Title  

The Innovation Coach  

A tool to facilitate the Front End of Innovation

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Date  

July 2006

Course  

MoT 2900 Master Thesis

Management of Technology

Revision  

1.1 Public

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Preface

This thesis is written for anyone interested in innovation. Reading this thesis requires little more than common sense and some understanding of what goes on in a company which is involved in innovation. The thesis is the result of six months fulltime research and is written as the last test before graduation of the author in the Management of Technology program at the Delft University of Technology.

This research is based on research endorsed by IBM. Contrary to popular belief, IBM is not a solid blue entity, but rather a collection of individuals. Some of these individuals helped me in writing my thesis. I would like to thank the following people for their contribution: Djeevan Shiferli, Tijs Wilbrink, Paul T. Baffes, Rene Leben, Jack van Driel, John Mullaly, and all the people I could interview about their projects.

From the Delft University of Technology I would like to thank: Marc Zegveld, Karel Mulder, Erik Jan Hultink, and Gerben van der Panne. Special thanks go out to Eric den Hartigh for his tireless efforts to provide feedback on my progress. My fellow MoT students Sander van Reijzen and Gerben Bakker have also been very helpful to listen to my ideas and give useful comments in return.

Anita Visser and Ralph Boymans, thank you very much for correcting my typos and supporting my work. And last but certainly not least, I thank Carla Nagel for showing off her skills in Lotus Notes.

Without all your support and participation this thesis would have been a purely theoretical exercise and not half as good as it is now.

Roeland
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Summary

The research done for this thesis was done within IBM Benelux. The tool, the procedures and the users are tailored to the situation within IBM. However, many of the aspects covered in this thesis can be generalized and used in other firms as well. The limitations of applying this research in other situations are stated where appropriate.

This thesis deals with the very first steps of an innovation process, the so-called Front End of Innovation. The Front End starts with the conception of an idea and ends when the idea is either rejected or turned into a project.

Innovation processes usually result in new products, services, business models, etc. In other words, new ways to generate revenues. Innovations are important for companies in competitive markets to stay ahead in the game and ensure their survival.

All innovations start as an idea, or a combination of ideas, by one or more people. However, only a few ideas that present themselves are worth pursuing. This makes the selection of the best performing ideas a big challenge for companies. The selection process, selecting only the good ideas among all ideas, costs scarce resources. Not selecting the best ideas to invest in can present significant opportunity costs. Where possible, companies want to prevent spending resources on projects that do not deliver the desired returns, or even worse, spend resources on projects that are terminated before delivering any benefits.

This thesis proclaims to aid in this filtering process within IBM. Implementing the procedures, the tool and recommendations presented here, will enhance the effectiveness of the Front End of Innovation by making this crucial part of the innovation process more transparent and aiding the employees in maturing their ideas on order for IBM to sponsor those ideas that help the company to reach its goals.

In the maturation process of ideas, the idea initiator checks whether the idea itself is viable, to what degree IBM is able to realize this idea and lastly the idea initiator needs to check if this idea is something IBM should pursue. If the idea initiator –after assessing the idea with the tool- still feels that the idea is something that IBM should develop, than other actors come into play.

The total population of IBM can assist in maturing the idea by providing information and giving feedback on the entries provided by the idea initiator. In this case, the population of IBM takes on the role of the community.
Decision-makers can then assess the idea and decide on the fate of the idea by dismissing it, shelving it, or turning it into a project straight away.

Use of the tool and the accompanying procedures as explained above, have certain benefits. Benefits on an idea level include:

- Filtering the ideas containing showstoppers
- Maturing viable ideas
- Aid in proposing the ideas that will survive in the company and add to the prosperity of the company

On a corporate level, the tool provides:

- A learning opportunity for those working with the tool enhancing their innovative awareness
- Leveraging the collective knowledge of the community as 330,000 IBM-ers know more than a handful
- Limiting the number of ideas reaching decision makers allowing them to pick those projects that have the least opportunity cost
- Better steering of the innovative capabilities by e.g. pinpointing whether the bottleneck lies in the early stages of innovation

This thesis draws on theory as well as practice. Four fields of research were consulted to find the factors influencing project outcome. These fields are: The Fuzzy Front End, Business Cases, Cost/Benefit Analysis and New Product Development. The validity of these factors was checked by reviewing six IBM projects. The knowledge gained from theory and practice was used to construct a tool and the procedure to use the tool within IBM. This tool was tested in various settings to see if the use of this tool would deliver the benefits discussed.

The first test with users indicates that the benefits on the level of individual ideas are realistic. The benefits on a corporate level are very plausible, but not tested yet.

This thesis provides a solid base to improve the Front End of Innovation. The thesis provides a roadmap to advance from the current test-state to the situation in which this tool is rolled out within IBM and even made into an offering for the clients of IBM.
In a large sample, companies that do not innovate, will perform less than companies that do.

Through their current 8 laboratories IBM will continue to bring forth innovations.

A part of the innovations in IBM originate from what can be called 'Top-down innovation' meaning: allocating resources down through the hierarchy.

Alternatively 'bottom-up' innovation takes place when IBM-ers look for resources and support higher up in the organisation, after which the ideas are realized through projects.

In bottom-up innovation, the scarce resources should only be spent on those projects giving the highest overall return.

The research done for thesis concentrates on the early stages of innovation, the so called Front End of Innovation. By developing a tool to aid idea initiators in maturing their idea, a lot of resources can be saved in the selection of the ideas that have the highest return.

Key issues from this chapter:
1 Introduction

"if the world was stable, there would be no need to change business operations and methods, nor to understand what has changed and what works well" (1997)

Since the world is not stable, this quote adequately addresses the need for a better understanding of processes in general to be able to keep improving what is already done. This thesis attempts to improve one aspect of the process of innovation. This attempt of improvement focuses on the front end of innovation where formal structures are not frequent (Vandermerwe, 1987 PP54) and improvements can significantly improve the chances of success of new product development (Zhang and Doll, 2001).

In section 1.1 the term innovation and its importance for this thesis is briefly explained. In section 1.2 the focus is put on the relation between IBM and innovation. section 1.3 addresses the relation between projected success, certainty of this projection and the resources spent to reach that certainty. As stated in section 1.4, a necessity to innovate is an original idea from which to start. Sources of ideas are many, the problem for companies lies in making sure the right ideas surface. This thesis claims to aid in this quest. How this thesis does this, is discussed in section 1.5.

1.1 Innovation

A lot of researchers e.g. (Griffin, 1997, Tidd et al., 2005, Jones, 2002, Christensen, 1997, Ernst, 2002) agree that innovation is key to a healthy company. Innovative companies, on average in a large sample, perform better than companies that do little or no innovation at all. Because innovation is apparently lucrative, a lot of research has been done to understand different aspects of innovations better.

Innovation is a term widely used in a lot of different contexts. While most definitions have in common that it involves ‘creating something new’, the definition is often narrowed down to developing this ‘something new’ until it has commercial value. A precise definition of an innovation is not a necessary requirement for this thesis, it is important for the line of reasoning that an innovation is commercially interesting for a company. Only if an innovation is commercially interesting, can it be claimed important for a company to pursue. This is one of the premises of this thesis.

In order for companies to innovate and maintain a competitive edge, the companies will have to foster an innovative climate. The topic ‘determinants of innovation in companies’ is a subject on its own. This subject is researched
in a thesis written by Sander van Reijzen (2006). Van Reijzen names the determinants and provides the means to assess how innovative companies are measured with these determinants. Although innovation might also happen sporadically in surroundings not favourable to innovation, it can be said that innovation is more likely to occur in an innovative climate.

Innovation, in a company, can be stimulated in a top-down approach by making use of an explicit vision, mission and strategy to focus the efforts of the employees. Even more explicit is to define target areas, develop initiatives, select most favourable ideas coming from those initiatives and develop them in projects to further detail. In this thesis, however, the focus is on bottom-up innovations. Ideas might pop-up in the minds of anybody at anyone at any time and may not be the result of a top-down approach. Some of the ideas originating in this way may be very valuable to the company. A company dismissing these ideas runs the risk of missing valuable opportunities and thus incurring opportunity costs.

1.2 IBM and innovation

From the number of times IBM mentions the word ‘innovation’ in their communiqués, it seems that IBM wants to be synonymous with this word. They even coined the term ‘being the innovators innovator’ which leads to believe they want to go beyond innovating and aid their clients in innovating. IBM in its long history has indeed innovated a lot. Groundbreaking technologies such as the architecture of the first personal computers and for example the scanning tunnelling microscope originate from the laboratories of IBM (Chesbrough, 2003, IBM, 1999).

Nowadays these laboratories are still the source of many innovations, but by no means the only source. IBM employs around 330,000 people in all parts of the world. All of them could have great ideas for IBM to follow up on, as ideas can be generated in all departments in a company (Kelly and Storey, 2000, Easingwood, 1986). Each idea -in theory- has got the potential to become the great innovative offering a company is looking for (Vandermerwe, 1987). How could IBM tap into this wealth of ideas?

Certainly not all of the ideas originating in the minds of employees are valuable and most ideas are not long-lived because the originator him/herself already finds flaws in the idea after which an idea is dismissed. In the consumer packed goods industry it was found that it takes 25 ideas to have one success in the market (Griffin, 1997). But what if the initiator still feels good about the idea after some more thinking? What if this person is not in the innovative environment of an IBM laboratory? What options does that
person have to advance with this idea? To aid this person in getting support for the idea, any system/procedure introduced should be accessible to all employees of the company (Vandermerwe, 1987).

