

THE PARADOX OF INVESTMENT: CONSTRAINING STRATEGY

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ABSTRACT

Studies show that managers forgo the economic benefits brought by research and development and cut these costs in order to face the pressure from investors for earnings per share. These studies are part of a relatively new discipline called value based management, that emerged as consultancy firms' advice in the 1990s and was implemented by companies around the millenium; it took several years for empirical studies about it to be possible. These two arguments have inspired a research about long-term decisions in companies according to value based management, and this article is part of this research. This article aims to analyze the arguments in favor of and opposed to correlating research and development costs to future economic benefits rather than to the period they are incurred. It is a multidisciplinary approach. The arguments in favor of relating research and development costs to future economic benefits come from strategic management and value based management. The arguments in favor of relating research and development costs to the period they are incurred come from financial accounting (with an exception) and short-termist behavior. We detect a break between forward looking information for management decisions (management accounting) and historic looking information for outside parties (financial accounting). Managers should use the former to make decisions, and value based management is the most recent stage in management accounting. Value based management practitioners among whom Siemens was selected as an example do treat research and development as an investment in the future despite the regulations of financial accounting to expend these costs. Whereas a causal relationship between research and development activities and future economic benefits is likely to exist despite uncertainty, current product sales and the cost of these sales bear no causal relation to incurred research and development costs. Management accounting that recommends the capitalization of research and development costs should inform managers about the implications of the break from financial accounting. The investment paradox is that the reason why strategic management indicates investment, uncertainty related to the early stages of a product, is the argument in financial accounting against capitalizing these costs and this latter is an obstacle to spending on research and development..

KEYWORDS: *research and development, IAS 38, value based management, product lifecycle, investment*

JEL CLASSIFICATION: *M160 International Business Administration*

1. INTRODUCTION

This paper addresses the correlation of research and development costs to future economic benefits rather than to the period they are incurred. The correlation of research and development costs to future economic benefits is called investment; it may involve the capitalization of these costs (treating them

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as an asset) or it may be an allowance for these costs so they are sufficient. When research and development (R&D) costs are treated as investment, they are related to the future economic benefits they cause (such as sales, innovation, competitive advantage, patents, cost reduction, better production processes, quality etc); by comparing these costs to the benefits they bring, it is possible to ascertain precisely if the investment adds value. If the future benefits research and development activities bring are not exposed, R&D will be an expense in the profit and loss statement. It will have to fit between the margin on current product sales and the profit demands of shareholders. When future economic benefits are not considered, there is no ground to decide on the level of research and development activities except what the entity can afford based on current sales; R&D activities are left unexplained. Considering the Edwards Deming quote "you manage what you measure", in the case of research and development, correlating R&D to the future allows the management of these costs, whereas their reporting in the period they are incurred shows nothing about their performance. **The capitalization of R&D brings information which allows the assessment and therefore the management of these costs strategically (on the long-term), whereas their expending only shows what is affordable based on current sales.**

The decision regarding the level of research and development activities is made by the Chief Executive Officer CEO of a company. This will determine related costs. The CEO may, for example, approve a project; he or she will therefore approve related costs. The CEO needs to approve the activities that will lead to a strategy being executed successfully and assign a realistic budget. Otherwise the strategy will fail. In the words of Ken Favaro, the head of the "Strategy+Business Magazine" (Price Waterhouse Coopers 2014): "the short-term long-term tension drags strategy down".

The objective of this research is to analyze:

- the arguments in favor of correlating research and development costs to future economic benefits
- arguments pertaining to strategic management
- arguments pertaining to value based management
- the arguments opposed to correlating research and development costs to future economic benefits
- arguments pertaining to financial accounting (with an exception)
- evidence of short-termism
- the case example of Siemens

and draw sensible conclusions.

The means of this research are literature review and case study. The literature review is interdisciplinary, involves analysis, comparison and critical reasoning. The article comprises strategic management theory, value based management theory, financial accounting theory. The case study is on Siemens, mainly because the conglomerate has made strong public statements about practicing value based management. Siemens is used to illustrate whether the decision models of strategic management and value based management are practiced and effective.

This article is relevant to management for several reasons. The first reason is that treating research and development as investment in future benefits will compute the exact value added by this investment and will give management a concrete number to address and decide on. The second reason is that firms make bad decisions about R&D which forgo strategy. The third reason is that treating research and development as investment is part of a management system called value based management, a subject that can only be researched empirically today. Please find these latter two explained below.

The decisions companies make regarding the level of research & development expenditure have been subject to serious criticism, especially lately (Rappaport, 2011; Barton, 2011; Barton & Wiseman, 2014). This is because top managers tend to forgo the future economic benefits provided by research

and development and cut these costs in order to meet quarterly targets for earnings per share. Analyzes and solutions to this issue, called "short-termism", "management myopia", "underinvestment" come from prominent authors and consultancy firms. Short-termism has recently come under fire in the United States of America, and attempts to overcome it span the globe; however the topic is not new. It has been addressed recently since 2013 as part of a Mc Kinsey initiative called "focusing capital on the long-term" which is available via the internet (www.fclt.org). The "focusing capital on the long-term" initiative was soon after commencement joined by Harvard Dean Nitin Nohria and related articles were published in Harvard Business Review (Barton, Wiseman, 2014). **The mission of this pursuit is to take an action-oriented, pragmatic approach to encourage a greater focus on long-term value creation. This mission inspires the research this article is part of.** Short-termism, or management myopia, is an issue long tackled by various authors throughout time; a substantial part of these arguments pertain to value based management. This issue was addressed in a 2010 mathematical study by Bartley Madden. Other arguments against short-termism come from Alfred Rappaport in 2011, and take the form of articles on this topic in Harvard Business Review. Similar writings come from Ken Favaro in 2007 and 2014. A much older attempt to combat this comes from Michael Porter. In 1992, Michael Porter and Harvard Business School argued against short-termism, using a two-year research project sponsored by the Harvard Business School and the Council on Competitiveness.

