



GLOBAL JOURNAL OF MANAGEMENT AND BUSINESS RESEARCH
Volume 11 Issue 2 Version 1.0 February 2011
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
ISSN: 0975-5853

Business case analysis in new product development

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Classification: *GJMBR-B: JEL Classification L15, L11*



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Business case analysis in new product development

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Abstract- This paper proposes business case as a means for analyzing ideas coming through new product development (NPD) process. Business case analysis aids decision-making to commit NPD resources into right projects. Analysis consists of market assessment, technical assessment and financial analysis and reflects to strategic fit. The study introduces a business case procedure as a systematical way to build business cases. It defines a logical flow of essential tasks and steps for business case analysis. The procedure can be used as a baseline in any organization aiming to implement or improve systematical business case analysis in NPD process. The study is theoretical construction that reflects empirical business case practice.

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1. INTRODUCTION

Competition in high technology industries tightens all the time because of increasing amount of competitors and shorter product development times. Enterprises must have an ability to adapt and evolve if they wish to survive. This makes new products critical to them. In virtually every industry the leading companies (e.g. Nokia, Google, eBay, Toyota, IBM, Microsoft...) have demonstrated their ability to innovate and seem to deliver impressive growth and/or return to their stakeholders. (Trott 2008). To fulfill their general mission of creating wealth for their owners, enterprises need to create continuous flow of innovations.

Basically there are two things that succeeding in product development requires: doing the right projects and doing the projects right. A challenge is that project selection and project prioritization are the weakest areas of the new product development (NPD) in general. Most of the successful companies seem to have formal NPD process in place. Besides a high-quality process, enterprises should also have a clear and visible new product strategy and enough resources – both people and money – to be successful. (Cooper 2001, Cooper & Kleinschmidt 2007). This paper proposes business case as means for analyzing ideas coming through NPD process to commit NPD resources into right projects.

Business case is a globally used term for evaluation of potential investments and selection of best alternatives. (Keen & Digrius 2002, Reifer 2001) According Keen & Digrius (2002) business case analysis describes business reasons why or why not specific investment options should be selected. The main goal of business case is to help management decide, in a rational way, the true business value of potential investment. Reifer (2001) has defined a software business case as “*materials prepared for decision makers to show that the idea being considered is a good one and that the numbers that surround it make financial sense*”. The first definition defines accurately the ideal purpose of business case analysis as understood in this study. The second definition describes business case as used often in practice: to show goodness of idea and surround it with good looking numbers to get funding but not that surely to make good decisions.

Cooper (2001) uses business case analysis in one stage of NPD, but otherwise there are very few studies of business case in NPD. Thus a systematical business case analysis for NPD is needed and this study aims to create potential one. The focus is set to evaluating ideas that come through a company's NPD process. A difference between NPD and investment business cases is the amount of business cases that need to be done. Companies do not invest in new technologies, software or factories every day. However, large companies generate and receive vast amount of ideas concerning new products. In order to make innovations arise out of ideas and to develop successful new products, ideas need to be analyzed, evaluated and prioritized frequently for choosing the right projects.

Based on literature reviewed (especially Cooper 2001, Cooper 2008, Ulrich & Eppinger 2008, Carbonell Foulquie et al. 2004) business case cover three kinds of information: market-related, technical and financial information, and embed the strategic issues in the decision making. Figure 1. illustrates that basis for business case building and main tasks for gathering and processing information.

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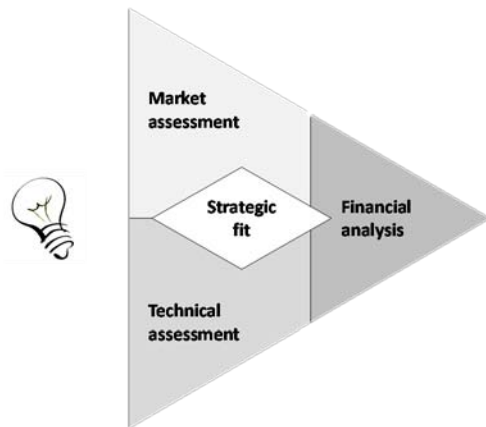


Fig.1 Main elements of NPD business case

This paper presents theoretical construction that reflects an empirical practice called business case. To clarify our aims in this article the following research questions are presented:

- RQ1: What are the attributes of NPD business case?
- RQ2: How to build business cases systematically?

