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Responsible Innovation and R&D&I Controlling

István Deák[1] – Miklós Lukovics[2]

The compulsion to quickly change technologies, continuously shortening product life cycles, the acceleration of product development processes, customers' increasing expectations regarding price, quality and services pose ever more difficult challenges on organisations in the keen market competition of our days. The importance of research and development is growing, expenditures on research, development and innovation (R&D&I) are increasing – yet, this can accompany an increase in the unintended negative impacts of the results of innovation. For this reason, the concept of "responsible innovation" has by now become a key focus point in the European Union. Controlling functions and tools must also be adapted to these challenges. The widespread application of controlling tools and methodology is becoming natural in nearly all companies. Consequently, it is also natural that companies willing to gain long-lasting competitive advantages that come from different sources need state-of-the-art R&D&I controlling to support their R&D&I activities. The importance and necessity of R&D&I controlling are, therefore, indisputable in our days.

This study will try to identify the reasons for the growing importance of the two current megatrends, R&D&I and responsible innovation. It will review the information content of R&D&I related costs and expenditures and the possibilities of their management in a decision supporting system, attempt to define the key components of R&D&I controlling and try to position one of these components, the concept of responsible research and innovation.

Keywords: accounting, R&D&I controlling, responsible research and innovation

1. Introduction

As a result of globalisation, market competition is also becoming ever more global: large companies' competition strategies reach beyond the boundaries of national markets and extend market competition to the entire developed world. „Corporate success clearly depends on innovation" (Lengyel 2003, pp. 101). In our days' information society, knowledge has become a key element of competitiveness and the driver of economic development. „The quick introduction of innovations and new

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technologies is a competitive advantage" (Lengyel 2000, pp. 980). Innovation can be considered as one of the most important sources of the competitive advantages of modern economies (Holbrook–Wolfe 2002). The ability to acquire, adapt and create knowledge determines the innovation opportunities and, through these, the competitive power of both companies and regions.

In the 1960s, the linear model of R&D&I was the generally accepted one (Inzelt 1998). Today, by contrast, a competitive advantage comes from the existence of a highly developed innovation culture. Product life cycles have shortened, processes must be accelerated: to improve competitiveness, the *simultaneous* development of research, innovation, education and vocational training, the spreading of scientific and technology related knowledge and its appearance among the competitive advantages of the businesses operating in a given region are a must. Lengyel, Imre (2003) highlights the importance of the knowledge based economy: „A corporate competitive advantage can be maintained in the long term only where innovation-targeted research and development activities, i.e. knowledge creation, are permanent" (Lengyel 2003, pp. 19).

The compulsion to quickly change technologies, continuously shortening product life cycles, the acceleration of product development processes, customers' increasing expectations regarding price, quality and services, environment consciousness requirements, etc. pose ever more difficult challenges on organisations in the keen market competition of our days and, in many instances, an unavoidable side-effect of this accelerated compulsion for innovation is the occurrence of certain unintended, negative impacts of the innovation activity. It is this challenge that Responsible Research and Innovation (RRI) addresses: RRI is a fast spreading approach in the European Union, which *has become a central element of the 2014–2020 programming period.* Responsible innovation is an important direction of development to the European Union, as the European Commission's most recent report entitled „*Responsible Research and Innovation (RRI), Science and Technology*" (published in November 2013) also shows. For the purposes of this study, the term 'responsible innovation' carries the following meaning: *Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products* (von Schomberg 2013, pp. 51-74).

2. Controlling in the Service of R&D&I

The importance of research and development is growing and the functions and tools of controlling must adapt to this change. As the application of controlling activities and tools is becoming ever more natural in nearly all companies (Horváth & Partners 2003), those that want to gain long lasting competitive advantages coming from

different sources will increasingly apply some controlling methodology to support their research and development activities. The aim of R&D&I controlling is to make research and development activities as transparent as possible with regard to costs, objectives and variances and is used for the target-oriented coordination of R&D&I activities (Jung 2001). R&D&I goals – similarly to most goals – may be strategic or operative. The starting point of R&D&I controlling is an up-to-date information system, whose data form the basis of all sorts of planning, variance analysis and information supply for decision preparation. For the reasons outlined above, the importance and necessity of R&D&I controlling are, therefore, indisputable in our days (Jung 2001).

In its research project closed in February 2003, the Boston Consulting Group surveyed the research activities of 13 market leading technology intensive large companies. Successful R&D&I management can be built around three factors (BCG 2003):

1. The corporate strategy must be the starting point for the definition of a clear R&D&I strategy and the strategic objectives of R&D&I must be detailed.
2. R&D&I projects must be prioritised. This is the only way to efficiently achieve the R&D&I objectives defined.
3. The efficiency of R&D&I projects can be improved through the use of so-called success boosting tools. These are time management, quality management, resource management, human resource management, knowledge management and R&D&I-controlling. The successful companies covered by the survey have a separate and independent R&D&I controlling office, which is responsible for the efficient utilisation of the available research and development costs and the achievement of R&D&I objectives.