The argument that research and development costs should be treated as investment pertains to value based management (Young, David S.; O'Byrne, Stephen F. 2000). Value based management emerged in the 1990's as an emulation between management consultancy firms Marakon Associates, LEK Consulting, Stern Stewart, Mc Kinsey, Boston Consulting Group, KPMG, Price Waterhouse Coopers, HOLT, other. Companies such as Hewlett Packard, Barclay's, Coca Cola, GAP, IBM, Cadbury, Siemens adopted this consultancy firms' advice around the end of the 1990s. At the same time, The International Federation of Accountants IFAC and The Institute of Management Accountants IMA recognized value based management as a management accounting discipline (Ittner 2001). It took several years of practice by companies to make empirical studies possible. The first empirical study of the companies which implemented the Economic Value Added program was published in 2013 and is called "Best Practice EVA" by Stewart G.B.; the book involves case studies, and does not include a quantitative research. A case study on value based management at Siemens is therefore of value today (Cozmiuc, Petrișor 2015).

2. IMPORTANT DEFINITIONS

Research and development activities are subject to definitions by the International Financial Reporting Standards IFRS, IAS 38 Intangible Assets (ACCA Association of Certified Chartered Accountants 2015; CIMA Certified Institute of Management Accountants 2014). In order to report expenses by this function, companies need to organize responsibility centers pertaining to each function; this means that in order to report research and development expenditure, companies need to organize responsibility centers for research and development activities and therefore define the organizational structure accordingly. Research and development activities incur research and development costs which may be expensed (reported as expense) or capitalized (reported as asset/investment).

Research is defined by IAS 38 as "original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding". Examples of research activities as per accounting books include: activities aimed at obtaining new knowledge, the search for applications of research findings or other knowledge, the search for product or process alternatives, the formulation or design of possible new or improved product or process alternatives. The same standard defines **development** as "the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products,

processes, systems or services prior to the commencement of commercial production or use". Development activities include: the design, construction and testing of pre-production 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 scale economically feasible for commercial production; the design, construction and testing of a chosen alternative for new/ improved materials. Innovation is a part of research and development activities, but not limited to them.

Using this definition, we infer that research and development activities are related to future action and not to current sales.

According to IFRS, **assets** are defined as "a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity".

IFRS defines **expenses** as "decreases in economic benefits during the accounting period in the form of outflows or depletions of assets or incurrences of liabilities that result in decreases in equity, other than those related to equity participants".

Investment is the purchase of assets for generation of future economic benefits. The correlation of research and development costs to future economic benefits is called **investment**; it may involve the capitalization of these costs or it may be an allowance for these costs so they are sufficient.

3. STRATEGIC MANAGEMENT ARGUMENTS ABOUT RELATING RESEARCH AND DEVELOPMENT ACTIVITIES TO THE FUTURE

An important pattern for the strategic management of a firm is the product lifecycle.

The product lifecycle is a curve which begins with the product launch phase, continues with the product growth phase, maturity and ends with decline. At the beginning of the product lifecycle, uncertainty is high and companies conduct research and development activities to gain knowledge and build future products. Investment is necessary. Sales are growing faster at a growing rate. As several companies learn about the new product, the next stage of the product lifecycle involves sales growth that slows down as a rate, continuing spending on research and development and investment. This is the stage that introduces competition. As the product matures, sales remain constant, spending on research and development and investment stops, and costs need tight control. The product maturity stage is followed by decline, when sales drop.

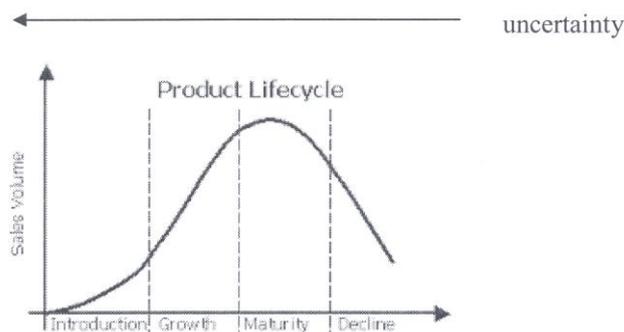


Fig. 1. The product lifecycle

Figure 1. The product lifecycle

Source: www.valuebasedmanagement.net

The product lifecycle model is a classical argument in strategic management that was worked into strategic management models of the 1960s such as the Boston Consulting Group matrix and the Arthur D. Little matrix. Strategic management classic literature recommends investment in a product when the product is at its launch or growth stage, and exit when the product declines. The

previously mentioned models are explicitly called investment models in strategic management. The Boston Consulting Group model is tied to the product lifecycle logic as question marks correspond to the launch phase, stars correspond to the growth stage, cash cows to the maturity stage and dogs to the decline stage. The Arthur D Little model explicitly considers the product lifecycle stages: embryonic, growth, mature, aging. Along with the competitive position: dominant, strong, favorable, tenable, weak, this model proposes product investment decisions.