1.3 Certainty, success and resources

Companies can investigate the potential of ideas by doing research on all aspects of the idea. Researching the potential decreases the risk of the undertaking. However, doing research means spending resources. This presents companies with a trade-off. Companies can do a lot of research trying to decrease the risk of an undertaking, accepting less performance (as resources are spent on the research), or going ahead with a project, accepting a larger risk (lower certainty of success) and being left with a bigger piece of the pie in case the risk pays-off.

The situation above can be visualised by three axes: estimated benefits of an idea, the certainty that the level of success will be reached and the resources spent to get to that certainty as shown in Figure 1-1.

![Figure 1-1, Boundaries of spending resources on potentially profitable ideas](image)

A) If you have an idea, there is usually some estimated benefit involved. As the idea is investigated further, the certainty of the estimated benefits will increase and the level of the estimated benefits will be corrected down or up to a more realistic level.

B) If the estimated benefits are below a certain threshold, no resources should be spent on that idea. If the estimated benefits are above the threshold, more resources can be spent on the idea. The higher the promise, the more the company is willing to spent on that idea.

C) If companies had a choice; they would prefer spending a low amount of resources to gain a high certainty of estimated benefits of an idea. The arrow indicates that a company would rather spend resources later than sooner to gain a particular certainty.

This thesis has an impact on both the certainty and the resources spent axis as will be shown later this thesis.
1.4 Evaluation of ideas

Given the number of employees of IBM, it is not hard to imagine a lot of ideas are being generated in the company. If all employees have the possibility to speak up and communicate their ideas to the company, some problems are imminent.

First of all, if somebody communicates their idea to the company, somebody else is needed on the receiving end of the communication. If there is no support for the idea, it will never become a project (Khurana and Rosenthal, 1998). Since the receiver of the message is a scarce resource, this means that only communicating ideas within the company already costs resources.

Secondly, most of the ideas will require some sort of resources to be realized or need funding for further investigating the opportunity. Since resources are limited in any company, there must be some kind of filter to separate ideas that will in the end generate more benefits than costs. This means that any project started should be viable to begin with, but also stands a good chance of not being terminated along the way as there are high costs involved in terminating projects (Kelly and Storey, 2000).

Thirdly, if good ideas are separated from bad ideas, there is still the possibility that the resources needed for developing good ideas are greater than the resources available. This means that the ideas have to be compared to each other to determine what the best idea is for the company. This comparison must be done not to incur opportunity costs. Vandermerwe recognizes that very little attention has been paid in literature on ensuring that the good ideas are reaching a go/no-go decision (Vandermerwe, 1987).

All steps described above take place in the fuzzy-front-end (FFE). The term fuzzy-front-end is used for the phases preceding the formal adoption of ideas, turning them into projects. The FFE includes phases like: idea generation, product strategy formulation/communication, opportunity identification/assessment, executive reviews. The FFE is complete when a manager -or an other entity like a business unit or investment board- in the company commits to funding, or decides on a no-go for the idea (Khurana and Rosenthal, 1998). Ernst Holger concludes after reviewing three decades of New Product Development (NPD) research, that “the presence of a formal or informal NPD process in the firm establishes the basis for success of new products” (Ernst, 2002). A lot of the items he mentions to be part of this NPD process, are part of the FFE stage as described above.

This thesis offers solutions to the issues stated above in the fuzzy-front-end. It describes a view, a taxonomy and a tool to overcome these problems.
1.5 Set-up of thesis report

The set-up of this thesis is very straightforward as can be seen in Figure 1-2. Chapter two describes how the whole research is set-up and what activities were undertaken to develop the end product and the conclusions and recommendations.

The literature which was consulted is discussed in chapter three. The findings from the literature research were used to create the RAW-taxonomy, which will be explained in chapter four. In chapter five the factors found to influence project outcome will be empirically tested in IBM projects using the RAW taxonomy. All gathered knowledge and best-practices will be used to develop the tool. The content of the tool and some of its possible features is discussed in chapter six. Parts of the tool will be tested in a real-life setting in an attempt to validate the findings and to gather support for the tool. This validation is the main aspect covered in chapter seven. The last chapter, chapter eight, will cover some reflections over the research performed as well as discuss the most important conclusions and recommendations from doing this research.

Figure 1-2, set-up of thesis
Chapter 2: Research design

Key issues from this chapter:

- The three main aspects when making innovation investment decisions are: is the idea good, can our company do it, is this the project we should invest in.

- Investment decisions -like those of selecting the best ideas to sponsor- are semi structured problems which can be solved with the aid of Information Technology.

- The tool which will be created -in content and outline- will be based on literature and IBM project reviews.

- The limitations of this research lie in a geographical bias, and limited validation of the findings, but the thesis offers a clear view on how to proceed in the future.
2 Research design

Griffin (1997) found that nearly every NPD research claims that multifunctional teams are crucial for NPD success. This seems logical as NPD success is a very multidimensional issue as can be found in the many factors associated with NPD success in many different studies. Research also shows that you need to filter ideas in an early stage (Hauser, 2001, Cooper and Kleinschmidt, 1995, Brentani, 1991, Song et al., 2000) to prevent wasting resources on ideas that will never contribute to the company goals. A logical conclusion –taking both claims into account- is to have a multifunctional team assess idea proposals on viability. However, assessing ideas with a multifunctional team also costs valuable resources.

One here presented alternative is to take the best-practices from the areas of the multifunctional teams and make that knowledge available to people with ideas. This is the line of thinking followed in this thesis: if an idea initiator is given the factors from each discipline that have a profound impact on the outcome of the development of an idea, the initiator can –to a certain degree- assess for him/herself if the idea is viable. After this first self-test, if the idea initiator still feels (s)he has a good idea, it is time to involve other actors in the process to finally be able to decide whether this idea has a future and whether this future lies within IBM.

In the next section, the goal of this thesis is stated more clearly and boundaries in which the thesis is built-up is given in section section 2.2. The logical reasoning to arrive at the research goal is given in section section 2.3. In section section 2.4 a detailed description is given of the approach that is taken to reach the goal of this research. The relevance for doing this research is stated in section 2.5.

2.1 Research Goal

The main goal of this research is to give options to improve the effectiveness of the Front End of Innovation. This is done by aiding in the selection and the selection procedures of ideas which will contribute most to the prosperity of IBM. To make this selection, this thesis claims that three questions need to be addressed:

1. How big is the opportunity of the idea?
2. To what degree can the company make use of that opportunity?
3. Is the company committed to invest the necessary resources?
To reach this goal, a tool will be created to have a selection procedure that takes less time and resources. This tool –or rather the outlines and content of the tool- will have the purpose of bridging the gap in the Front End of Innovation. This gap exists between the time an idea is generated and the time the idea is turned into a project. Using this tool gives users more insight in the idea and the process of developments of this idea.

The FFE is by some viewed as a creative process which should not be planned or turned into a formal process. The tool that is presented at the end of this thesis does not do this; it merely offers the idea initiator ‘food for thought’ and assists in the structuring of the idea. Although the content of the tool –the questions and suggestions- may seem to force all ideas in the same direction, this is neither the intention nor the truth. The tool aids the idea initiator to show the value of the idea –if there is any- to the company and does not interfere with the idea itself.

All in all, this tool claims to make the Front-End of Innovation more effective by streamlining the process of maturing ideas all the way to the point where decisions are made on the future of the idea.

2.2 Scope of the research

Although the aim of the thesis is to adopt a holistic view, there is of course a limit to the views, research, opinions and theories that can be included. The scope of this research will be to construct the content of a tool. The input for the tool will come from a limited number of fields of research, a limited number of projects within IBM and a limited number of procedures within . The tool will therefore be tailored to IBM and it might not be directly suitable to use in other companies. Also, an all encompassing tool that takes into account all factors of a new product development venture would be horrifically extensive. There is a clear need for any tool to be practically applicable within IBM. It is left to the discretion of the author to decide where to place the balance between completeness and user-friendliness.

Another limitation comes from the limits of types of ideas that can benefit from this tool. Ideas can be so varied in nature and impact, that a single tool to be used with all kinds of ideas is not feasible. The focus will therefore lie with those ideas needing funding, development, expertise, etc. to a greater extend than the idea initiator can muster up him/herself.
2.3 Used assumptions

The introduction of this thesis discussed innovativeness, innovation, ideas and the relation between them. The first assumption, one which was already mentioned in the introduction chapter, is that *innovation is needed for IBM to prosper* (A1). Together with another assumption of this research: *innovations stem from ideas* (A2), we can conclude that IBM needs to develop ideas in order to innovate. Vermeulen supports this assumption in his statement: ‘An idea is a necessary condition for an innovation’ (De Jong and Vermeulen, 2003). If this is the case, ideas in companies can be a valuable asset.

*Developing ideas costs resources such as time, money, supplies etc* (B1). In other words: *developing ideas requires scarce resources* (B). Of course not all ideas are brilliant and developing some can only lead to the waste of scarce resources. As *wasting resources is unwanted* (D), IBM wants to prevent this from happening. *Ideas must be filtered in an early stage to mature the ideas which show a high potential and stop wasting resources on those ideas that will never be profitable* (C1). This line of reasoning is shown in Figure 2-1.