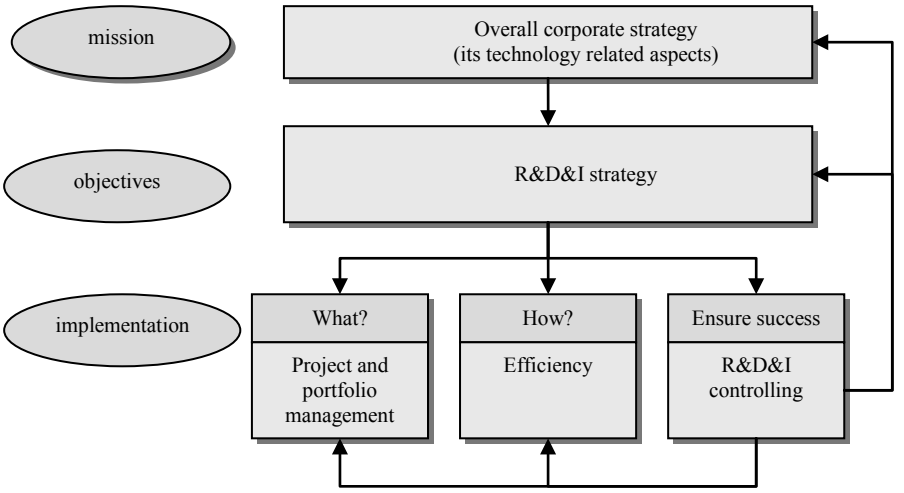
In successful companies, R&D&I controlling plays roles that are similar to traditional controlling functions (BCG 2003). Its aim is to make the whole process as conscious, transparent, easy to plan and controllable as possible. For the sake of controllability, it must certain items of information available to decision makers in a timely manner, in the appropriate quantity and quality and in the most cost efficient manner (Borchert–Hagenhoff 2003). In other words, it plays a key role not only in implementation but permeates the whole process, all the way from strategy compilation through implementation to feedback (Chart 1).

In general, controlling traditionally deals with hard data (cash-flow, payback, productivity, turnover rate, cost data, coverage amounts, etc.). In the knowledge based economy of our days, controlling must offer an increasing coverage of other factors, which affect the company's level of success but are difficult or impossible to measure, called "soft factors". This is where the *Balanced Scorecard* (BSC), a balanced system of strategic indices that became widely known in the late 1990s and quickly went very popular, offers some kind of help. Besides translating the strategy

into operative actions, it attempts to take into account soft economic factors – which is where it becomes significant for the purposes of our topic. What it does is it supplements traditional financial indices with further aspects, which map the strategic direction (Laue 2004). The BSC operating processes aspect[3] incorporates three fundamental processes (Kaplan–Norton 1999):

1. innovation process;
2. production process;
3. after-sales services process.

Chart 1. The connection of R&D&I controlling to the strategy and to the implementation level



Source: BCG (2003)

Many companies' performance measurement systems focus primarily on the efficiency of the production process when it investigates the operating process, though the efficiency of the research and development process is at least as important. One of the obvious reasons for this approach is that the relationship between the *input used* and the *result achieved* is far weaker and uncertain in the case of the research and development process than with the production process. The problems arising in connection with the measurement of the input-output ratio ought not to prevent the controlling system from translating the corporate strategy into indices and objectives for R&D as an operating process, following the BSC logic. The indi-

[3] The Balanced Scorecard is comprised of four aspects aspect: the financial aspect, the customer aspect, the aspect of operating processes and the learning and development aspect (Kaplan–Norton 1999).

ces applied – which make research and development „easier to handle" for controlling – could include[4] (Kaplan–Norton 1999, Laue 2004):

- Percentage of sales revenues from new products.
- Launching of new products compared to competitors or the plan.
- The potential in the production process.
- The time required for the development of a new generation of products.
- Number of innovation proposals.
- Ratio of successful product development projects.
- Ratio of idea utilisation

3. Strategic R&D&I controlling

To be able to take an even more sophisticated approach to the role of controlling in research and development, we must separate the strategic and operative levels. Strategic controlling works along a long term planning time horizon: it tries to tailor the company to its actual environment, aims at maintaining the already achieved success potential and return on capital and takes part in the compilation of the corporate strategy (Körmendi–Tóth 2003). Consequently, R&D&I controlling must make fundamental decisions at the strategic level, like set the route for the long term R&D&I activity (Borchert–Hagenhoff 2003). Based on these general features, the tasks of strategic R&D&I controlling can be described as follows (Göpfert–Hoppenheit 1991):

