MASTER

Delays in NSD
the causes and consequences

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Delays in NSD;
the causes and consequences

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Abstract

In performing new product development (NPD) projects, development speed has become more and more important. Bringing a product fast in the market helps companies to achieve first-mover advantages, such as the establishment of a dominant market share and the creation of customer loyalty. Especially in dynamic environments characterized by tough competition, short time-to-market can be critical for the eventual product success. Here, delays are thus not desirable. As delays cause that the intended launch-date of a new product has to be postponed, first-mover advantages may be missed. In general, delays can have multiple causes and effects. However, in current literature these causes and effects of delays are not extensively examined. Most often the focus has been on NPD speed, whereas delays have become partly underexposed. In particular within the context of new service development (NSD), delays are not often examined. Therefore this study aims to find the causes and effects of delays within service-innovation projects. By examining 48 projects conducted at KPN, one of the leading suppliers of telecommunications and IT-services in the Netherlands, important delaying factors and their effects are revealed. Important causes of delays appeared to be unclear goals, changing requirements and underestimation of complexity. Concerning the effects, it shows that the more additional time is taken, the better the quality of the eventual service is. Delays are thus positively affecting quality. This also holds for available budget; when more money is available a higher quality can be achieved. Remarkably, no significant effect of delays on costs is found. Apparently, delays do not necessarily lead to an increase in costs. Overall, the results show that KPN currently needs the delays to achieve all quality-requirements. Though, the causes of delays also show that project teams are currently not working very effectively. In case project teams start working more effectively, quality can be accomplished without the need of the delays. Therefore recommendations are made to improve the effectiveness of project teams. By following these recommendations, quality can be maintained while time-to-market can be reduced.
Management summary

This study aimed to reveal the causes and effects of delays in new service development projects. In current literature delays are underexposed, as most studies have focused on the antecedents of NPD speed. Though, as delays are a part of NPD speed, not all antecedents of NPD speed can also be related to delays. Besides, ambiguous findings are obtained concerning the effects of delays. On the one hand, studies have revealed a positive effect of delays on cost and quality, whereas on the other hand negative effects are found. In addition, very few studies have examined these relationships in the context of new service development. Therefore there is a clear need for an extensive examination of delays within the development of new services. Mainly the causes and effects need further examination. To investigate prior topics, an empirical analysis within KPN ZM is conducted.

Problem definition & methodology

Nowadays KPN is acting in a rapidly changing environment. One of the main characteristics of this environment is the upcoming trend in providing telecommunication and IT-related services. This ensures KPN is getting more competition from small, entering start-ups. Also the incumbents such as Vodafone and T-Mobile ensure a high degree of competition. The tough competition, together with the current economic situation in the Netherlands, forces KPN to set new services into the market rapidly. However, the current time-to-market of new services is still very high due to multiple delays. Especially the Business Market (ZM) of KPN is facing many delays within their new service development projects. Although it is known that NSD projects are delayed, the actual causes and effects of these delays are unknown. Based on previous information the following problem statement is established:

“Due to multiple delaying factors, the current cycle time of NSD projects within KPN ZM is too long.”

In order to find a solution for the prior problem statement an extensive data analysis is performed. Data of 48 projects conducted within the programs A and B of the department “Innovation & Programs” is collected. This data collection is done by direct observation, documentation, and by interviews with employees acting within KPN ZM. Of all the projects, the delays, costs and quality are measured. Important to note is that all projects were structured by the use of the Stage-Gate process, consisting of five toll-gates: Idea of Opportunity (IO), Decision to Justify (DJ), Decision to Fund (DF), Decision to go Public (DP) and a Decision to Handover (DH). As the planned and actual dates of taking each gate was known, the total duration of a project could be determined by adding up all durations between the five gates. Subsequently the delays are calculated by comparing the planned toll-gate dates and the actual toll-gate dates. Eventually in the analysis a delay is incorporated as the percentage at which the total planned duration of a project is exceeded. Furthermore, costs are reflected by the project-budget. Unfortunately about quality no effective data was available within KPN ZM. Since within literature quality is often defined as the conformance to requirements, within this study quality is measured by the degree to which a project fulfills both business- and customer-requirements. The business requirements are measured by the policy-check. One of the few quality-related issues known within KPN is the number of policies a project has to obey and the degree in which it actually obeys all these policies. Therefore the policy-check is reflected as the percentage at which a project obeys all policies which it has to obey. The requirement-score is determined by the use of a questionnaire. In this
questionnaire project managers were asked to make an estimation at which degree a project has fulfilled all customer requirements. Together the policy-check and requirement-check constituted a measure for the quality.

With regard to the data analysis, the causes of delays are analyzed qualitatively by the interpretation of delay-memo’s and interviews with project managers. The effects of delays on cost and quality are quantitatively analyzed by the use of PLS Path Modeling. PLS Path Modeling was in this case most suitable as analysis-tool, because PLS can estimate relations between multi-item constructs, it avoids small sample size problems and it does not make stringent assumptions about the distribution of variables and error terms. As both delays and quality are measured by the use of multiple measurement items, PLS is in this case better suitable than for example multiple regression, because within regression only relations between individual variables can be estimated.

**Empirical analysis**

The results of the empirical analysis showed that the average cycle time experienced at KPN ZM is less than one year. Compared to other companies, this is not extremely long. Besides, the average delay is 13 weeks. This means that about 25% of the cycle time is caused by a delay. Most of the delays are experienced at the Decision to Fund. Furthermore, it showed that the average budget lies around the 1.5 million Euros. But, one out of three projects did not stay within budget. When plotting the budget against the average cycle time of projects, it showed that the cycle time was quite constant across projects with a budget below 4 million Euros. This is remarkable, as there seems to be a minimum average cycle time that is needed to perform any project. With regard to quality it shows that overall business policies are well obeyed; on average ninety percent of the policies is obeyed. According to the project managers also customer requirements are most often exactly met.

**Causes of delays**

When looking at the causes of delays, in general a lack of budget was mentioned to be the main cause of delays. Though, when looking in more detail, the interviews revealed multiple root causes behind this lack of budget. Two general reasons for projects running out of time and budget are the inadequate assessment of the needed resources in advance and extended project scope or changing requirements. The inadequate assessment of needed resources can be partly blamed on the short time between the Idea of Opportunity and the Decision to Fund. Since about a year much emphasis is placed on the reduction of the time between the Idea of Opportunity and the Decision to Fund, which have ensured that almost no time is available to conduct any reliable tests or analyses. The lack of test results subsequently causes a lack of knowledge to make a good planning. Besides, as very few specialists are available within KPN ZM, also a lack of experience ensures too optimistic planned toll-gate dates. Another reason for the inadequate assessment of resources is the underestimation of complexity. Often the interests of external parties are not well taken into account, leading to problems later on in the project. With regard to the extended project scope and changing requirements, the lack of a concrete long-term vision and the lack of uniformity between the departments Marketing, KS&O and Innovation can be seen as most important causes. Project goals should be derived from the overall vision, but currently the opposite occurs. This causes projects goals to be unstructured and prone to changes. In addition, currently there is almost no integration between the Marketing, KS&O and Innovation
department. This is remarkable, as all departments work on the same projects. It seems that nowadays the ideas are passed on towards each other without any collaboration. This leads to many misinterpretations of ideas, which subsequently causes many changes in requirements and thus to delays. Also the involvement of customer and suppliers leads to extended project scopes and changing requirements.

Next to the reasons for running out of budget, two other general reasons for delays are discovered in this study. First, the low commitment for non-release projects, such as enhancements, is ensuring much delay. Given the high priority of projects included in releases, non-release projects are not given the full commitment of project members and therefore become heavily delayed. Second, as employees are assigned to multiple projects, they are not equally committed to projects. Additionally, there are many re-shuffles, which causes that knowledge cannot be maintained and it is hard to create a common understanding within a project team. As a consequence, projects are heavily delayed.

Overall, taken all prior findings together it can be stated that goal clarity, top-management support, project complexity, iteration and team experience are important antecedents of delays.

**Effects of delays**

As stated in the introduction, this study not only aimed to reveal the causes of delays, but also the effects. In particular the interrelatedness between delays, costs and quality is examined. The results of the PLS Path Modeling analysis indicate that delays are positively affecting quality, meaning that the more a project is delayed, the better the eventual quality of the newly developed service becomes. This relation also holds for costs and quality; the more money is available for a project, the better the eventual quality is. Remarkably is that no significant relation between delays and cost is found. The results of this study thus not support the notion of delays increasing project costs.

**Conclusion & Recommendations**

When looking at the results of the empirical analysis, it can be noticed that given the positive effect of delays on quality, KPN ZM currently appears to need the delays to cover all quality-issues. Also when more money is available, quality can be even further enhanced. Though, looking at the causes of delays, it can be stated that the effectiveness of project teams is currently quite low. Due to for instance unclear goals, changing requirements and lack of knowledge project teams are not able to effectively deal with all resources. In case the delaying factors are eliminated, the effectiveness of project teams can be enhanced and this ensures that the delays become unnecessary. Therefore, the recommendations of this study aim to enhance the effectiveness of project teams. By doing so, delays are avoided and eventually time-to-market can be reduced.

At organizational level, it is recommended to emphasize the first stages of the innovation trajectory. Here the intention should be to increase the time of the stages before the Decision to Fund. Currently inadequate assessments are done and requirements are not clear. By spending more time at the first stages, more tests can be conducted. Also more time can be taken to agree about the project goals. This way, better estimations can be made and rework can be reduced. As a consequence, delays later on in the development process can be avoided. Though, not only should the time of the first stages be
increased, but also tasks and responsibilities should be changed. For instance scoping-activities should be more integrated with Marketing and KS&O, scoping-teams should be charged with less deliverables and decisive power should be placed lower into the business hierarchy. For the smaller, non-release projects it is recommended to structure them with the Stage-Gate Lite version. This version allows only two gates for small projects, which will enable a faster decision-making process, which in turn increases the commitment of team members.

At project level, it is recommended to implement short “build-test-feedback-and-revise”-loops. More feedback will help to clarify customer requirements and project goals. By implementing these short feedback loops, changes can be more rapidly captured, which prevents extensive delays in the launch of a new service.

Finally at the team level, integrated teams are recommended. Here multifunctional teams should be created. More integration between and within departments is necessary to create uniformity. Currently the bad collaboration leads to many misinterpretations. In case a common understanding is created, these misinterpretations will not be encountered anymore. Besides, teams should be obliged to stay together for at least the duration of one project. Obliging team members to stick together will create a higher degree of team alignment and eventually increases the effectiveness of project teams.

**Discussion**

The findings of this study have several implications for both theory and practice. Concerning the contributions to scientific literature, this study provides a clear view about the interrelatedness between delays, costs and quality. The results have shown that delays are increasing quality, but no significant effect of delays on costs is found. Though, a significant relation between costs and quality is found. Besides, this study shows that goal clarity, top management support, project complexity, iteration and team experience are important antecedents of delays. It is remarkable that project complexity is found to be an antecedent of delays, as prior research has shown that complexity is not a significant indicator of new product development speed. This may suggest that complexity is more important within the context of new service development.

Most important managerial implication is the notion that reducing development time does not help to reduce time-to-market. It is precisely by giving more time in the beginning of the innovation trajectory, the overall cycle time can be reduced. Putting more emphasis on a well-defined business case will result in fewer delays later on. Second, managers must carefully consider the delays due to a lack of budget. This study has shown multiple causes for a lack of budget, which all can be solved by an improved effectiveness of project teams. Though, as budget remains a problem, managers need to consider the number of projects they are performing. When fewer projects are performed, more resources become available per project, which will enhance the quality of the services. Finally, managers should be more aware of the importance of documentation. Especially quality should be carefully traced. When evaluating the eventual project success, it needs to be known whether a project has fulfilled all requirements. If this is not known, lessons cannot be learned and no improvements can be made.
Finally this study has several limitations. First, concerning the timing of measurement, it has to be noticed that the research data is cross-sectional. Unfortunately no longitudinal data could be gathered. As a consequence, no differences between types of projects could be taken into account. Second, the quality-measure may be biased by subjectivity. As it is likely that project managers have assessed the projects more positive than they really are, to make their performances look better, the requirement-score may be actually a bit lower. Given prior limitation, a direction for future research is the development of a general quality-measure that is not prone to subjective influences. When such a measure is developed also studies can be better compared to each other. Third limitation is that the eventual effect of delays, cost and quality on project success could not be analyzed due to a lack of data. It is recommended for future research to take this effect on project success into account. Also future research should examine the relationship between delays and costs. In contrast to the findings of this study it is still expected that a significant relation will be found. Fourth limitation is that within the quantitative analysis the costs are not standardized. Though, as the standard deviation of the project costs appeared to be quite big, misleading relationships may have been found. This is a serious limitation of the research, but given the time frame of this research, the effects of standardization could not be taken into account anymore. It is recommendable for future research to include standardized costs within the analysis. Finally, this research has suffered from the bad documentation within KPN ZM. Out of x projects, only 48 projects could be fully traced. This small sample size may have led to misleading relationships.
Preface

The thesis lying before you is the result of my graduation project that constitutes the final hurdle in fulfilling the Master of Science degree in Innovation Management. The graduation project is performed at the department “Innovation & Programs” of KPN Zakelijke Markt (ZM) and was supervised by the sub-department Innovation, Technology Entrepreneurship & Marketing (ITEM) of Eindhoven University of Technology.

The performance of the research related to this master thesis strongly resembled an innovation trajectory. Multiple difficulties of the NPD process, discussed in several lectures, appeared to me. Uncertainty, iterative steps and complexity were all topics that I have encountered during these last six months. It showed that only with continuous collaboration and feedback, I could proceed towards a good final result. Therefore I would like to thank several people for their advice, motivation and support.

First of all, my gratitude goes out to Hans Berends, my first supervisor from the university. Not only his knowledge and experience regarding the field of innovation management, but also his commitment during the whole thesis trajectory has helped me to continuously improve myself. I have valued his thorough feedback and I am thankful for his valuable insights and guidance during the full master thesis trajectory. My gratitude also goes to my second supervisor Fred Langerak. I would like to thank him for his critical reviews during the last phases of my graduation project.

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Last, but certainly not least, I want to thank my parents, sister and boyfriend Willem for their unconditional love and support. They have helped me to stay focused and motivated me when I was struggling.

I hope you will enjoy reading this thesis.

Cynthia Knook
Eindhoven, August 2012
Table of Contents

Abstract.................................................................................................................................................. I
Management summary .......................................................................................................................... II
Preface.................................................................................................................................................... VII

1. Introduction........................................................................................................................................ 1
   1.1 Theoretical motive ...................................................................................................................... 1
   1.2 Practical motive ........................................................................................................................... 3
   1.3 Research design ........................................................................................................................... 3
   1.4 Outline .......................................................................................................................................... 4

2. Theoretical background .................................................................................................................... 5
   2.1 NPD structuring – portfolio management .................................................................................... 5
      2.1.1 Stage-Gate model .................................................................................................................. 5
   2.2 New product/service development speed ................................................................................... 7
      2.2.1 Antecedents of NPD and NSD speed .................................................................................... 7
   2.3 Delays in new product/service development ............................................................................. 10
      2.3.1 The planning fallacy ............................................................................................................ 10
      2.3.2 Fire fighting .......................................................................................................................... 11
      2.3.3 Other reasons for delays ...................................................................................................... 11
   2.4 The effects of delays ..................................................................................................................... 12
      2.4.1 Speed – Cost .......................................................................................................................... 12
      2.4.2 Speed – Quality ...................................................................................................................... 13
      2.4.3 Cost – Quality ......................................................................................................................... 14
      2.4.4 Trade-offs ............................................................................................................................. 14
   2.5 Conceptual model ......................................................................................................................... 15

3. Methodology ..................................................................................................................................... 17
   3.1 Case selection & description ....................................................................................................... 17
      3.1.1 Company description .............................................................................................................. 17
      3.1.2 Problem context ...................................................................................................................... 18
      3.1.3 Case description .................................................................................................................... 20
   3.2 Problem definition ........................................................................................................................ 20
      3.2.1 Initial problem statement ....................................................................................................... 20
      3.2.2 Preliminary investigation of the problem ............................................................................. 20
   3.3 Methods of analysis .................................................................................................................... 22
      3.3.1 Project approach .................................................................................................................... 22

4. Empirical analysis ............................................................................................................................. 26
   4.1 Descriptive Statistics ................................................................................................................... 26
      4.1.1 NSD project delay ................................................................................................................... 26
      4.1.2 NSD project costs ................................................................................................................... 28
      4.1.3 NSD project quality ............................................................................................................. 29
5. Solution design ................................................................. 44
  5.1 Requirements of solution ............................................. 44
  5.2 Potential solutions .................................................... 45
    5.2.1 Fuzzy Front-end ................................................. 46
    5.2.2 Spiral development ............................................ 46
    5.2.3 Flexibility enhancement ...................................... 47
    5.2.4 Integrated team composition ................................. 47
  5.3 Solution design .......................................................... 48
    5.3.1 Solution design at organizational level ..................... 48
    5.3.2 Solution design at project level .............................. 51
    5.3.3 Solution design at team level ................................ 51
  5.4 Conclusion ................................................................. 51

6. Discussion .......................................................................... 54
  6.1 Research implications .................................................. 54
  6.2 Managerial implications ................................................. 55
  6.3 Research limitations ...................................................... 56
  6.4 Directions for future research ........................................ 57

7. Bibliography ........................................................................ 58

8. Appendices ......................................................................... 61
  8.1 Appendix A: Antecedents of NPD speed ........................ 61
  8.2 Appendix B: Customer requirements checklist ................ 64
  8.3 Appendix C: Interview “Identifying root causes” ............ 65
  8.4 Appendix D: Correlations ............................................... 66
  8.5 Appendix E: Path-coefficients of PLS path modeling ........ 67
  8.6 Appendix F: Implementation plan ................................. 69
1. Introduction

Nowadays it becomes more and more important for companies to accelerate new product development (NPD) processes. The ability to reduce cycle time in new product development is increasingly viewed as a key to innovation success and profitability (Dröge, Jayaram, & Vickery, 2000, p. 24). Multiple advantages ensure that NPD acceleration is not only pursued by large multinationals, but also by small and medium enterprises (SMEs). One of the main reasons for NPD acceleration is to create first-mover advantages. Products which are the first in a market may be priced higher. Additionally, being the first in a market provides the opportunity to establish a dominant market share and to create customer loyalty. As NPD acceleration also entails significant cost benefits, speed has become increasingly important for managing innovation.

Given the multiple advantages development acceleration entails, more and more companies aim to speed up. A good way to speed up is by the elimination of delays in new product development processes. Although delays are not desirable for companies, it often occurs that processes are delayed. These delays can have multiple causes, varying from illness of project members to a lack of resources. But whatever the reason for the delays may be, delays can have serious consequences. First mover advantages can for instance be missed and costs can raise sky high. Therefore it is good to know how delays are caused and how they can be prevented. When this is known, development acceleration becomes more feasible for companies. This thesis aims to find the causes and effects of delays in an innovation trajectory, by performing an extensive data analysis within KPN. Since KPN is providing IT-services, the research is specifically conducted in a new service development (NSD) context. By doing so, the thesis contributes to both business knowledge and scientific literature.