With time, the product lifecycle model has been enforced and over enforced by strategic management literature. The New Economy of Knowledge and its emerging markets are characterized by high levels of uncertainty (Petrișor, 2001; 2007), which is associated by strategic management with the product launch stage. It is at this stage that research and development activities are tied to innovation and new markets. In 1993, the Treacy Wiersema value disciplines model ties competitive advantage with the product lifecycle logic (Harvard Business Review 1993). According to the Treacy and Wiersema value disciplines model, at the product launch stage, competitive advantage is likely to come in the shape of product leadership and innovation. Later on, as the product matures, sales are constant and uncertainty is lower, and competitive advantage focuses on costs. This model is enforced by consultancy companies such as Mc Kinsey (Copeland, Koller, Murrin, 2007) and Stern Stewart (Stewart, 2013).



Figure 2. Treacy and Wiersema's value disciplines

Source: www.valuebasedmanagement.net

The product lifecycle model has been linked to profit and cash flow as early as the 1960s. The emergence of the New Economy in the 1990s includes arguments in favor of the product launch stage and indicates that profit is high in emerging industries. Innovation has become pervasive and new "Blue Ocean" markets are created by companies which dominate the market. The new environment is VUCA (Harvard Business Review 2014; 2015) - volatile, uncertain, complex, ambiguous, and strategic management advises to embrace this state and turn it into an advantage using creativity.

4. VALUE BASED MANAGEMENT ARGUMENTS ABOUT RELATING RESEARCH AND DEVELOPMENT ACTIVITIES TO THE FUTURE

The topic of capitalizing Research and Development as an intangible asset is a central topic in value based management. The most prominent supporters of this accounting treatment are the proponents of Economic Value Added, Stern Stewart, in 1991; the proponent of the lifecycle valuation model, Bartley Madden in 2010. According to Stern Stewart, discretionary costs such as research and development, advertising, personnel training should be capitalized because they bring future benefits and do not relate to current activities. Bartley Madden conducted a wide scale

mathematical study spanning from 1970 to 2010 on a sample of American firms that should be representative of all USA. One of his findings is that shares are wrongly valued on stock markets because of differences between business economics and accounting treatments. The most important issue according to this study is not capitalizing research and development (that is treating it as an asset and investment).

The same study, Bartley Madden's "product lifecycle model" proves mathematically the lifecycle model in strategic management literature. Bartley Madden is a famous mathematician and author of value based management indicator cash flow return on investment CFROI. His findings show that at the launch stage of a project, innovation is high and so is return on capital compared to the cost of capital (that is economic value added); this is the stage where investment is important. As the product matures, the leading companies dominate the market, investment is not recommended, return on capital drops close to the cost of capital. It follows that the product fades out and the business model fails. Madden places the responsibility for this lifecycle pattern on management. He claims that "managerial skills and competition determine the pattern of life-cycle variables that drive the firm's net cash receipt stream". He proves Alfred Rappaport's statement that, over the long-term, net cash receipts drive firm value. As firm value is given by the market value of shares, he goes on to analyze the share price valuation and finds that errors in share valuation come from differences between business economics and accounting treatments. The top error is expending R&D rather than capitalizing it. Please find the life cycle valuation model depicted below:

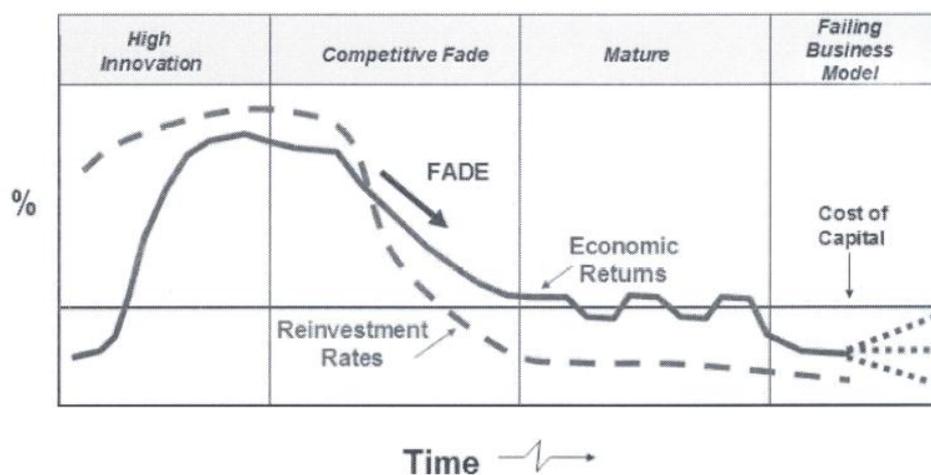


Figure 3 The product lifecycle model

Source: Madden, 2010

This is mathematical evidence that managers make good decisions when they invest in research and development and innovation at the beginning of the product lifecycle, when environmental uncertainty is high. This will give them the advantage of being the first on the market. This will also lead to high return on capital. At the beginning of the product lifecycle, the difference between return on capital and cost of capital is high and positive. This difference between the return on capital and cost of capital is named by other value based management authors Marakon Associates "the spread" (Marakon Associates 1981) and Stern Stewart "economic value added EVA" (Stewart 1991). The functional structure for each stage of the lifecycle valuation model is different.