1. One of the key tasks of strategic R&D&I controlling is to seek, find and evaluate new ideas. An idea can be channelled through the innovation process and can ultimately become a successful innovation result. For this, a variety of idea generating techniques is available and a database can be compiled of ideas that seem viable.
2. Recognition of technology trends: an obvious strategic matter is to define the research route which must be followed in the next few years. A prerequisite of this is the knowledge of current international trends. For this purpose, trend extrapolation can be performed and, at this point, we must also make mention of the follow-up and analysis of patents, which is also a task of strategic R&D&I controlling.
3. Preparation of technology related make-or-buy decisions, supply of the necessary information. The desired level of technology can be achieved, besides internal development, through the adaptation of state-of-the-art technologies and technology takeover/sharing, i.e. technology transfer

[4] Naturally, the indices applied are company-specific: they heavily depend on the actual corporate strategy and the management's information need.

(Buzás 2002). In general, the following company types stand on the demand side of technology transfer (Buzás 2002):

a) which do not have the opportunity or need to assemble an R&D&I unit of their own;
b) which need basic research that they can only obtain from external sources;
c) whose R&D&I capacity is already fully utilised;
d) which must amalgamate their own know-how with some external technology.

4. Setting and coordination of general corporate and R&D&I objectives. Strategic R&D&I controlling plays a coordinating role in the definition of the organisation's strategy – and this role comes into its own when the strategy's technology related aspects are defined. This is a key point as this is the cornerstone of the company's R&D&I strategy – which is the starting point of future activities in all areas. Once the strategy is defined, R&D&I-controlling fulfils the traditional controlling functions, i.e. planning, plan/actual variance analysis and information supply for the preparation of decisions.
5. Strategic controlling has the task of selecting that/those from all the project alternative(s) it is familiar with which is/are relevant from the point of view of the corporate and/or R&D&I strategy. Once this selection is made, the company's research programme has to be recorded.
6. Strategic control of research projects: strategic R&D&I controlling monitors the implementation of the strategic plan, evaluates variances (if any) and works out decision alternatives for cases where variances are identified.

Over and above these, the roles of strategic R&D&I controlling also include:

7. Supporting all decisions related to responsible innovation, provided that we consider responsible innovation as the narrowing down of the concept of 'sustainability' to 'innovation policy', which, in the broadest sense, is commitment to protect the future, which, in turn, can be implemented through the responsible handling of science and innovation today.

4. Operative R&D&I Controlling

By contrast, operative controlling works along a short and medium term planning time horizon: it focuses on the economic efficiency of operating processes. It primarily investigates the profit-return-cost dimension. Its goal is to ensure profitability, economic efficiency and liquidity (Körmendi–Tóth 2003). At an operative level, R&D&I controlling primarily performs the planning, controlling, coordination and

checking of the individual R&D&I activities, with an eye to ensuring that the objectives set can be achieved. Its tasks are (Göpfert–Hoppenheit 1991):

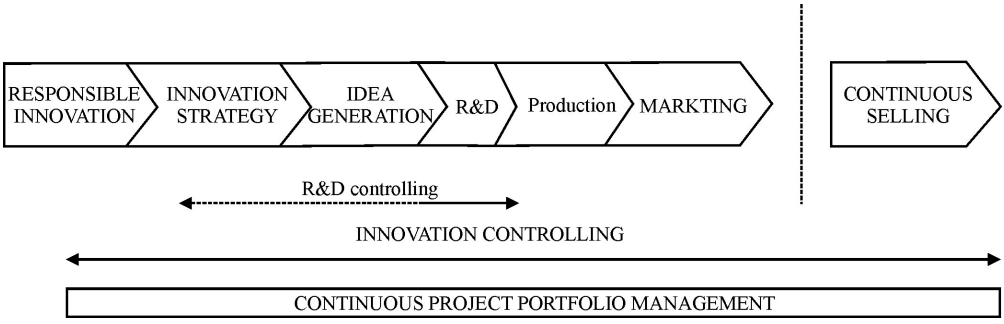
1. Support planning: operative R&D&I controlling helps to plan the rollout of the given research and development project, breaking it down to deadlines, responsible people and tasks. Another important task is assistance in the planning of the budget and the required human and technical resources. The documentation of the framework plans of the individual projects and partial projects and the making of proposals for the improvement of the efficiency of projects also fall in the scope of responsibility of operative R&D&I controlling.
2. Variance analysis. The follow-up of project goals and project plans – especially with regard to deadlines, costs and quality –, the identification of the reasons for and the expected impacts of any variances and the elaboration of adjustment proposals are among the key tasks of operative controlling. Further important roles include the identification and analysis of actual costs and the performance of efficiency analyses.
3. Coordination: the activities of the units and persons taking part in the R&D&I process must be coordinated. The vertical and horizontal coordination and integration of project goals and plans must be implemented.
4. Information supply: among other things, the difference between controlling and the performance of simple checking and monitoring tasks is that the former provides decision makers with information that can be used as grounds for and to prepare decisions (Körmendi–Tóth 2003). As part of these activities, such indicators can be defined and integrated into the system which recognise deviations from the planned route in time and hence enable early intervention. Operative R&D&I controlling plans and operates the information system which is relevant to research and development.