1.1 Theoretical motive

There are many ways by which NPD can be accelerated. In academic literature the relationship between NPD acceleration and innovative performance has often been topic of interest. Here, a special focus on the effectiveness of different NPD acceleration techniques can be noticed. One of the earliest studies about decreasing NPD cycle time is of Millson, Raj & Wilemon (1992). In this study five basic approaches for NPD acceleration are distinguished; (1) simplify, (2) eliminate delays, (3) eliminate steps, (4) speed up operations and (5) parallel process. The approaches are common principles, but each company can choose how to adopt and implement it (Millson, Raj, & Wilemon, 1992).

This study focuses on the second approach for NPD acceleration distinguished by Millson et al. (1992); the elimination of delays. Eliminating delays seems to be easy, but in practice it shows to be very hard to eliminate delays. In order to effectively tackle delays, the root cause has to be revealed and this is exactly what makes it so hard to eliminate them. Delays can have multiple causes, each having their own consequences. A delay in the processing of NPD tasks may for instance be caused by a rigid decision-making process that is blocking progress, but also a limited availability of resources can hinder progression. Although general causes of delays are known, within current literature not many studies have specifically focused on delays. This is striking, as the consequences of delays can be disastrous. In contrast, more research has been performed to examine NPD speed. Delays are closely related to NPD
speed, as delays ensure that the total NPD cycle time exceeds the planned duration. Within literature the NPD cycle time is defined as “the time elapsed from the beginning of idea generation to market introduction” (Cankurtaran, Langerak, & Griffin, 2012, p. 1). Since increased speed is achieved by decreasing the development cycle time, delays are negatively affecting the NPD speed.

Delays can be seen as a part of NPD speed. Therefore some antecedents of NPD speed will also have an impact on the presence of delays. However, in current literature it is not often examined which antecedents of NPD speed can also be related to delays. Concerning the general antecedents of NPD-speed, it can be stated that many studies are performed to reveal drivers of fast development. One of the most comprehensive studies is the study of Chen, Damanpour & Reilly (2010). In this study a meta-analytic review is performed to reveal most significant antecedents of NPD speed. The results of this study show that goal clarity, process formalization, concurrency, iteration and team experience are important determinants for NPD speed. Missing formal procedures, rules or disciplines makes it hard to perform tasks quickly and make adequate decisions. This is also found by Tatikonda & Rosenthal (2000), who show that “effective product development execution requires organizational flexibility within a structure” (Tatikonda & Rosenthal, 2000, p. 417). The lack of this and other prior antecedents may decrease NPD speed.

When companies experience a delay in their innovation projects, not only the cycle time is affected, but also costs and quality are influenced. Within literature, time, cost and quality are often seen as three interrelated NPD objectives. Though, mixed findings are revealed about the degree of this interrelatedness. For instance the studies of Calantone & Di Benedetto (2000) and Kessler & Bierly (2002) find a positive relationship between innovation speed and product quality. As the speed increases, product performance can be boosted. In contrast, the study of Sethi (2000) shows that because of time pressure, team members may be forced to consider a narrow range of decision alternatives and therefore the product quality may suffer. Also for the relationship between time and cost, mixed findings are revealed in literature. Here, the study of Langerak, Hultink & Griffin (2008) shows that development cycle time has a U-shaped relationship with development costs. In contrast, the study of McNally, Akdeniz & Calantone (2011) reveals that development costs are positively associated with speed to market. It is thus not clear whether a delay, and an increase in NPD cycle time, positively or negatively affects the eventual project costs and quality.

Especially within the context of new service development (NSD) it is remarkably that very few studies are focused on revealing the causes and effects of delays specifically within NSD. Services are often referred to as intangible, heterogeneous, simultaneously produced and consumed and perishable (Jong & Vermeulen, 2003). Given these characteristics, services are quite different from products and therefore the effects of delays may differ within NPD vs. NSD context. In the study of Papastathopoulou & Hultink (2012) an overview is created of the NSD literature in the period between 1982 up till 2008. Here it is noticed that the majority of articles focused on critical success factors of NSD. There is however still a lack of cross-disciplinary research that combines expertise in innovation management with expertise in operations management (Papastathopoulou & Hultink, 2012).
Given previous information it can be stated that there is a clear need to clarify the distinction between speed and delays. Here, mainly the antecedents of NPD speed that also relate to delays are underexposed. Besides, up till now literature did not provide a clear view about the exact effects of delays. There is especially a lack of findings in the context of new service development. Therefore the scientific aim of this paper is to contribute to literature by examining the direct effects of the delays on cost and quality within a NSD context. By conducting an empirical analysis a clear view can be established about how delays are affecting cost and quality. Additionally it will be examined how delays are caused in practice. This way, important antecedents for delays can be revealed.

1.2 Practical motive
As stated previously, the research is conducted at KPN. By providing customers with (mobile) telephony, internet and television, KPN has become one of the leading suppliers of telecommunications- and IT-services in the Netherlands, both in B2B as in B2C markets. Though, as competition is increasing and more and more services are rapidly set in the market, KPN has to fight for its incumbent position in the market. Obviously, this concerns the establishment of a faster new service development process.

Nowadays, innovation has a fundamental position in KPN’s perspective on growth. However, the incremental and radical innovations currently processed by KPN are not fast enough entering the market. This above-average cycle time of newly developed services has multiple causes. One of the main causes of the long cycle time is the strictly formalized decision-making process within KPN. KPN needs to find a balance between risk and control, meaning that KPN maybe can let go some of the policies in order to reduce time-to-market. However, this can only be done to a certain extent, since rules imposed by the government have to be complied anyway. Therefore a solution has to be found wherein the NSD process is formalized in such a way that a shorter time-to-market can be guaranteed.

Besides the formalized decision-making process, other causes ensure that NSD takes too much time. The dynamic and rapidly changing environment of KPN is for instance another generic cause of the long cycle time. Though many other generic causes of the long NSD process are known, the exact and specific causes of delays in the time-to-market are unknown. It is not clear which projects have taken most time and have experienced much delay. Furthermore, the consequences of these delays are even less well-known. Revealing the exact reasons for delays in the time-to-market and relating the delays to the consequences for cost and quality will be very helpful in improving the competitive position of KPN. By providing insights in the time-to-market and by revealing the specific causes for delays, KPN can use this paper to restructure the NSD processes and shorten the time-to-market.

1.3 Research design
The logic followed throughout this business problem solving (BPS) project is based on the design-oriented approach developed by Aken, Berends & Bij (2007). This approach is chosen because KPN defined the problem in
terms of a desired output that is currently not available, namely a shorter time-to-market. There is thus no need for a diagnosis, but only of a further analysis and justification of the need for that output. In order to perform this analysis well, a lot of descriptive information about the current situation is required to make the design match the current circumstances (Aken, Berends, & Bij, 2007). The eventual focus of the research will be on developing and evaluating a design for the specific problem. However, first a well-structured problem analysis has to be performed. This problem analysis will be structured by the use of the ‘reflective cycle’. The core of this reflective cycle is reflection. By reflecting on the results of the business problem-solving activity, people can learn and use the knowledge in future projects (Aken, Berends, & Bij, 2007). In Figure 1 the reflective cycle is shown. The green part refers to the reflective cycle. As can be seen, since the blue part refers to the regulative cycle, the regulative cycle is part of the reflective cycle. The regulative cycle ensures a structured problem solving process.

1.4 Outline
Figure 2 shows how the remainder of this paper will be structured. First of all, in Chapter 2 a specific literature review is performed. Here various antecedents of NPD speed, causes of delays, and research related to the effect of delays on costs and quality is discussed. The trade-offs that need to be made when eliminating a delay will also be extensively elaborated. Then, in Chapter 3 the methodology of the research is elaborated. This methodology not only includes the specific case selection and description, but also the methods of analysis are explained. Related to the methods of analysis are the actual actions taken in the problem solving process. As follows, in Chapter 4 the actual empirical analysis will be performed and elaborated. In Chapter 5 the analytical findings are taken as the point of reference for the creation of a solution design. This solution design is a redesign of the current NSD process of KPN. Finally in Chapter 6, limitations of the current research will be given and by reflecting on the current research directions for future research are established.

Figure 2: Paper outline
2. Theoretical background

In this chapter a literature review will be performed in order to find out what is already known about the topic chosen for this master thesis. It showed that speed and delays in NPD processes are well-known phenomena in academic literature. However, the main focus within current literature is on NPD speed, whereas delays are much less often examined. To perform a literature study as comprehensive as possible, various aspects of speed and delays in NPD activities will be discussed in this chapter. As NPD speed and delays are different concepts, they will be discussed separately.

First of all, in the first paragraph NPD speed is approached from an organizational perspective. In this paragraph it will be examined how the method of NPD structuring affects speed. Especially the impact of the Stage-Gate process is discussed. After this first paragraph the organizational perspective is changed for a more operational perspective. In the second paragraph an overview of antecedents of NPD speed will be provided. As the research of this master thesis will be performed at KPN, a large IT-service provider, also special antecedents of new service development (NSD) speed will be revealed. Next, in the third paragraph the delays within innovation projects will be taken into account. Here, underlying concepts behind delays will be elaborated and antecedents of delays in NSD are proposed. As follows, in the fourth paragraph the effects of delays on common development objectives are topic of interest. Here hypotheses are developed for the new service development context. Eventually, in the last paragraph the conceptual model including the proposition and hypotheses is elaborated and visualized.

2.1 NPD structuring – portfolio management

Nowadays companies can choose among multiple methods by which they can structure the portfolio of new product development (NPD) projects. A good portfolio management of new product development projects is critical to new product success and therefore very important for a company. According to Cooper, Edgett & Kleinschmidt (2001) portfolio management is a “dynamic decision process, whereby a business’s list of active new product projects is constantly updated and revised” (Cooper, Edgett, & Kleinschmidt, 2001, p. 364). The objective is to make the “right” decisions in allocating scarce resources to the right projects at the right moment in time (Cooper, Edgett, & Kleinschmidt, 2001).

2.1.1 Stage-Gate model

Currently many companies are still using financial methods or the business strategy as the basis for allocating money across different types of projects. Also bubble diagrams, scoring models and check lists are popular methods for managing NPD projects. Although each of these methods is helpful in selecting the right projects, they do not help to drive new products from idea to market faster and with fewer mistakes. Therefore the Stage-Gate model is developed (Figure 3). The Stage-Gate model helps to

Figure 3: Stage-Gate model (Cooper R. G., 1990, p. 46)
continue the right projects, while at the same time it helps to improve the efficiency of the development activities. According to Cooper (1990), who developed the original idea behind the Stage-Gate system, Stage-Gate is both a conceptual and operational model for moving new products from idea to launch. It is a blueprint for managing new product development processes to improve effectiveness and efficiency. The basic idea is: “A development process is divided into a number of stages. Between each of these stages there is a quality control checkpoint or gate, serving as a “go/kill” decision on whether to continue with the project. A set of deliverables is specified for each gate, serving as quality criteria that the product must meet in order to proceed to the next stage. So, the stages are where the product is done; and the gates ensure that quality is sufficient” (Cooper R. G., 1990, p. 46).

There is no uniform way in which the Stage-Gate model is implemented within companies. However, because the decision-making process of the Stage-Gate model is quite rigid, often company-specific adjustments are made to speed up the process. This is for instance shown by the study of Ettlie & Elsenbach (2007), which found that “firms modify their formal development regimes to improve the efficiency of this process” (Ettlie & Elsenbach, 2007, p. 20). Here, the Stage-Gate model is one of the most often modified development models. Modifications can be made with regard to the number of gates, the formalization of the stages and gates, etc. These modifications are very company-specific, as they imply personal trade-offs between cost and quality (Ettlie & Elsenbach, 2007).

Two recommended modifications to the original Stage-Gate model, is the implementation of many feedback loops and the overlap of stages (Hauser, Tellis, & Griffin, 2005). Including many feedback loops is also referred to as a spiral process. The idea behind the spiral process is that the product development team quickly goes through the stages from idea to testing. By putting a premium on speed, the team is forced to get engineering and market feedback quickly and often. As the product ‘spirals’ towards completion, the entire process is repeated many times and many feedback loops are conducted (Figure 4). This improves not only the NPD cycle time, but also the NPD quality (Hauser, Tellis, & Griffin, 2005). The original idea behind the spiral model is already developed in 1986 by Boehm (1986). He characterized the spiral model as “a concept that each cycle involves a progression that addresses the same sequence of steps, for each portion of the product and for each of its levels of elaboration, from an overall concept of operation document down to the coding of each individual program” (Boehm, 1986, p. 65).

The aim of overlapping stages is similar to that for spiral processes; greater speed and more rapid feedback (Hauser, Tellis, & Griffin, 2005). An example of overlapping stages is the testing of product ideas before fully released from previous stages. By implementing overlapping stages, products can be brought more rapidly into the market and feedback helps to decide whether the project can be continued or not. The overlapping stages are part of the Third-Generation Stage-Gate Process. The emphasis of the Third-Generation Stage-Gate Process is on speeding up an already effective stage-gate process and on more efficient allocation of development resources. This acceleration is ensured by
flexibility, fuzzy gates, permitting conditional Go decisions and allowing overlapping stages (Cooper R. G., 1994).

Previous information shows that there are multiple methods by which the management of NPD projects can be structured. Each of these methods has an impact on the NPD speed. There are however more direct antecedents of this NPD speed. These direct antecedents of NPD speed will be elaborated in the next paragraph.

2.2 New product/service development speed

Before continuing with the antecedents of NPD speed, it is important to make a clear distinction between the concepts of NPD speed versus delays within NPD projects. As previously mentioned, NPD speed and delays are not similar. For instance, increasing NPD speed does not necessarily mean that delays are eliminated. In literature, NPD speed is defined as “the ability to move quickly from ideas to actual products” (Kessler & Bierly, 2002). “Increased speed is achieved by decreasing development cycle time, which is the time elapsed from the beginning of idea generation to market introduction” (Cankurtaran, Langerak, & Griffin, 2012, p. 1). A delay is defined as “when the time taken to launch the product or service innovation exceeds the planned duration” (Chryssochoidis & Wong, 2000). Delays are thus actually a kind of ‘part of NPD speed’; the slack is a part of the total NPD cycle time. Therefore, when looking at the antecedents of NPD speed, not all antecedents of NPD speed are antecedents of delays. Given this information, NPD speed and delays denote to different concepts and have to be analyzed separately. As follows, first the antecedents of NPD speed will be elaborated. In the next paragraph, the causes of delays are taken into account.

2.2.1 Antecedents of NPD and NSD speed

In current literature, multiple studies are performed to reveal the drivers of faster product development, also called the antecedents of NPD speed. One of the most comprehensive studies is the study of Chen, Damanpour & Reilly (2010). In this study a meta-analysis is performed to reveal the most important antecedents of new product development speed. In total 70 studies are taken into account in this meta-analysis. The antecedents revealed by the meta-analysis are grouped into four categories; strategy, project, process and team. Remarkably no significant antecedents are found in the project-category. Although the study of Chen et al. (2010) seems to be comprehensive, several important findings are not included in this study. For instance in the study of Parry, Song, Weerd-Nederhof & Visscher (2009) and in the study of Kessler & Chakrabarti (1999), other significant antecedents are revealed. Also in the forthcoming study of Cankurtaran, Langerak & Griffin (2012), some additional significant antecedents of new product development speed are found. In order create a comprehensive understanding of the most important antecedents of development speed, in Appendix A an overview is presented that shows per category the most significant antecedents revealed across different studies. As the antecedents revealed by Cankurtaran, Langerak & Griffin (2012) are more detailed antecedents related to those discovered in the study of Chen et al. (2010), the detailed antecedents are subdivided under the general names of Chen et al. (2010). Only of the general concepts a definition is provided. As follows the main antecedents of speed will be discussed along the categories developed by Chen et al. (2010). Since the research of this master thesis will be conducted in a service context, in addition
specific antecedents of speed within the context of new service development (NSD) will be highlighted. These antecedents are also shown in the overview presented in Appendix A.

2.2.1.1 Strategic antecedents
Concerning the strategy-category, especially goal clarity is an important antecedent of development speed. Goal clarity is the extent to which the vision, mission, goals and definition of an NPD project are clear to project team members. NPD acceleration can only be achieved when there is a clear vision about the goals being pursued. A mission and related objectives provide focus and avoids changing directions (Chen, Damanpour, & Reilly, 2010). Besides, a limited scope of a project helps to remain focused. Prior results are underlined by the study of Kessler & Chakrabarti (1999). In this study it is found that clear time-goals have a significant positive impact on NPD speed. Furthermore, goal clarity helps to define an effective acceleration approach, which in turn also helps to speed up NPD (Kessler & Chakrabarti, 1999). Within the context of new service development, goal clarity is also an important determinant of NSD speed. The research conducted by Lynn, Reilly & Akgün (2000) included both product and services-related projects. The results of this study show that for both products and services vision clarity and stability allowed for a higher development speed. When a project team allows the vision to change and grow, the scope of the project expands and the cost and time required can increase drastically. In case the goal is stable, the team will be more likely to reach market quickly (Lynn, Reilly, & Akgün, 2000).

In addition it shows that top management support and the availability of resources are important antecedents of speed in both product and service development context (De Brentani & Kleinschmidt, 2004). In case senior management has a favorable attitude and commitment towards NPD acceleration, it is much easier to achieve NPD acceleration initiatives. According to Swink (2003) top management support facilitates the provision of adequate resources and additionally it motivates team members to take responsibility and tolerate risk (Swink, 2003). In case top management thus supports NPD initiatives, it is less likely that the project will suffer from a lack of budget and changing priorities.

Finally, the innovative climate is an important antecedent of both NPD and NSD speed (De Brentani & Kleinschmidt, 2004) (Parry, Song, Weerd-Nederhof, & Visscher, 2009). By stimulating entrepreneurial endeavors, employee’s engagement and enthusiasm is stimulated, which subsequently reduces the time needed to accomplish development tasks. Therefore an innovative climate is beneficial for increasing speed.

2.2.1.2 Process antecedents
With regard to the process-category, the most important antecedents of NPD speed are process concurrency and iteration. Process concurrency speeds up activities because the activities are performed in parallel and cooperation ensures less tension between various departments (Kessler & Chakrabarti, 1999). Besides, overlapping activities provide the opportunity to timely address and improve potential problems in the product (Eisenhardt & Tabrizi, 1995). Related to process concurrency is iteration. Iteration is the process of building and testing a prototype in an NPD initiative (Chen, Damanpour, & Reilly, 2010). By prototyping, potential errors can early be discovered and the improved understanding of the product eventually may lead to NPD acceleration (Eisenhardt & Tabrizi, 1995). For
services, there is no evidence that process concurrency is also a significant antecedent of NSD speed. Though, iteration and learning are also affecting the service development speed. Especially learning does positively impact speed-to-market, as teams that learn are more likely to innovate faster and better (Lynn, Reilly, & Akgün, 2000).

Furthermore, process formalization is in both NPD and NSD an antecedent of development speed. Process formalization reduces miscommunications, eliminates non-value-added activities and improves the project flow and therefore formalization significantly helps to increase speed (Froehle, Roth, Chase, & Voss, 2000). Although process formalization is thus beneficial for both products and services, it is remarkably that producers of manufactured goods are statistically more likely to implement process formalization than service providers are (Griffin, 1997). Service providers often make use of informal control mechanisms, whereas manufacturers implement Stage Gate to a larger extent (Griffin, 1997).

