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The success and failure of New Product Development – a study with focus on the early phases

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**THE SUCCESS AND FAILURE OF NEW PRODUCT  
DEVELOPMENT – A STUDY WITH FOCUS ON THE EARLY  
PHASES**

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## **ABSTRACT**

What factors affects New Product Development (NPD) and are the factors the same in different industries? These are two of the main questions explored when three organizations in different industries are studied from the perspectives of knowledge, motivation and organizational context. Focus is on the early phases of NPD, however the entire NPD process is included to better understand the results of the actions and factors throughout the process. The indications that knowledge and knowledge management are key tools in order to stay competitive in the market place are looked closer at and the empirical cases illustrate the use of knowledge within the given sub-cases and the implications thereof.

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## INTRODUCTION

The purpose of this paper is to explore the new product development (NPD) process in different industries to examine similarities and differences with a particular focus on the early phases of NPD. The crucial first steps in the process is where ideas are filtered by the organization and as a result both potentially “good” and “bad” ideas are either accepted into the NPD process or rejected. Chesbrough (2004) refers to this as true and false, positives and negatives.

Today, NPD is a prerequisite more than a strategic option as firms operate in markets with “shorter product life cycles; heightened competition from home and abroad; maturing industries and flat markets; and the quickening pace of technological developments” (Cooper and Kleinschmidt , 1987a, p. 175). 74% of companies in a UK study by Bain & Co. (1990) regarded innovation as “very important” to firm survival and the other 26% rated it “quite important”. However, NPD is associated with risk and thereby also failures. Crawford (1977) found failure rates of NPD to range from 20 to 90%. Other studies like Booz et al. (1982) found that 35% of the products introduced between 1963 and 1981 failed. Cooper (1990) in his study confirmed these failure rates.

One of the cornerstones in NPD research is the view on “success” and “failure”. There are numerous definitions of what “success” and “failure”, ranging from financial measures, sales measures to more “soft” factors (e.g. the opening up of new markets) (Cooper and Kleinschmidt , 1987a). Additionally there is an ongoing discussion on the long term gains and the notion of paradox “the success of failure and the failure of success” (Farson and Keyes, 2002). Within the framework of this paper there will be no attempt to further add to the discussion but rather accepting the success measures drawn up for each sub-case.

The early screening process is used to weed out what potentially will be “failures”. Cooper and Kleinschmidt (1987b) draw special attention to the importance of the evaluation activities in the early phase of the NPD process; “initial screening, preliminary market assessment, preliminary technical assessment, detailed market study or marketing research, and business/financial analysis”.

## THE CASE COMPANIES

The case companies are large multinational companies in three different industries operating in competitive markets – Alfa, Beta and Gamma. In Alfa the main focus has been on the design function of the organization and five sub-cases were included in the study, which all were product innovations of more incremental nature. In Beta, the three sub-cases were two product innovations of a slightly more radical type than in Alfa, and a radical process innovation. Two new products in line with the industry practice were studied in Gamma.

The heterogeneity of the case companies and their approach to NPD was chosen both to explore similarities and differences between industries.

## LITERATURE

“The potential for new ideas arising from the stock of knowledge in any firm is practically limitless – particularly if people in the firm are given the opportunity to think, to learn, and to talk to each other” (Davenport & Prusak, 1998, p.17). Organizational innovation can be viewed as a result of the combination of existing and new knowledge (Kogut and Zander, 1992). The organizations that can source and integrate new knowledge are more likely to be successful innovators.

Dutton and Thomas (1984) show that learning rates differ not only between industries and organizations, but also within the same or similar process and product areas. Studies have shown that there are more variations within organizations producing the same product (eg. Searly & Gody, 1945 on shipyards producing same vs. different ships during World War II). Similar results from other industries were found by Chew, Bresnahan and Clark (1990). In the search for the factors explaining these variations there has been several contributions. The productivity gains do not automatically come with experience. Hence the importance of understanding which variables actually leads to productivity gains are of interest.

D’Aveni (1994) and Lance et al (1998) highlight that very few firms can develop and master the wide range of knowledge and skills needed independently to be competitive. In relation to the knowledge needed, Szulanski and Rosella (2003) stress the importance of motivation in the transfer of knowledge by both from the source and the recipient of the knowledge. The role of the organizational structure related to knowledge and NPD is further explored by Kim (1993) describing that learning often is rooted in the knowledge structure of top management and the organizational structures and processes (Kim, 1993).