The information system supplies the input for the panning and monitoring system and is, therefore, tightly connected to it (Neubauer 2004). Accounting primarily deals with events of the past and, given that, can say very little about the future, though the value of the company is primarily no longer in its assets but in its strategy and the intellectual resources that support it (Daum 2001). Consequently, we consider it important that we describe how accounting handles research and development activities and, through that, what starting data it supplies for the controlling system. „… we must deal with those intellectual resources in more depth which lay the foundation for the future" (Buda 2003).

A typical case of recognising opportunities is when the research and development unit comes up with novelties, using their abilities and technology related knowledge obtained from previous products and innovation processes. Besides their internal resources, innovative organisations can use external sources – like universities, research institutes, suppliers – to collect ideas for their projects, from which

they can then assemble their R&D&I portfolio. The "research and development portfolio" means a mixture of projects of different types which the management continuously reviews, i.e. initiates new R&D&I projects and stops others due to their unsatisfactory results. The purpose of product development is to create an innovative product/service that is attractive to the target market and can be produced at an appropriate cost level. At the end of the product development cycle, the new product/service is prepared for commercial production. The project team made responsible for this task performs experimental development, makes a prototype, tests the finished product and, finally, initiates commercial production. The follow-up of the entire innovation process is the task of innovation controlling, within which R&D&I controlling plays a key role already during the collection and evaluation of ideas but, especially, in the course of the planning and development of products/services (Gleich–Schentler 2011). However, it is a good practice to manage the whole process through the eyes and approach of responsible innovation as the ethical acceptability, sustainability and social desirability of the product born as the result of the process are of fundamental importance (Chart 2).

Chart 2. The innovation process and controlling



Source: Edited by the authors, based on Gleich–Schentler (2011)

5. Input Data: Handling of R&D&I in Financial Accounting

The accounting of R&D&I activities basically means the accounting and recording of the costs incurred. In the course of this activity, at least three areas must be focused on:

1. the information needs of the controlling system;
2. the related provisions of accounting regulations;
3. the related taxation rules.

It is a good practice to create all these three areas within the closed system of accounting, i.e. in synthetic accounting, a purposefully compiled system of the cost accounts must be created. As much as practicable, the satisfaction of the needs and requirements of the controlling system must be ensured. When this is done, it is not easy to find the optimal relationship between the strictly regulated (standardised) accounting that ensures the satisfaction of external information needs and the accounting that is suited to internal information needs and supports the company-specific monitoring of operating processes.

In this area, there may arise a particularly strong need to utilise the opportunities offered by management accounting: it often happens that a cost appears in traditional accounting with a significant delay (when it becomes an economic event, i.e. when it is incurred) (Boda–Szlávik 2001). Financial accounting can support this, utilising the high level of freedom provided by regulations, by enabling the creation of a cost centre-cost bearer structure that is tailored to actual information needs. This is necessitated by factors like capitalization performed within the framework of accounting regulations, the separation of activities carried out for internal purposes and on order and the application of tax relief types offered by the taxation system.[5] With only a few exceptions, accounting rules usually prohibit the capitalization of such costs as the same would not comply with the general requirements of B/S capability, with special respect to the condition that future profit can be expected.[6] Nevertheless, the same procedures can be followed with the definition and keeping of cost accounts, the payment and allocation to order number of costs incurred and the breakdown (if any) of indirect costs as with any other self-produced assets. The costs of human resources, the value of the services provided by external experts or procured from other sources and of materials used, the depreciation of the tangible assets used for business activities, etc. and the costs subsequently divided among different projects are accounted among the direct costs of R&D&I activities, in different proportions, depending on the actual type of activity.

In accounting, a sharp distinction must be made and separation should be applied between the *research* and the *development* phases. The different accounting regulations (including the Hungarian one) take a uniform approach towards the accounting of *research* (basic and applied research) activities in that they do not permit the reallocation of such costs to different years either through capitalization or by accruing/deferring (Chart 3). The explanation behind this approach is that, during the cost accounting period it is (usually) not possible to verify the certain collection of future profits, which makes comparison with future revenues dubious. For this

[5] Not disputing the acceptability of the solution in which the exclusively cost type based accounting is supplemented with some sort of analytic collection.

[6] One of the most important features of research and development activities is their high level of uncertainty (Inzelt 1998).

reason, R&D&I mostly occurs in the reports of companies as an *invisible asset*[7] (Hollender–Deák 2004). The allocation of costs to the year of their incurrence may cause a significant variability of the result[8], rendering the direct comparison of the results of the different years unreliable. This statement may significantly change if the price of activities carried out on order is accounted as sales revenue and if the non-refundable subsidies that partly or fully provide the financing for R&D&I activities are accounted as other revenues.[9] The amount of subsidies received on or before the day of B/S compilation must also be stated in the reported year's financial report (as accrued income). Special attention must be paid to the accounting of the tangible assets serving R&D&I activities and the non-refundable supports received for these.