Value based management is the object of the research this article is part of. Value based management has been defined by Mc Kinsey (Koller, 1994) and the International Federation of Accountants (IFAC, 1998) as a holistic approach to management in which all company decisions are focused on the drivers of shareholder value.

5. FINANCIAL ACCOUNTING ARGUMENTS AGAINST RELATING RESEARCH AND DEVELOPMENT ACTIVITIES TO THE FUTURE

International financial accounting is harmonized by the International Financial Reporting Standards, which means a set of standards that entities should use to report to outside parties: investors, creditors and the state. The reporting of research and development expenses is regulated by IAS 1 "Presentation of financial statements" and IAS 38 "Intangible non-current assets" (ACCA Association of Certified Chartered Accountants 2015; CIMA Certified Institute of Management Accountants 2014).

According to IAS 1 "Presentation of financial statements", on a yearly basis, entities are obligated to communicate the following:

1. a statement of financial position
2. a statement of profit and loss and other comprehensive income
3. a statement of changes in equity
4. a statement of cash flows
5. notes, including a summary of significant accounting policies and other explanatory information

The standard further provides a list of the items to be shown in the statement of financial position. Among these assets, relevant for research and development activities are intangible assets. The statement of profit and loss and other comprehensive income can be presented according to two methods: the nature of expenses method and the function of expenses method. If the entity uses the nature of expenses method, it will aggregate expenses according to their nature: the purchase of materials, depreciation, wages and salaries, transport costs. According to IFRS, this is the easier method and is recommended for small entities. An option to the nature of expenses method is the function of expenses method. According to the function of expenses method, expenses are classified according to their function as part of cost of sales, distribution or administrative activities. The method allows that research and development expenses be presented separately. According to IAS 1, there is no uniform rule for the activities included by functions, and the classification of functional expenses may be arbitrary. This method allows the disclosure of research and development activities separately, but this is not mandatory. The function of expenses method is sometimes called the cost of sales method, and the logic of this method entails a relation between sales and cost of sales.

IAS 38 defines research and development activities and offers the possibility of relating research and development costs to future action rather than current sales. This standard defines research and development activities as argued before. IAS 38 comprises the arguments in favor of treating research and development activities as a period expense or as an investment in the future. According to this standard, research and development activities can only relate to the future if the following cumulative conditions are met:

1. the entity can demonstrate how the intangible asset will generate probable future economic benefits (this is demonstrated by the existence of an external market or by how the asset will be useful to the business if it is to be used internally)
2. the entity can demonstrate its intention to complete the intangible asset and use or sell it
3. the entity needs to demonstrate the availability of adequate technical, financial or other resources to complete the development and to use or sell the intangible asset
4. the entity needs to prove its ability to use or sell the intangible asset
5. the entity needs to demonstrate the technical feasibility of completing the intangible asset so that it will be available for use or sale
6. the entity needs to prove its ability to measure reliably the expenditure attributable to the intangible asset during its development

All these criteria need to be fulfilled in order to recognize an intangible asset.

According to financial accounting guidelines, "it can be difficult to determine whether an internally generated intangible asset meets the IAS 38 recognition criteria. In some cases, the cost of an internally generated intangible asset is difficult to distinguish from the cost of running day-to-day operations". The guidelines also state that there will not usually be an active market for an intangible asset. At the research phase, it is not possible to recognize an intangible asset and research costs must be charged to the profit and loss statement in the year they are incurred. Research costs by definition do not meet the criteria for recognition under IAS 38. This is because, at the research stage of a project, it cannot be certain that the probable future economic benefits will flow to the entity from the project. There is too much uncertainty about the likely success or otherwise of a project. Development activities, however, tend to be much further advanced than the research stage. Where the entity can demonstrate that future economic benefits will flow to the entity from the project, the entity may be able to recognize an intangible asset. According to IAS 38, once capitalized as an intangible asset, at the time the asset is available for use, development costs must be amortized - recognized as an expense to match the costs with the related revenue or cost savings.

In summary, the uncertainty regarding research and development expenses decides their accounting treatment. As this uncertainty is usually high, research and development activities are reported as period expenses in the profit and loss statement. When the uncertainty related to research and development activities is low enough, research and development activities are related to the future and capitalized as an intangible asset (treated as investment).

Whereas the IFRS standards find it difficult to relate research and development costs to the future because of uncertainty, they find that additions to property, plant and equipment can easily demonstrate probable future economic benefits. This is regulated in IAS 16 Property, Plant and Equipment. It has been assessed by financial bodies that tangible assets and intangible assets are recognized as assets because, by the definition of assets, assets are "a resource controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity". The uncertainty regarding research and development activities producing future economic benefits is argued as the reason to relate them to period sales in the profit and loss statement rather than to future benefits.