Finally, with regard to the antecedents of speed, IT usage appears to be mainly important in the context of new service development. Information Technology (IT) usage facilitates innovation by enabling rapid communication and feedback, reducing errors and redundancy and streamlining service design processes. Besides, IT ensures timely access to accurate information, which positive influences the NSD speed (Froehle, Roth, Chase, & Voss, 2000) (Barczak, Hultink, & Sult, 2008). This influence of IT-usage is not yet found in NPD.

### 2.2.1.3 Team antecedents

The final category of team-antecedents contains most significant antecedents of development speed. For new product development, team leadership, experience, dedication and internal integration, have the greatest effect on speed. Strong team leaders are able to overcome organizational resistance and can communicate effectively. Together with a high level of experience and dedication, an effective and rapid new product development process can be ensured (Chen, Damanpour, & Reilly, 2010). Besides, internal cooperation has a significant impact on NPD speed. This internal integration helps to create a common-value-based focus (Eisenhardt & Tabrizi, 1995). Such a common-value-based focus can be best achieved by creating a longer tenure among team members (Kessler & Chakrabarti, 1999). Also in the context of new service development, internal integration appears to be an important antecedent of NSD speed. Mc Donough (2000) shows that the integration of different functions promotes closer and more frequent communication between different departments. This is an important means of speeding up development activities (McDonough, 2000). However, in service context leadership is less important (Griffin, 1997). Though, commitment of team members (De Brentani & Kleinschmidt, 2004) and external integration are also important antecedents for new service development speed. In particular the involvement of customers within development activities positively affects NSD speed. Continuously seeking customer feedback during development validates and confirms the product design and thereby minimizes the probability that last-minute changes need to be processed. This reduction of last-minute changes ensures that speed can be increased (Carbonell, Rodríguez-Escudero, & Pujari, 2009).

Previously, the main antecedents of both NPD and NSD speed are discussed. An overview of these and additional antecedents is provided in Appendix A. As follows, the concepts behind delays in development activities will be elaborated.
2.3 Delays in new product/service development

As explained previously, NPD speed is influenced by the presence of delays. A delay can ensure that a project cannot be finished within the planned duration. This can have serious consequences; a delay may even lead to product failure. Obviously, as a delay is a part of the NPD speed, some antecedents of NPD speed will also have an impact on the presence of delays. However, current literature does not provide a uniform view about which antecedents of NPD speed can also be related to delays. Therefore in the next section some general concepts behind delays will be discussed and antecedents of NPD speed will be related to these concepts. Unfortunately, very little research has been conducted to reveal causes of delays specifically in new service development context. Given the elaborated findings in this paragraph, a proposition is made concerning the antecedents of delays within a new service development context.

2.3.1 The planning fallacy

One of the most important causes of delays within NPD projects is the planning fallacy. The planning fallacy refers to the underestimation of development time at the initiation of projects. This underestimation of development time is caused by a combination of two factors; in the project’s early phases, workload is typically underestimated and the size of the development team is typically overestimated (Oorschot, Sengupta, Akkermans, & van Wassenhove, 2010). Regarding the underestimation of workload, it can be stated that managers often tend to underestimate the project size and complexity, because they only focus on the highly visible components and thereby missing the less visible components. Besides missing the less visible components, customers can also change or add requirements. An early definition or specification might thus result in a firm becoming locked into an incorrect definition (Oorschot, Sengupta, Akkermans, & van Wassenhove, 2010, p. 831). This incorrect definition can cause many delays later on in the development process.

The other determinant of the planning fallacy is the overestimation of the development team. Overestimation of the development team refers to the fact that the effectiveness of a project team initially does not meet the expected performance level. Due to several types of delays that come into existence when ramping up a project team, the performance level is lower in the early development phases of a project. In the study of Oorschot et al. (2010) four types of these delays are discussed. First there is the hiring delay. A hiring delay refers to the time it takes to hire a team member from outside, including job interviews and salary negotiations. Second, there is an assimilation delay, which relates to the time it takes for a new team member to become as productive as the experienced team members. The third delay explained by Oorschot et al. (2010) is the reallocation delay. A reallocation delay refers “not only to the time it takes for the firm to reallocate resources from other, delayed projects but also to the time it takes for team members to disengage physically and mentally from their previous projects. Most projects end up being behind schedule and this leads to longer reallocation delays and sometimes to postponement of the next project” (Oorschot, Sengupta, Akkermans, & van Wassenhove, 2010, p. 831). Finally a turnover delay causes an overestimation of the development team, implying the time that team members remain with the firm or continue with the same project. Due to the planning fallacy, caused by the underestimation of workload and the overestimation of the development team, many NPD (NSD) projects are likely to start with a false start and therefore are rapidly running out of budget.
2.3.2 Fire fighting
Another important reason for delays in development activities is the presence of development errors. In the study of Repenning (2001) it is shown that high project complexity and newness are important causes of development errors that are in turn slowing down development activities. Development errors are often solved by allocating engineers and other resources that can fix problems late in a product’s development cycle. This allocation of scarce resources to solve unanticipated problems is called fire fighting (Repenning, 2001). Fire fighting is however very costly and is prone to become part of a vicious cycle. This latter refers to the fact that managers do not learn to manage rework-situations well. In the study of Repenning (2001) it is for instance shown that managers overweight the short-run positive benefits, while ignoring the long run, negative consequences. Therefore, managers do not learn to overcome the undesirable dynamics that rework creates, and so rework remains an important cause of delays (Repenning, 2001).

2.3.3 Other reasons for delays
Although not many studies are performed that focus especially on delays in development activities, there are some more reasons for delays besides the planning fallacy and rework. Related to the planning fallacy is the instability of product specifications and project scope. In the study of Cooper & Edgett (2008), the importance of a clear product definition is underlined. In case the product is not clearly defined and requirements are not specified, many delays can be expected. A change in requirements can have multiple causes, for instance the customer did not know what he wanted beforehand, or he changed his mind as the product evolved or the project team did not listen very well, or a competitive product was introduced. When requirements are changed during the latter stages of the development process, the whole schedule is changed and this often causes a delayed launch. Therefore, according to Cooper & Edgett (2008), unstable product specs and project scope are two of the main causes of significant project delays.

The study of Chryssochoidis & Wong (2000) reveals that insufficient availability of delivery channels and marketing personnel and funds for the innovation, delays the launch of an innovation. Another important cause of delays revealed by this study is the lack of proficient execution of (pre)development activities. Preparation and smoothly execution of development activities are valuable in avoiding delays (Chryssochoidis & Wong, 2000).

Finally, uncertainty is another cause of delays. Many companies are nowadays operating in a dynamic and rapidly changing environment, which causes a high degree of technological uncertainty. This technological uncertainty requires extra work, as alternative conceptual solutions need to be developed. Also new, advanced technologies which may offer improved performances are often disregarded, as they make the product development process more risky and challenging. Disregarding these new technologies can however ensure much delay in the product development process as competition may rapidly proceed by using them instead (Krishnan & Bhattacharya, 2002).

Overall it can be noticed that the speed-antecedents of goal clarity, top management support, project complexity, and iteration and team experience also seem to be important antecedents of delays. For instance, lack of support in budget or unclear goals or lack of test results all may cause a lot of rework
and thus delays. Although project complexity did not appear to be a significant antecedent of NPD speed (Chen, Damanpour, & Reilly, 2010), given the prior literature about the planning fallacy and rework it is expected that complexity is a significant antecedent of delays. As the prior elaborated concepts behind delays also seem to be applicable in the context of NSD, the following proposition is made:

**Proposition 1:** “Goal clarity, top management support, project complexity, iteration/learning and team experience are important antecedents of delays within NSD-projects”

As now all antecedents of both NPD speed and delays have been elaborated, as follows the relation of speed and delays with common NPD / NSD objectives are discussed.

### 2.4 The effects of delays

In new product development, not only time-to-market, but also product cost and quality are determining product success (Tatikonda & Montoya-Weiss, 2001). As it is hard to cover all three objectives in an equal degree within NPD, often trade-offs are made between time, cost and quality (Oorschot, Langerak, & Sengupta, 2011). These trade-offs are however complicated, because the three NPD-objectives are highly interrelated. This interrelatedness is especially visible when experiencing a delay in NPD; the delay not only affects time, but also cost and quality. In the following sections, different findings regarding the prior interrelatedness will be elaborated. As an increase in cycle time and a decrease in speed denote the same concept, the two terms will be used interchangeably.

Furthermore, the effects of delays specifically within the new service development context will be hypothesized. In current literature this service-context is not often taken into account. A good example that illustrates prior statement is the meta-analysis of Cankurtaran et al. (2012). In this meta-analysis 56 studies are included, of which only 8 also examined service-related projects. Within these 8 studies, the main focus was more on revealing the antecedents of NSD speed, instead of the effects of delays. Given the lack of research in the NSD-area, the hypotheses concerning the effects of delays within a NSD-context are valuable for current literature.

#### 2.4.1 Speed – Cost

In case a NPD project is delayed, the speed is decreased. In current literature conflicting viewpoints exist regarding the effect of this decrease in speed on development costs. Here, development costs are defined as “all the monetary and human resources needed to develop a new product” (Cankurtaran, Langerak, & Griffin, 2012, p. 8). On the one hand, it has been argued that delays are costly, as high speed ensures low development costs. For instance, according to Kessler & Bierly (2002), fast product development ensures more intense communication, which in turn increases efficiency. Also in the study of Brown & Eisenhardt (1995) the improved communication between team members is emphasized. When speed is promoted by overlapped phases, testing and iteration, also team communication, cohesion and learning is fostered (Brown & Eisenhardt, 1995). Subsequently, the intense communication reduces costly work redundancy, errors and recycling and therefore faster speed can be linked with reductions in costs (Kessler & Bierly, 2002). Also the study of Kessler & Chakrabarti (1996) revealed a positive relation between cycle time and costs. Here, it is revealed that fast product development promotes efficient resource use, because there is less time for peripheral activities and the number of man-hours is limited (Kessler & Chakrabarti, 1996) (Eisenhardt & Tabrizi, 1995). According to Davis,
Dibrell & Janz (2002) shorter cycle times require lower levels of inventory and working capital and therefore a reduction of cycle time reduces costs and boosts productivity (Davis, Dibrell, & Janz, 2002).

Contrary to prior studies, there are also studies that reveal that an increase in speed also increases project costs. A good example of this is the study of McNally, Akdeniz & Calantone (2011). In this study it is found “development expenses support speed to market in their association with shorter manufacturing phases while at the same time contributing to reduced manufacturing expenses” (McNally, Akdeniz, & Calantone, 2011, p. 67). In addition to this argument, Kessler & Chakrabarti (1999) show that an increase in speed requires more resources, since increased speed can only be achieved by a special project team composition, which is managed in a thoughtful way (Kessler & Chakrabarti, 1999). Furthermore, increasing speed is often managed by eliminating critical process steps, which may result in costly mistakes (Murmann, 1994).

Besides the prior contradicting views, literature also includes intermediate viewpoints. A good example of such a study is the study of Langerak, Hultink & Griffin (2008). The key results of this study show that development cycle time has a U-shaped relationship with development costs. This U-shaped relationship implies that there may be an “optimum” cycle time that minimizes development costs and maximizes product profitability (Langerak, Hultink, & Griffin, 2008). This U-shaped relationship is consistent with the findings of Bayus (1997), who found that there is an optimal development time when considering development costs (Bayus, 1997).

Overall, there is thus no unequivocal answer about whether a delay increases projects costs. Though, given the convincing findings of Kessler & Chakrabarti (1996) and Davis et al. (2002) and as it seems to be common sense that a delay increases costs, the following hypothesis is made for the new service development context:

**Hypothesis 1**: “A delay within a NSD-project increases the project costs”

### 2.4.2 Speed – Quality

Also concerning the relation between speed and quality, literature includes mixed findings. In general, quality is defined as the conformance to requirements (Parasuraman, Zeithaml, & Berry, 1985). A high quality is achieved when the product is able to perform its primary required functions. As the development speed increases, quality is affected. According to Calantone & Di Benedetto (2000) this relationship between speed and quality is positive. As the speed increases, product performance can be boosted. Especially by the use of overlapping stages, development activities can be fine-tuned, and this increases the overall quality (Calantone & Di Benedetto, 2000). Eventually this increased quality enhances profitability and sales. Also Kessler & Bierly (2002) find a positive relation between innovation speed and product quality. The results of this study show that speed improves the accuracy of forecasting and thus increases customer fit (Kessler & Bierly, 2002).

Contrary to prior studies, the study of Sethi (2000) shows that because of time pressure, team members may be forced to consider a narrow range of decision alternatives and may not be able to think deeply about the various ways to build superiority into the product. The time pressure can also make it difficult for team members to create a common-based understanding about the new product (Sethi, 2000).
Besides, as increasing speed is often managed by eliminating critical process steps, crucial mistakes are likely to happen (Murmann, 1994).

As an intermediate to previous studies, the study of Lukas & Menon (2004) demonstrates that new product development speed has an inverted U-shaped effect on new product quality. This means that too little as well as too much NPD speed has a negative effect on new product quality (Lukas & Menon, 2004).

Taken previous information together, there is no consensus about how a delay in NPD, which slows down the innovation speed, affects new product quality. Given the convincing reasoning behind the results of the study of Sethi (2000), the following is hypothesized:

**Hypothesis 2**: “A delay within a NSD-project increases the eventual service-quality”

### 2.4.3 Cost – Quality

Within the interrelatedness between the NPD objectives, not only speed is interrelated with cost and quality, but also cost and quality are interrelated. Also about this relationship no clear view is reached within literature. In addition, the number of studies mainly focused on this relation is remarkably low. One of the few studies that take into account the effect of development costs on product quality is the study of Calantone & Di Benedetto (2000). In this study it is stated that for boosting the performance level, additional resources are required. Logically, it is obvious that for the development of a product which needs to fulfill complex customer requirements, more development resources are necessary. However, according to Davis et al. (2002) a reduction of cycle time may enhance productivity, and therefore under time pressure, a high quality may be reached with an equal amount of resources. This latter finding suggests that the relation may change under different circumstances. Though, as it seems obvious that an increase in budget will increase quality, the following is hypothesized:

**Hypothesis 3**: “As project costs are increased, the eventual service-quality is also increased”

### 2.4.4 Trade-offs

As all relationships between speed, cost and quality are discussed, it is known how a delay, or decrease in speed, affects the three NPD objectives. In case of experiencing a delay, companies need to choose which of the objectives they value most. One of the few studies that covers the exact trade-offs that can be made between speed, cost and quality is the study of Oorschot, Langerak & Sengupta (2011). In this study the effect of four trade-offs on profitability is examined. As follows, each of the four trade-offs will be elaborated.

- First, when discovering a delay, the project team can choose to **do nothing**. This refers to the situation where the project team simply continues their work with the original team size and project specifications. Project teams that choose this option are often afraid of “losing face” if specifications are changed. This is also called escalation of commitment (Oorschot, Langerak, & Sengupta, 2011).
- Second, when discovering a delay, a project team can value **time** most. In case time is most important, the project team still wants to enter the market on time, but realizes that this is not going to be achieved when continuing in the same way. Therefore an intervention such as increased
team size has to be taken to speed up the project. Here the trade-off involves time versus costs. Increasing speed will decrease the development time, but increases costs (Oorschot, Langerak, & Sengupta, 2011).

- Third, when discovering a delay, a project team can value costs most. When costs are most important, the project team still wants to stay within budget and will try to manage the development time in a way that minimizes development costs. This can be done by reducing the product’s quality, which lowers the overall workload and development time. Here, the trade-off involves costs versus quality. Reducing quality will lower development time and costs, but lowers the eventual product performance (Oorschot, Langerak, & Sengupta, 2011).

- Finally, when discovering a delay, a project team can value quality most. In case quality is most important, it does not matter that the project is running out of time and budget. The time and costs are tried to be ignored, as the attractiveness of the product is boosted. Here, the project teams embraces change and perceive the delay as an opportunity to increase product performance. The trade-offs involves quality versus time and costs. Increasing quality will increase time and costs, but enhances the eventual product performance (Oorschot, Langerak, & Sengupta, 2011).

Looking at the impact of the prior trade-offs on profitability, it shows that the effectiveness of the trade-offs depends on the temporal stage of the NPD process. “If the delay is detected before two-thirds of the scheduled development time has elapsed, the best intervention is to focus on quality. It is not beneficial to reduce development costs or speed up the process at this stage.” (Oorschot, Langerak, & Sengupta, 2011, p. 860) Quality can be best achieved by increasing the product performance, but this requires additional resources. Therefore the best intervention increases simultaneously the level of product performance and team size. By doing so, not only development costs raise, but also new product sales and profits are enhanced compared to the other decision heuristic scenarios (Oorschot, Langerak, & Sengupta, 2011). In contrast, when the delay is detected later, the only way to improve new product profitability is to focus on time and costs. Increasing the productivity and decreasing product performance are best to gain revenues (Oorschot, Langerak, & Sengupta, 2011). By launching the low-cost product as soon as possible, new product sales and profitability can be retained. This finding is in line with other studies, as it shows that time-pressured development teams are inclined to get the project back on track quickly by increasing team productivity and reducing workload (Lyneis & Ford, 2007).

2.5 Conceptual model

In this chapter an overview is presented about current literature focused on the causes and effects of delays within innovation projects. As delays are part of the development speed, also speed is extensively discussed. It showed that within current literature no clear answer is provided about which antecedents of speed can also be related to delays. Especially within the context of new service development this is unknown. Therefore a proposition is made with regard to the antecedents of delays within new service development projects. Besides, previous literature study showed that within current literature there is a lack of consensus with regard to the effects of delays on costs and quality. To clarify prior relationships, hypotheses are made about the interrelatedness between delays, costs and quality. In Figure 5 the hypothesized relationships are depicted. As can be seen, the cycle times are not separately put into the
model. As delays are in fact an increase in development cycle times, the cycle times are incorporated in the variable “NSD Project Delay”. Since the research is conducted in a new service development context, in the remainder of this paper the focus will be on NSD (instead of NPD).

Figure 5: Conceptual model
3. Methodology

In this chapter the general methodology for the research will be elaborated. In the first paragraph the selection process of the case will be discussed and a clear description of the case will be given. In the second paragraph the exact problem will be defined. Then, in the third paragraph the methods of analysis will be elaborated. Here the data collection methods and analysis methods are elaborated.

3.1 Case selection & description

3.1.1 Company description

KPN is one of the leading suppliers of telecommunications and IT-services in the Netherlands. KPN provides customers with (mobile) telephony, Internet and television. Target markets not only include consumers, but also the business and wholesale market is targeted. For business customers, KPN offers complete telecommunications and IT-solutions. Currently KPN is not only active in the Netherlands. Besides the Dutch market, Germany, Belgium, France and Spain are part of KPN’s scope.