Firstly, literature review on success factors in NPD, gate review practices and gate criteria in NPD is made. Secondly, the detailed content of business case main elements (Fig. 1) is defined by selecting and refining decision gate criteria from literature to business case attributes. Then the attributes are studied, explained and arranged into a business case procedure that introduces logical flow of building a business case. Finally, challenges of business case analysis and the meaning of the procedure are discussed.

II. LITERATURE REVIEW

When large amount of ideas are generated and collected, a company needs to decide which are worth of further development. Business cases are done to aid decision-making before substantial effort is committed to development. Based on Cooper (2001) business cases are reviewed in gates. Reviewing business cases in gates ensure that organization's competence is widely used for business decisions and product development decisions are based on reasonable judgment. To ensure that business cases are done effectively and to enable comparison between cases, the analysis should be done systematically. To achieve that existing literature on best practices on new product development is reviewed.

- 1) *Review on best practices and success factors in new product development*

During the last three decades a significant research effort has been put in place to find the critical

success factors and best practices of new product development. (e.g. Cooper & Kleinschmidt 2007, Ronkainen 1985) In short, the extensive list of these factors includes everything from quality process and execution to innovative climate of the company and adequate resources of people and money. However, most of the interest was focused on factors that affect the earliest stages of the product development where business cases are done and the good ideas are selected for execution. In a general level findings can be separated in two groups: process related and strategy related things. At first, a formal product development process that demands up-front homework should exist (Cooper & Kleinschmidt 2007) and the gates between the stages should be effective, because firms nearly always have more ideas than available funding and people (Koen et al. 2001, Schmidt 2004, Toubia & Flores 2007). Secondly, there should be a defined strategy that sets goals for business's total new product effort and helps to focus and guide the limited resources (Cooper & Kleinschmidt 2007).

Formal new product development process is crucial for product success and usually consist a series of stages and gates to drive ideas to products and to markets. Fig. 2 illustrates a formal development funnel for new product projects. Form and the number of stages and gates can vary between companies and different projects, but the logic is always same (Ulrich & Eppinger 2008). For smaller projects the stages in process may be embed into other, while in larger projects more stages and controlling gates are used. During the stages the project team undertakes the pre-defined work, gathers needed information and does the data integration and analysis. The following gates are go/kill decision points where the deliverables from stages are presented and ideas in case evaluated. The benefits of such processes are well known as they improve effectiveness and efficiency by shortening development times and increasing the output of successful products. (Cooper 2008).

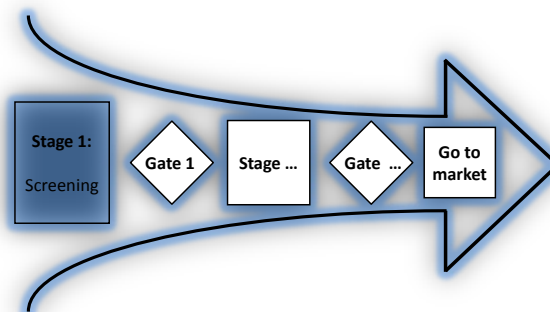


Fig.2. From idea to market funnel

The front end of the new product development process has been identified as a phase where firms have the most of the problems. The activities undertaken in the front end are often recognized chaotic,

unpredictable and unstructured. (Koen et al. 2001). Too many projects are moved from idea to development without necessary assessments that provide basic constraints for development and consider whether or not the idea is a good one. The necessary up-front homework tasks should include both marketing and technical assessments and the voice-of-customer should always be taken into account. Then information should be integrated to financial and business analysis to determine the overall business rationale of the project. Early product definition to clarify target market, benefits and positioning is also one of the best practices along with self-evident quality of execution. (Cooper 2001, Cooper & Kleinschmidt 2007).