![Figure 2-1, logical structure of assumptions leading to conclusion C1](image)

The second line of reasoning tries to show the need to make a tool to evaluate ideas. This line of reasoning is –in a summarised fashion- shown in Figure 2-2. It starts with the distinct possibility that *an idea might arise with a person who does not necessarily possess the knowledge to be able to judge this idea on all relevant aspects* (F1). The knowledge that the initiator has, can be very valuable in for example delivering unique benefits to customers, but that same idea might have flaws in it that make the idea as a whole worthless for a company to pursue. *Ideas should therefore be checked for flaws –so called ‘show-stoppers’– on all relevant aspects.*

The combination of the two statements above lead to the conclusion that *an idea initiator might need help in assessing the viability of the idea* (F).
In the same line of reasoning that a company does not want to spend resources on bad ideas, it is also true that companies do not want to spend a lot of resources on the screening of the good ideas. Therefore, the screening of ideas should be done as efficient as possible (E). The screening of ideas will ‘require a combination of standard solution procedures and individual judgement’ (Turban et al., 2004) making it a semi-structured problem (G). For these types of problems an IT tool called a Decision Support System is most suitable to use (H). Using IT tools ‘can improve the quality of the information on which the decision is based’ (Turban et al., 2004). These statements together support the conclusion that building an IT tool can enhance the possibility of filtering ideas in an economic way (C2).

Figure 2-2, logical structure to show the need for an IT tool (C2)

The total overview of all assumptions is given in Table 2.1. For each assumption it is stated if the assumption is supported by argumentation, literature, empirical evidence or a combination thereof.
<table>
<thead>
<tr>
<th>Assumption/statement/conclusion</th>
<th>Validation</th>
<th>Sources/support</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 Innovations are needed for IBM to continue to exist and prosper</td>
<td>Literature</td>
<td>(Griffin, 1997, Tidd et al., 2005, Jones, 2002, Christensen, 1997, Ernst, 2002)</td>
</tr>
<tr>
<td>A2 All innovation started somewhere in time as an idea from one or more people</td>
<td>Literature, research finding</td>
<td>(Vandermerwe, 1987, Bronnenberg and Engelen, 1988) and interviews with IBM-ers (see §Fout! Verwijzingsbron niet gevonden.)</td>
</tr>
<tr>
<td>A IBM needs to identify and develop ideas into innovation to prosper</td>
<td>Literature, argumentation</td>
<td>(Chesbrough, 2003) and §1.2</td>
</tr>
<tr>
<td>B1 Development of ideas costs time/ money/ supplies/ etc.</td>
<td>Literature, argumentation</td>
<td>(Cooper, 1985), §1.4</td>
</tr>
<tr>
<td>B Development of ideas requires scarce resources</td>
<td>argumentation</td>
<td>§1.4</td>
</tr>
<tr>
<td>D IBM does not want to waste resources on bad ideas</td>
<td>argumentation</td>
<td>§1.4</td>
</tr>
<tr>
<td>C1 IBM wants to filter ideas to develop only the good ideas</td>
<td>argumentation</td>
<td>§1.4, not IBM specific: (Kelly and Storey, 2000)</td>
</tr>
<tr>
<td>E Screening ideas should be done as efficient as possible</td>
<td>argumentation</td>
<td>§1.4</td>
</tr>
<tr>
<td>F1 Idea initiators do not possess the knowledge to judge viability of ideas on all relevant aspects</td>
<td>Empirical evidence</td>
<td>§1.4, §5.1, §7.2</td>
</tr>
<tr>
<td>F2 Ideas need to be checked on multiple aspects to spot 'show stoppers'</td>
<td>Literature, argumentation, empirical evidence</td>
<td>(Ernst, 2002, Cooper, 1985, Bronnenberg and Engelen, 1988, Montoya-Weiss and Calantone, 1994), §Fout! Verwijzingsbron niet gevonden., §3.6</td>
</tr>
<tr>
<td>F Idea initiators need help in assessing viability of ideas</td>
<td>Empirical evidence</td>
<td>§5.1</td>
</tr>
<tr>
<td>G Checking 'idea viability' is a semi structured problem</td>
<td>Literature</td>
<td>(Turban et al., 2004)</td>
</tr>
<tr>
<td>H IT tools can be developed to help solve semi-structured problems</td>
<td>Literature</td>
<td>(Montoya-Weiss and O'Driscoll, 2000)</td>
</tr>
<tr>
<td>C2 IT tools enhance the possibility of filtering ideas in an economic way</td>
<td>Literature</td>
<td>(Montoya-Weiss and O'Driscoll, 2000)</td>
</tr>
</tbody>
</table>

*Table 2.1, overview of used assumptions*
2.4 Approach to research

The choice has been made to reach the goals of this research by creating a tool. This section will stipulate the approach which is used to come to the content of this tool. The following sections will go into separate matters which together form the construct of the tool. Figure 2-3 shows the set-up to come to the tool requirements. Sections 2.4.1, 2.4.2, 2.4.3 will deal with the sources of the requirements in more detail. An already used tool within IBM will be evaluated to come to the conclusions whether it is best to include the findings on this thesis on t or make the findings of this thesis into a stand-alone tool.

![Diagram of tool requirements]

*Figure 2-3, structure of this thesis*

2.4.1 Theory requirements

This research does not start in a greenfield, the topic is very much suited to advance on theory already devised and proven. For this reason, the relevant theory should be consulted and used. The method chosen to gather the relevant theories is a literature study in some fields that provide insight in the mechanisms of the development of new products and services. The method of doing a literature study was picked over alternatives such as the use of interviews or questionnaires with experts. The results from a literature study would require far less time and resources and would probably provide similar results.

The goal of this phase of the research is to gain insight in the research that has already been conducted. Building upon existing research gives the opportunity to advance science in this area if new insights are created. Moreover, existing research can be used to inspire the creative process and provide a solid base for the use of questionnaires in later stages of the research.
The approach to the literature study entails the following steps: Start looking for relevant field of research, scan articles in the main journals of that field, check the references in those articles to broaden search, read the main articles, gather the relevant data, analyse this data over all chosen articles and finally make a list of the theoretical requirements of the tool.

2.4.2 User requirements

Montoya-Weiss and Calantone (1994) conclude from their meta analysis of 47 empirical studies on new product performance that “no study examined the differences between top management’s perception and the various functions’ perception of the determinants of new product performance”. Devising a tool separate from its users does not increase the chances of those users actually using the tool. Any effort in building a tool should therefore have an appeal to its intended users. To be able to understand the user groups of this tool it is necessary to understand their world, their incentives and the reasons for their actions.

This understanding will be best understood by talking with the user groups. The method chosen is to conduct semi-structured interviews with selected IBM-ers. Selection of the interviewees will be based on their position within IBM, if they have participated in projects in early stages, and/or if they had any influence on go/no go decisions within the projects. An alternative to conducting interviews would be to review project logs and distil the necessary information from those sources. This was not done as not all information from suitable projects was/could be made available. Alternatives within the option of conducting interviews would be to ask very open questions or the opposite, very closed questions. These alternatives were not chosen as open questions would probably divert too much in the topics discussed and closed-question interviews would most likely not capture the essence of the proceedings within projects.

The goal of the interviews would be to test the criteria found in the literature review and get a good feel on how projects are carried out within IBM. Moreover it allows the practical review of the use of procedures in projects. This can be used in the next phase of the research which is the review of the official procedures in IBM.

The approach to attaining the user requirements are to construct a list of data that needs to be gathered, find questions which can be asked to provide that data and prepare the semi-structured questions with this information. After this, the questions can be tested in a test-interview to see if indeed the
questions lead to data that can be analysed. The real interviews can be conducted after the necessary adjustments have been made.

2.4.3 Official requirements

In the same way that the theoretical part of this research does not take place in a greenfield, neither does the part where the official procedures - concerning the funding and development of new ventures- in IBM come into play. The tool should respect the procedures in IBM to make a logical transition possible between the Front End of Innovation and later stages in the road towards commercialisation.

The method to come to the requirements to fit the tool in the procedures is to either interview the policy-makers devising these procedures or alternatively the people working with these official procedures. After these interviews, the documents that describe these procedures can be further studied in detail.

The goal of this part of the research is to come to the requirements that allow a good alignment between the tool and the procedures that follow the development of the idea in later stages. In short, the procedures take over where the tool leaves off.

Policy makers were not available for interviews. Instead, people working with these policies were asked what policies they have to deal with. Those policies were studied in more detail.

2.4.4 Alpha version

After collecting the three sources of requirements –theoretical, user, procedure- a basic version of the tool can be constructed.

The method chosen to construct the first draft of this tool is to analyse the different sets of requirements and see the impact that these requirements would have on the tool, the users, and IBM. Conflicting requirements –if any- should emerge in this way. If this happens, these requirements should be dealt with by choosing which of the conflicting sources has more support or is more appropriate for this thesis.

The goal of this phase of the research is to come to a first draft of the tool. In this draft almost all requirements should be present and the tool should be testable for users. The tool is discussed in chapter six.

The approach to reach this goal is to find the common ground in the sets of requirements, make different categories, place the requirements in those categories and make sub-categories. This should result in a taxonomy-like
categorisation of the requirements. This version of the tool is now ready for alpha-testing.

With the first version of the tool ready, it is time to enter a cycle of testing the tool and gaining feedback to improve the tool again. This iterative process is explained in detail in chapter seven. This chapter deals with the seven steps identified to take the tool from the initial version to a version that can be rolled out in IBM or even a tool that can be made commercially available to clients of IBM.

The goal of this phase is to validate the tool in a real-life business setting and thereby creating the initial support and momentum to be able to promote the use of this tool within IBM.

2.5 Relevance of research

Closing the gap between idea generation and the official procedures has both a theoretical relevance as well as a practical relevance.

