading to these assets do not burden the current costs but will be revealed as depreciation in the next few years. All these details might be considered as a trifle to the project manager while managing a few million project, but make a substantial difference while considering the profitability of the project.

**Bibliography**


Insights in Innovation Management – Tangible Results from IMProve; European Commission; Europe INNOVA Paper no 10; 2008. *International Accounting Standard 38 Intangible Assets.*


Ustawa z dnia 29 września 1994 o rachunkowości (Dz.U. 1994 No 121, poz. 591, as amended).


Ustawa z dnia 30 kwietnia 2010 o zasadach finansowania nauki (Dz.U. 2010 No 96 poz. 615, as amended).