The importance of learning as a factor for competitiveness is stressed by Stata (1989) who argues that the rate at which individuals and organizations learn may become the only sustainable competitive advantage, especially in knowledge-intensive industries.

Together with previous research and the literature review in appendix 1 (summarized in table 1), the categories for the study emerged; knowledge factors, motivational factors and organizational contextual factors. The categories are not always mutually exclusive resulting in some of the factors in table 1 have fallen into more than one category. The main purpose of this type of framework is to create an initial order to the heterogeneous flora of factors from studies suggested to contribute to productivity. The aim of this study is to continue the quest for understanding how NPD can be improved.

All of the studies included knowledge factors which was the most common type of factor. Factors relating to the organizational context (structure, risk and management) were represented in most of the studies. Motivational factors on the other hand were rarely described as a factor on its own.

	Knowledge	Motivation	Organizational context	
National Industrial Conference Board (1964)	4	0	0	
Myers & Marquis (1969)	4	0	2	
SAPPHO: Rotwell et al. (1972, 1974)	4	0	2	
Roberts & Burke (1974)	1	1	4	
Cooper (1975)	3	0	1	
Rubenstein et al (1976)	6	0	6	
Cooper (1979)	4	0	1	
Cooper (1980)	8	0	3	
Maidique & Zirger (1984)	6	0	6	
Dutton & Thomas (1984)	2	0	3	
Voss (1985)	2	0	3	
Hayes & Wheelsright (1985)	3	1	3	
Link (1987)	5	0	4	
Cooper & Kleinschmidt (1987)	2	0	1	
Lieberman (1987)	2	0	1	
Argote (1993)	3	1	2	
	59	3	42	104
	57%	3%	40%	

Table 1 – Summary of factors related to NPD categorized<sup>1</sup>

Over the almost three decades of selected research summarized in table 1 there has been little change over time according to the categories of the framework. Whether this implies that there is little progress or change in what variables effect NPD would be speculation at this point. However, it does indicate that the framework potentially serves as a way to get an overall view on the range of factors that are suggested to drive NPD.

<sup>1</sup> Some factors have been allocated to more than one category. For the complete list see appendix 1.

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Improvements and adjustments of NPD processes to allow for faster NPD has led to the introduction of an “overlapping” process described in figure 1 (Takeuchi and Nonaka, 1986). The more technical details related to project management and process management will not be included in this study as the focus is primarily on the early phases of NPD. The implications and issues arising from Type A or Type B approach will be the main point of interest.

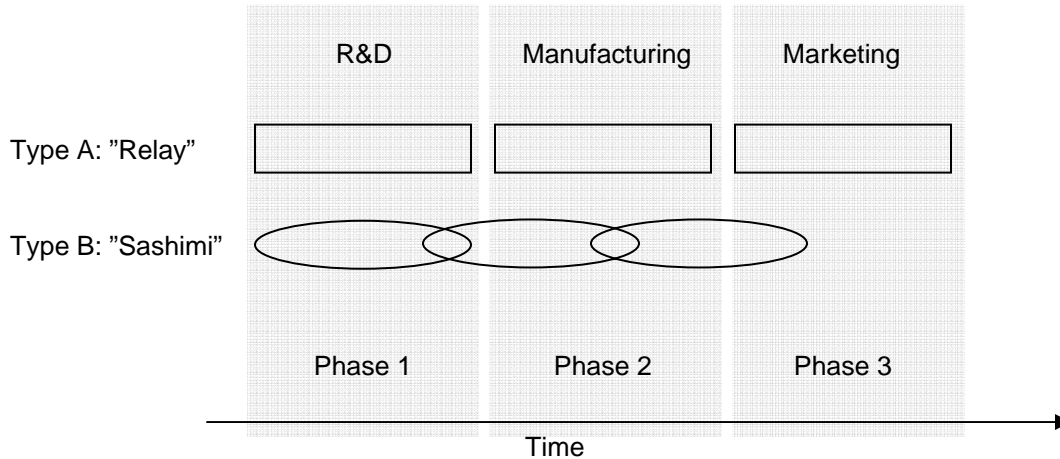


Figure 1 – Sequential vs overlapped development phases (Takeuchi and Nonaka, 1986)

While the knowledge factors and organizational context are related to the firms “ability” to store, transfer, use and grow knowledge, the motivational factors are related to the “willingness” to make it happen.