6. SHORT-TERMIST BEHAVIOR AGAINST RELATING RESEARCH AND DEVELOPMENT ACTIVITIES TO THE FUTURE

Short-termism, sometimes called management myopia or underinvestment, is the behavior of corporate managers who reduce discretionary costs such as research and development in order to meet quarterly earnings per share targets imposed by financial markets. Studies show how and why managers forego profitable investment in order to meet short-term shareholder expectations. We will depict these studies in reverse chronological order.

The difficulty in investing in research and development "R&D" (Harvard Business Review 2011, 2014) is subject to a debate of significant worldwide proportions conducted by Mc Kinsey since 2013, the "focusing capital on the long term" initiative that Harvard Dean Nitin Nohria joined (www.fclt.org). The explanation for this short-term orientation points to the short tenure of shares on US markets (6 months in average). Another cause is that managers fear a drop in share price if they don't meet quarterly earnings per share targets. Moreover, managers' bonuses may be related to short-term performance. Studies show that family owned businesses do not have this short-termism problem. Mc Kinsey seeks solutions for this, one of which is changing the behavior of institutional investors.

Other arguments against short-termism come from Alfred Rappaport (Rappaport 2006, 2009, 2011), and take the form of articles on this topic in Harvard Business Review. Short-termism is addressed as management behavior; according to Alfred Rappaport, managers cut on discretionary costs such

as R&D because they fear capital markets will lower share prices if quarterly earnings per share targets are not met. Rappaport argues that managers needn't fear a drop in share price inflicted by quarterly earnings, because capital markets rationally value shares in relation to future discounted cash flows of firms. Managers should maximize the net present value of discounted cash flow instead.

Ken Favaro, former Marakon Associates, now Price Waterhouse Coopers; in 2007, writes about "the value tensions", and one of three value tensions is the trade-off between the long-term orientation and the short-term orientation. According to this view, focusing on either one of the two is erroneous. Managers should manage the long-term and the short-term jointly, and the solution is sustainable earnings per share. If they don't, according to a 2014 article, the short-term long-term tension will bring the strategy down.

As written, short-termism is an old topic that remains unsolved. In 1992, Michael Porter and Harvard Business School argued against this. According to Michael Porter, short-termism occurs because of errors in capital allocation internal and external to companies. His conclusions came out of a two-year research project sponsored by the Harvard Business School and the Council on Competitiveness. Although this prominent author tried to solve the issue, evidence shows that short-termism persists. There are numerous studies on this topic, which argue essentially the same, but a full literature review is beyond the scope of this article.

Short-termism is an obstacle to R&D and strategy to be considered, because managers may choose a higher short-term profit over an investment in the future.

7. THE PRACTICE OF SIEMENS

We will conduct a case study about research and development at Siemens. This will be structured as following:

1. the history of Siemens and the inception of value based management
2. how Siemens treats research and development activities as investment
 - a. the value creation cycle
 - b. the economic value added driver tree
3. innovation and strategy at Siemens
4. organizational structure at Siemens

(1.) Siemens is a world renowned firm, headquartered in Berlin and with 190 locations around the world. In 2014, it employed 362 000 staff and had a turnover of 71.9 billion Euros. Siemens was founded in 1847, by Werner Von Siemens and Johann Georg Halske selling an innovation related to the telegraph. In 1848, the company built the first telegraph line in Europe, linking Berlin to Frankfurt. 1867, Siemens built the indo-european telegraph line linking Calcutta to London. In the 19th century, Siemens diversified its technologies and inventions, going as far as the first electrical street lighting in the world in London, building trains and light bulbs. In 1907, Siemens was the 7th largest company in Germany. The diversification strategy continued; in the 1920-1930 the conglomerate produced television sets, radios and electromical microscopes. Throughout history, Siemens has marketed a variety of innovative products. In the 1950s, the company produced, among others, computers and washing machines. The diversification strategy continued and involved a series of innovations and company acquisitions in varried businesses. Siemens became a conglomerate, with a wide and everchanging portfolio. In the 1990s, Siemens had businesses in energy, industry, information and telecommunications, transportation, medical care, lighting. In 1993, according to annual reports, Siemens initiated a transformation process from a technological company to a professional company which they called "TOP". This TOP strategy was soon followed by a more decisive strategy initiated in 1998 called "TOP+". The core of this strategy was turning Siemens profitable, and the "TOP+" strategy had the explicit goal of creating positive shareholder value beginning with 2001. It was in 1998 that Siemens implemented value based

management on a global basis, and employed consultancy firm Stern Stewart to conduct a full economic value added upheaval program throughout the company. The economic value added program is one of the ten points of the TOP+ program Siemens communicated in the 1998 annual report. According to Siemens, under the TOP+ program, "all company decisions must be focused on creating shareholder value". Value based management at Siemens is complex and beyond the scope of this article. Within the scope of this article is, however, arguing technological innovation and research and development as investment in the future at Siemens.