Looking at the history of KPN, we have to go back to the 1st of January, 1989. It is then when the Dutch government decided to change the “Staatsbedrijf der PTT” into the “Koninklijke PTT Nederland” (KPN). Whereas the previous company was mainly focused on telegrams and telephony, the newly created company was more directed towards internet and telephony. In 1998 KPN was split up into PTT post and PTT telecom, where PTT telecom became the Royal KPN NV. Almost at the same time the monopoly KPN always had experienced ended, as the government liberalized the market. Because of the liberalization of the whole European telecommunication-market, the market share of KPN inevitably decreased. In response, KPN developed new strategies. Internet, mobile telecommunication and customization became more important than ever before. Until 2006 KPN had a hard time in keeping up with the competition, but when in 2005 the confidence returned, KPN started to make profit again. In 2008, KPN announced a new phase in their strategies; “Back to growth”. With this new strategy KPN anticipated to the future challenges in the IT and telecom market (KPN, 2012).

Currently it is the ambition of KPN to maintain a top position between the best European telecommunication providers. Especially telephony is important to achieve this goal. In the Netherlands KPN holds a big portfolio of qualitative service brands, each serving a different target market. For instance Hi is focused on young people and KPN is targeting entire households. Also Telfort is an important brand for KPN, as this brand is competing on price. KPN serves furthermore not only the Dutch market, but is also active in foreign markets (Figure 6). In Germany and Belgium KPN is following a ‘multiple-brand’ strategy, including E-Plus and Base. With these brands, KPN holds a third position in the German and Belgian market. Besides, with iBasis, KPN owns an efficient IP-based infrastructure, by which worldwide multiple wholesale network services can be offered to other operators. From the 31st of December 2011, KPN served in total 44 million customers, of which 40.4 million phone customers, 2.5 million customers using the internet connection of KPN and 1.4 million television Customers. With more than 31 thousand FTE’s KPN obtained in 2011 a turnover of 13.2 milliard Euros (KPN, 2012).

In Figure 6, a division of the markets approached by KPN is shown.
As can be seen in Figure 6, one of the main markets of the Dutch Telco market is the Business Market, which consists of business customers. In the remainder of the master thesis this market is called KPN ZM, which is the Dutch abbreviation for Business Market (Zakelijke Markt). Not only telephony, but also other IT connectivity services are provided in this market. As communication is getting more and more important in the current society, the overall mission of KPN is to enrich work and leisure with extensive services in the field of communication. For the business market this mission is of high value, as especially this market is building upon a good communication system. Businesses related to medical care, education and safety projects are of societal importance and need a reliable and qualitative IT-service provider. Therefore KPN ZM is currently aiming at the provision of good advices and customized services. By doing so, KPN ZM is trying to become the leading provider and preferred supplier of IT-services in the Dutch Telco market.

3.1.2 Problem context
One of the main characteristics of KPN ZM is the severe competition. There is an upcoming trend in providing telecommunication and IT-related services and so KPN ZM is getting more competition from small, entering start-ups. Also the incumbents such as Vodafone and T-Mobile ensure a high degree of competition. The tough competition together with the economic situation in the Netherlands these days developed a sense of urgency. This means that KPN ZM feels kind of forced to accelerate towards future objectives. The development of new, simple services is thus important to maintain a good market position. In Figure 7 the division of the multiple departments within KPN ZM is shown. Especially the department of “Innovation and Programs” is involved in the development of the new and simple services. It is the task of this department to quickly develop new services. The time-to-market of these
new services has to be short, to be optimally competitive. This is however not easy as the innovative services have to comply by lots of rules and procedures.

![Figure 7: Departments within Corporate Market (Anonymous, 2011)](image)

Nowadays the innovations developed within the department of “Innovation & Programs” are structured by the use of a Stage-Gate process. As already explained in the previous chapter, the basic idea of the Stage-Gate model is that the development activities are performed within the stages and the checks performed at the gates ensure that quality is sufficient. In Figure 8 an overview is provided of the Stage Gate system that is currently used within KPN ZM.

![Figure 8: Overview of Stage Gate system of KPN ZM](image)

By implementing the above Stage-Gate process, the department of “Innovation & Programs” is forcing employees to work along a strictly formalized process. Although quality is being ensured by the use of this process, the process is very time-consuming. Given the numerous documents that need to be completed for each gate and the many people involved at each gate, big delays are experienced. These delays have to be eliminated, as time-to-market is currently too high. In order to reduce the time-to-market KPN ZM has set several design principles that serve as a guideline for the future. With these design principles KPN ZM is trying to maintain a competitive position in the market. Noticeable is that both of these design principles relate to a shorter time-to-market. In case the cycle time can be decreased, competition can be better defeated and KPN ZM’s position on the market can be maintained.
3.1.3 Case description
Given previous information, reducing time-to-market of the services developed at KPN ZM is the topic of interest for this master thesis. Here, a special focus will be on eliminating delays currently experienced within the NSD process of KPN ZM. Part of these delays is due to the current Stage Gate process. As KPN ZM is losing too much time by strictly obeying all Stage-Gate principles, another approach is needed to be developed. This approach can include guidelines by which the KPN ZM should deal with the Stage Gate process, but also other principles that can shorten the NSD cycle time can be included. This study aims to find the causes of delays and the effects on cost and quality. By knowing these direct impacts, it becomes much easier to prevent delays and to enhance the competitive market position of KPN.

3.2 Problem definition
As stated in the introduction, the reflective cycle of van Aken (2007) is used to structure the problem analysis. This reflective cycle includes the regulative cycle, which provides a structure for the actual problem-solving process. When looking at the current phase in the reflective cycle, it can be stated that the first step of choosing a suitable type of problem and related case has been performed. According to the regulative cycle, now a problem mess and problem definition has to be made. Therefore as follows the problem statement is given and a preliminary investigation of the problem is elaborated.

3.2.1 Initial problem statement
According to van Aken et al. (2007) the problem definition is a crucial part of the project proposal, as it forms the basis for the whole BPS project. To clarify the problem definition, often a problem statement is used. A problem statement refers to either a business performance that is unsatisfactory, or a state-of-affairs that is undesirable because it leads to lower performance. Based on previous information, this study deals with the following problem statement:

*Due to multiple delaying factors, the current cycle time of NSD projects within KPN ZM is too long.*

3.2.2 Preliminary investigation of the problem
In order to gain a more comprehensive and detailed view of the problem, ten short, explorative interviews are conducted with multiple employees of the department “Innovation & Programs” of KPN ZM. Currently this department is organized around four programs; A, B, C and D. Per program several projects are running. These projects are conducted in multifunctional teams. It is tried to interview at least one person per function (details in Table 1). The aim of the interviews was to get a better understanding of how employees experience the current time-to-market. This way, the interviews provided a good in-depth interpretation concerning the problem statement. As a result of the interviews, a problem mess and subsequently a cause and effect diagram are made. In Figure 9, the main causes of the too long time-to-market revealed by the employees are shown. These causes can be seen as delaying factors within the innovation projects of KPN ZM. The causes are categorized by the use of the categories of antecedents of development speed distinguished in the study of Chen et al. (2010).

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Date of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person 1</td>
<td>Business Consultant</td>
<td>22nd of February, 2012</td>
</tr>
<tr>
<td>Person 2</td>
<td>Project manager</td>
<td>23rd of February, 2012</td>
</tr>
<tr>
<td>Person 3</td>
<td>Quality manager</td>
<td>23rd of February, 2012</td>
</tr>
</tbody>
</table>
The causes revealed by the use of the interviews (Figure 9) are giving a general view of the problem statement. However, much more detailed information has to be gathered and analyzed in order to be able to develop an approach by which the time-to-market can be shortened and more important by which delays can be prevented. This information gathering and analysis has to be structured and therefore the following research questions are established.

1. **How well are NSD projects currently performed within KPN ZM?**
   a. What is the average cycle time of NSD projects performed within KPN ZM?
   b. What is the average delay of NSD projects performed within KPN ZM?
   c. What is the average project cost of NSD projects performed within KPN ZM?
   d. What is the average quality of NSD projects performed within KPN ZM?

2. **What are the causes for the excessive cycle time of NSD projects within KPN ZM?**

3. **Are the delays in the NSD projects having an impact on costs and quality?**
   a. Are time, costs and quality also interrelated?

4. **How should KPN organize the NSD process in order to shorten the cycle time of NSD projects?**
3.3 Methods of analysis
In this paragraph the research-approach will be elaborated. As the problem context is described and the related problem is already identified, now a concrete project approach is made. As follows the methods of analysis and research will be explained.

3.3.1 Project approach
A project approach exists of two parts; a conceptual project design and an operational project plan. The conceptual project design presents the outline of the project, whereas the operational project plan includes the elaboration of the line of work (Aken, Berends, & Bij, 2007). In the earlier paragraphs the conceptual project design already has been established. Now, the operational project plan still needs to be developed. This project plan is founded upon two components; a literature search and an empirical analysis of the business problem. The literature study performed prior to this research design provides the contents for the theoretical literature search of the first component. Though, the empirical analysis of the second component still needs to be performed. According to van Aken et al. (2007) this empirical analysis includes the unit of analysis, a description of the data collection process and a description of the data analysis process. As follows each of these components will be elaborated.

Unit of analysis
The overall objective of this study is to find a way by which the time-to-market can be reduced. As currently many delays are experienced within KPN ZM, a special focus is on the elimination of delays within NSD projects of KPN ZM. It will be examined how delays are caused and how they impact cost and quality. As much data related to this topic is available within KPN ZM, a clear focus has to be maintained in order to obtain the best and most applicable data. This clear focus is established by the choice for a unit of analysis. A unit of analysis is the type of object that is the focus of interest. Knowing what type of object is the focus of interest provides guidance and helps making a good selection of data.

- Critical incidents
  Critical incidents are the first unit of analysis chosen for this research. Critical incidents are events in which something went wrong, went nearly wrong or went particularly well (Aken, Berends, & Bij, 2007). In this research, the delays within the NSD process can be referred to as critical incidents. Taking these delays as unit of analysis, allows the use of the critical incident technique (CIT). This CIT is developed to obtain more insight in the execution of tasks by employees. By the use of the CIT more insight can thus be gained in the reasons behind the delays. Knowing these reasons makes it possible to identify ways to accelerate NSD.

- Project level
  Projects are the second unit of analysis chosen for this research. Within KPN ZM, the programs A and B include the most important projects. In total these two programs include about x projects. For a part of these projects it is known when a gate was or should be taken. Knowing this allows for a comparison of time schedules between different projects. From this comparison it can be concluded which steps in the process take much time and where the serious delays are hiding. As projects can be classified according to project budget, also a comparison can be made between different categories of projects.
Data collection

Only with a comprehensive and detailed analysis, optimal ways to eliminate delays can be found. In order to provide reliable recommendations, it is important that all relevant data is included in the analysis. This relevant data is collected in several ways. First, quantitative data is gathered by the use of direct observation and documentation. As mentioned previously, currently there are about x projects within the two programs of A and B. For a part of these x projects, the exact dates of taking a gate in the NSD process are known. These dates are available at FocalPoint, which can be entered by authorized employees of KPN. By determining the times between the gates, the duration of the time-to-market is decomposed. Besides the dates included in FocalPoint there is also data available at SharePoint. SharePoint contains all information about the contents of the projects. Knowing the content of a project helped to categorize the projects. Furthermore, reasons for possible delays could be found at SharePoint. Additionally, SharePoint contains the deliverables which are obliged to be handed in for each gate. Checking whether all deliverables are handed in at the right gate is also a source of information.

Besides the dates and contents of gates, also the project budgets and quality issues of projects were considered by the use of documentation. Currently it is noted in Focalpoint whether a project stayed within budget or not. Also the exact budget is tracked on Focalpoint. The quality issues are furthermore noted in the deliverables that are put on SharePoint.

The second way of data collection is more qualitative. When all the cycle times of the projects are known and analyzed, it had to be revealed why a project is processed in a certain way. For instance it needed to be known why exactly the project was delayed or why a project was running out of budget. In advance it was already known that the information at SharePoint was not sufficient to answer previous questions and therefore interviews with project managers are conducted. Additionally, although all quality issues should have been noted in the deliverables, it is generally known that this is not complete, and therefore also interviews are conducted to get to know all quality issues of the NSD projects. During these interviews more detailed information is obtained. The interviews were semi-structured, meaning that a list of specific questions is used, but there was sufficient room for additional information. This way underlying concepts and interpretations could be discovered.

Finally, comparing multiple projects with each other was the third way of data collection. Here the documentation part is of high importance. By comparing for instance the time consumed for completing a stage, categories of delays/inefficiencies are determined. Subsequently relationships between the various delays at each of the five gates are revealed. To do so, statistical software, such as SPSS, is used.

It has to be noticed that not all x projects could have been analyzed, as multiple projects are stopped or put on hold. As a consequence, these projects did not pass all tollgates and therefore do not form a complete dataset for this analysis. Furthermore, projects started before 20xx are not documented very well and thus not provided reliable data. Besides, there are many projects just started, and these projects cannot provide any data concerning the output in time, cost or quality. In addition, there were also many projects very bad documented; here at least one tollgate-date could not be traced. To deal with previous problems, a specific case selection is made, containing only those projects that provide
reliable data, which can contribute to a good analysis. This means that all stopped projects, projects on hold, projects started before 20xx and projects not further than DF are all excluded from the list. Eventually, 48 projects are selected; 35 of the program A and 13 of the program B.

Variables
All of the selected projects are analyzed using multiple variables. As this study aims to reveal the effects of delays on costs and quality, in total three variables are distinguished (Figure 5). The first variable is the “NSD project delay”. As mentioned previously the actual cycle time of a project consists of the planned cycle time plus the amount of delay. The overall planned duration of projects is calculated by adding up the times between the planned dates of taking each of the five tollgates. By comparing the planned dates with the actual dates at which a tollgate was taken, the total amount of delay could be determined. Eventually, the project delay is determined as the percentage at which the total planned duration of a project is exceeded; so \[ NSD \text{ project delay} = \frac{\text{Total delay}}{\text{Total planned duration}}. \]

The second variable is the “NSD project costs”. The costs of the projects are measured by the use of the project budgets that were documented in FocalPoint. In addition, a dummy variable was added, which represented whether a project stayed within budget or not. This dummy variable is defined as 1 if the project went out of budget and 0 when the project stayed within budget. It has to be noticed that the dummy-variable is only used for the descriptive statistics. So, in the analysis only the budget is included.

Finally, the third variable is the “NSD project quality”. The project quality is determined by the use of two measures. In literature, quality is defined as the conformance to requirements (Parasuraman, Zeithaml, & Berry, 1985). Given this scientific information, the conformance to requirements is included in the measure of project quality. The conformance to requirements is two-sided. KPN ZM has to deal with business-related requirements, as the government is obliging all telecom-companies to work along certain policies. Next to the business requirements, there are customer-related requirements (performance specifications). The conformance to the business-related requirements is measured by the use of a policy-check. This policy-check covers which policies a NSD project has to obey and whether this is done or not. Here, a percentage is calculated by taking the number of obeyed policies divided by the total number of to-obey policies. The conformance to the customer-related requirements is measured by the use of the 13-point Likert scale, also used by Kessler & Bierly (Kessler & Bierly, 2002). In this scale customer requirements are referred to as performance specifications. By asking project leaders to check one of the categories of this scale, the conformance to performance specifications is identified. In this scale the first 6 scales refer to a project that is not able to meet the preset performance specifications, a 7 indicates a project is meeting all the preset specifications and from 7 to 13 a project exceeds the preset performance specifications (Kessler & Bierly, 2002). As this scale is also used and validated in the study of Kessler & Bierly (2002), this scale is assumed to be very useful for this research. The exact measurement scale of performance specifications (customer requirements) can be found in Appendix B.

Data analysis
The focus of the analysis is on revealing underlying inefficiencies and delays in the Stage Gate process. Therefore the interpretation of data is the point of gravity in this analysis. The times between the gates and the delays in taking the gates, constitutes the basis of the analysis. As soon as the times were
known, more detailed information of the project managers is analyzed. This way a good overview of the current situation is obtained. Knowing the detailed information saved in the deliverables and other contents of the projects, helped to categorize the projects. Distinguishing between multiple categories of projects was very useful in understanding the relations between delays and type of projects. Besides, the information obtained by the deliverables and interviews, revealed the most important causes of delays. The causes mentioned in the Exception Reports are validated and complemented with the information obtained in the interviews. Prior information shows that a qualitative analysis is performed to find evidence for the antecedents of delays mentioned in Proposition 1. Whereas the causes of delays are revealed by qualitative analysis, the effects of delays are examined quantitative.

The effects of delays, Hypotheses 1, 2 and 3, are tested quantitatively by the use of PLS Path Modeling. PLS path modeling is suitable for this research, because it helps to estimate models with multi-item constructs. This means that PLS allows for formative variables, which are variables composed out of several independent indicators. Prior characteristic is in the case of this research very beneficial, as both delay and quality are measured by multiple indicators. In the conceptual model (Figure 5) it can be seen that quality is regarded as the eventual output variable. Quality is measured by the policy check and the requirements-check. By using PLS, these measures do not have to be combined to create data for one dependent variable. Also the delays at each gate can be taken into account separately, but still within the same model. Besides, it is more likely that PLS finds more significant relationships compared to for instance multiple regression analysis. This is because multiple regression analysis estimates relations between individual variables, whereas PLS estimates relations between multi-item constructs.

Concerning the sample size, according to Henseler, Ringle & Sinkovics (2009), PLS path modeling avoids small sample size problems and can therefore be applied in situations where other methods cannot. In the case of this research, the 48 cases are thus not a problem, which makes PLS even more suitable. Additionally, PLS path modeling makes less stringent assumptions about the distribution of variables and error terms (Henseler, Ringle, & Sinkovics, 2009, p. 283). In for instance multiple regression analysis, an important assumption is that errors should be normally distributed. Within PLS this is not the case, which makes PLS very useful.

Given the prior reasons, PLS is chosen as analysis method for this research. Therefore, all hypotheses depicted in Figure 5, are tested by the use of PLS path modeling. The results of PLS path modeling reflect the $R^2$ of the variables, measurement item loadings and the path coefficients of the relationships. The $R^2$ is a “measure of the amount of variation in the outcome variable that is accounted for by the model” (Field, 2005). An $R^2$ of 1 indicates that the model perfectly fits the data. The loadings of the multiple measurement items reflect how well the indicator predicts the variable. A rule of thumb employed by many researchers is to accept items with loadings of 0.7 or more. Finally, the path coefficients reflect the relative effects of one variable on another. For the path coefficients a value near 1 is pursued. PLS also provides t-values for the path-coefficients. A t-value above 1.960 suggests that the relationship is significant at p < 0.05, whereas a t-value above 1.645 suggests that the relationship is significant at p < 0.10.
4. Empirical analysis

This chapter depicts all information to answer the first three research questions: (1) How well are NSD projects currently performed within KPN ZM?, (2) What are the causes for the excessive cycle time of NSD projects within KPN ZM?, and (3) Are the delays in the NSD projects having an impact on costs and quality? In the first paragraph of this chapter, the descriptive statistics of the delays, NSD cycle times, costs and quality will be elaborated. These descriptive statistics provide an answer for the question how well the NSD projects are currently performed. Then, in the second paragraph, the overview of root causes for the long time-to-market provided in the previous chapter will be validated and checked on its completeness. This will be done by the analysis of Exception Reports and interviews with project managers. Prior qualitative analyses provide an answer for the second research question. The actual impact of delays on costs and quality is analyzed more quantitative. In paragraph three this quantitative analysis, which is conducted by the examination of correlations and PLS path modeling, is discussed. In this paragraph an answer is provided for the questioned interrelatedness between delays, costs and quality. Finally, in the last paragraph an overall conclusion of the results is elaborated.