The various factors found in the literature lead us to the framework used in the study (figure 2). Together these factors create the climate upon which new products and services can be created.

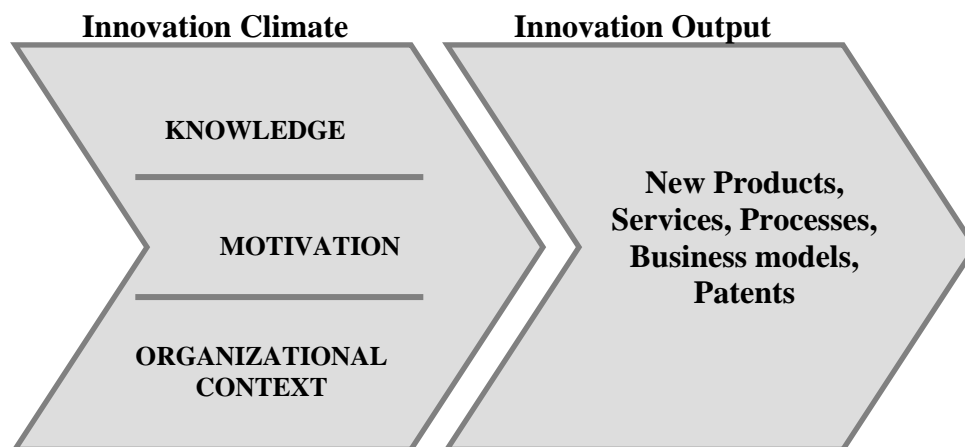


Figure 2 – Framework of the study



## **METHOD**

The population variety makes direct comparisons between studies difficult (Craig & Hart, 1992). However, the framework in this study aims to bring together differences in population and industries to find similarities and differences on a broader scale. Like much of the more current research, this study involves both factors affecting the success and failure of NPD.

The semi-structured interview was chosen to be able to handle the potential differences between the cases as well as allowing for additional factors and issues related to the NPD to surface during the interviews. The main limitation of this qualitative study is the limited ability to project the findings on to other cases. However, the main objective of the study has not been to single out the most important issues and factors or in any other way zoom in on a particular area of NPD, but rather to explore the NPD in the case companies from a broader standpoint. The three categories in the framework allows for some order of the various factors involved in the process to be created both in relation to the literature and the empirical findings.

The interviews were conducted with employees involved with the particular sub-cases in the study and ranged from team member to senior management depending on which case. The interviews that were semi-structured to allow for additional input and exploration by the respondents lasted approximately 1,5 to 2,5 hours. For most of the sub-cases one or two people were interviewed.

The study guide (appendix 3) was created based on the documented NPD processes described in appendix 2.

## **EMPIRICAL FINDINGS**

In the following sections, the empirical findings from Alfa, Beta and Gamma will be discussed based on the framework. First we examine the success measures used within the cases followed by the empirical findings divided into the three main categories of the framework (knowledge, motivation and organizational context). By comparing and contrasting the diverse cases, the objective is to identify similarities and differences related to NPD.

## SUCCESS FACTORS

Based on the findings related to success factors it is clear that there is variety in which success measures that are used, even between projects within the same firm as can be seen in table 2.

	Alfa			Beta			Gamma	
	Unit 1	Unit 2	Unit 3	Project A	Project B	Project C	Project X	Project Y
Profit goals							Yes	
Quality specs.	Yes	Yes	Yes		Yes	Yes		
Speed to market			Yes		Yes	Yes	Yes	Yes
Other	51% hit rate						Creating "buzz"	
Success / Failure	Success	Success	Success	Success	Success	Failure	Success	Success/ Failure?

Table 2 – Success measures in the cases studied<sup>2</sup>

For most cases the success or failure was fairly uncomplicated to determine even though some of the measures were of subjective nature. However, in Gamma (Project Y) there were two senior managers interviewed on the same project disagreeing on whether it was a "success" or a "failure". Whether the investments into technology for this and other future products were to be covered only by the sales of Project Y was the core of the disagreement leading to the different views.