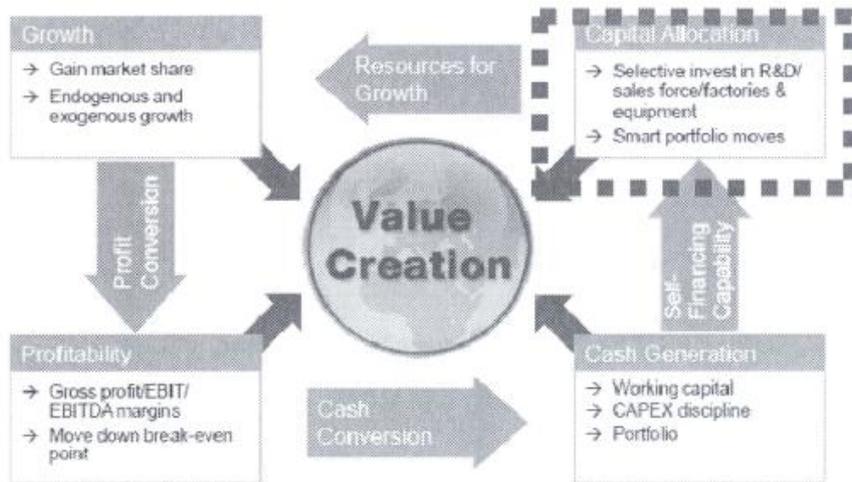


Figure 4. The value creation cycle at Siemens
 Source: Thomas, 2013

(2a.) Investment in research and development is oriented towards the future and works according to the value creation cycle as per Fig 5. The value creation cycle begins with investment in research and development, sales force and factory equipment. It continues with growth which is converted to profit. This profit is converted to cash flow which may be used for dividends or further investment.

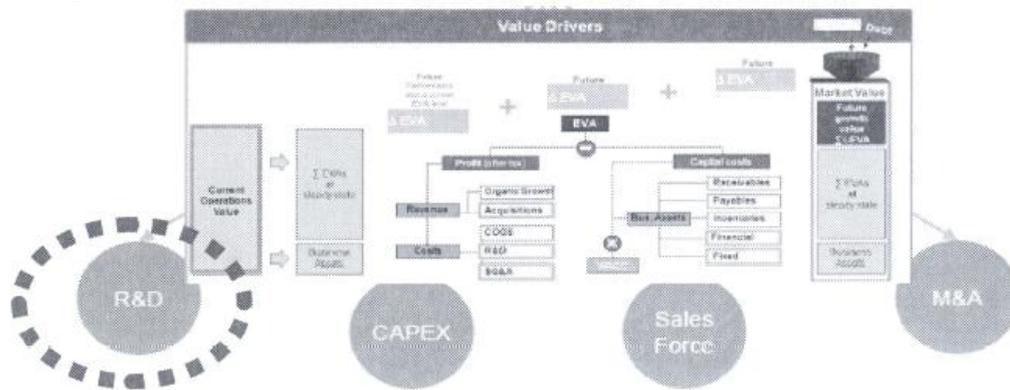


Figure 5. The EVA driver tree at Siemens
 Source: Thomas, 2013

(2b) As per fig 6., Siemens drives its strategy and operations to maximize economic value added EVA in the short-term and the long-term. This is value based management. Economic value added is defined as the spread between return on capital employed and the weighted average cost of capital, multiplied with capital employed. It is the leading indicator of value for investors.

According to Siemens, the main driver of economic value added is profitable investment in research and development, in sales force, in property, plant and equipment and external company acquisitions. This is highlighted in Siemens annual reports. Value drivers are factors which influence EVA either positively, such as sales, or negatively, such as costs.

(3) Siemens believes innovation is the outcome of research and development. According to Siemens annual reports, innovation is measured by several indicators, the most important of which are research and development costs, R&D staff and patents.