2) *Effective gates and review practice*

Regardless the existence of a formal process, the gates must also work to ensure the efficiency of the process. Tough decisions are necessary because developing new products is expensive and the cost and time to complete each subsequent stage increases dramatically. Slow decisions also lengthen the development time while weak decisions hurt all new product development efforts by tying limited resources. (Schmidt 2004). But in what good decisions are based on?

The chosen literature sources represent different kinds of viewpoints that have significant amount of research and practical experience behind them. This makes the sample both extensive and reliable. Loutfy and Belkhir (2001) presented a submission form to idea council used by Xerox while Lilien et al. (2002) shows an idea description form from highly innovative 3M. Then there are two extensive studies on gate criteria (Hart et al. (2003) and Carbonell-Foulquie et al. (2004)). These two studies were assessed keeping focus on early decisions and in most regularly used criteria. Ulrich and Eppinger (2008) and Cooper (2008) represent viewpoints of long-term product development pioneers and their opinion what the decision criteria in early stages should look like.

Hart et al. (2003) studied evaluation criteria in decision gates presenting 20 criteria that were grouped in four dimensions: market acceptance, financial performance, product performance and additional indicators. Criteria such as technical feasibility and product uniqueness were included in additional indicators that are mostly used in the first two stages in the seven stage NPD process that was used in their study. Market acceptance and financial performance dominate the third, business analysis gate. Carbonell-Foulquie et al. (2004) did a similar research relating decision criteria in gates. They listed 16 criteria that are used in making go/no-go decisions and grouped them into five dimensions: strategic fit, technical feasibility,

customer acceptance, market opportunity, and financial performance. According to their study criteria under the dimensions of strategic fit, technical feasibility and market opportunity are the most frequently used in new product concept gate, the first of the four gates in their NPD process. Cooper (2008) presented "a typical scorecard" for gate 3 (go to development), where criteria were grouped under six dimensions. Those dimensions are strategic fit and importance, product and competitive advantage, market attractiveness, core competencies leverage, technical feasibility, and financial performance.

The dimensions of different gate criterion can be summarized and divided into three groups: *market related criteria*, *technical criteria* and *financial performance criteria*. Market potential and opportunity have been identified as important dimensions in early gate decisions and are also dominant drivers for new product success. (e.g. Ronkainen 1985, Henard & Slymanski 2001). Market related criteria are listed in table 1. It includes also customer, product and competitive aspects.

Table1- The most used gate criteria in market assessment

Source	Market criteria
Loutfy & Belkhir (2001)	Description of customer needs for the product value proposition, basis for competitive advantage, <i>Description of initial market(s) targeted:</i> market size, competitive analysis, any potential partners; Probability of marketing success
Lilien et al. (2002)	Originality of customer needs, novelty, global market potential, fit with current sales and distribution channels
Hart et al. (2003)	Customer acceptance, product uniqueness, margin, market potential
Carbonell-Foulquie et al. (2004)	Customer satisfaction, market acceptance, product quality, window of opportunity, alignment with firm's strategy
Ulrich & Eppinger (2008)	<i>Market opportunity & segment:</i> Market size, market growth rate, competitive intensity; Depth of the firm's existing knowledge of the market, fit with the firm's other products
Cooper (2008)	<i>Market attractiveness:</i> market size, market growth and future potential, competitiveness - toughness and intensity, margins earned by players in this market; <i>Product & competitive advantage:</i>

	Unique benefits, excellent value for money, differentiation, positive customer feedback; Leveraging core competencies and strengths in marketing/sales/distribution
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Technology considerations can be major factors of the outcome of a new product and according to Carbonnell-Foulquie et al. (2004) technical feasibility dimension is crucial in approving the new product concept. Technical criteria are presented in table 1.