Notably Project A (Beta) had no formal success measures at all. The project was accepted by senior management through a compelling argument from the product champion indicating an un-satisfied need with large market potential. Speed to market was the closest to a success measure as senior management informally indicated that they would like to see it on the market as soon as possible (yet no formal date was set).

The heterogeneous outcome was to some extent to be expected between the organizations. However, the differences within the same organization were not expected to be as fundamental as the study point out. From a learning perspective there was little evidence of knowledge sharing and learning from both successes and failures for future NPD.

In the following three sections we examine the empirical findings related to knowledge, motivation and organizational context in more detail.

<sup>2</sup> Success factor groups based on Griffin (1997)

## **KNOWLEDGE**

One notable observation in the three cases was the importance of critical mass and scale in early NPD processes. Scale and mass allow for specialist organizations, and in the two larger cases (Beta and Gamma), people involved in NPD were specialized on component skills. In the case where NPD was scattered geographically into smaller units (Alfa), it was clear that individuals were forced to master diverse skills, including production economics, transport economics, design creativity and negotiation tactics, simply because the units were so small that being specialized became a luxury. This also underlined the diversity of NPD-required knowledge and competence, and the importance of thinking through the impact of the character of knowledge on the structuring of NPD activity. In the larger and centralized units (Beta and Gamma), NPD staff could be specialized into very narrow subject areas.

The importance of a broad competence base for top management was underscored by the project manager (and champion) within Beta (Project A) in a long struggle before a “low tech” NPD was given funding. The respondent described that “There was no one in leading position with retail experience” and “The background of top managers drive priorities”.

Another sub-case within Beta (Project C) involved only technical staff in a high-end engineering project. The study indicates that there is a risk of losing track of the original objective as team members get caught up in the technical excellence. “We were very excited to be part of what had the potential to revolutionize our industry. The existing process was introduced decades ago” the project manager described. The lack of knowledge diversity within the project was one of the factors leading to the failure of Project C.

The involvement of the customer throughout the NPD process is a new approach to both Beta and Gamma used with great success. In addition to the traditional market research, further engagement by the potential customer in the development of the concept or prototype through focus groups played an important role in the development of the concept related in speed and accuracy of the finished product. “The people in the focus group practically created the product for us” the manager of project A (Beta) explained. Knudsen (2007) finds that customers are the most frequently used party outside the organization in the NPD-process.

Jiyao et al. (2005) found in their study there is generally a positive relationship between time and success. However, in Gamma a realization that speed might not always need to be minimized to ensure success was experienced. By introducing a product at a less attractive point in time it did not reach the targets. With further knowledge about the market and factors affecting the possible outcome the importance of “timing” rather than “time” or “speed” was a major learning point.

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In both company Alfa and Beta, the experience gained from the NPD projects were not communicated outside the team involved (and at times not even within the group) resulting in very limited knowledge sharing and potential learning.

The experience of sales staff proved very valuable in Unit 1 (Alfa) when the customer was of a different view of the type of solution to go for. The persistent and experienced sales person took a calculated risk and pushed for a more advanced solution resulting in great success both for the customer and Alfa. “Without a wide variety of knowledge, ranging from sales experience to technical expertise, this type of challenge would have been destined to fail” according to the marketing manager of Unit 1.

We have now explored parts of the factors related to “ability” (the organizational context also relates to this), next we look into the motivational issues – the “willingness” and drivers of pursuing NPD.

## **MOTIVATION**

The motivational issues leading to NPD-projects in Alfa were mainly driven by customers. Within the NPD process the key performance indicators ranging from a “hit rate” for the sales and marketing functions to production KPI’s related to flawless volume output without consideration for the complexity indicates a lack of synchronization of overall objectives. As a result motivational issues take a hit when sales and marketing try to push for more advanced NPD and the production department want to avoid this type of NPD.