4.1 Descriptive Statistics

Initially, a general analysis is performed to obtain some more insights in the time, costs and quality of the NSD projects executed by KPN ZM. As mentioned in the previous chapter, a selection of projects is included in the research analysis of this master thesis. In total, 48 projects of the programs A and B are taken into account. Here it has to be noticed that for the sake of creating a general understanding of the time-to-market, in this section the delays and cycle times are separately represented in weeks. Later on, in the quantitative analysis, delays will only be incorporated as percentages of exceeding the planned cycle time (as explained in Chapter 3).

4.1.1 NSD project delay

In Table 2 the average cycle time and delays of the projects are reported. As can be seen, the average total cycle time of projects that have taken a Decision to go Public (DP) is 40 weeks. In this measure delays are also included. Since the average delay for projects that have taken a DP is more than 8 weeks, it shows that nearly 20% of the cycle time consists of delays. Besides, on average 32% of the planned project duration is exceeded. For the projects that also have taken a Decision to Handover (DH) (subset of projects including DP), the average total cycle time is 51,5 weeks. Here the average delay is 13 weeks and so more than 25% of the time is caused by delays. Here, on average 43% of the planned cycle time is exceeded. Furthermore, about 75% of all projects is delayed (35 of 48). Most of the delays occur at the Decision to Fund (DF). Besides, much delay is experienced at taking a DH. Overall, Table 2 shows that the standard deviations are quite high. This can be explained by the data, as there are many extremes. Especially in the total cycle times there are many differences between the lowest and highest cycle time.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of projects</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO – DP; projects until DP</td>
<td>48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• CYCLE TIME (IO-DP) (incl. delays)</td>
<td>48</td>
<td>40 weeks</td>
<td>20,4 weeks</td>
</tr>
<tr>
<td>• IO – DJ</td>
<td>48</td>
<td>7,8 weeks</td>
<td>7,3 weeks</td>
</tr>
</tbody>
</table>
In addition to Table 2, a distinction has been made between several types of projects and between the projects of the programs A and B. From here and further on, the projects that have taken a DP are taken as the point of reference. For each of the types of projects, the average cycle time and average delay is calculated. This can be found in Table 3.

As shown in Table 3, there is only a small difference between the projects of the programs A and B. The projects conducted within the program B take somewhat longer. This is remarkable, as the projects conducted within this program are in general less radical compared to the program A. Here less cycle time would have been expected. Furthermore, it shows that most of the projects KPN ZM performs are improvements of existing services. The innovations of KPN ZM can therefore be characterized as incremental. Besides, it shows that a release takes most time for KPN ZM. As a release is defined as “the realization of a collection of business requests at one moment in time”, this finding is not peculiar.
Concerning the average delays, it can be noticed that most delays are experienced by project categories 1, 3 and 5. Remarkable is the low average delay in the category 2 and 4.

Figure 10 and Figure 11 show how the cycle times and delays are divided across all the projects that have taken a DP. It shows that most projects have an average cycle time between 21 and 40 weeks. There are only a few projects that consume much more or much less time. Additionally, it can be stated that most projects encounter a delay of zero till six weeks. Besides, the probability of encountering a delay of more than six weeks is about equal to the probability of encountering a delay of more than 30 weeks. Though, this is a very small probability.

4.1.2 NSD project costs
With regard to the project budget, Table 4 shows that the average project budget lies around the 1.5 million Euros. Though, this average has a very big standard deviation of 1.7 million Euros. The size of this standard deviation shows that there is a very big range in different project budgets. Table 4 also shows that projects within the program B are more costly compared to those within A. In addition to this it is determined that, in general, one out the three projects (16 of 48) did not stay within budget. This means that 33% of the projects are not achieving its goals by using the initial estimated budget. Especially improvement-projects and new service development-projects run out of budget.

Furthermore, it can be noticed that projects in category 4 are most costly.

<table>
<thead>
<tr>
<th>Project Category</th>
<th># Projects</th>
<th>Average project budget</th>
<th># Projects outside budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>€ 557.831,-</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>€ 1.870.882,-</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>€ 1.377.144,-</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>€ 3.950.232,-</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>€ 777.956,-</td>
<td>3</td>
</tr>
<tr>
<td>Program A</td>
<td>35</td>
<td>€ 1.505.089,-</td>
<td>11</td>
</tr>
<tr>
<td>Program B</td>
<td>13</td>
<td>€ 1.837.346,-</td>
<td>5</td>
</tr>
<tr>
<td>Overall</td>
<td>48</td>
<td>€ 1.595.075,-</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 4: Descriptive statistics of NSD project budget
In Figure 12, categories of project budget are plotted against the average cycle time. From this graph it can be concluded that projects that are somewhat cheaper, do not necessarily take less time. In contrast, Figure 12 shows that the cheapest projects take slightly more time than the projects that are more costly. Furthermore, it is remarkable that the average cycle time is quite constant for all projects with a project budget below 4 million Euros. After this point, the cycle time quickly raises as the budget increases. Next, Figure 13 shows that the more costly projects do not necessarily encounter a higher delay. As can be seen, the average project budget does not vary much across the different categories of delays.

4.1.3 NSD project quality
Concerning the quality of a project it is determined that on average the exact initial requirements of the customer are fulfilled by the projects; average 7 on a scale of 1 to 13 (Table 5 & Appendix B). There are various outliers above and below, but overall the customer requirements are met. The other aspect of quality, the business requirements, is also well applied within KPN ZM. Overall the projects obey more than 90% of the business policies that need to be obeyed by a project.

In Table 5 also a distinction is shown for the quality scores per project category and per program. Overall, it can be concluded that projects in category 4 are performed best. For both the business policy check and for the customer requirements check, category 4 obtained the highest score. It is noticeable that for category 3 the business policy check is relatively low, while customer requirements have been good fulfilled. The other way around happens for category 1 projects. Here, the policies are very well obeyed, but the customer requirements are not completely fulfilled. The projects related to the category 2 are, after category 4, a good example of high quality-projects. Finally, the projects within the
program A better obey business policies compared to those in the program B. Concerning the score on customer requirements, both programs are equal.

<table>
<thead>
<tr>
<th>Project Category</th>
<th>Average score policy check</th>
<th>Average score customer requirements check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>95,0%</td>
<td>6,8</td>
</tr>
<tr>
<td>2</td>
<td>92,2%</td>
<td>7,1</td>
</tr>
<tr>
<td>3</td>
<td>85,0%</td>
<td>7,2</td>
</tr>
<tr>
<td>4</td>
<td>100%</td>
<td>8,0</td>
</tr>
<tr>
<td>5</td>
<td>88,0%</td>
<td>5,8</td>
</tr>
<tr>
<td>Program A</td>
<td>91,1%</td>
<td>7,0</td>
</tr>
<tr>
<td>Program B</td>
<td>87,9%</td>
<td>7,1</td>
</tr>
<tr>
<td>Overall</td>
<td>90,3%</td>
<td>7,0</td>
</tr>
</tbody>
</table>

Table 5: Descriptive statistics of NSD project quality

### 4.2 Qualitative analysis – the causes of delays

After the general analysis of the variables was performed, a first investigation of the causes of delays is made by reading and analyzing Exception Reports. Exception Reports are reports wherein information about the causes and effects of a delay is documented. In total 20 Exception Reports were found. As of all projects that have taken a DP, 35 projects were delayed, it can be concluded that 57% (20 of 35) of all delays is covered by an Exception Report. The causes and effects of the remainder of the delays is not documented.

As follows, the conclusions out of the Exception Reports will be discussed. This discussion is structured by the use of the antecedents elaborated in the study of Chen et al. (2010). As explained in Chapter 2.2, Chen et al. (2010) distinguish between four categories of antecedents of NPD speed, which are strategic, project, process and team. As delays are part of speed, some of the antecedents can also be related to delays. However literature does not provide a clear view about which antecedents exactly can be related to delays and therefore all antecedents of speed are included in this examination. In Chapter 3 the main causes of delays revealed by conducting general interviews are already divided into the categories of Chen (Ishikawa diagram). By taking the causes mentioned in the preliminary problem investigation as a reference point, the number of times a specific cause was mentioned in an Exception Report could be counted. This way the main causes of delays could be identified. In addition, it shows which antecedents of speed are most important for delays. The results of the counting process are shown in Table 6.

<table>
<thead>
<tr>
<th>Antecedents of NPD speed categorized by Chen et al. (2010)</th>
<th>Cause of delay (mentioned in interviews)</th>
<th># times mentioned in Exception Reports / memo’s / DFu’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Emphasis on speed</td>
<td>● No rewards to speed up</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Management is too financially focused (costs are more important than time)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Change in project approach to speed up activities (releases)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Top management support</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Goal clarity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Project newness</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Project complexity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Process formalization</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Process concurrency</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Iteration</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Team leadership</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Team experience</td>
<td></td>
</tr>
</tbody>
</table>
Table 6: General investigation of causes of delays using Exception Reports

As can be concluded from Table 6, the main causes for delays of NSD projects performed within KPN ZM are “budget not sufficient”, “changed or extended scope”, “change in project approach” and “wrong customer requirements”. As these are all relatively abstract causes for delays, interviews with project managers were necessary to reveal the reasons behind the abstract causes for delays in the NSD projects. Besides, additional causes could be revealed by the interviews. In total eight interviews are conducted with project managers of the projects that were delayed because of one of the main causes mentioned previously. The questions included in the interviews can be found in Appendix C. The interviewees can be found in Table 7.

Table 7: Interviewees

4.2.1 Insufficiency of budget

The analysis of the Exception Reports shows that the insufficiency of budget is the most important cause of delays. The information obtained in the interviews revealed that there are several reasons for a delay caused by a lack of budget. The main reasons for running out of budget are the inadequate assessment of the needed resources in advance and an extended project scope or changing customer requirements.

As explained previously, nowadays, the new service development activities of KPN ZM are structured by the Stage Gate process. This Stage Gate process is arranged in such a way that at the first gate, the Idea of Opportunity (IO), already a very strict and accurate business case is submitted. Until recently this was different. A year ago, the precise details of the business case had to be handed in at the third gate, the
Decision to Fund. This provided the project teams with the opportunity to test and analyze the possibilities of the newly designed service and to come up with more precise and better estimates of required resources. As this is changed, project managers are asked to make an accurate planning long before even a test or analysis can be conducted. “A lack of experience and specific knowledge and the dynamic environment of KPN make it very hard to establish a reliable planning. Additionally, the so-called ‘wishful-thinking’ ensures that planned dates are often too optimistic. As the estimations are thus not realistic, eventually a lack of budget is experienced” (R5).

Another reason for the inadequate assessment of resources is the underestimation of complexity. The interviews revealed that “it often occurs that the interests of external parties and the complexity of newly developed services are underestimated” (R2). For example, “in the case of Project M, the technical platform did not work as it was expected to work and scheduling-difficulties with the external party ‘N’ were not incorporated in advance” (R3). The underestimation of complexity is in most cases mainly due to a lack of knowledge and experience. This lack of knowledge and experience causes that “a long test-phase is not included in the initial planning and analysis. As a consequence, much design errors are experienced and policies are not well obeyed. Workarounds need to be made to cover these mistakes. Since these workarounds are very costly, they lead automatically to insufficiency of budget” (R3). This shows that currently much rework exists. Though, management rather chooses to solve these issues on a short term, while not preventing them in the future.

In addition to the inadequate assessment of resources, changes in scope and wrong customer requirements are other reasons for running out of budget. The changes in scope are mainly blamed on the dynamic environment of KPN ZM. “Due to the rapidly changing environment, KPN ZM does not make specific choices for the long term vision and organizational goals. This lack of concrete vision causes project goals to be unstructured” (R5). The project goals should be derived from the overall vision and goals, but currently the opposite occurs. As a consequence, project goals are not fixed and are often changed. “These changing goals lead to adjusted and extended project scopes that subsequently cause a lack of resources. When more concrete choices are made concerning long term goals, projects can be better structured and this will help to remain focused” (R1).

Besides the lack of a concrete long-term vision, the changes in requirements are also blamed on the lack of uniformity between the pre-IO ideas of the Marketing and KlantenService & Operations (KS&O) department and the ideas of the department Innovations & Programs of KPN ZM. Nowadays, the original ideas of new services are developed by Marketing and KS&O employees. By conducting market research and customer questionnaires, the abstract requirements of a new service are established. The activities conducted by the Marketing and KS&O department are not included in the total NSD cycle time of a project, as they are really considered as pre-activities. After the Marketing department has finished the pre-IO activities, the abstract requirements are passed on towards the department Innovations & Programs of KPN ZM. As the employees of this latter department are more technically oriented, the abstract requirements of Marketing are often misinterpreted or assessed as unfeasible. It is remarkable that this misinterpretation or unfeasibility is most of the times discovered very late. When this is the case, a project starts with unclear and sometimes unfeasible requirements and the project team is thus actually wasting time and effort. Therefore it is necessary to create uniformity in the ideas
of Marketing and Innovation, before the actual development activities are started. Uniformity will help to prevent that adjustments are needed to be made in the requirements, which will subsequently minimize the delays.

Regarding the changing requirements due to external parties, it is stated that “currently, the changing project requirements are causing much delays in the development process” (R7). It shows that not only customers, but also suppliers and other external parties are often changing the initial requirements of a project. For example, “in the project O many different interests had to be taken into account. Due to these different interests, the scope of the project was often changed and extended. Eventually this resulted in an infeasible project. However, before it was concluded that the project became infeasible, much money was wasted” (R4). This example shows that due to the changing requirements, a project cannot continue in a structured way. Therefore it is stated that “KPN needs to dare to make choices to avoid such situations in the future. Only with clearly defined project requirements, the project goal can be achieved within budget” (R4).

4.2.2 Change in project approach
Another main reason for delays shown by the analysis of the Exception Reports (Table 6) is the change in the project approach. The information obtained by the interviews revealed more details about these changes in project approach. Nowadays, many projects are included in a release. These releases exist of multiple projects that are in the same phase of development. “The projects included in a release are the projects that have the highest priority for KPN ZM. By combining these projects in a release, it is easier to make decisions around the Gates and to keep track of the projects. Although the organization is better structured by the use of releases, for the projects that fall outside the scope of a release, it causes serious delays” (R7). Obviously, the projects that are not included in a release are given less priority. “Project members are working at multiple projects and thus need to spend their time between projects that fall within and outside a release. Given the high priority of releases, employees are spending more time on the release-projects, even though the other projects are suffering from this” (R6). In the worst case, some projects that were not included in a release were put on hold. An example of this is the project S. This project was put on hold as no time could be spend on this project because the releases were asking too much time. Due to the introduction of releases, part of the projects is thus heavily delayed, while the other part of the projects is running exactly in time. Therefore there is a “high demand to structure the projects that are not included in releases” (R7).

4.2.3 Team alignment
The final important reason for delays in NSD projects is not shown by the analysis of the Exception Reports, but is only revealed by the interviews with project managers. This reason includes the low level of team alignment. To achieve the best results, members of a team should share a concrete understanding of what they are trying to achieve and how they are going to achieve it. As the project goals are often unclear within KPN ZM, “team members do not have a common understanding of the project and this enables them to perform tasks in their own way. For every team member it is possible to pursue their own goals. The lack of a clear goal ensures that there exists a lack of focus and the collaboration is not as effective as it should be” (R1).
The fact that “team members are assigned to multiple projects and thus have different priorities is also contributing to a low level of team alignment” (R6). The projects included within a release require more attention of employees. When an employee is assigned to a project that is included in a release and to a project that is not included in a release, he will pay more attention to the one that is included in a release. This explains why team members are not equally committed to a project. “The different priorities of team members ensure that a team cannot become easily aligned. In turn, this causes that no learning curve can come in existence and performances are thus not easily increased over time” (R1).

Finally, the low level of team alignment is reinforced by the “moderate availability of team members” (R6). Although the teams are composed in a multi-functional way, there is often a lack of specific technically educated team members. This causes a lack of technical knowledge and experience. It shows that there are “only a few people within KPN ZM who know the details and exact applications of service-platforms. Since these people change jobs quickly, it is hard to maintain the knowledge level within a project” (R1). Because of the re-shuffles, project teams are thus not able to build on the knowledge of their team members. As a consequence, project leaders depend more and more on the experience of their suppliers and other external parties and this result in higher costs. “The involvement of external parties also lowers team alignment, as they have a different background and a different view on the project” (R2).

4.2.4 Predictability of delays

During the interviews it is also questioned whether the delays could have been predicted in advance. Given one of the main reasons for running out of budget, the too early estimation, in most cases the delays were expected. “As the environment is constantly changing, no good estimation can be made in advance and therefore it is likely that adjustments are needed to be made to the original planning. Especially when a new service is developed, the uncertainty is high and in such a case the lack of experience often results in a delay” (R3). Also the changing priorities appeared to be an important source of the predictability of delays. “As team members are assigned to multiple projects, not all team members are equally committed to a certain project. In addition to these different internal priorities, also the various involved external parties ensure that no consensus can be reached within a project. Taking all the different priorities together, it can be expected that a delay will be experienced. However, the amount of delay cannot be predicted in advance, as it depends on the involved parties how rapidly consensus is reached” (R2).

Furthermore, currently goals are not very clear within KPN ZM projects. “Since no strict choices are dared to be made, the scope of many projects is not clear, and figuring out what the exact goal of a project is, costs a lot of time. So, in case the project scope is not clear in advance, a delay can be predicted” (R4). Previous argumentation shows that “more pre-control is needed to avoid the predictability of delays” (R6).

Finally, it has to be noticed that in all interviews, the interviewees agreed that delays are predictable. “Because of the pressure from the management, planned time and budget is not always very realistic” (R5). In addition, the targets of the management ensure that “a tight planning needs to be made, as otherwise fewer resources are directed towards the project” (R4). The delays are thus expected and KPN
ZM accepts the risks of these delays. “Although the planning is much too optimistic, management continues with the project schedule, as in the end often 70% of the initial goal is accepted as good enough” (R7).

4.2.5 Avoidance of delays
As final part of the interview, it was questioned whether a delay is avoidable. Here, the interviewees did not agree. One half of the interviewees stated that “a delay is certainly avoidable, but this will cost a lot of effort” (R2). Various solutions were proposed to avoid delays in the future. For example “by outsourcing all development-activities to other parties and by only designing the service, delaying factors are removed and delays can thus be avoided” (R2). Another proposal to avoid delays is “by using much more iterations with a lot of feedback, also called the scrum-method. When the NSD-process is cut down into smaller pieces, quality can be better assured and planned dates are much more feasible. The smaller parts provide a better overview and this way it becomes easier to add value” (R3). “In general, providing structure, focus and expertise will also help to avoid delays” (R4).