IBM can benefit from this thesis by adopting the views presented. The following benefits can be reached:

- providing a learning opportunity for those working with the tool enhancing their innovative awareness
- leveraging the collective knowledge of the community as 330.000 by involving them in the maturation process of ideas
- limiting the number of ideas reaching decision makers allowing them to pick those projects that have the least opportunity costs

The relevance to the scientific community must be found in the testing of the success and fail criteria reported in many articles on the Front-End of Innovation. The factors reported will be taken into consideration when conducting interviews. Furthermore, a taxonomy will be introduced which discriminates the success and fail criteria in components of ‘ready’, ‘willing’ and ‘able’. Although the concept as such is not new, the explicit distinction between those components and the exploitation of the possibilities this taxonomy offers is new. Chapter eight contains some notions and recommendations that could help other researchers who have an interest in the Front End of Innovation.
Table 2.2 shows that this thesis will expand known theory by combining different fields in finding the success and fail criteria. This is done through already known methodology of a literature review, doing interviews, workshops and holding questionnaires. The result –the content of the tool- will expand the application of the theory in a way that IBM can use to make their organisation of the Front-End of Innovation more effective.

<table>
<thead>
<tr>
<th></th>
<th>replicate</th>
<th>expand</th>
<th>renew</th>
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</thead>
<tbody>
<tr>
<td>Theory</td>
<td>Combine</td>
<td></td>
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<tr>
<td></td>
<td>different fields</td>
<td></td>
<td></td>
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<tr>
<td>Methodology</td>
<td>Interviews, questionnaires</td>
<td></td>
<td></td>
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<tr>
<td>Application</td>
<td>Make tool for IBM</td>
<td></td>
<td></td>
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</tbody>
</table>

*Table 2.2, overview of contribution of this thesis to science and application*
Chapter 3: Theoretical background

Key issues from this chapter:

◦ The Success and Fail Criteria from research come from the fields of: New Product Development, Cost Benefit Analysis, the Fuzzy Front End, and Business Cases.

◦ When assessing the viability of an idea check aspects of development, finance, marketing, product properties and the vision behind the idea.

◦ The ability of a company to realize an idea can be divided into two categories: does the company have the Capabilities and is the company Compatible with the idea.

◦ Whether a company should want to pursue an idea depends on the strategy, portfolio, life-cycle of portfolio, performance criteria.
3 Theoretical background

The theoretical framework used in this thesis builds on the knowledge already available and attempts to extend by combining four fields of research into the tool under development. In section 3.1 these four fields are introduced; in sections 3.2 to 3.5 the four fields are discussed in detail. In these sections the aspects that are found to be of influence on projects are gathered. These aspects will be used in the creation of a taxonomy-like structure under the categorization of ready, able and willing, as discussed in section 3.6.

3.1 Literature review

The literature review is comprised of 4 fields of research, as shown in Figure 3-1. The choice to study these fields was made because all of them have an impact on the process of developing an idea into a commercialized product. The four fields were discussed with scholars to verify that studying the papers published in these fields would indeed lead to the necessary success and fail criteria of projects. Reading these papers did not lead to links with other fields of research relevant to this thesis. Taking into account the opinion of scholars in the field and the content of the papers it is fair to say that these fields are the right sources for the theoretical background of this thesis.

The assumption is that studying the four fields and extracting the relevant elements will give a solid base to construct the tool. It can be expected that the most important aspects relating to a successful NPD process will probably emerge from more than one field. Factors found in only one field will complement the total picture.

Figure 3-1, 4 fields of research are used in the literature review

For this literature review, articles were read which were predominantly published in the Journal of product innovation management. This journal focuses on research, theory and practice of New Product Development (NPD) and New Service Development (NSD) and is therefore an important source of information for this thesis. In Table 2.1, a brief overview is provided of the lessons which can be learned from the different fields of research and the most prominent authors of articles used in the literature review.
### Field Lessons to learn Authors/sources used

<table>
<thead>
<tr>
<th>Field</th>
<th>Lessons to learn</th>
<th>Authors/sources used</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Product/Service Development</td>
<td>Success and Fail criteria</td>
<td>Cooper, De Brentani, Griffin, Page, Easingwood</td>
</tr>
<tr>
<td>Cost/Benefit Analysis</td>
<td>The total picture of all costs and benefits</td>
<td>Rabobank, ABN-AMRO Bank, ING Bank, Chambers of Commerce</td>
</tr>
<tr>
<td>Fuzzy Front End</td>
<td>Processes taking place before formal development</td>
<td>Khurana, Rosenthal, Koen, Zhang, Montoya-Weiss</td>
</tr>
<tr>
<td>Business Cases</td>
<td>Requirements of creditors before approval of a loan</td>
<td>Rabobank, ABN-AMRO Bank, ING Bank, Chambers of Commerce</td>
</tr>
</tbody>
</table>

*Table 3.1, sources for literature review*

The following 4 sections give more details why these fields were chosen and what lessons can be drawn from these fields.

#### 3.2 NPD/NSD research

The research on the factors influencing NPD/NSD projects is ongoing for more than 30 years. In these years a lot of aspects have been investigated using different angles of approach.

Four studies have been found that have made attempts to capture the full range of literature in the field from a certain point of view. A study done by Griffin and Page (1993) focussed on the measures that are used to determine success or failure of NPD projects. Ernst Holger (2002) focussed his summary of literature on the success factors themselves. Researchers Montoya-Weiss and Calantone (1994) took a more holistic approach in their meta-analysis. Finally researchers de Jong and Vermeulen (2003) concentrated on the organisational characteristics in their literature review.

Although these four studies cover a broad range of the NPD/NSD research already, other studies were used as well to complement the factors to take into account for the tool.

A lot of the studies on Success and Fail Criteria (SFC) use the same methodology. The researchers want to test factors they think influence project outcome and test this using statistical processes -such as (multi)regression analysis or factor analysis- to prove statistical relevance between the factors and project outcome. Although the methods are quite similar, comparing the results and finding common ground is no easy task as the result variations are large and all researchers’ research different factors.
Or, as Montoya-Weiss and Calantone (1994 pp 397) put it: “the extreme variability in the reporting of research results severely limits the ability to consolidate findings”.

The most cited researcher that has done this research for New Product Development is Robert G. Cooper. On New Service Development a lot has been published by Ulrike de Brentani. Other researchers in this field are for example: Abbie Griffin, Albert L. Page, Chris Storey and Christopher J. Easingwood. Table 3.2 gives an overview of the studies reviewed for this thesis, along with their results and the factors that will be used in the tool.

Differences between studies

The focus of the studies reviewed in this section differs from study to study. Some of the differences between the studies are briefly addressed below.

When studies were done on SFC, the first studies concentrated on the development of new products. Some of these studies even said that the same study could also be used on services. Later researches suggest that services have some characteristics which differentiate them from new products (Brentani, 2001, Storey and Easingwood, 1998).

The research done by Cooper (1985) allows the findings from projects in the past to be used when evaluating the project on forehand. The findings of this research allows the calculation if the likelihood of success of projects. Research done by others, such as Griffin and Page (1993) is only useful for determining the level of success of projects that are in the past. The conclusions of the later research cannot be used to make estimations on the likelihood of success of projects to come. Still these papers can contribute to this thesis as apparently the SFC found in the research are measures later used to determine success or failure. A measure like ‘has the project met the revenue goal’ is not very helpful when the project has yet to commence, but it does show you that this measure will later be used to determine success or failure. What can be learned from this is that paying attention to set revenue goals and the revenue generating capabilities of the project is important. Similar conclusions can be drawn also from the less obvious measures.

Cooper’s NewProd model (1985) can be used on a project level only. The model does not take into consideration that all projects together form a program which may be the result of a strategy and portfolio management decisions. Studies like those from Griffin and Page (1996) are more appropriate when reviewing the effect of individual projects on total performance of the firm.

-28-
<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Perspective</th>
<th>Goal of research</th>
<th>research design</th>
<th>Method of analysis</th>
<th>Sample</th>
<th>Tested</th>
<th>Outcome</th>
<th>factors to include in analysis of theoretical requirements of tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitzi M. Montoya-Weiss &amp; Roger Calantone (1994)</td>
<td>SFC</td>
<td>review and meta analysis of NPD</td>
<td>quantitative comparison of all factors found in studies</td>
<td>Meta analysis</td>
<td>47 studies on NPD factors</td>
<td>coherence in NPD factors</td>
<td>18 factors in 4 categories cover all factors in studies reviewed</td>
<td>all 18 factors and categories</td>
</tr>
<tr>
<td>Christopher J. Easingwood (1986)</td>
<td>NPD differs from NSD</td>
<td>Test how service organisations practice NPD</td>
<td>select suitable service industry, hold interviews, use data to make questionnaire</td>
<td>interviews, questionnaire</td>
<td>63 organisations with NPD activity</td>
<td></td>
<td>Impact of the differences between products and services have an effect on the NPD process in service companies</td>
<td>no difference between B2C and B2B for results; sources of ideas in companies (feature of tool)</td>
</tr>
<tr>
<td>Jeroen P.J, de Jong &amp; Patrick A.M. Vermeulen (2003)</td>
<td>NSD</td>
<td>classify NSD literature dealing with organisational characteristics</td>
<td>Search for relevant sources, categorize in 5 time frames</td>
<td>literature review NSD</td>
<td>38 studies on NSD</td>
<td></td>
<td>current literature reveals 8 organisational characteristics and 7 factors influencing innovation climate</td>
<td>all 15 factors</td>
</tr>
<tr>
<td>Holger Ernst (2002)</td>
<td>NPD success factors</td>
<td>summarize the most important findings of NPD research of last three decades</td>
<td>select empirical studies on the relation of success factors to NPD success with large samples</td>
<td>literature review NPD</td>
<td>46 studies on NPD</td>
<td></td>
<td>some factors seem to come back in most studies</td>
<td>21 factors found in studies</td>
</tr>
</tbody>
</table>