In Project B (Beta), the development of the concept was not fully finished when the production unit commences their work due to the importance in speed (see figure 1 in the literature section for example on “sashimi”). Information about a new entrant coming into the market was received and the evaluation that the current market was not big enough for another player was made. In this case the motivation for NPD was driven by the competitor who was about to introduce a new type of product. The obvious benefits of shortening the development time also have drawbacks related to motivation as adjustments of fundamental nature is made once production begun their work, resulting in frustration and tension. “We had just solved a technical production issue when new specifications on the product were introduced” the technical manager of the project described as a disappointment at the time. In addition, the risk potentially increases as sudden changes in a not fully researched area would possibly result in termination of the NPD with many staff involved and investments made. Long and short term strategies do not always fit well together as was experienced by Beta. A parallel development of the same product was simultaneously developed externally without any information of the production shared with the team in this case. The external development would not be able to deliver on time (and time was of the essence), but once finished it would be a financially better solution than the internal one. Once this became known (after the internal team had finished their work), motivation took a hit.

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In Project C (Beta) the close relationship with university research led to the development of the new production process. The NPD team consisted of only technical staff. The team's enthusiasm resulted in a "technical euphoria" which lacked the basic critical question "is there a market/customer for this?". "In hindsight it is evident that we should have had marketing and sales people involved to some extent" the manager of the project describes.

"After months of lobbying I finally managed to persuade a senior manager I happened to sit next to on the Christmas party to endorse the project and spare a small team for the project" the project manager of Project A (Beta) described. "Without his backing I do not think we would have been able to venture into the project at all" the manager continued.

For Project X (Gamma) the idea for the project had been around for some time in Gamma but not ventured into as the technology did not allow for it to be completed within the frame of the values of the firm. With technological advancement and new management the step was taken and Project X was developed. Gamma identified the main market for Project X which both was more developed and larger than other markets. A tight team was assembled in the main potential market and the NPD was developed with top-management at head office overseeing the project.

From the cases we find that the sources of motivation range from staff and competitors to technology and university research relations. We have now looked into knowledge and motivational factors which leads to the final category of the framework – the organizational context. The organizational contextual factors can affect the "ability" of the organization to be more or less successful in the NPD identification and process.

## **ORGANIZATIONAL CONTEXT**

The organizational context factors are divided into structure, risk and management. Structural factors include how the organization is structured, the systems in place and how it relates to NPD. Next, the view on risk held by the firm is explored. Finally the implications of managerial concerns are covered.

### **STRUCTURE**

A fundamental difference between the case companies is that NPD is centralized in Beta and Gamma. In Alfa, the need to be located close to the customer results in a more decentralized approach. In addition, the numerous production plants in Alfa need to be closely integrated with the design function.

The key performance indicators (KPI's) are instrumental in communicating to the organization/ unit/ individual what is being valued. Within Alfa, the discrepancy between units on what was valued (volume or profit) resulted in a reluctance from production units in producing more advanced solutions as it would potentially result in a lower volume and additional errors in the finished product. Also, the KPI involving "hit rate"

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on the amount of new products that are successfully launched allows for managers to control and adapt in order to reach the desired target as the level of innovation (ranging from minor adjustments to grand new designs) was not part of the measurement. Without a more graded definition there is a risk of the KPI becoming a target which is “managed” by the people involved potentially without link to the overall objectives of the organization.

The history of the firm and the core competencies from the past driving identity is engrained in the organizational structure as experienced in Gamma. “Market research has low status at Gamma” one of the managers describes. Indications of a move towards a more balanced view by the firm were identified through the success of Project X which was tuned and adjusted to meet the needs and wants of the customer with great detail.

In both Beta and Gamma, smaller teams were tested. In the cases where the teams had a broad knowledge base great success was experienced. The failure (Project C in Beta) lacked the marketing and sales functions which was one of the factors leading to its failure.

In Beta (Project A) non-participants questioned the quality of the project due to the rapid progress it made. “Will it really result in the level of quality needed” was a comment from several people during the project to the manager. As the NPD was successful it raises a few questions related to the current process steps used by Beta and possible attitude issues within the organization.

The process steps listed in appendix 2 have small variations but mainly depict a flow of steps from initial idea to finished product/service. In unit 2 (Alfa) there were indications that this process would make “loops” as the tollgate system allowed for sending NPD projects back several steps in the process without financial or any other consequences. The additional resources added, the strain it put on the organization and effects on other NPD was not taken into account. It should also be noted that the design units do not have financial targets which would possibly have made the unit more attentive to this type of issue.