Table2- Most used gate criteria in technical assessment

Source	Technical criteria
Loutfy & Belkhir (2001)	Description of technology involved, key risk factors, teams & skills required, scope of work, probability of technical success
Lilien et al. (2002)	Fit with current manufacturing capabilities, intellectual property protection
Hart et al. (2003)	Technical feasibility, product performance
Carbonell-Foulquie et al. (2004)	Availability of resources, leverage of firm's technical resources
Ulrich & Eppinger (2008)	Feasibility of product concepts, production feasibility, depth of the firm's existing knowledge of the technology, fit with the firm's capabilities
Cooper (2008)	<i>Technical feasibility:</i> Technical complexity, technical gap, familiarity of technology to business; Leveraging core competencies and strengths in technology/production/operations

Financial criteria are rarely used to evaluate new products at the beginning of the NPD process, because data converted into financial metrics are not much better than educated guesses. (Cooper 2001) However, many decision-makers are more than eager to see the best available estimates of sales and costs when making a decision. Financial criteria are listed in table 3.

Table3- Most used gate criteria in financial analysis

Source	Financial criteria
Loutfy & Belkhir (2001)	Revenue potential, profit potential, incremental project funding and other resources required
Lilien et al. (2002)	Estimated sales, estimated loss/gain on sales of related product, operating profit, <i>probability of business success</i>

Hart et al. (2003)	Sales in units, sales growth, sales objectives, market share, profit objectives
Carbonell-Foulquie et al. (2004)	Sales volume, total cost for a given cycle time, market share, long-term sales growth
Ulrich & Eppinger (2008)	<i>Timing and magnitude of future cash inflows and outflows:</i> Sales revenues, sales and production volume, unit price; Development, ramp-up, marketing, support and unit production costs
Cooper (2008)	Size of financial opportunity, financial return, productivity index, certainty of financial estimates, level of risk and ability to address risks, impact on business

NPD decisions are mainly done against marketing, technical and financial criteria. Furthermore, strategic fit and leveraging core competencies are also relevant issues to consider, but they seem to be related to main elements, mainly either with marketing or technical dimensions. That is the reason why strategic fit is not considered as a main element of business case, but a necessary dimension that links ideas to others and to firm's ultimate objectives. Strategic fitness is an important factor to determine new product success and criteria used in defining strategic fit are listed next in table 4.

Table4- The most used gate criteria in defining strategic fit

Source	Strategic fit criteria
Loutfy & Belkhir (2001)	Relatedness to strategy
Lilien et al. (2002)	Strategic importance, fit with current strategic plan
Hart et al. (2003)	N/A
Carbonell-Foulquie et al. (2004)	Alignment with firm's strategy
Ulrich & Eppinger (2008)	<i>Consistency with the firm's overall product plan and technology strategy:</i> fit with the firm's resources and objectives, compatibility with the firms emphasis on technical excellence and uniqueness

Cooper (2008) Alignment of project with company business strategy, importance of project to the strategy, impact on business

Businesses that are most likely to succeed with new products are those that have an articulated new product strategy. A good innovation strategy defines the goals and strategic focus arenas of the development effort. The degree, to which the project fits within a defined area of strategic focus, should be the first criterion to use against any new product idea. (Cooper 2001). Importance of strategic fitness is also backed by Ulrich & Eppinger (2008). They have stated that product development decisions should be consistent with the enterprises' overall product plan and technology strategy. According them strategic fitness answers to questions like how well does a proposed new product fit with the enterprise's resources and objectives; is it compatible with the enterprise's emphasis on technical excellence; and is it compatible with the enterprise's emphasis on product uniqueness.

III. SELECTION OF BUSINESS CASE ATTRIBUTES

The detailed content of business case elements is defined by extracting various kinds of decision gate criteria from literature, and then refining them to business case attributes. Results of this work are depicted in table 5 below.

Table5- Selected business case attributes

Associated element	Selected attributes
Market assessment	Customer need, customer benefits, customer value, opportunity window, target market, total market size, market growth, intensity and extent of competition
Technical assessment	Technical complexity, technical uncertainty, availability of resources, technical synergies, work effort estimation
Financial analysis	Price estimation, <i>Sales estimates</i> : direct sales, additional sales, impact on sales; <i>Cost estimates</i> : development cost, production cost, other lifecycle costs; payback level, cash flow statement
<i>Strategic fit</i>	Fitness to product strategy, fitness to technology strategy

Attributes selection is made in co-operation with one large ICT company. Suitability of each criterion for business case purpose is evaluated in workshops where several experts from different organizational functions

related to NPD participated in discussion. Selected and refined business case attributes were approved and validated by 21 business minded managers.