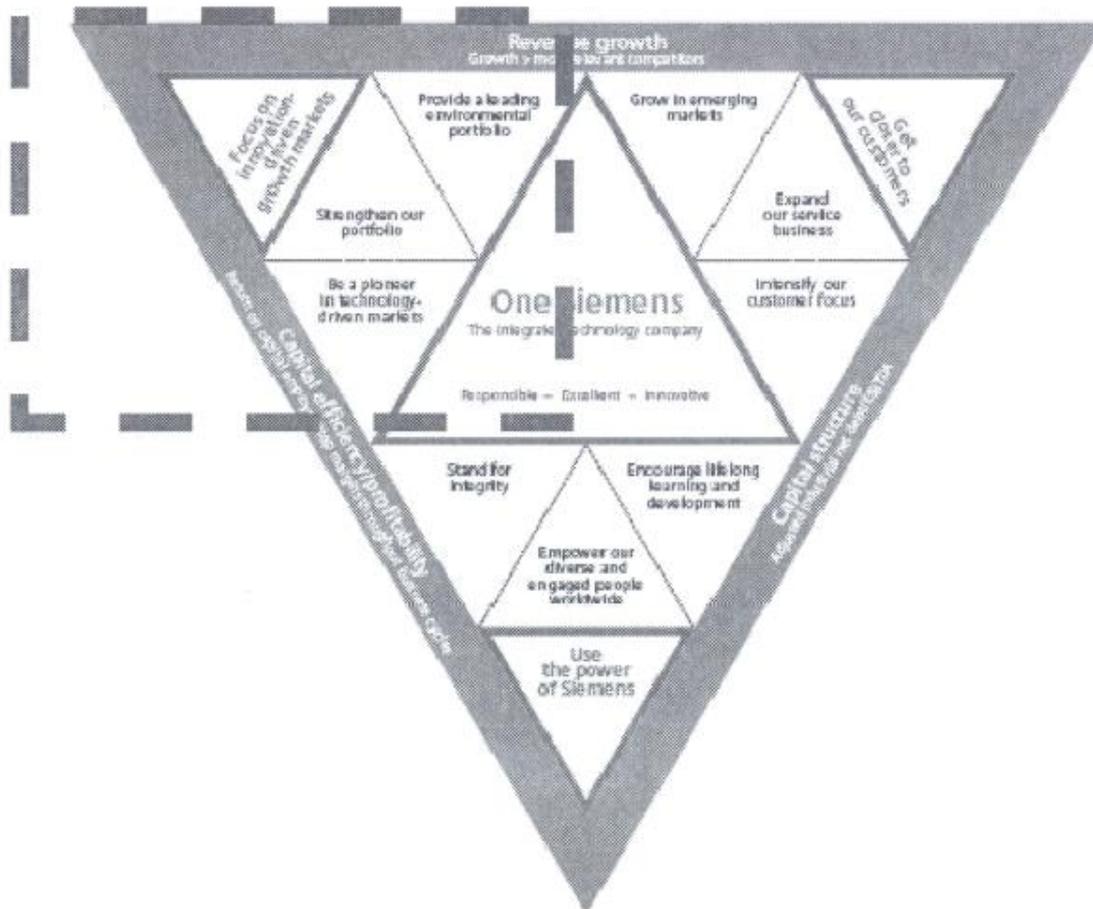


Figure 6. The One Siemens strategy

Source: Siemens annual report 2011

Innovation is the strength of Siemens, its vision for the future and its core value. Siemens' vision about the corporation is that Siemens is a pioneer in innovative technology markets. Siemens as a pioneer in technology is at the heart of Siemens, a core value of the company that dates back to the creator of the company Werner Von Siemens. Beginning with 2010, Siemens has constructed its entire portfolio around innovation. Whereas, beforehand, The TOP+ program introduced economic value added centered management and portfolio changes, to date, Siemens portfolio has involved a series of acquisitions and divestments. At the beginning of the 2000s, under the Fit 4 More strategy, Siemens designed its portfolio as a collection of businesses with a growth rate of twice the gross domestic product over a period of 5 years and where Siemens was either number 1 or number 2 on the market. This is the classical Boston Consulting Group logic. This changed in 2010 under the One Siemens strategy. The new portfolio logic for Siemens was investing in new growing businesses where Siemens could be the market leader based on its strength in innovation. This is the Arthur D. Little investment pattern, based on product lifecycle and competitive position. Siemens

communicated this business investment strategy as the One Siemens strategy. The conglomerate aimed to focus its businesses, and the businesses to be included in the portfolio were "innovation driven growth markets". Siemens aimed to be a pioneer in technology driven markets. Siemens relies on its strength in innovation to decide the markets it invests in. Siemens does have a strength in innovation. In terms of the number of patents, Siemens holds over 56000 patents, is number four in Germany, number two in Europe, and thirteen in the United States of America. Today, Siemens is cited by Wall Street Journal as the leader of the fourth industrial revolution in Europe, the use of cyberphysical systems for manufacturing. Siemens calls these solutions. Cyberphysical systems are the innovation strategy for the European Union worked into Horizon 2020. It is a competition effort joined by other companies such as Bosch.

As Siemens is an adept of value based management, the strategic directions highlighted in the strategy need to produce financial performance; this financial framework, as per Fig. 7, is the desired outcome of strategic directions.

Not only does Siemens focus on innovation driven growth markets, but it also uses innovative technology as a synergy among businesses. According to the 2014 annual report, the Siemens mission is: "we make what really matters by setting the benchmark in the way we electrify, automate and digitalize the world around us. Ingenuity drives us and what we create is yours. Together we deliver." Based on this shared technology, Siemens seeks to improve its value. The first trend is electrification, which should lead to 2-3% expected market growth. The further trend is automation, which should lead to 4-6% expected market growth. The greatest opportunity is digitalization, which should lead to 7-9% expected market growth. This shared technology should be a competitive advantage based on innovation; it may also help contain costs.

Innovation is at the core of Siemens, its vision for the future, the basis for choosing businesses to invest in and the basis for the synergies in business portfolio. As written before, technological innovation is the outcome of research and development activities. Research and development activities produce innovation, which is the basis for Siemens' corporate and business strategy. At Siemens, investing in research and development costs leads to future economic benefits; to name but a few: new product sales, patents, royalty payments for patents, competitive advantage based on innovation, synergies in portfolio, material cost reduction through the design to cost activities conducted by the R&D departments, spending on quality conformance costs in order to reduce quality non-conformance costs, tailored solutions, other.

(4) Siemens organizes research and development activities as a network of knowledge. Siemens portfolio is divided into products, across several industries, and solutions. Siemens practices knowledge management in many ways: investing in research and development (heavily - according to their assessment), building intranet platforms where employees can share ideas, partnering with universities and other companies, awarding top performers. There are books written about knowledge management at Siemens. Research and development at Siemens involves a central department and business specific departments. The central department is in charge of patents and cross-business solutions. Cross-business solutions have a high potential of being distinctive from competitors, and have been increasingly important at Siemens. The central department is a worldwide network with primary locations in Germany, the U.S., China, Russia, India, and Austria. The businesses focus their research & development efforts on the next generations of their products and solutions. In contrast, the aim of the central department is to work with operating units to develop the Group's technology and innovation strategies, especially for the next generation of their products and solutions. In addition, the central department strives to secure the technological and innovative future through commonly developed core technology initiatives such as future of automation, data to business or system integration. The central department is also networked with leading universities and research institutes worldwide, as part of the open innovation (OI) concept, through which Siemens aims to overcome the barriers of silo thinking, to prove and truly leverage the potential of an open network enterprise.