### RISK

In Beta risk is measured by the actual amount and resources invested resulting in an inclination of favoring smaller investments with a possible incremental tendency. The actual level of risk is not viewed from a cost/benefit perspective in its true sense resulting in fewer NPD projects of more radical nature. In Project C (an NPD project of more radical type) Beta co-developed a new production process with another organization. The spreading of the risk and cost was a key reason for this team work. However, the collaboration took a hit when the priority of the project was viewed differently in the two organizations. “One mother is needed” was the conclusion from the Beta manager involved in the project who believe a joint venture would have been a more successful approach when involving more than one firm.

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In Beta (Project B), described earlier, speed to market was a matter of survival to the organization. The way to improve the speed in the project was to simultaneously develop the concept from a marketing perspective as well as build the production plant for the product. Figure 1 in the literature section describes this alternative approach as “Sashimi”. Very few NPD’s take this format in Beta due to the high risk. The project was successful; however it put strain on the organization as fundamental changes in the functionality of the product were altered at late stages in the process.

The ideal function of the “hit rate” in Alfa is to drive the organization to a specific level of risk set out by management. However, with the lack of grading on NPD, the risk of the unit actually “managing” the projects to get to the target is possible. This would possibly lead to a sub-optimization with little possibility to spot without being involved in the unit itself.

#### MANAGEMENT

Once the commercialization phase was reached in Project A (Beta) and it was time to manage the marketing and sales plans there was a lack of expertise within the department taking over. “There was no one to hand over to managing the product once it was launched” the respondent described.

The importance of personal relationships and trust was made very clear in Gamma when the NPD process of a large new investment was started with very limited research. The key to the quick decision was due to the strong faith the CEO at the time had in the senior management introducing the idea. Another example of personal relationships was the hardships from management experienced by the product champion in Project A (Beta) before the meeting with senior management at the Christmas party as described in the motivational section.

## DISCUSSION / CONCLUSION

The framework allowed a categorization of the wide range of factors into three main groups (knowledge, motivation and organizational context). The variety presented by the literature indicated possible overlap between categories in some cases, which can be viewed as a weakness of the framework, or as seen by the authors a result of the complexity making up the innovation climate in which NPD is created. The empirical findings stress several peculiarities, such as the sudden breakthrough on an NPD at Christmas dinner. The lack, or possibly embedded in other factors, of motivational factors in the literature possibly indicate it as a factor of inferior value in the NPD process. However, the cases studied clearly emphasize the role of motivation (both on an individual and organizational level) as one of the main drives to the level of success accomplished.

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With the wide variety of sources leading to NPD, a more open and less stringent system would possibly be more suitable in order to ensure that ideas can be captured by the firm. All case companies have thorough tollgate systems and processes that in detail described the steps and routines for the project once they had started. However, the link between the broad possible sources of NPD and the actual process was often not as stressed. Without having a “receptive” early phase of NPD, the filtering will possibly be more a result of true product champions who keep pushing to get their idea to the initial screening stage. The importance of knowledge from outside the firm is stressed by strategy research (e.g. Dyer and Singh, 1998) as well as the cases in this study.

In the light of “overlapped” NPD described by Takeuchi and Nonaka (1986) and explored by Beta in Project B the importance of communication, understanding and relationships between functions possibly becomes more important factors to ensure smoothness and long term success in this type of NPD process. In particular the need for understanding between the dissimilar functions that R&D and marketing represent is an area of vital importance.

Within the framework the cases had several similarities even though the differences looked substantial at first glance. The tendency to look outside the organization for inspiration and answers to questions (e.g. closer customer involvement in the NPD) was a common denominator and also the closer collaboration with other entities and sources in the early phases of NPD. However, the more complex situation that is created, it can be expected to have new possible pitfalls. The findings from this study point to the need to have clear objectives and success measures when venturing into an NPD with another firm (Project C in Beta).

The balance of the firm related to the early phases of NPD involves the attention and absorption of new ideas into the organization, yet not to create systems that automatically filters out possible successful new products. The interface that the filter makes up between idea and the NPD-process is an essential part of successful NPD.