IV. BUSINESS CASE PROCEDURE

Business case analysis in NPD aims to propose decision whether or not a company should commit its resources and money to develop a certain idea into product. Systematical analysis can ensure that all the necessary information areas that decision-making needs are covered and gathered. Extent and depth of business case analysis and weighting of different tasks can vary depending on the nature of business. Thus the procedure has to be applied on an enterprise terms as well as attributes modified to match with specific enterprise context.

The business case procedure (in Fig. 3) guides business case building more practically and accurately compared to three main tasks. The procedure introduces a logical flow for business case building. Market and technical assessments of product idea are quite independent information areas and thus can be done simultaneously. Instead the financial analysis is dependent on information gathered in those previous assessments. In financial analysis the data is integrated and analyzed to convert intangible data to tangible metrics, and ideally the outcome is the true business value of the product idea.

Business case analysis necessitates a definition for the product itself although the definition will be sharpened during analysis. An early product definition is identified as a best practice in product development to avoid any disorientation in the development phase. The business case procedure contains attributes similar to what Cooper (2001) included into product definition list e.g. benefits and target market.

1) Market assessment tasks

Market assessment aims to gather relevant market information and knowledge. The first task of the proposed business case procedure is to define the value of the idea to customers. Defining the customer value can be divided to three phases. First *the customer needs* (adapted from Loutfy and Belkhir (2001), Lilien et al. (2002) and Ulrich & Eppinger (2008)) must be identified. This is why customers would be interested in product in a first place. Then the *benefits* (Lilien et al. (2002), Hart et al. (2003), Cooper (2008) and Ulrich & Eppinger (2008)) that the customers would gain after acquiring the product can be assessed against the customer needs. Needs and benefits define the source of the value, but not the amount of it. The *customer value* of the product (Loutfy and Belkhir (2001) and Cooper (2008)) needs to be defined and concretized in the monetary terms. This is a crucial step as the

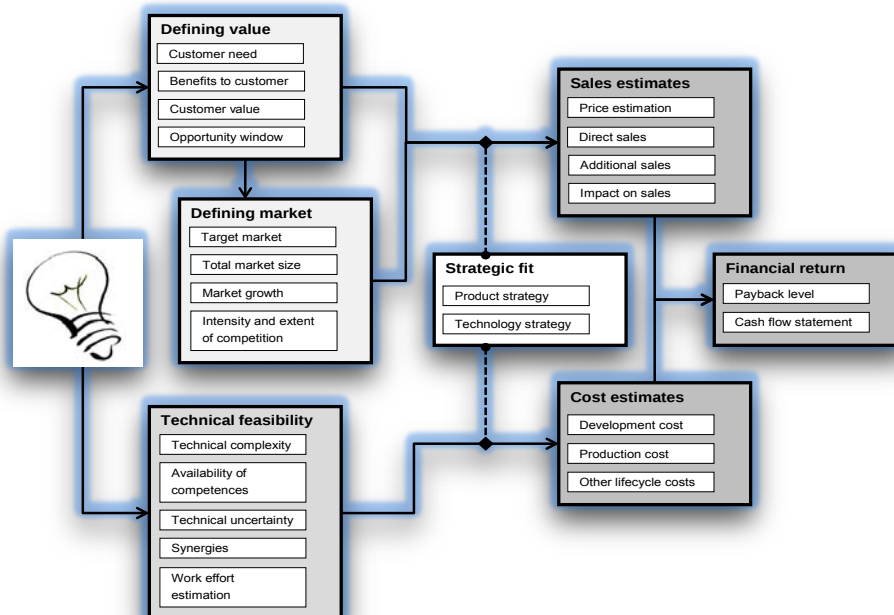
customer value and the price of the product are the two components that affect to customers' willingness to pay. Finally it must be considered how long is the opportunity window (from Carbonell-Foulquie et al. (2004)) for the product, which refers to time that the product would be seen valuable by customers.