Table 3.2, overview on New Product and Service Development research
<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Perspective</th>
<th>Goal of research</th>
<th>Sample</th>
<th>Tested</th>
<th>Outcome</th>
<th>factors to include in analysis of theoretical requirements of tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert G. Cooper (1985)</td>
<td>NPD</td>
<td>propose a screening model for idea selection: NewProd</td>
<td>200</td>
<td>success/failure</td>
<td>NewProd model has a predictive ability of 84%. 48 criteria were reduced to 8 independent, significant factors</td>
<td>8 significant, independent factors</td>
</tr>
<tr>
<td>Ulrike de Brentani (1989)</td>
<td>NSD</td>
<td>Find how firms measure success in services, characteristics of services, impact of characteristics on performance</td>
<td>115</td>
<td>success/failure</td>
<td>4 performance factors were identified (Sales and Market share performance, competitive performance, &quot;other booster&quot; and cost performance)</td>
<td>4 performance factors including 2 levels of subcategories stated in paper</td>
</tr>
<tr>
<td>Ulrike de Brentani (2001)</td>
<td>NSD</td>
<td>attempt to gain insights in influence of product innovativeness of the factors linked to new service success and failure (incremental vs. discontinuous innovation)</td>
<td>115</td>
<td>success/failure</td>
<td>4 factors with sub factors found to be significant: Product related factors (5 sub factors), market (3 sub factors), company (2 sub factors), NSD process (2 sub factors)</td>
<td>4 factors + 12 sub factors; weight of factors is different depending on newness of product</td>
</tr>
<tr>
<td>Chris Storey and Christopher J. Easingwood (1987)</td>
<td>ASO</td>
<td>examine the relative contribution of components of augmented service offering (ASO) to success of new services</td>
<td>115</td>
<td>success/failure</td>
<td>ASO consists of 13 significant factors depending on the used definition for success (profitability, sales performance, enhanced opportunities)</td>
<td>use 4 factors + 13 sub factors</td>
</tr>
</tbody>
</table>

(Table 3.2 continued)
<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Perspective</th>
<th>Goal of research</th>
<th>Research design</th>
<th>Method of analysis</th>
<th>Sample</th>
<th>Tested</th>
<th>Outcome</th>
<th>Factors to include in analysis of theoretical requirements of tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. G. Cooper &amp; E.J. Kleinschmidt (1987)</td>
<td>NPD</td>
<td>Test 10 hypotheses on success and fail criteria</td>
<td>test hypotheses using the answers to the questionnaires</td>
<td>Interviews based on lengthy questionnaire. Correlations of the questions to the hypothesis were calculated on the 0-10 scale answers to the questions.</td>
<td>203 new products in 125 firms</td>
<td>10 hypotheses based on 46 items</td>
<td>3 of the hypotheses have a strong correlation, 6 others were significant</td>
<td>include 9 significant hypotheses (+sub categories) in SFC list</td>
</tr>
<tr>
<td>J.J.A.M. Bronnenberg &amp; M.L. van Engelen (1988)</td>
<td>NPD</td>
<td>Test the NewProd model by Cooper (1985)</td>
<td>use a set of new projects to verify the results claimed by Cooper in his NewProd research (1985). Propose measures to improve accuracy of predictions</td>
<td>empirical testing of proposed model</td>
<td>28 projects of which 9 success, 10 failures, 9 still in development (at time of start research)</td>
<td>the model proposed by Cooper (1985)</td>
<td>results were same from Coopers’, Bronnenberg found the variance in outcomes too high to make predictions, unless success/failure is clear-cut</td>
<td>improvements made involve the introduction of threshold values for factors, this will be taken into account in tool</td>
</tr>
<tr>
<td>Abbie Griffin &amp; Albert Page (1996)</td>
<td>NPD measures of success and failure</td>
<td>Test hypotheses on measures of success and failure, distinguishing between newness of product to market and newness to firm</td>
<td>present product development professionals with new product scenario’s and ask them to select a set of measurements suitable to that situation</td>
<td>simulations with project managers and CEO’s</td>
<td>80 usable surveys collected (49.4%)</td>
<td>differences of measuring success and failure in different new product scenarios</td>
<td>Depending on the type of company (prospector, analyser, defender, reactor) different measures of success are useful for different types of new products</td>
<td>Since most factors found are on a program level and only obtainable after a project is done, only a limited number of criteria are moved to the list</td>
</tr>
<tr>
<td>Abbie Griffin &amp; Albert Page (1993)</td>
<td>NPD measures of success and failure</td>
<td>compare measures for success and failure between academia and practice to recommend a set of ‘approved’ measures for academic researchers</td>
<td>list all measures used, group them and see how and if companies used these measures</td>
<td>literature review, surveys, expert group consensus. Make hierarchy in groups with experts. Factor analysis for results</td>
<td>75 studies on NPD, 50 responses from surveys</td>
<td>75 measures</td>
<td>5 general almost independent categories; firms use on average 3.7 measures to measure success/failure</td>
<td>16 factors in 4 categories can only be used if altered since all measures are retrospective</td>
</tr>
</tbody>
</table>

(Table 3.2 continued)
Shortcomings

The research tradition in which a lot of the studies were done is not without objections. A number of authors mention shortcomings for this type of research. Some are mentioned below.

Many of the companies interviewed had to choose the projects -on which they would answer the question from the questionnaires- themselves. This leads to a possible bias in which only clear-cut successes and clear-cut failures are considered (Bronnenberg and Engelen, 1988). This bias can lead to a compromise in internal validity (Montoya-Weiss and Calantone, 1994). Also failed products often do not have the same life-span in a company because they will get aborted. This leads to incomplete data for failed projects (Montoya-Weiss and Calantone, 1994).

Ernst (2002) indicates that often studies fail to mention reliability coefficients and he further reports that if regression is used, there is the assumption that relations are linear, while non-linear effects can be expected in some cases.

If the outcome of projects should be predicted solely on the factors tested, it would probably yield better results than guessing. But, while the factors researched are found to have statistically relevant correlations with projects outcome, the final explained variance is rather low in most studies. It could very well be that there are simply too many variables involved in determining project outcome. All shortcomings mentioned above are reasons why three additional fields of research were chosen to complement the research field of Success and Fail Criteria.
**Result of NPD/NSD literature research**

The 12 studies reviewed resulted in a list of 250 factors. The process of going from this long list of terms to a manageable number to take into account when evaluating an idea, is shown in Figure 3-2.

Extending on the goal of the research—to improve the Front End of Innovation—the 250 factors found will be divided over three components *ready, able and willing*, depending on the meaning of the factor. Ready addresses whether the idea is viable; able addresses the ability of the firm to realize the idea and willing addresses the willingness of the firm to invest in the opportunity. The concept of RAW (ready, able, and willing) is explained in more detail in chapter four.

Some of the factors were so broad that they could fit in more than one category—making the total number of factors in ready, able and willing higher than the initial 250 factors found. This division left 186 terms in the ready category, 100 in the able category and 40 in the willing category.

The second step was to combine terms with the same meaning, eliminating redundancy by leaving 65 distinguishable factors in ready, 33 in able and 18 in willing. The next two steps involved combining similar factors in groups and naming these groups with a term that captured the spirit of all the terms. This resulted in the basis of the taxonomy which is used throughout the rest of the thesis. Other fields of research and the empirical part of this research will complement the list created after this session. The taxonomy created after the NPD/NSD research is shown in Table 3.3.
Aspects related to:

**Ready**
- Development: Time/resources planning, stages, use of milestones
- Finance: Impact on costs to clients and developing/using firm
- Marketing: Knowing your clients and competition
- Product: Description/use/benefits of product
- Vision: Concept and vision on the whole idea

**Able**
- Capability: Fit with of knowledge/experience/time/facilities
- Compatibility: Fit with processes/tools/structure/composition of firm

*capability and compatibility must be assessed for all involved departments Marketing, R&D, Engineering, HR, Legal, Finance, Sales, etc.*

**Willing**
- Commitment: Is the firm willing to commit to the opportunity?
- Strategy: in line with strategy?
- Finance: in line with wanted return on investment?
- Portfolio: in line with portfolio composition?
- Performance: in line with market share/volume/revenue goals?
- Opportunity cost: Is this option the best option to invest in?
- Risk: Can the firm take the risk involved?

*Table 3.3, results of the NPD/NSD literature study*

### 3.3 Cost/Benefit literature

In order to be able to measure success or failure of a project, one must be able to define success and failure. Success can be defined in many ways and along many dimensions. A simple way to define success is when the complete lifecycle of a product creates more value than it costs. However, performing a precise calculation is impossible as it would require the comparison of two situations of which one can never take place. What is possible is to predict what the effects will be of going ahead with a project and predicting what would happen if this project was abandoned. The difference between the two scenarios would be the deciding factor (Reh, 2004). But what should be the effects to include in the comparison? Surely direct financial costs and benefits are important in the equation, but some effects of doing a project (or not) which are not directly financial, can have dire consequences and should be taken into consideration as well.

With this line of thinking in mind, literature was searched to discover the most important effects to include in a cost/benefit analysis. However, there were no sources found which had the aim to construct such a list. Instead, some papers already reviewed for the success and fail criteria do mention effects
which can be considered in this respect: creating customer value, increasing strategic success (De Jong and Vermeulen, 2003), improved reputation, improved NPD capabilities, enhanced customer loyalty, moving the company in a new direction, increased consumption of existing products, new customers (Storey and Easingwood, 1998), completing a product line (Easingwood, 1986).

Generalizing the items from literature give the main dimensions on which we can plot the effects of doing a project. The process of generalization was done through the following steps:

- Listing the parties mentioned in the sources and logically extending that list to include more stakeholders.
- Match benefits mentioned with appropriate stakeholder.
- See if same benefits are also applicable to other stakeholders.
- Mention the opposite of each benefit in the ‘cost’ column.
- Extend the created list with other possibilities.