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### APPENDIX I: CRITICAL SUCCESS FACTORS<sup>3</sup> RELATED TO THE FRAMEWORK

Study	Factor	Framework factor <sup>4</sup>
National Industrial Conference Board (1964)	Marketing knowledge poor	Knowledge
	Technical defects	Knowledge
	Bad timing	Knowledge
	Poor marketing	Knowledge
Myers & Marquis (1969)	Ideas for innovation come from new information	Knowledge
	Personal contacts and personal experience the best sources	Knowledge
	Innovation is a multifunctional task	Organizational context
	Market-led innovation	Knowledge
	Small incremental innovations lead to technical change	Knowledge /Organizational context
SAPPHO: Rotwell et al. (1972, 1974)	Understanding user needs	Knowledge
	Attention to marketing	Knowledge
	Perform development work efficiently	Knowledge /Organizational context
	Make use of outside advice	Knowledge
	Management authority	Organizational context
Roberts & Burke (1974)	Management support	Organizational context
	Management involvement	Organizational context
	Project champion	Organizational context /Motivation
	Need and opportunity identification	Knowledge
	Management communication of needs and opportunities throughout organization	Organizational context
Cooper (1975)	Lack of understanding of marketplace	Knowledge

<sup>3</sup> Based on Craig & Hart (1992) with additional studies included

<sup>4</sup> Knowledge, Motivation or Organizational context

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	Lack of understanding of customer	Knowledge
	Lack of understanding of competitors	Knowledge
	Inward orientation	Organizational context
Rubenstein et al (1976)	Recognition of needs	Knowledge
	Relative advantage of the innovation to the user	Knowledge
	Clarity of performance requirements	Organizational context
	Frequency of contact with customers/ users	Knowledge /Organizational context
	Lack of interdepartmental communication	Organizational context
	Level of project team communication	Knowledge
	Clarity in the communication of project demands and responsibility	Organizational context
	Degree of effectiveness in communication amongst organizationally independent groups	Knowledge /Organizational context
	Availability of information about sales potential	Knowledge /Organizational context
Cooper (1979)	Product uniqueness and superiority	Knowledge
	Market knowledge	Knowledge
	Marketing proficiency/ efficiency launch	Knowledge
	Technical production synergy	Organizational context
	Technical production efficiency	Knowledge
Cooper (1980)	Proficiency of process activities	Knowledge
	Special importance of marketing activities	Knowledge
	Product advantage	Knowledge
	Product quality	Knowledge
	Sales force distribution targeting	Organizational context
	Customer price sensitivity information important	Knowledge
	Buyer behavior information is important	Knowledge
	Customer needs, wants and specifications information is important	Knowledge
	Market launch activities	Knowledge
	Prototype activities with customer	Organizational context
	Test marketing	Organizational context
Maidique & Zirger (1984)	Customer and market understanding	Knowledge

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	Product with high performance to cost ratio	Knowledge
	Proficiency in marketing	Knowledge
	Commits significant resources to selling and promoting	Organizational context
	Product performs high margin to the company	Knowledge
	Well planned and executed R&D process	Organizational context
	Interfaced and coordinated create, make and market functions	Organizational context
	Early product introduction	Organizational context /Knowledge
	Synergy with existing business	Organizational context
	High level of management support	Organizational context
	Technical prowess	Knowledge
Dutton & Thomas (1984)	Engineering	Knowledge
	Labor skills	Knowledge
	Managerial expertise	Organizational context
	Improvement in capital goods	Organizational context
	Materials	Organizational context
Voss (1985)	Recognizing user needs	Knowledge
	Good communication by innovator	Knowledge
	Good management of technical aspects	Organizational context
	Presence of product champion with status	Organizational context
	Availability of adequate resources	Organizational context
Hayes & Wheelsright (1985)	Individual learning	Knowledge
	Selection and training of new staff	Knowledge /Organizational context
	Improved methods	Knowledge
	Incentives	Motivation
	Leadership	Organizational context
	Better equipment and substitution of material and/or capital for labor	Organizational context
Link (1987)	Management of launch execution	Organizational context
	Synergy with existing business	Organizational context
	Completeness of marketing intelligence	Knowledge