In the case of projects in the *experimental development* phase, it is now allowed by regulations to include these costs in the B/S as an intangible asset, if so decided by the company (stringent conditions applying), and to thus offset the expenditure burdens of the different years[10] (Chart 3). Similarly to the research phase, the allocation of costs to the year of their incurrence may cause a significant variability of the result, rendering the direct comparison of the results of the different years unreliable.[11] A precondition of capitalization is the properly documented statement of the future extra revenues or cost savings achieved as a result of experimental development and providing a return on coverage. When determining the self-cost of the asset so stated, the related provisions of the Accounting Act must be applied, i.e. only those costs may be taken into account which have been directly paid and accounted as the development to be capitalized, with the contents described in the company's internal regulations on self-cost calculation (Nagy 2004). Capitalization does not depend on whether any non-refundable support (subsidy) has been used to finance development. In such cases, it is reasonable to apply accruals for that part of the accounted supports (subsidies) among the reported year's revenues (due to capitalization) which is not offset with costs and to thus allocate the support (subsidy) to those years in which the capitalized development cost is accounted.

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[7] For the purposes of this document, the authors of this article, similarly to the authors referred to or quoted herein, use the term „*intangible assets*", widely used in international professional literature, to mean 'intangible assets', as used traditionally, *and* the 'invisible asset' types described in the body text *together*.

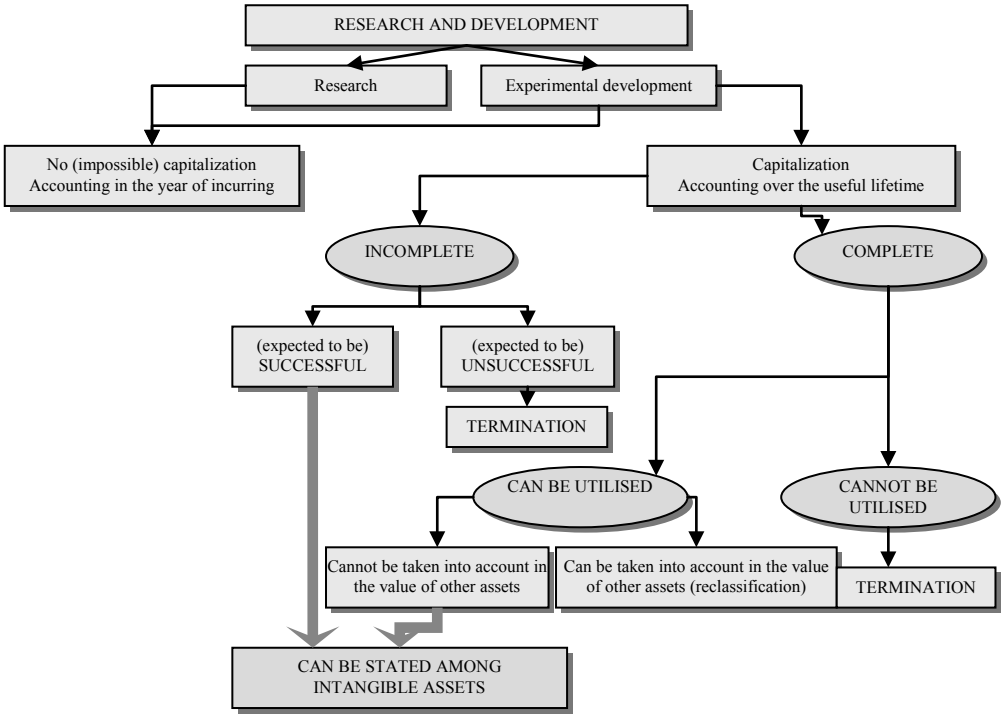
[8] Because, in the vast majority of the cases, these costs are not incurred evenly in time.

[9] The amount(s) of subsidies/supports already received under contracts or law to cover costs must be accounted as other revenues.

[10] It must be emphasised that the motivation behind capitalization may never be to improve the financial result.

[11] In the electronic industry, the product development process is usually comprised of two years of product development, followed by a five-year sales phase. As a result, the company starts to receive the first items of feedback about the level of success of the product development process (Kaplan–Norton 1999).