The other half of the interviewees stated that delays cannot be avoided. “As long as there remain different priorities within a project team, delays cannot be avoided” (R7). These differing priorities are hard to prevent, as employees need to be assigned to different projects. Besides the priorities, the “early estimation of resources makes it impossible to guarantee the processing of a project without delays. Since the management has chosen for this project approach, it has to be accepted that adjustments need to be made to the initial estimations” (R5). “The only thing what can mitigate the consequences of a delay, is the early identification of it. So if a delay is noticed, actions should be taken to minimize the effects of the delay” (R6).

Regarding the avoidance of delays, some of the interviewees questioned whether the delays should be avoided anyway. One of the interviewees for example stated that “KPN ZM is acting with a certain mindset that does not allow for any flexibility. Therefore the delays are seen as delays, but actually delays are facts that they are not willing to accept. When KPN ZM starts to accept the delays, the effect of it will be minimal” (R1).

4.2.6 Summary
Overall, it can be stated that there are various causes of delays in the NSD-projects of KPN ZM. As the investigation of the Exception Reports showed, the main reason for delays appeared to be a lack of budget. However, the interviews revealed multiple root causes behind this reason for delays. Projects are often running out of budget and time because of an extended project scope and adjusted customer requirements. As the initial requirements of Marketing are often misinterpreted or assessed as not complete, requirements are added and this ensures that project goals become unclear and scope is too limited. Also the too optimistic planning of NSD activities is a reason for an insufficiency in time and budget. As KPN ZM is acting in a dynamic and rapidly changing environment, it appears to be hard to make a reliable and realistic planning. Here, often the complexity is underestimated, which eventually also causes a lack of budget. Besides the lack of budget, the changes in project approach and the low level of team alignment are main causes of delays. Projects included in releases are given a higher priority than projects that are not included in a release, which subsequently causes that some projects
are running exactly in time, while other projects are heavily delayed. Additionally, team members have different priorities and are thus not equally committed to a project. The low level of commitment taken together with a lack of specific knowledge and expertise is another source of delays. In sum, the analysis shows that the following antecedents of NPD speed also seem to be applicable as antecedents of delays: goal clarity, team dedication, project complexity and management support. Also a lack of iteration and team experience can be mentioned as causes of delays. Prior information provides evidence for Proposition 1.

Concerning the predictability of delays, all interviewees agreed that delays are predictable. The high level of uncertainty and the targets of management ensure that often estimations are too optimistic. Although the delays are thus predictable, the interviews revealed that it is hard to avoid delays. Rigorous methods, such as outsourcing and scrum, are proposed to avoid delays. Also more flexibility is stated to be required to deal with delays. However, mainly the need of more structure and focus is emphasized to minimize the effects of delays.

4.3 Quantitative analysis – the effects of delays
Now all causes of delays are revealed, the actual impact of delays on costs and quality will be analyzed. As follows the hypotheses elaborated in Chapter 2.5 will be tested. The first part of this analysis consists of the examination of the correlations between all the measurement items of the variables. The correlations are calculated by the use of the program SPSS. By examining these correlations, a first investigation of the relationships is established. The actual model analysis is the second part of the analysis. The model analysis is conducted with PLS path modeling.

4.3.1 Correlations
In Table 8 the correlations between the total-measures are shown. Here the delay represents the percentage at which the total planned cycle time is exceeded, budget refers to the project costs and quality refers to how well business and customer requirements are fulfilled. These measures thus represent the totals in delay, costs and quality of the 48 selected projects conducted within KPN ZM. Later on in this report, the more specific measures will be taken into account. In order to gain a general understanding of the relationships, first the correlations of the general measures are analyzed. As can be seen in Table 8, delay is neither significantly correlated with budget, nor with quality. This finding suggests that the delay does not affect project costs and/or quality. Though, given the scientific literature elaborated in Chapter 2 it is expected that there is some degree of interrelatedness and therefore as follows it will be examined whether the correlations of the smaller, more specific measures do show any interrelatedness.

In Appendix D the correlations between the multiple items of delay, quality and costs are shown. Here it has to be noticed that the delay in IO is not included, as this delay was in all projects measured to be 0
and can therefore be regarded as a constant. Table 2 (Appendix D) shows that the delays in the Decision to Justify (DJ) and the Decision to Fund are significantly positive correlated. This suggests that a delay in DJ also ensures a delay in DF. This is quite obvious, as the DF is made by the use of a well-defined business case. In case this business case is not justified, it is unlikely that the original fund-date still can be achieved. Furthermore, Table 2 shows that almost all measurement items of delay are significantly correlated with the total delay. Except for the delay at the DJ, all three other delays are significantly contributing to the total delay in NSD cycle time.

Concerning quality, Table 2 (Appendix D) shows that the total delay is significantly correlated with the requirement-score. As a project is more delayed, the requirements are thus better processed. When looking at the delays per gate, especially the delay in DF is significantly positively related with the requirement-score. This finding suggests that a delay in DF increases the probability that a new service is meeting all specifications set by the customer.

With regard to costs, in Table 2 (Appendix D) it is shown none of the delays are significantly correlated to the project budget. Also none of the delays correlate with the probability of being within or outside the budget. This suggests that a delay does not have a direct effect on NSD project costs.

As a first investigation of relations has been performed, now the exact relationships will be examined by the use of PLS path modeling. In the following section this model analysis is elaborated.

4.3.2 Model analysis
As mentioned previously, the actual effects of delays are examined by the use of PLS Path modeling. As follows, it will be analyzed whether the output of PLS supports the three hypotheses mentioned in Chapter 2. Here after, a further analysis is performed to find out more about the time-dependency and program-dependency of the relationships.

Testing of hypotheses
In Figure 14 the output of the model analysis is shown. The variables are depicted as formative variables, meaning that the indicators cause a change in the variable (construct). Furthermore, the construct is fully derived by its measurement. Whereas Figure 14 shows all t-values of the relationships, the path-coefficients are shown in Appendix E. From the t-values the eventual significance of the relationship can be derived. When looking at Figure 14, only the relationship between Delay and Costs is non-significant. Remarkable is that Figure 1 of Appendix E shows that this relation between Delay and Costs is negative. This suggests that more delay will reduce the project costs. However, as this relation is not significant, this finding cannot be generalized. Besides, the negative impact and the non-significance of the relationship are in contrast with Hypothesis 1 and therefore Hypothesis 1 is not supported.

Furthermore, in Figure 14 it can be seen that the relations between Delay and Quality and Cost and Quality are significant. Figure 1 of Appendix E shows that prior relations are positive. This provides support for Hypothesis 2 and 3. Apparently an increase in project delay enhances the eventual NSD project quality. Additionally, when more money is available, the project quality can be even further improved.
Further analysis
When looking at the data, it can be seen that specific delays at for instance the Decision to Fund, contribute more to the total delay, than for instance the delay at the Decision to Justify. As some delays are more severe than others, it seems that certain gates are more susceptible for delays. The effects of delays at these gates may subsequently have a bigger impact on cost and quality than the delays at gates which are less susceptible for delays. Therefore, the effect of delays may be time-dependent. To find out more about this time-dependency of the relationships, the effects of the delays at each gate are analyzed separately. The results of these separate analyses were striking. In case only the delay at DJ was incorporated in the model, none of the relationships was significant. Also when only including the delay at DP into the model, none of the relationships appeared to be significant. This may be explained by the effect of an omitted variable. In case one variable is dominant and this variable is deleted, no significant relationships are found. Prior explanation is kind of confirmed, as when analyzing the effects of a delay at DF, all relationships became significant (Figure 15). Even the relationship between Delay and Costs is significant in this case. As can be seen in Figure 2 of Appendix E, the relationship between Delay and Costs is negative. This suggests that as the delay at DF increases, the costs will decrease. Concerning the relationships between Delay and Quality and Costs and Quality, Figure 2 (Appendix E) shows that a delay at DF positively affects the quality and costs also positively affect quality. This is in line with prior findings. Overall, it can be concluded that the effect of delays on costs and quality indeed are time-dependent. In particular the delay at the Decision to Fund is an important determinant.
Besides the time-dependency, it is also examined whether the effects of delays differ between the two programs at which the data is gathered; A and B. As can be seen in Figure 16 and 17, the programs have several differences. First, all relationships are significant for the program A, whereas only the relation between Cost and Quality is significant for the program B. When looking more closely at the relationship which is significant for both programs, the relationship between Costs and Quality, contradicting findings are found. Whereas the relation is positive for the program A, the relation is negative for the program B (Figure 3 and 4, Appendix E). Within the program A, projects thus seem to benefit of a higher budget, while in the program B, this is not the case.

Second difference between the two programs is the relationship between Delay and Costs. As can be seen in Figure 3 of Appendix E, the relationship between Delay and Cost is negative for the program A. Figure 4 of Appendix E shows that for the program B, this relationship is positive. This finding suggests that within the program A, delays reduce costs and in B, the delay increases costs. For the program A the finding is significant and therefore delays are thus beneficial within A. However, as this relationship was not significant for B, more research is necessary to confirm the increase in costs due to a delay. The same applies for the relationship between delay and quality. Within the program A, delays are significantly increasing quality. However, within the program B this relationship is non-significant and therefore needs further research.

Finally, in addition to the time-dependency and program-dependency it is analyzed whether costs act as a mediator of the relationship between delay and quality. As quality can be increased when more time and money is available, this mediating effect seems to be evident.

Figure 18 shows that the mediating effect of costs on the relationship between delay and quality is not significant. In Figure 5 of Appendix E, it is shown that the moderating effect is negative. This suggests that as costs increase, a delay has a less positive effect on quality. However, this finding is not significant and therefore cannot be generalized.
4.3.3 Summary

The quantitative analysis performed for this research consisted of two parts. First the correlations between measurement items were analyzed, where after the actual impact of a delay on costs and quality is analyzed by PLS path modeling. The correlations showed that almost all measurement items of delay are significantly contributing to the total delay. Except for the delay at the Decision to Justify, all other delays were significantly positively correlated to the total delay. Furthermore it showed that a delay at the Decision to Fund increases the processing of customer requirements; delay DF and requirement-check were positive correlated. Overall, the total delay was also significantly correlated with the requirement-check. This finding suggests that a delay increases the probability that a new service is conform customer specifications. The latter finding increased the expectancy that delay and quality are positively related (Hypothesis 2). Furthermore, no significant correlations are found between the delay measurement items and budget.

As the second part of the analysis, the hypotheses are tested by the use of PLS path modeling. The results of the analysis only provided support for Hypothesis 2 and 3. A significant, positive effect of delays on the eventual service-quality is revealed. Also a significant, positive effect of costs on quality is shown. Unfortunately, no significant effect of a delay on costs could be found. To refine the findings about the hypotheses, the effects of the delays are tested on time-dependency and program-dependency. It showed that mainly the delay at the Decision to Fund is responsible for significant relationships. Remarkably was that a negative, significant relationship was found between Delay and Costs. A delay in the Decision to Fund thus appears to reduce costs. Besides, all relationships were significant for the program A, whereas only the relationship between Costs and Quality was significant for the program B. However, as the sample size of the B-program was very small, the results may be a bit misleading. Finally, it showed that costs do not mediate the relations between delay and quality. So as more delays are experienced, costs do not enhance quality even further.
4.4 Conclusion – qualitative and quantitative results

At the end of this chapter an overall conclusion about the results obtained during the qualitative and the quantitative analysis will be provided. First of all, looking at the descriptive statistics it is shown that the average NSD cycle time currently experienced at KPN ZM is less than one year. Comparing this NSD project cycle time with other companies, this is not extremely long. Especially the development of new services takes an equal amount of time at other companies. Though, looking at the delays, the average delay is 13 weeks. This shows that more than 25% of the project time is caused by a delay. This suggests that much time is wasted and the effectiveness in performing NSD projects can be enhanced. Regarding the quality, it showed that on average the customer requirements are fulfilled, but not all business policies are obeyed. This also shows that the effectiveness is not good enough. Overall, the project cycle time is thus not really the problem, but the low effectiveness of the NSD project teams is.

Looking at the causes of delays, elaborated in the qualitative analysis, reasons for the low degree of effectiveness are revealed. Mainly the underestimation of complexity and low level of team alignment appear to be causes of delays in the NSD projects. Also unclear goals and rapidly changing requirements are important antecedents of delays. When relating these causes of delays to the literature elaborated in Chapter 2, it can be concluded that KPN ZM is suffering from the planning fallacy and the fire fighting strategy. Prior issues represent exactly what is happening at KPN ZM. Because of the so-called ‘wishful-thinking’, planned dates of toll-gates are often too optimistic. In addition, no development errors are incorporated in the planning and issues with external parties are not included. Furthermore, in advance of a project it is expected that all team members are equally committed and dedicated towards the project. This is however not the case. Since project members are assigned to multiple projects, they have different priorities and so they are not equally committed to the projects. Prior findings show that workload is typically underestimated and the development team is typically overestimated; which is exactly the planning fallacy. Besides the planning fallacy, KPN ZM is also conducting the fire fighting strategy. This strategy suggests that managers rather choose to fight fires, instead of preventing them. Since there is a minimal level of feedback and learning, certain errors keep coming back. By solving these errors, short-run positive benefits are gained. As managers overweight these short-run positive benefits and ignore the long-run negative results, managers do not learn to overcome the undesirable dynamics of rework. Therefore, rework and the underestimation of it remain important causes of delays.

As the planning fallacy and the fire fighting strategy cover the underestimation of complexity and low level of team alignment as causes for delays, the unclear goals and changing requirements can be related to a lack of clear vision. In Chapter 2 it is emphasized that NPD acceleration only can be achieved when there is a clear vision about the goals being pursued. A mission and related objectives provide focus and avoids changing directions. Since KPN ZM lacks a certain concrete vision and mission, project goals are unclear and are subject to change. The lack of a clear vision also ensures that the ideas of the Marketing department are not matching the ideas of the department Innovation & Programs. Due to the different perspectives, both departments work at different purposes. This ensures that unnecessary tasks are performed and team effectiveness is decreased. Overall, when relating the causes of delays to the antecedents of NPD speed, it can be stated that the following antecedents of NPD speed are also
applicable for delays: goal clarity, project complexity, team dedication, management support and team experience. This is in line with Proposition 1.

Where all causes of delays are revealed in the qualitative analysis, the actual effects of delays are examined by a quantitative analysis. In Table 9 an overview is provided that shows which hypotheses are supported. As can be seen in Table 9, only support is found for the relations between Delay and Quality and Costs and Quality. So, a delay indeed is increasing the NSD project quality (H2) and an increase in project costs ensures a higher project quality (H3). Since about 75% of all projects in the sample for this research were delayed, it means that in 75% of the cases, the project quality is increased due to the delay. Unfortunately, no support is found for the relation between delay and costs (H1). Furthermore, a more detailed analysis showed that when the delay is experienced especially at the Decision to Fund, the delay has a more direct impact on costs. Remarkably is that this impact is negative. Therefore, a delay at the Decision to Fund decreases costs and increases quality. This suggests that the delay has very positive results. Besides, in the program B, only the relation between Costs and Quality was significant, whereas in the program A all relations were significant. Delays have thus a much more positive impact in the program A, since in this program delays increase quality.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Supported or not supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Delay → NSD project costs</td>
<td>Not supported</td>
</tr>
<tr>
<td>H2: Delay → NSD project quality</td>
<td>Supported</td>
</tr>
<tr>
<td>H3: NSD project costs → NSD project quality</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Table 9: Overview supported hypotheses
5. Solution design

As this business problem solving project is structured by the use of the reflective cycle developed by van Aken (2006), the ‘analysis and diagnosis’ step has to be followed by the ‘plan of action’ step. In the previous chapter the main causes and effects of delays in the NSD projects of KPN ZM are revealed. In this chapter these findings are taken as a point of reference for the creation of the solution design. A solution design is the ultimate deliverable of this project, since it includes the guidelines towards the intended performance improvement of the business system in question (Aken, Berends, & Bij, 2007). Eventually, the realization of the designed solution should result in the solution of the defined problem statement. Therefore, in this case the solution will focus on reducing time-to-market by improving the effectiveness of NSD project teams acting within KPN ZM. By doing so, the fourth research question will be answered: (4) How should KPN ZM organize the NSD process in order to shorten the cycle time of NSD projects?

As follows, potential solutions for the problem will be elaborated in the second paragraph. These potential solutions need to fulfill certain requirements, which are discussed first. Then, in the third paragraph, a solution concept will be chosen and the eventual solution design will be elaborated in more detail.

5.1 Requirements of solution

Potential solutions for the current business problem have to comply with several specifications in order for them to be effective. According to van Aken et al. (2007) there are four requirements that help to ensure effective solutions. These four requirements are:

- **Functional requirements**: “realization of the solution should solve the business problem, which is the key requirement, and the benefits should exceed the costs”
- **User requirements**: “the people presently working in the business system should have the competences needed to work in the new system or to use the new tools or procedures, and the new system should be user-friendly”
- **Boundary conditions**: “the system should comply with legal requirements, including those on health and safety, the system should comply with the present business policies of the company and the system should fit with the present company culture”
- **Design restrictions**: “the realization of the solution should change as little as possible in the present business system, and the project should not be costly and very time-consuming” (Aken, Berends, & Bij, 2007, p. 89)

When looking at the results of the empirical analysis elaborated in the previous chapter, the main functional requirement of the eventual solution is to enhance the effectiveness of NSD project teams who are acting within KPN ZM. The analysis showed that more than 25% of the overall project time is caused by a delay. As the overall cycle time was not extremely high compared with other companies, it shows that not more pressure has to be put on decreasing the cycle time, but the focus should be on increasing the NSD team effectiveness. Looking at the causes of delays, project teams are currently not able to effectively deal with available resources. It even shows that project teams need the delays to
accomplish all requirements. Though, in case the project teams work more effectively, this additional time and money is unnecessary and time-to-market can be reduced.

Concerning the **user requirements** it can be stated that the eventual solution should fit into the current Way-of-Working that is processed within the department Innovation & Programs. Since about a year a new method is introduced for structuring the innovative developments being processed. Here, for example, parallel processing and benefit management are emphasized. The solution should add value to this way-of-working and not change too much, as people are just getting used to this new method. Coming up with a total new method will not be effective, as now structural effects are gained of the new way-of-working. Therefore, people starting to like this method and by keeping the positive aspects and changing the delaying-factors, most positive results can be gained. Furthermore, the solution has to be feasible for all kind of team members including scope, change and delivery.

With regard to the **boundary conditions** it has to be noticed that the solution has to guarantee the compliancy with all internal and external policies. NSD projects following the new solution have to be compliant with all policies and therefore these policies should be kept in mind. Besides, the solution should fit within the present company culture. The department Innovation & Programs is very committed to the Stage-Gate process and therefore this process should be respected.

Finally, there are no really concrete **design restrictions**. A quick implementation is preferred, but no concrete number of months is mentioned. Given the current market situation of KPN ZM, it is also preferred for the solution to be as cheap as possible. By implementing a quick and cheap solution, it is most likely to gain fast results of the solution.