The result is shown in Table 3.4. The main dimension is whether the effect is positive (benefit) or negative (cost). Other dimensions are: internal (effect on firm itself) – external (effect on other stakeholder) and direct (directly calculable to finance) – indirect (2nd order effects).

<table>
<thead>
<tr>
<th>Impact on</th>
<th>costs</th>
<th>benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal direct financial</td>
<td>invoices</td>
<td>revenue, profit</td>
</tr>
<tr>
<td>time</td>
<td>man-hours</td>
<td>increase efficiency</td>
</tr>
<tr>
<td>facilities</td>
<td>used space</td>
<td>increase efficiency</td>
</tr>
<tr>
<td>supplies</td>
<td>used supplies</td>
<td>increase efficiency</td>
</tr>
<tr>
<td>Internal indirect experience</td>
<td>opportunity cost</td>
<td>increase experience</td>
</tr>
<tr>
<td>knowledge portfolio</td>
<td>opportunity cost</td>
<td>increase knowledge, IP</td>
</tr>
<tr>
<td>strategy</td>
<td>diverting from strategy</td>
<td>help sales of other products, completing product line</td>
</tr>
<tr>
<td>strategy</td>
<td>diverting from strategy</td>
<td>aiding in reaching strategic direction</td>
</tr>
<tr>
<td>External competition</td>
<td>easily copied</td>
<td>competitive edge</td>
</tr>
<tr>
<td>partners</td>
<td>increase dependency</td>
<td>improved cooperation</td>
</tr>
<tr>
<td>clients</td>
<td>decreased reputation, cause clients to defect</td>
<td>improved reputation,</td>
</tr>
<tr>
<td>suppliers</td>
<td>increase dependency</td>
<td>increased customer value,</td>
</tr>
<tr>
<td>legislators</td>
<td>increase unwanted attention</td>
<td>increased customer loyalty</td>
</tr>
<tr>
<td>environment</td>
<td>liability pollute</td>
<td>improved cooperation</td>
</tr>
</tbody>
</table>

Table 3.4, Effects of doing a project shown in costs and benefits
This list is far from complete and can be extended over time when users of the tool include more items in each column. For this reason, the users should have the option to include more options when filling this particular question in the tool.

3.4 Fuzzy Front End research

Researchers studying the Fuzzy Front End (FFE) concentrate their efforts on the phases and processes taking place during the very early stages of development of an idea. The definition of when the Fuzzy Front End ends is not consistent within the consulted literature. In all cases it starts with the generation of an idea and usually ends at the time a business unit decides to either support or reject the idea (Khurana and Rosenthal, 1998). Some even refrain from using the word ‘fuzzy’ as they feel it suggests the front end to be unmanageable. They prefer to use the term the Front End of Innovation (Koen et al., 2001).

The importance of this research is described by many scholars as they found that the biggest gains in optimizing NPD procedures lie in the improvement of the FFE (Koen et al., 2001, Zhang and Doll, 2001). This makes the link with this thesis clear. Factors that improve the FFE as a whole can potentially also improve the chance of individual projects.

A model presented by Khurana & Rosenthal (1997) presents the FFE as a series of three phases after which a go/no-go decision is made. The first phase –pre phase- zero includes a market and technology analysis. This phases is followed by a second phase –phase zero- in which the concepts and definition are made. The third and final phase in the front end –phase one- is used to define the product and make a planning.

Koen et al (2001) describe the FFE as in a model that consists of 5 elements – idea genesis, opportunity analysis, opportunity identification, concept & technology development, idea selection- the powering engine and the external factors. This description of the FFE stresses that this phase is not a sequential follow-up of sub-phases, but rather an iterative phase in which gathered information and knowledge constantly influence each other. This approach makes better use of the fuzzy nature of the front end. This is both a blessing and a curse as iterating could make the end-product better, but has the inherent risk that decisions are postponed.

Table 3.5 shows an overview of the main aspects of the literature reviewed for this thesis.
<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Topic</th>
<th>Goal of research</th>
<th>Method of analysis</th>
<th>Sample</th>
<th>Tested</th>
<th>Outcome</th>
<th>Factors to include in analysis of theoretical requirements of tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandra Vandermerwe (1987)</td>
<td>organisational causal model integrating FFE</td>
<td>come to a list of the barriers - impeding the development of an idea - found in organisations.</td>
<td>study literature for factors, define causal relations in a proposed model</td>
<td>-</td>
<td>-</td>
<td>7 barriers impeding diffusion; requisites for selling idea in organisation: 4 categories with in total 29 components</td>
<td>barriers and requisites also some diffusion characteristics from literature applied to the internal organisation</td>
</tr>
<tr>
<td>Qingyu Zhang &amp; William J. Doll (2001)</td>
<td>organisational causal model integrating FFE</td>
<td>distinguish between cause and effect variables in the front end, proposing a causal model</td>
<td>use knowledge of companies to gain insight in causes for NPD hampering factors</td>
<td>100 senior businessmen</td>
<td>-</td>
<td>7 critical activities in the front end of innovation</td>
<td>elements which can cause fuzziness in NPD processes</td>
</tr>
<tr>
<td>Anil Khurana &amp; Stephen R. Rosenthal (1997)</td>
<td>organisational causal model integrating FFE</td>
<td>aim to improve the effectiveness of the front end process</td>
<td>grounded theory approach; iterating between after each round of interviewing in dissemination workshops</td>
<td>-</td>
<td>-</td>
<td>7 activities in two categories were found to be influencing NPD</td>
<td>7 activities (in 2 categories); checklist for diagnosing the front end;</td>
</tr>
<tr>
<td>Anil Khurana &amp; Stephen R. Rosenthal (1998)</td>
<td>organisational causal model integrating FFE</td>
<td>come to the construct of a holistic view on the front end</td>
<td>cross-industry case studies, NPD literature, semi-structured interviews</td>
<td>11 companies; 75 interviews</td>
<td>-</td>
<td>There are two approaches to achieve a holistic front end: formal process for NPD or a culture driven approach</td>
<td>best practices for a holistic front end</td>
</tr>
</tbody>
</table>

*Table 3.5, overview of research on the Fuzzy Front End*
<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Topic</th>
<th>Goal of research</th>
<th>Goal of research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koen et al. (2001)</td>
<td>language of FFE</td>
<td>Develop a theoretical construct to provide a common language and insights on the</td>
<td>Come to a 'general solution concept' of the FFE (to achieve Y in situation Z, do</td>
</tr>
<tr>
<td></td>
<td></td>
<td>front end activities</td>
<td>X)</td>
</tr>
<tr>
<td>J.E. van Aken (2004)</td>
<td>FFE different from other phases</td>
<td>investigate whether firms use systematic procedures to generate and screen ideas for</td>
<td>bringing structure to the FFE of NPD without sacrificing innovation and creativity</td>
</tr>
<tr>
<td>David Kelly &amp; Chris Storey (2000)</td>
<td>screening in FFE</td>
<td>new services</td>
<td></td>
</tr>
<tr>
<td>Mitzi M. Montoya-Weiss and Tony M. O'Driscoll (2000)</td>
<td>tool can facilitate FFE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>research design</td>
<td>analyse the front end in firms to come to a general understanding of activities and terms</td>
<td>get in-depth knowledge on the FFE process in companies to generate the general solution</td>
<td>categorize firms in approach to innovation, ask firms about their NPD process, compare results</td>
</tr>
<tr>
<td>method of analysis</td>
<td>study front end in firms</td>
<td>5 case studies in 5 different companies</td>
<td>iteratively testing process structures and phases in projects</td>
</tr>
<tr>
<td>sample</td>
<td>8 companies</td>
<td>surveys of executives</td>
<td></td>
</tr>
<tr>
<td>tested</td>
<td>-</td>
<td>expert feedback on analysed structure found</td>
<td></td>
</tr>
<tr>
<td>outcome</td>
<td>The New Concept Development model</td>
<td>manage the FFE process striking a balance between exploration and main stream development</td>
<td>firms with formal strategies are more satisfied with their innovative capabilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Front-end idea-developing and evaluation process in a software tool</td>
</tr>
<tr>
<td>factors to include in analysis of theoretical requirements of tool</td>
<td>model describes 5 iterative front end activities</td>
<td>list roles in project with responsibilities</td>
<td>not only screening of ideas is important, but more so prioritizing them</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Use of a software tool for FFE is an economic sound way of filtering ideas.</td>
</tr>
</tbody>
</table>

(Table 3.5 continued)
Result of FFE literature research

The 8 studies reviewed resulted in a list of 210 factors. The process of going from this long list of terms to a manageable number to take into account when evaluating an idea, was the same as used in section 3.1.

All factors found could be integrated in the distinction already made in section 3.2. Appendix 1 lists the results on what sources contained factors to parts of the taxonomy.

Other points that could be learned from the FFE sources were process related. The main additions to the tool based on FFE literature are:

- Not only the screening of ideas is important, but more so prioritizing them (Kelly and Storey, 2000). This was later added to the procedures of using the tool.

- Use of a software tool for FFE is an economic sound way of filtering ideas (Montoya-Weiss and O'Driscoll, 2000). This is one of the arguments which support the development of the tool.

- Elements which can cause fuzziness in NPD processes are: poor definitions, technological uncertainty, lack of senior management support, poor project management (Zhang and Doll, 2001). Checks on these items were added to the tool.

- Use a checklist for diagnosing the front end (Khurana and Rosenthal, 1997). Where possible, the checklist was rephrased to check with the Raw structure. All points fit the existing structure.

- Use the described best practices for a holistic front end (Khurana and Rosenthal, 1998). The key points addressed concern clearly defined roles in the process and adopting a holistic view including the link with elements such as strategy, concept development, executive reviews. All elements are accounted for in the final tool.
3.5 Business Cases

Although not a field of scientific research as such, business cases can help when searching for factors that influence project outcome. The sources that were consulted for this part were the questions that financial capital providers ask their (potential) clients when they apply for a business loan additionally the business model that Chesbrough describes in his book (Chesbrough, 2003) is used.