The other part of the market assessment is to determine the market potential for the product idea. Identifying a *target market* Cooper (2001) and Loutfy and Belkhir (2001)) for the product gives a good base for both product design and financial estimates. Expanding this group of primary customers to all potential customers reflects to *the size of the total market* (Loutfy and Belkhir (2001), Lilien et al. (2002), Hart et al. (2003), Ulrich and Eppinger (2008) and Cooper (2008)) and indicates the market potential of the product. But because market is tied both value and time, *the market growth* (from Hart et al. (2003), Ulrich and Eppinger (2008) and Cooper (2008)) should be taken into account. The most profitable innovations are placed to growing markets where the customer value will sustain longer or in the best case even increase. One more thing that may affect to market potential of the idea is competition. Strict competition lowers margins and makes customer acquisition and retention harder. That is why *the intensity and extent of competition* (from Loutfy and Belkhir (2001), Ulrich and Eppinger (2008) and Cooper (2008)) should be assessed in the business case.

2) Technical assessment tasks

Technical assessment focuses on defining the feasibility of the product idea from viewpoints of both technology and competence. First *the complexity level* (Cooper 2008) of the product needs to be determined to know what kind of effort is needed to develop the product. This may also include rough conceptual design of the product that would be part of the early product definition. After the understanding of the complexity level is acquired it is time to check the *availability of competences* (from Loutfy and Belkhir (2001), Lilien et al. (2002), Carbonell-Foulquie et al. (2004), Ulrich and Eppinger (2008) and Cooper (2008)) within the company and in its partner network. Developing new products and in particularly using new technology always hold some sort of risks. This is why *technical uncertainties* (Loutfy and Belkhir 2001) should be studied to increase the awareness of those uncertainties. In the technical assessment also the possible *synergies* (from Lilien et al. (2001), Carbonell-Foulquie et al. (2004), Ulrich and Eppinger (2008) and Cooper (2008)) should be assessed. Synergies can be found e.g. from leveraging core competences, utilizing manufacturing capabilities or using existing technical resources. Needed *work effort* (adapted from Loutfy and Belkhir 2001) on different phases of development idea to product should be estimated based on technical assessment in order to provide solid foundation for cost estimates.

Fig. 3. Business case procedure



3) Defining strategic fit

Until now a business case covers information on customer value, market potential and technical feasibility. Although an idea would be seen as valuable, potential and feasible in a certain extent, it is not obviously logical to develop it further. An important issue is to consider idea's *fitness to strategy* (Loutfy and

Belkhir (2001), Lilien et al. (2002), Carbonell Foulquie et al. (2004), Ulrich and Eppinger (2008) and Cooper (2008)). Strategic fit should include comparison against both *product* and *technology* aspects. E.g. avoiding potential contradictions between firm's other products and supporting the defined goals of the company or its

development efforts could be seen strategic fits from product aspect. Utilizing company's core technologies could be seen strategic fit from technical point of view. However, each enterprise should create own practical way to define strategic fit. This refers to Cooper & Kleinschmidt (2007) finding that one success factor in NPD is a defined strategy that sets goals for business total new product effort.

4) *Financial analysis tasks*

Financial analysis sums up in monetary terms the information gathered in previous assessments. It estimates both sales and costs and ends up to *financial return*. Basically the market assessment provides information for sales estimates while technical assessment is the base of cost estimates. To develop any further in financial analysis the price estimation is needed. This estimation is supported both previously defined customer value, what are they ready to pay compared to competition. *Direct sales* (Lilien et al. (2002), Hart et al. (2003) and Carbonell-Foulquie et al. (2004)) for the product are obviously estimated, but in some cases it is recommended to analyze also the *impact on the sales of other products* (Lilien et al. (2002)). Introducing a new product may accelerate sales of existing products, but sometimes also harm them. In some cases *the additional sales* e.g. service sales can be even more important than the direct sales of the product. The other side of the financial analysis is the *cost estimations* (Carbonell-Foulquie et al. (2004)). Work effort estimation gives a good base to estimate *development* and *production costs*. In some cases it is also worthwhile to estimate *other lifecycle costs* of the product caused by e.g. delivery, maintenance or recycling responsibilities.