**5.2 Potential solutions**

In the previous paragraph the requirements of potential solutions are elaborated. Besides the requirements, several types of input should be considered for developing the potential solutions. In total, three types of input are used. First, the problem analysis and diagnosis elaborated in the previous chapters provides a starting point for the design process. Here, the main conclusions of the empirical analysis are most important. Not only all the causes of delays need to be considered, but also for instance the finding that delays are causing an increase in NSD project quality, is important to include. Second, the current NSD business system is another source of inspiration for the redesign. Typically, a solution to a business problem is a redesign of an existing system. In this case, the current Stage Gate model used by KPN ZM to structure the NSD process may be reconsidered. Finally, ideas for possible solutions are a type of input to the design process (Aken, Berends, & Bij, 2007). These ideas have multiple sources. For instance, the diagnosis of the causes of the delays provided clues for the solution design. Besides, intern ideas about decreasing the NSD cycle time are useful to consider. Also literature provides many ideas about solution concepts.

The multiple sources of input have resulted in the creation of four possible solutions. As follows, these four potential solutions will be shortly elaborated.
5.2.1 Fuzzy Front-end

Since about a year, KPN ZM is focusing on reducing the time between the Idea of Opportunity and the Decision to Fund. As explained in Chapter 4.2, this decision has been made to shorten the overall NSD cycle times. However, the qualitative analysis showed that by shortening the time between IO and DF many delays are caused; goals are not clear and no common understanding is created about the requirements. Project managers are asked to make an accurate and reliable planning of required resources, but the short time between IO and DF does not give them the opportunity to conduct detailed analyses and tests. In addition there often exists a lack of knowledge and experience. Together this causes that wrong estimations are established and projects are subsequently rapidly running out of budget and time. Furthermore, due to the lack of solid analyses and test results, much development errors and unfeasible requirements are noticed too late. Therefore, it can be stated that shortening the time between IO and DF does not have the intended results.

As the short time between IO and DF is a main cause of delays early in the NSD process, it also ensures that the overall time-to-market increases. A solution to solve the problems due to the short time between IO and DF is the adjustment of the current Stage Gate model used by KPN ZM. Here the main objective should be to increase the time between IO and DF. As can be seen in Table 2, the current time between IO and DF is about 12 weeks. The total cycle time of projects that have also taken a DH is more than 51 weeks. This means that currently the first stages of the NSD process take only 22% of the total time. Besides, it is noticeable that most delays are experienced at the DF. The quantitative analysis shows furthermore that these delays at the DF improve the quality of the eventual new service. Prior findings show that project teams apparently need more time especially at the first stages of the innovation process to achieve quality-requirements. By making the NSD process of KPN ZM much more front-end loaded, more time and money can be spend on the first stages of the Stage-Gate process and quality can be better enforced. This will enhance estimations and reduce rework later on in the process, which subsequently reduces delays at the Decision to Fund, the Decision to go Public and the Decision to Handover. Together effectiveness is thus improved and time-to-market can be reduced.

5.2.2 Spiral development

According to the qualitative analysis, two other main causes of delays for projects performed by KPN ZM are the change of scope and instability of requirements. As customer expectations are not clear and because interests of external parties need to be taken into account, there exists much pressure to change the initial requirements. Even when the project is already in the development-stage, currently requirements are sometimes adjusted. Since these adjustments are only delaying the overall project, they need to be prevented.

In the study of Cooper & Edgett (2008), unstable product specs and project scope are also mentioned as two of the main

![Figure 19: Spiral development within Stage Gate model](image-url)
causes of long times to market, which can even lead to product failure. In case prior problems are experienced, Cooper & Edgett (2008) suggest combining the Stage Gate model with spiral development. As explained in Chapter 2, spiral development ensures that feedback is constantly taken into account. In Figure 19 the spiral development process combined within the Stage Gate model is shown. As can be seen, the spiral process includes a lot of feedback loops. These iterative loops of “build-test-feedback-and-revise” ensure that changes in requirements and scope can be quickly captured by the project teams. Since the iterations are very short, extensive delays are prevented. For KPN ZM, the spiral development would be a good solution for reducing the NSD cycle time, as there is currently a lack of good feedback. Nowadays it takes much time before changes in requirements become known and also development errors are noticed very late. Besides, even delays are necessary to process feedback and enhance quality. By implementing the spiral process, more feedback can be taken directly into account. As the feedback can be more rapidly processed, subsequently quality can be faster achieved, without needing any delays. Together this will improve the effectiveness of project teams and reduce the overall NSD cycle time.

5.2.3 Flexibility enhancement

Another solution for the long NSD cycle time of projects conducted within KPN ZM is the enhancement of flexibility. Nowadays, KPN ZM tries to put all projects through the entire Stage Gate process. Even the low-risk, small projects have to complete all stages and gates. As revealed by the qualitative analysis, the projects included in a release are given a much higher priority than projects which are not included in a release. This causes that non-release projects are heavily delayed, while the projects included in a release are running exactly in time. Besides, team members are more committed to projects included in a release. As the non-release projects are often small projects, which are focused on implementing an existing service in another program or improving the errors of a new service, they do not necessarily need to pass all stages and gates of the Stage Gate process. By allowing a quicker version of the Stage Gate process for the smaller, non-release projects, it becomes much easier to complete such projects. When less deliverables need to be made and less time of the team members is needed, the commitment can be maintained. The maintenance of commitment subsequently enhances the effectiveness of the project team. In case effectiveness is enhanced, quality can be achieved without needing any delays and this will eventually reduce the time-to-market.

5.2.4 Integrated team composition

The final potential solution for the high NSD cycle time of projects conducted within KPN ZM is the structured composition of teams. Although teams are currently composed in a multi-functional way, the qualitative analysis revealed that project teams often experience a lack of specific knowledge and experience. Besides, it shows to be hard to maintain the knowledge level within a team. As there are much re-shuffles, it often occurs that a project team starts with the right people, but in the latter stages knowledge is lost.

The lack of knowledge ensures that quality cannot be rapidly achieved and therefore delays are necessary. In order to prevent this additional time, it is recommendable to compose project teams for a longer amount of time. By forcing team members to stick together for a certain amount of time, team members can better interact. In addition, team members get the time to learn to know each other and
to work effectively together (Kessler & Chakrabarti, 1999). Furthermore, it is important to combine different functions in a team. Nowadays, there is strong distinction between Scoping, Changing and Delivery teams. In addition, Marketing, KS&O and Innovation & Programs are acting separately. By integrating prior teams, more specific knowledge becomes available in one team. This will lead to more discussion, but also to better and more specific output. By doing so, effectiveness can be improved and time-to-market can be reduced.

5.3 Solution design

In general, all previous solution directions are contributing to a higher effectiveness of NSD project teams and thus to a shorter time-to-market. Each of the four solutions is directed towards other causes of delays and therefore they are complementing each other. Prior reason shows that an integrated solution design, in which the four solutions are combined, seems to be optimal. In this paragraph this integrated solution design will be discussed. The adjustments related to this design can be distinguished across three operational levels within KPN ZM. First, at the organizational level some things need to be changed. Second, at the project level some changes are processed and finally at the team level adjustments are recommended. As follows, the solution design will be elaborated per operational level. A concrete implementation plan can be found in Appendix F.

5.3.1 Solution design at organizational level

At the organizational level, the solution design recommends a different approach for projects included in a release versus the projects which are not included in a release. The qualitative analysis showed that the projects which are not included in a release are currently often delayed, as they are not given the full commitment of team members. Also knowledge is lost within these projects, because due to a lack of priority, many team members drop out. Since the projects which are not included in a release are typically the somewhat smaller, not rigorous projects, it is recommendable to make fewer decisions for these types of projects. Here, concrete, the Stage-Gate Lite version should be applied. The Stage-Gate Lite version allows for taking only two or three gates (Figure 20) and therefore it enables a faster decision-making process for the small projects. This will enhance commitment of team members, which increases the likelihood that project team members do not drop out. This way knowledge is maintained and the effectiveness of a project team can be enhanced. Eventually this way the small projects can be faster completed.

Besides the distinction between separate versions of the Stage Gate process, at organizational level it is recommendable to put more emphasis on the front-end of the NSD organization. Here the intention...
should be to increase the time of the stages before DF. The results of the quantitative analysis showed that currently most delays are experienced at DF. Remarkably, these delays are increasing the quality of the newly developed services. This shows that especially at the first stages of the innovation trajectory more time is needed to fulfill all quality-requirements. In general, also costs appeared to affect quality. It showed that if more money is available, quality is improved. By spending more time and money at the first stages of the innovation trajectory, more tests can be conducted and this way quality can be better enforced within the beginning of a project. This will enhance estimations and reduce rework later on in the process, which subsequently reduces delays at the later gates. Though, for this solution to be effective, not only should the time and money of these first stages be increased. Also the tasks and responsibilities should be adjusted:

- First of all, the tasks should be more integrated with the pre-IO activities. The qualitative analysis showed that currently the scoping teams of the department Innovation & Programs are not effectively cooperating with the Marketing-department. Also the department “KlantenService & Operations” (KS&O), which is responsible for customer feedback, is not optimally involved in the scoping-activities. All three departments are thus performing their own part of a project, without knowing the history and having a common understanding of the project. Subsequently, this bad cooperation between the departments ensures that requirements are often changed and project goals are not clear. This change of requirements and goals appeared to be an important cause of delays. By integrating the tasks of Marketing and KS&O within the tasks of the department Innovation & Programs, more consensuses can be reached. The integrated Marketing-KS&O-Innovation teams should aim to process more research together. It should be avoided that Marketing is developing the general idea of a new service, which accordingly needs to be further explored by the scoping teams. Activities such as market research and concept testing should be performed within one team. Especially the value-to-customer assessment should be more extensively examined, as this is an important determinant for eventual success. The Fuzzy Front-end solution also aims for additional testing. Mainly the technical assessments should be improved. Therefore, the integrated teams should conduct more tests to assess the feasibility of the project. Eventually, it will be much easier for an integrated team to reach consensus about the feasibility of project goals, scope and requirements than it is for teams which are acting separately. In case the requirements and goals are sharp before the operational development, a large part of the delay at the Decision to go Public can be prevented. As currently much delay is experienced at this gate, it is very worthwhile to focus on the improvement of requirements.

- In addition to the integration of teams, for the Fuzzy Front-end to be more effective, the number of deliverables needs to be reduced. Here, especially the number of deliverables within the first stages needs to be decreased. As nicely stated by Cooper (2008): “the emphasis of deliverables should be on making expectations clear to project teams and leaders and they should not serve as an “information dump” for the gatekeepers. Clearly when project teams are preparing one-hundred page reports, but gatekeepers are only reading the first ten pages, there is a serious disconnect about what’s needed and what’s expected” (Cooper R. G., 2008, p. 19). Currently this is exactly what is happening. The observation of the current way of working showed that team members need to
hand in very much deliverables and sometimes they need to be handed in, in both Dutch and English. As the English language is not the native language of most employees, it cost them a lot of time, while in the end it often appears to be unnecessary. In addition, gatekeepers are basing their decisions on the main information, provided in the main NPD-deliverables, so the multiple other (detailed) deliverables seem to be a waste of time. Therefore a balance needs to be found in processing deliverables that provide the right information, without costing a lot of time. It is better for the scoping teams to spend their time to explore technical feasibility of requirements, than on copy-pasting the same information into multiple deliverables. Principles that can be used to minimize the number of deliverables are: “information only has a value to the extent it improves a decision” and “the deliverables package should provide the decision-makers only that information they need to make an effective and timely decision” (Cooper R. G., 2008, p. 19). Given the previous principles it can be stated that the enormous amount of detailed deliverables obliged for the scoping-teams should be reduced, as decisions should be based on the main NPD-deliverables. Reducing the number of deliverables will enhance the effectiveness of project teams, which subsequently reduces the overall cycle time of a project.

Another issue related to emphasizing the Fuzzy Front-end is the authority for making the decisions at the gates. Nowadays the authority to make a decisive judgment on whether a project can proceed to the next stage lies very high in the hierarchy of the organization. This authority obliges the processing of many deliverables, which is very time-consuming. When the program-board becomes responsible for dividing the actual money, it becomes much easier to make faster decisions, as the program board is much more involved in the projects. Since the program board has more knowledge about the contents of a project, it is better able to assess whether a project is worth the money or not. Besides, the possibility of extended scopes will be decreased. As shown by the qualitative analysis, currently there is a fire-fighting strategy, meaning that management is extremely busy with solving minor problems, while not preventing them in the future. Solving minor problems often refers to adding small tasks into existing projects and this result in extended scopes. As this extension of scope is obliged by management, it cannot be refused. Nowadays projects are thus often extended with extra tasks that need to solve the minor problems of management. By putting the authority lower into the organization, it can better be assessed whether a task fits into a project and whether it will delay the project or not. Furthermore, when the program board gets decisive power, the toll-gates can become leaner and simpler. Given the closer involvement of the program board within the projects, fewer deliverables are necessary to provide information. Also the progress of a project is better known by the program board. Lowering the authority to make decisions will thus not only speed up the decision-making process, but also development activities.

Overall, at the organizational level, the solution design aims for another decomposition of time within the Stage Gate model. For the smaller, non-release projects it is recommended to structure them with the Stage-Gate Lite version. This version will enable a faster decision-making process. Besides, in general, a more front-end loaded process should be aimed for. A more front-end loaded process makes it possible to achieve uniformity about project goals, requirements and scope and subsequently this will prevent important causes of delays. Focus on the front-end of the innovation process not only requires
more time for the first stages of the innovation process. Also a better integration between Marketing, KS&O and scoping teams is needed. In addition, scoping-teams should be charged with less deliverables, to create more time for relevant activities. Finally, for an optimal result, decisive power should be placed lower into the business hierarchy. By doing so, effectiveness can be increased and better and faster decisions can be made.

5.3.2 Solution design at project level
At the project level, mainly the impact of the spiral development solution is of importance. It is very recommendable for the innovation projects to build in much more short-term feedback loops. As shown by the results of the qualitative analysis, the main causes of delays are the underestimation of complexity and changing project requirements. Currently not only customers are changing their requirements during the whole innovation process, but also within the development teams no clear view is created about the requirements. This makes it very hard to point out what exactly the project goal is. Additionally, because of a lack of knowledge and experience, team members are unable to make a good estimation about the complexity of certain goals or requirements. In order to solve prior problems, KPN ZM needs to bridge the gap between the need for sharp, early and fact-based service definition before development begins versus the need to be flexible and to adjust the service’s design to new information and fluid market conditions as development proceeds (Cooper R. G., 2008). This can be achieved by including iterative loops of “build-test-feedback-and-revise” within the innovation process. By implementing these loops, changes in requirements and scope can be quickly captured by the project teams. Since the iterations are very short, extensive delays are prevented. Also the feedback of the customer makes it possible to gain knowledge about the exact requirements, which accordingly makes it possible to make better estimations about the complexity of the project goal. As the iterations are meant to be short, no additional time is needed anymore to process the right quality.

In practice, most feedback loops should be implemented before the DP. In the stage before the DF the voice of the customer assessment and the concept test should be introduced. Next, in the development-stage, more prototyping testing should be performed. Currently, only after the development, tests are conducted. This should be changed to prevent the long iterations.

Overall, at project level, especially the voice of the customer should be more often taken into account. When integrating more with the customer, goals can be much faster clarified and changing requirements can be captured without causing delays. This way quality can be guaranteed without the need for additional development time.

5.3.3 Solution design at team level
The final operational level in which the redesign includes changes is the team level. The analysis showed that nowadays the low level of team alignment is causing a lot of delays. Due to different priorities people are not equally committed to a certain project. Also it shows to be hard to maintain the knowledge level within a team. As there are much re-shuffles, it often occurs that a project team starts with the right people, but in the latter stages knowledge is lost. These re-shuffles also cause changing requirements, especially when particular information is not properly transferred to the new persons. In order to prevent these delaying factors in the future, project teams should be composed for a longer
amount of time. By forcing team members to stick together for at least the duration of one project, team members can better interact. In addition, team members get the time to learn to know each other and to work effectively together.

For the teams to be effective, they should start with a kick-off meeting. Currently the team members are not introduced to each other in a proper way. As it is important for the team members to have a common understanding of what the intention of the project is, it is recommendable to start with a general brainstorm-session. This brainstorm-session helps to get all ideas of all individual team members clear and to a certain extent these ideas can be incorporated. The combination of ideas will help to decrease the possibility of running into other opportunities later on in the project.

Furthermore, it is important to combine different functions in a team. Nowadays, teams are meant to be composed in a multi-functional way. Though, basically it comes down to putting engineers together. As explained at the organizational level, more people of Marketing and KS&O should be involved in the innovation-teams. Also it is recommendable to involve a team member of Sales. When looking internally at the department of Innovation & Programs, there is strong distinction between Scoping, Changing and Delivery teams. It would be better to integrate these teams, as in that case more specific knowledge becomes available in one team. This will lead to more discussion, but also to better and more specific output. Putting a multi-functional team together will not be easy, as almost all people within KPN are very busy. The reason why there is currently a very low degree of integration is mainly because of the schedules of the Marketing people. It is stated that these people do not have time to join the meetings of the Innovation & Programs teams. Therefore the only way to accomplish multi-functional teams seems to be the obligation of it. By making the diverse team-composition obliged, a project cannot be started before the right people are tied for at least one year. Good negotiations with the Marketing, KS&O and Sales department are necessary to achieve such a regulation.

Overall, at the team level, the main change is to compose multi-functional teams, which are obliged to stay together for at least the duration of one project. This will create a much higher degree of team alignment. By organizing a kick-off meeting and regular team sessions, team members will become more committed and this will subsequently enhance effectiveness.

5.4 Conclusion

Few development projects actually are able to follow their initial schedule of development activities (Griffin, 1997). The delays that rise within NPD-projects can have multiple causes and effects. Within current literature not many studies have specifically focused on revealing the exact causes of delays. Up till now, the main focus has been on the antecedents of NPD speed. Though, as delays are part of NPD speed, not all antecedents of speed can also be related to delays. Given this difference, there is a clear need for research that focuses specifically on delays. Besides, past research included mixed findings about the effects of delays. In particular, conflicting results are found concerning the effects of delays on costs and quality. Especially within the context of new service development, prior relationships are unclear. Therefore, this study aimed to contribute to current literature, by revealing the main causes and effects of delays within the new service development context of KPN. As KPN is currently dealing with a long time-to-market due to multiple delays in NSD projects, this study is also of high importance
for KPN. Knowing the exact causes and effects of delays will help to enhance their competitive market position.

The results of the empirical analysis conducted at KPN ZM showed that about 75% of the examined NSD projects are currently struggling with delays in the innovation trajectory. These delays have multiple causes. The analysis of Exception Reports and interviews with project managers revealed that mainly the unclear goals and rapidly changing requirements are important determinants of delays. Also the underestimation of complexity and low level of team alignment appeared to cause delays in the NSD projects. Here, the planning fallacy and the fire fighting strategy, elaborated in prior studies, are thus of interest. With regard to the antecedents of NPD speed, this study shows that goal clarity, team dedication and experience, management support, iteration and project complexity can also be regarded as antecedents of delays. Looking at the effects of delays, the output of the model analysis showed two important effects. In line with expectations, the results showed that a delay increases quality. Furthermore, the results showed that when more money is available, the quality of the eventual new service can be even further enhanced. Though, no significant effect of delays on costs is found.