7. THE PARADOX OF INVESTMENT

In strategic management, environmental uncertainty is a signal the product lifecycle is at its early stage and investment is most recommended. In financial accounting IAS 38, uncertainty is the reason why research and development activities are not treated as investment but expended. This is the paradox of investment:

- at the launch stage of the product lifecycle when uncertainty is high, companies invest in research and development as the key to the company's long-lasting future performance
- at the launch stage of the product lifecycle when uncertainty is high, financial accounting finds in uncertainty the reason why research and development activities are not probable enough to bring future economic benefits and are therefore not capitalized (recognized as asset/ investment) but expended.

The paradox of investment poses a real issue to the firm. At this point of the lifecycle, the product is new and some investors may be sceptical. Spending on research and development should lead to high share value on the long term, but it will lower accounting profit for the short term. Some short-termist investors may react to this in a negative way and this may impact the firm. There are studies (Rappaport 2011) which show investor reactions triggered by short-term earnings per share do not matter. There are other studies (Favaro 2007, 2014) that argue managers should consider short-term earnings per share along with the long-term view. There are again other studies which show that managers do over emphasize earnings per share in practice (Mc Kinsey 2013). These are the studies we have referred to under "short-termism".

If this paradox did not exist, and research and development were capitalized, there would be no more negative impact on period profit. When the intangible asset were available for use, its costs would be matched against the benefits it brings and the margin would be computed. Of course it may happen that the intangible asset is not available for use and it brings no benefits. Furthermore, there would be a cash issue in the year of the investment in R&D that allows for less free cash flow to be distributed to shareholders.

8. CONCLUSIONS

Relating research and development costs to future economic benefits is challenged by uncertainty. However, uncertainty does not mean improbability. There is a causal relationship between research and development expenses and their future effects; by netting these two, it can be fairly assessed whether the investment in R&D is worth or not. There is a plethora of economic benefits research and development costs can bring: profitable sales; innovation; competitive advantage; patents; royalty payments for patents; sales of patents; quality; cost reduction and more. Relating research and development activities to future economic benefits is recommended by strategic management especially at the early stage in the product lifecycle. Value based management explicitly recommends the capitalization of research and development costs, and an impressive mathematical study proves this necessary; furthermore, the product lifecycle logic shows that investing in R&D at the beginning of the product lifecycle yields a high return on capital. Capitalizing R&D is only possible in financial accounting in exceptional cases, because of the uncertainty surrounding these expenses. A high spending on research and development may lead to an accounting profit level unacceptable for some investors. Managers do make decisions treating research and development as investment, and Siemens is an example for this. When they do make this better decision, they use management accounting, particularly its latest trend, value based management. Mathematician Edwards Deming is famous for the quote: "You manage what you measure"; whatever the truth to this statement, measuring the effects of research and development using management accounting is

precise. Correlating research and development costs to their future economic benefits provides the exact measure of their impact and enables the management of these costs over lifetime.

Relating research and development costs to the period they are incurred in is clear and certain. However there is no causal relation between current sales, cost of these sales and period R&D. R&D is defined as an allowance after the margin on sales (gross profit) and before operational profit. It is often measured as a percentage on sales, the so called "R&D intensity". This is the treatment in financial accounting, the information investors have. Some investors will react negatively to a lower earning per share due to spending on research and development. Financial accounting does not report any of the future economic benefits brought by research and development costs. The impact of research and development costs is not assessed by the sales in the current period they do not inflict, unlike the cost of these sales which belong to the period. The impact of research and development costs is better assessed in relation to the future economic benefits they bring, which take a variety of forms none of which are possible to evidence using financial accounting solely. The R&D intensity is a ratio between two independent variables, current research and development costs and current sales; the best this ratio can show is how much the entity affords to expend R&D based on current sales.

Chief Executive Officers who make decisions about spending on research and development activities need to manage the fact that at the point when this investment in research, innovation and development is imperative according to the lifecycle model in strategic management, this spending is likely to reduce accounting profit and may trigger a negative reaction from some short-termist investors who look at earnings per share solely. This is the constraint to research and development this article aims to argue as the investment paradox. Whereas management literature includes manuals about "the do's" and "how to's" regarding research and development, this article describes an obstacle to research and development and strategy that top management needs to consider.

Chief Executive Officers who make decisions about the future should use management accounting, particularly the latest trend in management accounting called value based management.

Value based management will indicate correlating research and development activities to the future economic benefits they provide, and will assess R&D fairly. This will allow the precise management of these activities and a plethora of investment scenarios. The argument that this should be done is presented in this article. The wider research this article is part of will show not only that this should be done, but also how it can be done and how this is done in practice. We intend to investigate the management accounting tools that relate research and development costs to their future economic benefits. This article and subsequent ones are part of a wider research about value based management decisions regarding the future.

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