Entrepreneurs usually have an idea which they want to pursue, but lack the financial means to make it happen. This is the parallel with the situation inside a company researched in this thesis as people inside a company are also looking for the means to pursue ideas. Of course the situation inside a company is not the same as the relationship between a bank and an entrepreneur applying for a loan. Inside a company there is a trust factor, which is fuelled by the knowledge that both parties (sponsor and project manager) are both playing for the same team. But perhaps the insights in the procedures between two external parties can create new insights and factors to include in the taxonomy.

When asking banks or venture capitalist for a loan, they will want to make reasonably sure that they can collect the interest and amortization on this loan. One thing an entrepreneur can do to convince capital providers of is present them with a business plan in which it is explained how the financial injection is going to be invested and how this investment is going to give a return. To be able to extract the requirements the capital provides have, the websites of the three largest banks in the Netherlands -ING Bank, ABN AMRO Bank, Rabobank- were visited. On these sites, tools are provided to guide entrepreneurs in new ventures by asking them questions. All questions were gathered from the sites and translated to terms capturing the spirit of these questions. Terms with the same meaning were combined in one term and similar terms were grouped in the same categories and sub-categories of the SFC categories described in section 3.2.

Almost no references are made to categories in the willingness component. This low percentage in willingness is not surprising taking into consideration that the business cases under review are meant for small entrepreneurs who, perhaps by default, are willing to pursue an idea when applying for a loan. Further study of the factors found in these sources learns that a lot of attention is being paid to the marketing aspects of the idea. Little attention is being paid to the development and finance aspects as mentioned in the taxonomy.
The general claims that Chesbrough uses in his business models, contrast the specifics dealt with by the tools provided by the banks. Chesbrough covers a broad area with a statement like: “Knowing the intended market, the intended value proposition, and the intended specification of the offering, you can construct the value chain that will deliver these elements”, offering little help to aid an entrepreneur in the specifics of this claim. Banks on the other hand ask very specific questions, tailored to the need of entrepreneurs. Banks also focus much of their attention on the entrepreneur her/himself, giving clues as to what is takes to be a successful entrepreneur such as, creativity, decisiveness, cooperation skills, social abilities and such.

Result of Business Case sources

This is the first source which addresses the issue of applicable legislations. Since legislation is definitely a factor which can severely hamper the development or even legitimacy of an idea, this factor is included in the taxonomy under a new category ‘environment’ (which refers to the external situation rather than mother-nature).

Some of the reviewed tools asked explicitly about the traits the entrepreneurs would need to have a good chance of succeeding in their ventures. Among the traits mentioned were: aware of own weaknesses, endurance, level of self sufficiency, flexibility, taking initiative, creativity, decisiveness, organisational talent, people skills, cooperative skills, logical reasoning, risk aversion, social abilities, persistence. These factors could not fit the existing taxonomy and were added to the taxonomy under Able>capabilities under the group: traits.
3.6 Theoretical design requirements

All four fields discussed in the literature review have the same overall goal, which is to try to aid in the selection of those projects that will in the end help to make the entity investing resources in those projects reach their goals. NPD/NSD research does this by giving some insight in the success and fail criteria of projects. Cost/Benefit analysis aid in the full understanding of the impact of any project by trying to give insight in all costs and benefits of such a project. The literature on the Fuzzy Front End tries to give the reader insight into the proceeding in the early stages of ideas and how to structure those ideas to increase the likelihood of success. The Business Case documents are used to be able to assess the potential that some new ideas have in a business environment.

The taxonomy created after the review of the SFC literature was the basis on which the other three fields were complementary. The end result of the theoretical part of this thesis is a taxonomy-like structure with the components of ready, able and willing at the base. The total overview is given in Table 3.6.

Each of the three consulted fields have their specific focus when seeing it from the ready, able and willing perspective. Looking at Figure 3-3, it can be concluded that the Business Case sources focus on the ready component, as 58% of all factors found in these sources fit this component. The SFC literature has a more balanced view, paying more attention to the willing component (14%).

The most balanced view comes from the FFE literature who have almost as much factors relating to the idea itself (ready), as the number of factors relating to the ability of the company to realize that idea (able).

A more detailed view of the contribution of the sources to the taxonomy can be found in appendix 1.

[Figure 3-3, Focus of the different fields of research concerning ready, able and willing]
### Ready

<table>
<thead>
<tr>
<th>Aspects related to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development</td>
</tr>
<tr>
<td>Planning</td>
</tr>
<tr>
<td>Stages</td>
</tr>
<tr>
<td>Finance</td>
</tr>
<tr>
<td>Client side</td>
</tr>
<tr>
<td>Company side</td>
</tr>
<tr>
<td>Marketing</td>
</tr>
<tr>
<td>Business intelligence</td>
</tr>
<tr>
<td>Customer relations</td>
</tr>
<tr>
<td>Market</td>
</tr>
<tr>
<td>Pricing</td>
</tr>
<tr>
<td>Sales</td>
</tr>
<tr>
<td>Marketing strategy</td>
</tr>
<tr>
<td>Product</td>
</tr>
<tr>
<td>Benefits</td>
</tr>
<tr>
<td>Costs</td>
</tr>
<tr>
<td>Description</td>
</tr>
<tr>
<td>Other booster</td>
</tr>
<tr>
<td>Use</td>
</tr>
<tr>
<td>Vision</td>
</tr>
<tr>
<td>Strategic focus</td>
</tr>
<tr>
<td>Clear concept</td>
</tr>
<tr>
<td>Environment</td>
</tr>
<tr>
<td>Environment</td>
</tr>
<tr>
<td>legislation</td>
</tr>
</tbody>
</table>

### Able

<table>
<thead>
<tr>
<th>Aspects related to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability</td>
</tr>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td>Experience</td>
</tr>
<tr>
<td>Resources</td>
</tr>
<tr>
<td>Traits</td>
</tr>
<tr>
<td>Compatibility</td>
</tr>
<tr>
<td>Structure</td>
</tr>
<tr>
<td>Processes</td>
</tr>
<tr>
<td>Tools</td>
</tr>
<tr>
<td>Culture</td>
</tr>
<tr>
<td>Network</td>
</tr>
<tr>
<td>Motivation</td>
</tr>
</tbody>
</table>

*capability and compatibility must be assessed for all involved departments Marketing, R&D, Engineering., HR, Legal, Finance, Sales, Etc*

### Willing

<table>
<thead>
<tr>
<th>Aspects related to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commitment</td>
</tr>
<tr>
<td>Strategy</td>
</tr>
<tr>
<td>Finance</td>
</tr>
<tr>
<td>Portfolio</td>
</tr>
<tr>
<td>Performance</td>
</tr>
<tr>
<td>Opportunity cost</td>
</tr>
<tr>
<td>Risk</td>
</tr>
</tbody>
</table>

*Table 3.6, RAW-taxonomy*
Chapter 4: Ready, Able and Willing

Key issues from this chapter:

- IBM will not successfully complete a development of an idea to commercialization, unless it is ready, willing and able to do so.

- By making the distinction in ready, able and willing, the Front End of Innovation becomes transparent, allowing the company a valuable glance in the bottlenecks of bottom-up innovations.

- Through the transparency, the Front End of Innovation can be better steered to deliver better results, making the Front End more effective, and efficient.
4 Ready, Able and Willing

If you as an employee of IBM have an idea and pursue commercialization of this idea, than this effort can either fail or succeed. The factors that influence success and failure and the processes that are involved were discussed in chapter three. In this chapter, the distinction in ready, willing and able in the RAW-taxonomy from chapter three will be further explained. The distinction between ‘ready’, ‘able’ and ‘willing’ (RAW) is one of the pillars of the tool explained in chapter six.

After introducing the main components of the taxonomy in section 4.1, the focus will shift towards explaining what possibilities this taxonomy offers in section 4.2. The last section will cover some other aspects of the possibilities with the RAW components.

4.1 Distinguishing Ready, Able and Willing

The concept of this distinction is one of the most basic principals in business and perhaps even in life when something should be done: something will not be done successful unless someone is ready, willing and able to do that thing. If either component is missing, the endeavour will probably fail. If we put this statement in the perspective of this thesis, it reads: IBM will not successfully complete or even start the development of an idea to commercialization, unless it is ready, willing and able to do so. What the concepts of ready, willing and able entail will be explained in the next sections.

Ready

In bottom-up innovation, this is the first step to be made. The ready component in this taxonomy concentrates on the idea itself and the way this idea can generate value.

In this component, the idea initiator has to come up with a business case which takes into account the innovation, marketing, market, financial, and development aspects of the idea. In short: everything needed to show that this idea is able to generate more benefits than costs.

This component of the taxonomy is only externally focussed. It does NOT concern itself with procedures, capabilities, and strategy inside the company. These aspects will be dealt with in the other two components of the taxonomy. In essence, the ready component gives the outlines for the organisation which is needed to make this idea happen, because this component requires the idea initiator to state the development phases and the competencies needed to be successful in development.
The *ready* component is based on the assumption that an idea can be viable on its own. This means, an idea can be commercially interesting in itself, regardless of the company trying to exploit it. Do note that this does not mean that any idea is good for any company. If the idea itself is not viable, there is no use in pursuing it. In the analysis of viability, all factors that are beneficial must be mentioned. This analysis includes 2nd order effects and non-financial measures if appropriate.

*Able*

The second component in this taxonomy concentrates on the ability of a given firm to make use of the idea presented in the ‘ready’ part.