Chart 3. Decision making tree for the accounting of R&D&I activities



Source: Edited by the authors, based on Róth (2001)

The division of the costs of R&D activities into 'direct' and 'general' parts is necessary not only to determine the cost value, necessary for capitalization, but also to comply with certain taxation related rules and regulations. The purpose of the so-called innovation tax, introduced in the year 2004, is to collect government funds (Research and Technology Innovation Fund / "Kutatási és Technológiai Innovációs Alap"/) through direct taxation, to finance R&D. When the amount of this tax is determined, companies carrying out R&D activities can decrease the base of the tax with the amount of the direct costs accounted for this activity, whether or not such costs can be capitalized from an accounting point of view. The said decrease may not contain direct costs covered from any subsidy received from any local or regional organisation managing state budget funds.

Special types of tax relief are granted to companies performing research and development activities also in company tax and local business tax rules. These tax relief types can be applied when calculating the amount of tax base. According to this regulation, the amount of the direct costs of research and development activities performed for internal purposes or on order and accounted can be deducted from the tax base. Depending on the decision of the company, the tax base can be reduced in

one amount, in the year when the costs are incurred (accounted), or, alternatively, (in the case of experimental development that can be capitalized according to the Accounting Act) in the amounts of depreciation accounted in the individual years of depreciation. No tax relief can be applied after the value of R&D activities ordered from other parties, to avoid the deduction of the same amount as tax relief in different business organisations. For this reason, special attention must be paid to the separated accounting of these. This limitation does not apply to research and development ordered from organisations that operate in a state budget management system or from public benefit non-profit organisations. A special rule applies to companies that carry out their research and development activities jointly with an institute of higher education or with the Hungarian Academy of Sciences ("Magyar Tudományos Akadémia") or with any research institute founded by either of these. In these cases, the amount of deduction from the company tax base can be three times the original amount, though may in no case exceed HUF 50 million. As a result of tax base reduction, the company tax base may become negative. This negative amount may be offset against the positive tax base(s) of later years, in accordance with rules related to the carrying forward of losses. Companies carrying out research/development activities can reduce their company tax, local business tax and innovation tax payment obligations and can apply for state subsidizing for such activities. However, it is not possible to deduct such R&D costs from the tax base which have been financed from non-refundable support/subsidy (received, for example, from the Fund itself). It is obvious from the above that special care must be taken in the accounting and registration of costs related to R&D activities.

6. The Answer of Financial Accounting to Challenges

As was presented in the previous chapters, some of the costs of research and development appear in accounting with a certain delay, in an uneven distribution and in a manner that does not enable their offsetting against current revenues. Moreover, an often significant part of R&D remains hidden to the eyes of analysts preparing a report based on financial accounting, as an invisible asset. These make the identification of the company's real value difficult (Daum 2001). The U.S. Securities and Exchange Commission recognised this and tried to give an appropriate answer to new challenges. They made the proposal that, with the assistance of experts, it should be investigated how additional information could be provided on a voluntary basis about invisible asset types in addition to the currently compulsory reports and what further information could be used to help investors make the most accurate possible estimate of the future performance of a company (SEC 2001).

This approach also appears in the Hungarian Accounting Act: the rules on the textual parts of the financial report contain provisions regarding the presentation of R&D&I. As a general rule, the supplementary appendix must contain those data and

textual explanations that are required for the fullest possible presentation of the company's real wealth and financial situation and the result of its operation. According to the Act, the itemised supplements to the P/L Statement shall include the presentation of the costs of research and experimental development incurred in the reported year. As one of the purposes of the report is to present the data of at least two years beside one another, it is a good practice to state the R&D&I data of not only the reported year in the supplementary appendix but also those of base period(s). There are no rules as to how and in what form this should be done, it is up to the company to create the form of presentation with which it can best translate this rule into useful information supply, making sure that that usability of the information made available to the public should be in proportion with the costs of its collection and generation. As the data published in the supplementary appendix must also be supported with bookkeeping data, the obligation to comply with this rule also justifies the breakdown of costs by project and, within each project, into direct and indirect costs.

Research and development are focus areas of information supply not only in the supplementary appendix but also in the business report, which is a compulsory document to be compiled with the annual report. According to the Act, the business report must discuss business management together with the main risks and uncertainties occurring with the business activities, in an analytic manner. In our opinion, R&D&I activities (especially research) can be identified as such a risk factor and, as such, cannot be left out of consideration when the business report is prepared. As opposed to the supplementary appendix, which presents facts, the business report, which though also uses actual data, should put more emphasis on expected and planned factors and processes (expected results, expected time of completion, future research and development plans, etc.).

We think it is important to note that special care should be taken when the level of detail of the information published in the report is determined. We ought not to forget the trivial fact that financial accounting provides information for *external* stakeholders and, therefore, the essence of research and development would get lost if anyone could collect information about all of its details.

7. Responsible Innovation as a Part of R&D&I Controlling

To the management, it is of fundamental importance that they receive up-to-date and accurate information regarding corporate research and development. Financial accounting that complies with regulations can be a useful tool to achieve this. The arrangement, further breakdown and follow-up of the base data so collected belong to the competence of the controlling system.