Financial analysis should be summarized with few informative figures about financial return (from Cooper (2008)). Estimating a payback level gives a good indication of profit potential of the product. It can be easily compared to size of the target market and if reaching a break-even point requires almost perfect penetration into target market the project might be too risky. Thus it is very useful financial attribute for measuring risk tolerance of a company. Final step is to prepare a statement of expected cash flows.

5) *Decision proposal*

The main purpose of business case is to aid decision-making. To fulfill this purpose business case should be concluded to the decision proposal (c.f. Cooper 2001). To make the proposal, business case attributes need to be studied solidly, and needed resources for development and expected business impacts have to be expressed clearly. The crucial decision to be proposed in analyzing new product ideas is *go/kill decision* because developing new products is expensive and the cost and time to complete each

subsequent stage increases dramatically (Schmidt 2004). In principle, go-decision could be also iterate or hold, and go-decision can be added e.g. by *priority index* and a proposal for *time to market*.

It is not necessary to express all information that is worked out during the procedure to decision-makers. Cooper (2008) states that information has value to the extent it improves a decision, and only information that decision-makers need to make an effective and timely decision should be provided. In addition, it is not necessary to build complete business case for every idea. Some ideas will be defined not valuable enough or not feasible within reason already at early stage of business case analysis. Also market for a product can be defined not attractive enough or the product itself might not fit to the strategy. Decision to kill those ideas should be made early without spending any more effort of studying business value of them. This is also way to increase effectiveness of NPD idea screening phase and helps an enterprise to focus on better ideas.

6) *Challenges concerning business case analysis*

Building business case for new product idea is a laborious task due to many reasons. One reason is the need to search information from multiple sources and to integrate information. Needed information might not be available or the reliability can be questionable. Another reason is uncertainty faced in early phase of NPD process when the product idea is not well-defined and market is non-specific. Business case analysis is most probably an iterative process when new product ideas are concerned.

Understanding and defining value of a product idea for customer is one of the most critical points of business case. It can be conceptually simply, but in real business it is not. Defining value can be more art than a systematic task and is always in relation to alternatives, such as competitive products. The similar challenge relates to market definition, there can be significant uncertainty in market information depending on market acceptance if the product will be commercialized. Also there is always more than one alternative to form a product from an idea in technical sense. Selection between alternatives can impact on cost, value and market of product idea. This need to be considered in technical assessment and synchronization with market assessment is probably needed.

Financial analysis combines information in monetary terms. The basic challenge is that mistakes done in earlier phases will be repeated in financial analysis. Whenever possible, reliability of sales and cost estimates should be verified by historical or comparable data.

V. CONCLUSION

This study proposes business case as means for analyzing ideas that come through a company's NPD process to commit NPD resources into right projects. The study is theoretical construction reflecting empirical business case analysis in NPD. Business case analysis consists of three main tasks: market assessment, technical assessment and financial analysis, and additionally strategic fit need to be argued.

The study identified and listed a number of potential business case attributes from literature (RQ1). Attributes used in the procedure were selected respecting the business context of a specific company. Those attributes are associated with market assessment, technical assessment, financial analysis or strategic fit. Market assessment defines value at first, by clarifying customer needs, benefits and value, and opportunity window during which a product would be valuable for customers. Then the market is defined by estimating target market, total size of market and market growth, and assessing the intensity and extent of competition. Technical assessment is focused on technical feasibility of an idea by studying technical complexity and uncertainty, revising the availability of competences, seeking technical synergies and ending to the work effort estimation. Financial analysis consists of sales estimates and cost estimates, and combines them to financial return. In addition, strategic fit is considered both from product and technology strategy aspects.

This study introduces a business case procedure as a systematical way to build business cases (RQ2). The procedure is based on attributes selected for the business context of a specific company. It defines a logical flow of essential tasks and steps for business case building. The procedure can be used as a baseline in any organization aiming to implement or improve systematical business case building in NPD process.

Follow-up studies to ensure practical validity of the attributes and procedure will be carried in the future.

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