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	Product / market attractiveness	Knowledge
	Novelty of product	Knowledge
	Quality of product	Knowledge
	Existing credibility of supplier	Organizational context
	Export market acceptance	Knowledge
	Level of resources devoted to the project	Organizational context
Cooper & Kleinschmidt (1987)	Product advantage	Knowledge
	Proficiency of pre/development activities	Knowledge
	Protocol / clear definitions	Organizational context
Lieberman (1987)	Improved organizational and individual skills	Knowledge
	Improvement in product and process designs	Knowledge
	Improvements in capital equipment	Organizational context
Argote (1993)	Improvements in the performance of individual workers	Knowledge /Motivation /Organizational context
	A better understanding of who in the organization is good at what	Knowledge
	Tooling and layout	Organizational context
	Improvements in organization's structure	Organizational context
	Improvements in technology	Knowledge

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## APPENDIX 2: SELECTION OF NPD PROCESSES AND THEIR STEPS

<b>Griffin (1997)</b>	<b>Kotler (1980)</b>	<b>Pugh<sup>5</sup> (1983)</b>	<b>BSI (1989)</b>	<b>Cooper &amp; Kleinschmidt (1987c)</b>
(1) Idea generation	(1) Idea generation	(1) Market	(1) Trigger	(1) Initial screening
(2) Idea screen	(2) Screening	(2) Specification	(2) Product planning	(2) Preliminary market assessment
(3) Business Analysis	(3) Concept development and testing	(3) Concept design	(3) Feasibility study	(3) Preliminary technical assessment
(4) Development	(4) Marketing strategy	(4) Detail design	(4) Design	(4) Detailed market study/ market research
(5) Test and validation	(5) Business analysis	(5) Manufacture	(5) Development	(5) Business/ financial analysis
(6) Commercialization	(6) Product development	(6) Sell	(6) Production (manufacture, transport, installation)	(6) Product development
(7) Success	(7) Market testing		(7) Distribution (packaging, transport, installation, commissioning)	(7) In-house product testing
	(8) Commercialization		(8) Operation (use)	(8) Customer test of product
			(9) Disposal	(9) Test market/ trial sell
(10) Trial production				
(11) pre-commercialization business analysis				
			(12) Production start up	
		(13) Market launch		

<sup>5</sup> The process is iterative

### APPENDIX 3: STUDY GUIDE

	Study Guide	Questions
Backgr ound	How is PD defined in case company?	What constitutes "PD"? (Definition. Boundaries.)
	What criteria is used to measure success in NPD?	Please elaborate on what "NPD success" is to your company
Prod. Dev process	Steps from initial idea to commercialized product	Firm's NPD process: initial idea to commercialized product?
	Details in Process Steps	For each process step: who is involved?
	“Skunk work”, projects outside firm’s NPD structure	Are there alternative processes for NPD in your company?
		If yes, why and what are they? When do they apply?
Proj to be studied	Successful: profit, qual specs & speed to market	
	Project A	\$ goals, qual specs & speed to market goals? Outcomes?
	Project B	\$ goals, qual specs & speed to market goals? Outcomes?
	Un-successful	
	Project C	\$ goals, qual specs & speed to market goals? Outcomes?
	Project D	\$ goals, qual specs & speed to market goals? Outcomes?
For each successful and un-successful project	Project description	What did the process look like? Please describe each step, including idea generation
	Adherence to /departure from firm’s NPD process	In what way did the project depart from generic NPD process?
	Details	List steps outlined by respondent & check differences
	Presence of enabling and/or hindering factors	
	Multifunctional teams	What were the competence areas of the core (initial) team?
	Top management support	In what way was top mgt involved? How did they communicate?
	Open innovation	Does your company apply open innovation? In this project? How?
	Entrepreneurial people	Level of entrepreneurship among the project members?
	Intelligent risk taking	What was the official "risk level"? How did you rate it?
		n of high-risk projects? n outside the pre-defined market?



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	Innovation process planning	How does your company plan & re-organise the NPD process?
	Project evaluation ex-ante and ex-post	What were the framework, method, and data for evaluation?
	Incentives	Are there any incentives for NPD? (individual, team, dept)
		What is the format of such incentives? Please exemplify
		What criterias need to be met? (link to success measures?)
	Other factors raised by respondents	Is there anything you would like to add concerning this project?
Open-ended data points	Examples of success and failure in case companies	Other examples of success and failure in case companies
	Reflections on reasons to success and failure	Why do you think NPD projects succeed and fail in your firm?