Kaplan and Norton make an attempt at taking into account the earlier defined 'intangible assets' (Hungarian: "nem anyagi eszközök"[12]) in the company value. From the point of view of responsible innovation, such an approach is very important as the application of responsible innovation principles in R&D&I practice is an intangible asset whose internalisation may be a very important step towards successfully convincing decision makers that responsible innovation activities are a must.

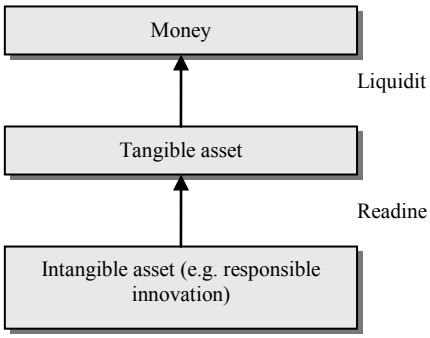
The strategic map is a framework which connects intangible assets, through the four aspects of the Balanced Scorecard, to the calculation of shareholder value (Buda 2004). The strategic map helps identify the internal processes that are properly aligned to intangible asset types and value creation. Value creation takes place along four main internal processes (Kaplan–Norton 2004a):

1. Operation management.
2. Account management.
3. Innovation process.
4. Society, regulatory environment.

Intangible assets fundamentally determine the efficiency of the above four processes and, hence, the entire corporate value creation and the successfulness of strategy implementation. To convert intangible assets into added value, all of the company's intangible assets must be defined, they must be aligned to the corporate strategy and the readiness of each intangible asset must be determined (Kaplan–Norton 2004a). By the term 'readiness' the authors mean the extent to which the given asset can satisfy the requirements of the corporate strategy. The higher this extent is, the sooner the given intangible asset will begin to generate money (Chart 4). The extent to which the given asset contributes or fails to contribute to the performance of internal processes determines the role of that asset in the company's value creation (Kaplan–Norton 2004b).

[12] As there is no generally accepted Hungarian translation for the term „*intangible assets*" yet, the translation of Szabolcs Buda ("nem anyagi eszközök") is used, based on the term's content and meaning (Buda 2004).

Chart 4. The role of intangible assets in value creation



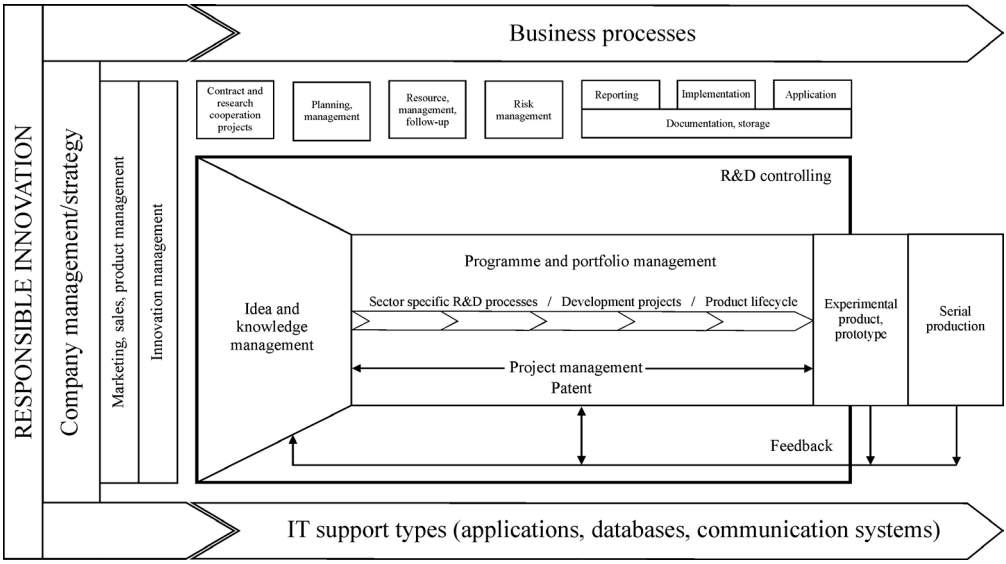
Source: Edited by the authors, based on Kaplan–Norton (2004b)

An intangible asset can be converted into tangible outcome (revenue increase or cost reduction) only if it is coordinated with the strategy. For this reason, companies are unable to allocate an appropriate financial value to intangible assets since financial value can be gained only from the successful implementation of the selected strategy. To achieve this, we must be able to define, measure and manage the readiness of each intangible asset. In practice, for each intangible asset type a table has to be compiled, which contains, in actual figures, the objective to be achieved – readiness can be determined in the light of and as the level of achievement of that objective (Kaplan–Norton 2004b). In practical terms, this is nothing else than variance analysis well known from controlling – just for an asset/asset group that was left out of the traditional toolset of controlling due to its 'soft' nature.