It is noticeable that the results of this study show that a delay increases quality. Apparently the projects performed within KPN ZM need more time to accomplish all quality-requirements. Besides, the results showed that if more money is available, quality can be even more improved. However, given the causes of the delays it can be stated that project teams do not work very effective. For instance unclear goals and changing priorities ensure that team members cannot optimally use resources. In case the project teams start working more effectively, the additional time and money is unnecessary and time-to-market can be reduced. As a reduction in time-to-market is the ultimate goal of KPN, this study elaborated several recommendations to enhance the effectiveness of NSD project teams acting within KPN ZM. The recommended actions are distinguished at three operational levels. At the organizational level another decomposition of time within the Stage Gate model is recommended. Especially the fuzzy front-end of the innovation should be more emphasized. Not only should the time and money of the first stages be increased, but also tasks and responsibilities should be changed. For instance the scoping-activities should be more integrated with Marketing and KS&O, scoping-teams should be charged with less deliverables and decisive power should be placed lower into the business hierarchy. By doing so, requirements can be better established and complexity can be better estimated. Also a faster decision-making process can be achieved. In addition, especially early delays are prevented. At the project level the redesign mainly focuses on the implementation of short “build-test-feedback-and-revise”-loops. More feedback will help to clarify customer requirements and project goals. Finally, at the team level, the redesign emphasizes the importance of multi-functional teams. More integration between and within departments is necessary to create a higher degree of team alignment. Here, it seems to be necessary to oblige a commitment for at least one project, in order to prevent the high amount of re-shuffles.

In case KPN ZM starts working with the previous recommendations, not only delays can be prevented, but also the effectiveness of NSD project teams will be enhanced. Together this will shorten the overall NSD project cycle time. In addition, the competitive position of KPN ZM can be remained and enhanced, as a shorter time-to-market allows KPN ZM to gain first-mover advantages.
6. Discussion

Based on a review of the innovation literature, one proposition concerning the causes of delays and three hypotheses related to the effects of delays in NSD projects are developed in this study. Five antecedents of NPD speed were proposed to be also applicable for delay. Besides, an increase in costs and quality due to delays was expected. The analysis, based on data collected from 48 projects conducted within KPN ZM, indicated that goal clarity, management support, project complexity, iteration and team experience are all antecedents of delays. Here, for instance the underestimation of complexity or the lack of enough resources appeared to be important causes of delays. It was also found that delays are enhancing the quality of NSD projects. Besides, as more money is available for a project, the quality can be even further enhanced. Prior results showed that the current focus of KPN ZM on decreasing the NSD project cycle time is also an important source of delays. As projects are conducted with a limited amount of resources, quality-requirements cannot be achieved and many delays are experienced. Finally, contrary to expectations, the results showed that a delay not necessarily increases costs. In some cases, for example at the Decision to Fund, a delay may even reduce costs. However, as mixed findings are revealed about the effect of a delay on costs, no generalization can be made with regard to this relationship.

The findings of this study have several implications for both theory and practice. In this final chapter, the research implications and managerial implications will be elaborated. Also research limitations and directions for future research will be discussed.

6.1 Research implications

This study contributes to the cycle time literature in several important ways. First, the findings of the qualitative analysis showed that project complexity is an important antecedent of delays within the context of new service development. This finding is surprising, because the study of Chen et al. (2010) did not find a significant effect of project complexity on NPD speed. Although it was expected that project complexity could be related to delays, it is noticeable that this finding holds within the context of a new service context. As services differ from products, it may be suggested that complexity has a bigger impact on services compared to products. This may be due to the intangibility of services or due to the fact that services are perishable.

Another important finding of this study is that in general, delays cause an increase in NSD project quality. This is remarkable, as many studies have found the opposite (Kessler & Bierly, 2002; Calantone & Di Benedetto, 2000). The inverted U-shaped relationship suggested by Lukas & Menon (2004) cannot be excluded by the findings of this research. It is very likely that, up till a certain extent, a delay improves quality, but if the delay exceeds its optimal duration, quality will decrease. Importantly, the finding that a delay increases quality may be attributed to the use of a perceptual measure. It is certainly possible that project managers have increased the extent to which customer requirements are met, in order to make their performances look better. However, as the quality is also measured by the policy-check, which is accurately recorded by KPN, the measure of quality is not fully biased. Besides, since the
relationship between quality and delay was in all scenarios found to be significant and positive, there is enough evidence to state that quality indeed is improved if additional time is spend on a project.

Third, the results of the quantitative analysis conducted by the use of PLS path modeling showed that a delay at DF reduces costs. Though, in case the delay was experienced much earlier or later on in the innovation trajectory, costs were increased as the delay increases. This finding shows that effects of delays are dependent of the moment in time at which they are experienced. This is in line with the results obtained by van Oorschot et al. (2011), who stress that interventions should depend on the development time elapsed. According to van Oorschot et al. (2011), in case a delay is found relatively early, project teams can best focus on time and quality. The results of this study agree with this intervention, as costs are not increased much when a delay is experienced early. Therefore no intervention should be made to reduce costs. In case a delay is found later, van Oorschot et al. (2011) propose to reduce costs. As the results of this study show that when a delay is experienced later on in the NSD process, costs increase, it is indeed best to focus on a reduction of costs.

Finally, this study contributes not only to cycle time literature, but also to NSD literature. Up till now there was a lack of research that focused specifically on revealing the causes and effects of delays within the context of new service development. This lack is partly solved by the findings of this research. Concerning the causes of delays, the results of this study showed that goal clarity, top management support, project complexity, iteration and team experience can all be seen as antecedents of delays within new service development projects. With regard to the effects of delays, no consensus was reached within current literature. This study showed that delays increase quality. Also costs appeared to have a positive impact on quality. However, no significant effect of delays on costs was found. Given the clear findings of this research, this study helped to reduce ambiguities within current NSD literature.

6.2 Managerial implications
From a managerial perspective, this study emphasizes the importance of the fuzzy front-end of innovation trajectories. Currently KPN ZM is putting much pressure on the reduction of the total time-to-market of new services. This is for example tried to be achieved by reducing the time of the first stages in the NSD process. However, reducing this time between idea and decision to fund seems to work opposite. The results of the qualitative analysis showed that as there is no time anymore to conduct reliable tests and analyses, requirements are often unclear and complexity is often underestimated. This results in many delays later on in the development process. In addition, the results of the quantitative analysis showed that a delay improves the quality of the eventual newly developed service. This finding also shows that managers can better spend more time on the stages before a decision to fund is made. By conducting more tests and analyses, requirements can become more clear and limited and this will eventually lead to higher effectiveness of NSD project teams. This increase in effectiveness will subsequently lead to a lower time-to-market. Thus, managers must not want to rush the NSD process, as it shows that taking more time in the beginning of the innovation will eventually be more beneficial.

Second, the findings indicate that the quality of a new developed service benefits from additional resources. In this research, a lack of budget is often mentioned as an important reason for delays. This
lack of resources showed to have many root causes, which all can be solved by enhancing the effectiveness of project teams. Though, as budget still remains a recurrent problem, managers need to carefully consider the number of projects they are performing. In case all projects need to be continued, managers accept the risk that a lack of budget may become a delaying factor within the projects. On the other hand, if managers decide to perform fewer projects, more resources become available and the eventual quality of the new services can be enhanced.

Another managerial implication is that team alignment is much more important than currently is thought within many companies. The results of this study show that different priorities and a low level commitment are important causes of delays in NSD projects. Besides, miscommunications between various functions are also causing delays. Prior findings emphasize that managers should spend more time in putting the right team members together in a multifunctional way. Cross-functional teams can accelerate NPD decisions and lessen inter-functional conflict. Besides, learning and feedback can be enhanced (Parry, Song, Weerd-Nederhof, & Visscher, 2009). Eventually, an aligned team will be more effective, which results in lower NSD cycle time and costs.

Finally documentation seems to be the key to success. The results of this study have shown that in practice often the wrong issues are documented. For example the causes of delays logged in the Exception Reports often did not match the reasons mentioned during the interviews. In case the reasons for delays are better documented, managers can respond more rapidly. Besides, when knowing the exact reasons for delays, more appropriate actions can be taken. This will avoid delays later on in the development process. Therefore, managers should emphasize the quality of documentation and check this on a regular basis.

6.3 Research limitations
There are several limitations of the present study. First, concerning the timing of measurement, it has to be noticed that the research data is cross-sectional, since all data is gathered at one moment in time. Unfortunately no longitudinal data could be gathered and therefore the collection of longitudinal data remains a challenge for the future. As a consequence of the non-longitudinally measurement, the progress of the projects could not be analyzed and differences between types of projects could not be taken into account. A second limitation of this research is the subjectivity of the quality measure. The quality is measured by the use of estimations of project managers. These estimations are mainly based on the own experiences of project managers and therefore they may have had different interpretations. Third, within the quantitative analysis the costs are not standardized. Though, as the standard deviation of the project costs appeared to be quite big, misleading relationships may have been found. This is a serious limitation of the research, but given the time frame of this research, the effects of standardization could not be taken into account anymore. It is recommendable for future research to include standardized costs within the analysis. Fourth limitation of this research is that the eventual effect of delays, cost and quality on project success could not be analyzed, as the outcome is currently not measured within KPN ZM. However, as the relationships with eventual project success are often analyzed in other studies, this was not a big problem. Finally, this research has suffered from the bad documentation within KPN ZM. Out of the x projects that are currently performed within KPN ZM, only
48 projects could be fully traced. This sample size of 48 is quite small and may have led to misleading relationships.

6.4 Directions for future research

Finally, this study contains several issues that need to be further explored. As stated in the first paragraph of this chapter, contradicting findings are revealed regarding the effects of delays. In this study no significant effect of delays on costs is found. Though, given scientific literature (Brown & Eisenhardt, 1995) (Davis, Dibrell, & Janz, 2002), a relationship is expected to exist. Therefore, additional research is needed to reveal how a delay is affecting costs. Here, especially further research should be performed to confirm the U-shaped relationship suggested by Langerak, Hultink & Griffin (2008).

Furthermore, as the sample size of this research was quite small, the research can be extended by a larger sample size. In case the sample size is larger, findings will be more reliable and significant. When the sample size is bigger, it will also become possible to conduct multiple regression, which maybe can lead to new insights. In addition, a longitudinal research is recommendable for analyzing the actual progress of projects. In this research, the actual progress of projects is derived from abstract dates which were entered in a database. By conducting a longitudinal research better comparisons can be made between the projects.

A final direction for future research is the development of a general quality-measure. In this study the quality-measure is developed by the use of a checklist (Kessler & Bierly, 2002). Although this checklist provided useful quality-indications, it is important for both theory and practice that a general quality-measure is developed. Currently, in much studies quality is measured in a different way. By developing one general measure, studies can be better compared with each other. Additionally, with the same measure, studies better complement each other.
7. Bibliography


## 8. Appendices

### 8.1 Appendix A: Antecedents of NPD speed

<table>
<thead>
<tr>
<th>Category</th>
<th>Antecedents of NPD Speed</th>
<th>Definition</th>
<th>Study</th>
<th>Antecedent of NSD speed</th>
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<tbody>
<tr>
<td>Strategic</td>
<td>Distinct approach incremental vs. radical innovations</td>
<td>“extent to which acceleration approaches are different for incremental and radical innovations” (Kessler &amp; Chakrabarti, 1999)</td>
<td>Kessler &amp; Chakrabarti (1999)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emphasis on speed</td>
<td>“the relative importance of time in comparison with other performance criteria” (Chen et al., 2010, p.19)</td>
<td>Cankurtaran et al. (2012)</td>
<td></td>
</tr>
<tr>
<td>Formal NPD strategy</td>
<td></td>
<td>“strategy that specifies the firm’s NPD goals, ties those goals to the firm’s business strategy and outlines a plan for reaching those goals” (Parry et al., 2009, p.629)</td>
<td>Parry et al. (2009)</td>
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<tr>
<td>Goal clarity</td>
<td></td>
<td>“the extent to which an NPD project’s vision, mission, goals and definition are clearly identified and communicated” (Chen et al., 2010, p.19)</td>
<td>Chen et al. (2010), Kessler &amp; Chakrabarti (1999), Cankurtaran et al. (2012)</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>• Goal effectiveness</td>
<td></td>
<td>Cankurtaran et al. (2012)</td>
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<tr>
<td>Innovative climate</td>
<td></td>
<td>“environment in which employees have the freedom to define their work and the time and support to develop unplanned new ideas” (Parry et al., 2009, p.630)</td>
<td>Parry et al. (2009), Cankurtaran et al. (2012)</td>
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</tr>
<tr>
<td>Top management support</td>
<td></td>
<td>“senior management’s favorable attitude and commitment to NPD objectives” (Chen et al., 2010, p.19)</td>
<td>Chen et al. (2010)</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>• Availability of resources and facilities</td>
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<td></td>
<td>• Organizational support</td>
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<tr>
<td>Process</td>
<td>Iteration</td>
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<td>Chen et al. (2010)</td>
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<td></td>
<td>• Testing</td>
<td></td>
<td>Cankurtaran et al. (2012)</td>
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<td></td>
<td>Learning</td>
<td>“the process through which a project team gains or creates knowledge in performing NPD activities” (Chen et al., 2010, p.19)</td>
<td>Chen et al. (2010)</td>
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<td></td>
<td>• Team learning</td>
<td></td>
<td>Cankurtaran et al. (2012)</td>
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<td></td>
<td>Process concurrency</td>
<td>“the extent to which stages of the NPD process overlap” (Chen et al., 2010, p.19)</td>
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<td>Process formalization</td>
<td>“the use of explicit rules and standard procedures in the NPD process” (Chen et al., 2010, p.19)</td>
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<td>• Standardization</td>
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<td>• Formal process use</td>
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<table>
<thead>
<tr>
<th>Team External integration</th>
<th>“the involvement of external partners like suppliers and customers in a new product initiative” (Chen et al., 2010, p.19)</th>
<th>Chen et al. (2010), Cankurtaran et al. (2012)</th>
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</thead>
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<tr>
<td>• Supplier &amp; customer involvement</td>
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</table>

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<thead>
<tr>
<th>Team Internal integration</th>
<th>“the degree of cooperation among multiple functions and interaction among team members in an NPD initiative” (Chen et al., 2010, p.19)</th>
<th>Chen et al. (2010), Parry et al. (2009), Cankurtaran et al. (2012)</th>
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<tbody>
<tr>
<td>• Cross functional teams</td>
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<td>• Organizational integration</td>
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<tr>
<td>• Teamwork quality</td>
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</table>

<table>
<thead>
<tr>
<th>Team dedication</th>
<th>“the degree to which team members dedicate themselves to an NPD initiative” (Chen et al., 2010, p.19)</th>
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<tr>
<td>• Team stability</td>
<td></td>
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<tr>
<td>• Team commitment</td>
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<tr>
<th>Team empowerment</th>
<th>“the decision-making autonomy of the project team” (Chen et al., 2010, p.19)</th>
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<tr>
<td>• Management style</td>
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<tr>
<th>Team experience</th>
<th>“the degree to which team members possess experience, knowledge and skills” (Chen et al., 2010, p.19)</th>
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<table>
<thead>
<tr>
<th>Team leadership</th>
<th>“the degree to which a project’s leader possesses skills, knowledge, and experience relevant to both management and technical aspects of the project” (Chen et al., 2010, p.19)</th>
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<tbody>
<tr>
<td>• Strength and influence of team leader</td>
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<tr>
<th>Tenure among team members</th>
<th>“time in which employees are active within an organization”(Kessler &amp; Chakrabarti, 1999)</th>
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<td>• Problem solving proficiency</td>
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</table>
- Project priority
- Technical proficiency

Table 1: Overview of antecedents of NPD speed
8.2 Appendix B: Customer requirements checklist

Quality-checklist (Kessler & Bierly, 2002)

Please place a check next to the statement that indicates the extent to which the preset performance specifications for this project have been achieved.

We have exactly met the preset performance specifications ___ (7)

We have achieved more than the preset performance specifications with

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8.3 Appendix C: Interview “Identifying root causes”

1) Voor project X is er een exception report; de toelichting hierbij is dat er een aanvraag voor extra budget is gedaan wegens een vertraging door gebrek aan budget en veranderde project approach. Kun je hier wat meer over vertellen?

____________________________________________________________________________
____________________________________________________________________________
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2) Was de opgelopen vertraging vooraf voorspelbaar (had er een betere inschatting gemaakt kunnen worden?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

a. Was de planning te optimistisch?

____________________________________________________________________________
____________________________________________________________________________

b. Bestaat er druk vanuit het management om TE strak te plannen?

____________________________________________________________________________
____________________________________________________________________________

3) Was de opgelopen vertraging vermijdbaar, en zo ja, hoe dan?

____________________________________________________________________________
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### 8.4 Appendix D: Correlations

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<tr>
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<th>DELAYDJ</th>
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<th>DELAYDP</th>
<th>DELAYDH</th>
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<th>WITHIN BUDGET</th>
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**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Table 2: Correlations between all measurement items
8.5 Appendix E: Path-coefficients of PLS path modeling

Figure 1: PLS path modeling – investigation of hypotheses – path coefficients

Figure 2: PLS path modeling of the effects of delay at DF – path coefficients
Figure 3: Model for program A - path coefficients

Figure 4: Model for program B - path coefficients

Figure 5: PLS path modeling of the effects of cost as mediator – path coefficients
## 8.6 Appendix F: Implementation plan

<table>
<thead>
<tr>
<th>Implementation level</th>
<th>Action</th>
<th>Decisions to take</th>
<th>Responsibility of</th>
</tr>
</thead>
</table>
| **Organizational**   | Implement Stage-Gate Lite to speed up non-release projects (include only the most important improvement- and new service-projects in a release, administrative and projects focused on fixing mistakes can be performed outside a release → this distinction should be more rigorous) | - Decide which projects do not have to be included in a release  
- Decide upon the number of gates that can be taken  
- Deliverables per gate and specific go/kill criteria | xxxxxx |
|                      | Emphasize the Fuzzy Front-End: extend duration from Idea of Opportunity till Decision to Fund from 12 to 20 weeks to capture current delays and to guarantee quality  
- Integrate scoping-tasks of Marketing, KS&O and Innovation & Programs  
- Make an overview of the top-priority deliverables and reduce the number of deliverables especially for scoping teams  
- Allow for decisive authority lower into the organizational hierarchy (present ideas and benefits to management) | - Decide how additional time can be best divided across first stages  
- Decide upon the degree of integration; multi-functional teams are suggested  
- Decide which deliverables are most important for scoping activities (create new ones)  
- Decide upon the amount of budget available for each program per year | xxxxxx |
| **Project**          | Create short iterative loops of “build-test-feedback-and-revise” within the innovation projects to capture changing requirements quickly (create at least the six loops mentioned by Cooper & Edgett (2008)) | - Decide upon the number of tests  
- Decide upon the degree of involvement of external parties, such as customers and suppliers | xxxxxx |
| **Team**             | Compose fixed teams  
- Integrate Marketing, Sales, KS&O, I&P, Engineering, etc. into one team | - Decide how to organize the integrated teams; (de)centralized | xxxxxx |
<table>
<thead>
<tr>
<th>Oblige teams members to stay within the team for the whole duration of one project (avoid the many re-shuffles)</th>
<th>Decide about the composition of a team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrange a good kick-off meeting of a project and regular team sessions during the project</td>
<td>Decide the obliged duration of being part of a team</td>
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</tbody>
</table>

| Decide about standard organization of kick-off meeting and team-sessions | |