This component will show the alignment between the resources and capabilities of the firm and the resources and capabilities required as presented in the *ready* component of the idea. The end-result of this component can tell whether the company is able to make enough use of the idea, and if this company can keep the idea viable.

As every company has different resources and capabilities, the results for this component are different for each company presented with the same opportunity. For this reason, the ‘able’ component of this taxonomy can serve as a basis to the investigation whether this company it the right company to pursue this idea.

*Willing*

Having an idea that is *ready* and being *able* to make this opportunity happen, does not mean it should happen. The *willing* component of the taxonomy concentrates on the question whether it is the best option for a company to pursue an idea.

This component deals with aspects such as strategic fit (does this idea help us move in the desired direction), opportunity cost (is this the best way to invest our resources), Portfolio management (do we have the right mix of projects), and Life cycle management (can we sustain another project at this time).

In this component, decision makers have to decide on the willingness to invest and whether to commit to the idea and dedicate the necessary resources to the development

### 4.2 Managerial control with RAW taxonomy

The concept of distinguishing between ready, willing and able is not new. Past studies e.g. by Ulrike de Brentani (2001) have already shown that new
product success is influenced by factors related to the product itself, the company and the market. However, explicitly distinguishing between the three aspects - as done in this thesis - is new. Making this distinction presents new opportunities for more control on a program and company level.

This control on a company level starts with using data from the tool on the number of ideas in the system; more precise: the number of ideas deemed ‘ready’, the number of ideas on which the company is ‘able’ to pursue and the number of ideas the company is ‘willing’ to pursue. Different levels on the different components can be analyzed and present data on the fitness of the company to innovate bottom-up, as explained in the scenarios below.

Scenario 1:
If a lot of ideas in the tool are marked ‘ready’ (meaning that the idea is in theory viable), but the company is not ‘able’ to realize the idea, than the organization is either generating the wrong ideas or the company has the wrong competencies in their workforce. A remedy could be to stimulate the creative process in the direction of the desired development of the company.

<table>
<thead>
<tr>
<th>high</th>
<th>low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation: Ready is high, rest low</td>
<td></td>
</tr>
<tr>
<td>Problem: Many ideas in tool, but not the ones that inspire</td>
<td></td>
</tr>
<tr>
<td>Remedy: More education needed on the type of ideas that are wanted</td>
<td></td>
</tr>
</tbody>
</table>

Scenario 2:
If the company is able to realize most of the ideas which are viable, but too many of those ideas do not pass the willing phase, it could indicate that the company is a) unable to decide which ideas to invest in, or b) the company has a lack of resources to sponsor all ideas or c) the wrong ideas are generated. This could indicate that the top management has not succeeded in getting the right message across when informing the IBM-ers on the strategy to follow. If the problem is not the type of ideas or lack of resources, senior management should encourage decision makers to be more active in investing the available resources in the most promising ideas.

If the employees in a company generate the right ideas, which the company is able to realize, but not enough resources are available to sponsor them all, the company can than pick the most promising ideas among all ideas. This is the situation in which the Front End should be.
Situation: Ready and Able are high, Willingness is low
Problem: Indecisiveness, lack of resources or wrong ideas generated.
Remedy: Increase awareness of strategy to generate the right type of ideas, increase budgets or make management more decisive

Scenario 3:
If for many ideas, the lights are green for both ready and willing, but too few are given a green on able part, it could indicate that the ideas are not compatible with the abilities. This means that either the abilities needed must be hired/acquired or the company should spend more energy in matching abilities to the proposed ideas.

Situation: Willingness higher than ability
Problem: The right ideas are proposed, but the organisation does not have the right abilities
Remedy: Hire/acquire the needed competencies

In conclusion, what this tool does is making the process of the front end more transparent. The tool can do so by showing the status of all ideas to the involved parties. Idea initiators can find out if their ideas are viable, something the company could do and something the company would be willing to pursue. For idea initiators this could be a learning curve to know what type of ideas can make it in the company. This provides clarity on the level of the individual ideas.

On the level of the innovation process, the use of RAW also provides clarity. Using the RAW distinction allows analysis of the problem areas in the Front End of Research. More detailed analysis will uncover where the bottleneck lies, and as done in the three scenarios above senior management has the information it needs to able to work on the bottlenecks and improve the Front End of Innovation in this way.

4.3 The taxonomy in practice
As stated before, the ‘ready’ component will probably be used first in case of a bottom-up innovation. After this, the remaining two components can be used and altered simultaneously. There is no real need to have a strict sequence in the use of the components. The components may thus be filled in concurrently or sequentially. In practice this might mean that a decision maker waits with a decision until it becomes clear that there are enough capabilities and competencies within the company who are able to make the
idea happen, before deciding on a go/no go from their side. It could also be that a decision maker is taken with the idea to a level that he will ensure that the right abilities are found to make the idea happen. This can also include bringing in outside parties to facilitate in development.

A realistic scenario could also be that a decision maker says ‘no go’ to an idea, with the comments that if certain aspects are improved, altered or proven, that the ‘no go’ can still become a ‘go’. The initiator then, has a choice whether to accommodate the decision maker, or to stop pursuing the idea.
Chapter 5: Research results

Key issues from this chapter:

- Confidential.
5 Research results

<rest of chapter only available in uncensored version>
Chapter 6: The tool

Key issues from this chapter:

- A tool as developed for this thesis is in its simplest form a checklist aiding users in covering all the basics; in an advanced form it is a coaching tool guiding users through the necessary steps to come to an end evaluation of the idea.

- The tool presented here is still more a check-list and offers the vision and insights to evolve the tool to a higher level.

- The use of levels in the tool –each dealing with the idea in more detail– stimulates the users to mature their ideas to a level in which a good evaluation is possible.

<confidential>
6 The tool

<rest of chapter only available in uncensored version>
Chapter 7: Validation of taxonomy and tool

Key issues from this chapter:

- Based on interviews with knowledgeable people, the taxonomy—including the distinction in ready, able and willing—was accepted.

- From a limited number of tests among users of the tool, the tool was found to aid in maturing ideas.

- The concept of the tool was accepted as having a positive influence on the Front End of Innovation from an user perspective.

Advantages of using the statistics of tool-use to control and/or influence the innovative capability of IBM can only be assessed after a pilot project on a larger scale.
7 From research to commercialization

<rest of chapter only available in uncensored version>
Chapter 8: Conclusions

Key issues from this chapter:

- Confidential

- On the level of individual ideas, the tool facilitates the surfacing of good ideas and filters out bad ideas by making the Front End of Innovation more transparent and coaching idea initiators in the maturation process.

- On the level of the innovation process as a whole the tool claims to lower opportunity cost by offering the method to sponsor those projects that add the most value to the company.

- Confidential
8 Conclusions

<rest of chapter only available in uncensored version>
References


IBM (1999) Research History Highlights. IBM.


Appendices

<Pages correspond to the uncensored version of this thesis>

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1. Contributing literature sources to taxonomy

As said in the thesis, the different fields of research contributed different factors to the taxonomy. In the following three pages, three fields of research are shown. In the table the taxonomy can be found in the rows of the table and the sources contributing to the taxonomy are displayed in the columns.

Below more explanation is given on how to read the information from the table.

<table>
<thead>
<tr>
<th>Main components</th>
<th>Categories within the components</th>
<th>Groups within categories</th>
<th>Of all factors found in all sources, 48% related to ready</th>
<th>Of all factors found, 4% related to group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>Category 1: 48%</td>
<td>Group 1: 46%</td>
<td>Source 3 contributed factors to category 1</td>
<td>Source 3 did not contribute factors to category 2</td>
</tr>
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2. Interview questions for project reviews

For the project reviews in IBM, 6 projects were reviewed following a semi-structured interview set-up. This set-up used in the interviews is shown below.

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3. Scoring form used at the end of project reviews

This score form was filled in by all project members about their respective projects. The results were used in the analysis of the projects in section 5.3

<confidential>

4. Project summaries

The six projects that were reviewed were analysed to see if the factors impeding or helping the development could be found in the theoretical RAW-model. The analysis per project is given in the following pages.

<confidential>

5. Information given to tool testers

This was all the information that was provided to the tool testers prior to using the tool.

<confidential>

6. Questionnaire given to tool testers

To grade the usefulness of the tool, all testers filled in a questionnaire about the use of the tool. Since the roles are different, some questions were specifically designed for each user group. The three different questionnaires for the user groups are given in the next few pages.

<confidential>
7. Screen dumps of on-line test tool

From the description of the tool in chapter 6, the most essential features of the tool were selected and made into a Lotus Notes database. Screenshots from the database are shown on the next pages.

<confidential>

8. Tool questions for Idea initiators level 1

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9. Tool questions for Idea initiators level 2

The following questions make up level 2 of the tool for the idea initiator. These questions were not entered in the on-line tool and are therefore displayed in a different style.

<confidential>

10. Tool questions for Community levels 1 and 2

The following questions are meant to help the community to provide feedback to the idea initiators.

<confidential>

11. Level three

Level three in the tool is the most detailed level. In this level the user will have to cover the full RAW-taxonomy to show the value of the idea to the company.

<confidential>
12. Level 4: Decision maker questions

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13. M&A TP ideas

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14. Results from on-line questionnaires

In the next few pages, the raw data can be found on the scoring of the on-line questionnaires from the test tool.

<confidential>

15. List of acronyms/abbreviations

**Acronyms/Abbreviations**

BC Business Case  
CBA Cost Benefit Analysis  
DM Decision Maker  
FEI Front End of Innovation  
FFE Fuzzy Front End  
IT Information Technology  
NPD New Product Development  
NSD New Service Development  
PT Project Team  
RAW Ready Able and Willing  
SFC Success and Fail Criteria

<confidential>