We can see that R&D&I is an area of increasing importance but its handling in financial accounting does not provide the information content that decision makers would need. By introducing R&D&I controlling, we can set up a constant process oriented model, with an eye to planning, measuring and controlling R&D&I activities as best as possible. Future-focused factors like forecasts, risks evaluations and early warning signs play an important role in the operation of companies.

Controlling should be viewed not as an independent, isolated solution but as an integral part of economic processes and as part or corporate controlling processes. R&D&I controlling follows R&D&I activities throughout the entire lifecycle, i.e. from operation through the strategic requirements of business development, marketing and production management to systematised feedback from the appropriate areas of development and knowledge management. However, it is a good practice to manage the whole process through the eyes and approach of responsible innovation as the ethical acceptability, sustainability and social desirability of the product born as the result of the process are of fundamental importance (Chart 5).

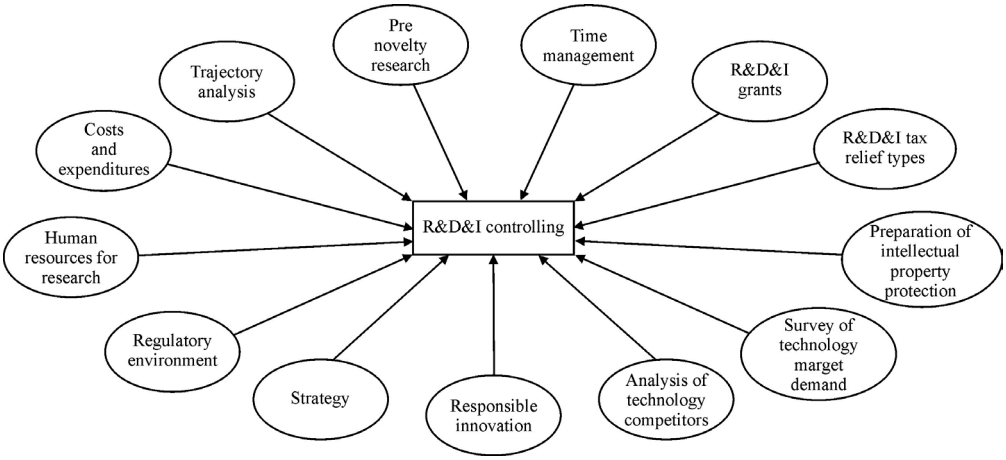
Chart 5. Tailoring responsible innovation and R&D&I controlling to company processes



Source: Edited by the authors, based on Plaut (2014)

As the above pages show, R&D&I controlling is a very complex system, in which a large number of components can be defined (Chart 6). These components can have different weights in the R&D&I controlling model in different organisations since innovative businesses and organisations have very different characteristics. There is no „average" innovative organisation and, consequently, R&D&I controlling functions can neither be tailored en mass: the heterogeneity of different organisations requires individual tailoring in each organisation. The chart found below is an attempt to present a general model, which, in our experience, contains the most common components, which most innovative organisations are likely to need when it comes to R&D&I controlling. Naturally, due to the impossibility of mass tailoring, it is possible that certain individual organisations consider completely different aspects as important in the area of R&D&I controlling.

Chart 6. Most typical components of R&D&I controlling



Source: Edited by the authors

8. Conclusions

Some of the costs of research and development appear in accounting with a certain delay, in an uneven distribution and at a time different from the time of collection of R&D revenues. Moreover, an often significant part of R&D remains hidden to the eyes of analysts preparing a report based on financial accounting, as an invisible asset. These make the identification of the company's real value difficult.

There is a possibility to follow up intangible assets using controlling methods – but this requires an approach somewhat different from the simple application of traditional controlling tools and methodology. Nevertheless, we consider that since innovative companies are more successful than others, the same may be true for the controlling methodology applied. We are, therefore, convinced that there will be a trend that only those companies will be able to gain a lasting competitive advantage from different sources that operate a controlling system that is more enhanced than that of its competitors'.

Those companies will be able to gain a lasting competitive advantage from different sources which are able to operate a controlling system that is more enhanced than that of their competitors'. Hungarian politician, reformer and statesman Count István Széchenyi suggested as long ago as in the first half of the 19th century that cost advantages cannot provide long lasting competitive advantages; the latter can only be achieved in a knowledge based economy, through innovation: *„It is not fertile plains, mountains, climate et cetera that make public wealth but the mind that can use them wisely. There is no truer weight n' power than the human brain. The more there is of it the luckier the nation will be – the less there is, the less luck we*

will have." (*„Nem termékeny lapány, hegyek, ásványok, éghajlat 's a' t. teszik a' közerőt, hanem az ész, melly azokat józanon használni tudja. Igazibb suly 's erő az emberi agyvelőnél nincs. Ennek több vagy kevesebb léte a' nemzetnek több vagy kevesebb szerencséje"*) (Széchenyi 1830, pp. 178).

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