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Success criteria and critical success factors for contractors of urgent and unexpected projects

A multiple case study within the maintenance & repair sector

Master thesis

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Preface

This thesis was written as a final testing of proficiency for the major Supply Chain Management, being part of the part-time Master of Science Business Administration at the Rotterdam School of Management, Erasmus University.

Herewith I would first of all like to thank Stephanie van Winsen, my caring and supporting girlfriend who strongly encouraged me, while being confronted with the necessary study frustrations during the last two years. I would also very much like to thank my coach Dr. Fabian Sting for his infectious enthusiasm, reflective feedback, and methodological expertise, and co-reader Dr. Serge Rijsdijk for his methodological reflection and practical contributions. My thanks also go out to my family who were very supportive and willing to provide feedback on the form, language and content of this thesis. Finally I would like to thank the company Stork and its employees, with a special thanks to Dr. van Beek, for making this master's degree financially possible and providing me access to extensive data which was used during this research.

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Content

Summary

Companies face many challenges today, in addition to overall rising costs, economic volatility and increasing focus on safety, technical assets have to remain operational while maintenance budgets shrink. When a breakdown occurs, immediate action is required as downtime costs increase at a staggering rate. A specialised company is generally contracted to initiate a project and repair a damaged asset within the shortest possible lead time. Seen the costs involved, realising project success is of the essence. Despite project success being a dominant theme in the project management literature, there is still little consensus on the factors that lead to project success (Müller & Jugdev, 2012). Prior research has largely attempted to develop a universal theory on project success, by trying to establish a set of success factors applicable to all projects. Some scholars argue that this long-term strategy may be inappropriate, seen the fundamental differences between projects (Dvir, Lipovetsky, Shenhar, & Tishler, 1998). Numerous recent studies indicate that project success factors are contingent on the type of project (Shenhar, Dvir, Levy, & Maltz, 2001; Söderlund, 2004; Müller & Turner, 2007; Howell, Windahl, & Seidel, 2010; Dalcher, 2012). This study therefore takes a confined perspective by solely focusing on projects which are both urgent and unexpected. Urgent and unexpected projects are defined as those that require continuous additional attention to minimize the overall lead time, and which were not regarded as likely to happen when planning resources in advance. Urgent and unexpected projects substantially differ in approach from best practice project management, as they do not start after an extensive feasibility study and completion of a detailed scope, budget and risk analysis (Meredith & Mantel, 2006). With the costs of asset downtime in mind, it is relevant for the field of operations management to understand which factors are critical for the success of these projects. A prerequisite to determine success factors is knowing if a project is successful. According to literature, an assessment can be made using project success criteria. For over fifty years project success has been linked to cost, time and quality. Critics however argue that these criteria are too limited and therefore suggest alternatives (Turner & Zolin, 2012; Westerveld, 2003; Atkinson, 1999). The objective of this study is therewith to contribute to the development of theory regarding urgent and unexpected projects by identifying the success criteria and critical success factors for contractors and specify their relation. This leads towards the following research question:

What are the success criteria and critical success factors for contractors of urgent and unexpected projects in the maintenance & repair sector[1], and what is their relation?

To answer this question, this study utilises a multiple case study research strategy to build new theory. The unit of analysis is urgent and unexpected projects. The empirical evidence is based on data collected from six projects at a large technical service provider called Stork. Three successful and three unsuccessful cases were selected with the aim of matching patterns in polar type cases. In this study multiple sources of evidence were used and triangulated in order to strengthen construct validity. Data was primarily collected by interviews, direct observations and reviewing of project documentation. The empirical data was analysed in two phases. During the first phase, the project success criteria and critical success factors were identified by tagging, refining and grouping rich qualitative data into concepts. In the subsequent phase, these concepts were rated and assigned a

[1] This kind of services includes maintenance and repair of goods by an undertaking which is not the owner of the goods (Centraal Bureau voor de Statistiek, 2014)

score. The scores were systematically reviewed leading to the specification of relations and development of new propositions.

The results of the cases studied by this research suggest, that the perceived success of urgent and unexpected projects can be determined by evaluating performance against the dimensions: (1) profit, (2) customer satisfaction, (3) lead time, (4) quality, and (5) safety. The findings provide evidence supporting the existence of several relations between the success criteria. Customer satisfaction is for example influenced by the criteria safety, lead time and quality. The results indicate that project success is a multidimensional concept and therewith corroborates with prior research (Wateridge, 1998; Baccarini, 1999; Cooke-Davies, 2002). In addition, the evidence leads to believe that some success criteria (i.e. profit, customer satisfaction, lead time, quality) are universal to all projects, while others (i.e. safety) are contingent on a specific type. The results also suggest, that the following six factors are critical to the success of urgent and unexpected projects: (1) communication & feedback quality, (2) sufficient flexible & skilled personnel, (3) risks addressed, assessed and managed, (4) quality of customer/user relation, (5) competent project manager, and (6) sufficient flexible & skilled suppliers. The first four of these dimensions express a deterministic relation, suggesting that the success of urgent and unexpected projects can be determined based on their assessment. The last two dimensions express a probabilistic relation, implying that their performance may at best increase the likelihood of project success. The sets of critical success factors is found to vary among the projects studied by this research. Each project has a number of corresponding and non-corresponding factors. Despite the commonalities between urgent and unexpected projects, differences within remain to exist. The evidence suggests that some critical success factors may be applicable to all urgent and unexpected projects, while others may be specific to a certain, more distinct type. As a result, some success factors may be more potent in contributing to project success than others. The results of this study may have several implications for managers and practitioners at large. If the propositions are tested and support the findings of this study, then managers should adopt a multidimensional approach to the concept of project success. Managers should try to specify the project objectives based on the criteria identified by this study and direct project member attention to the expected results. The success criteria can also be used as a benchmark measure to evaluate project success and learn from the factors that attributed to it. The research furthermore suggests that if companies wish to increase the success of urgent and unexpected projects from a contractors perspective, they need to ensure good communication and feedback between all stakeholders. Personnel carrying out the project needs to be flexible, skilled and available in sufficient quantities to ensure that lead time is kept to a minimum, and the desired quality is met. The assigned project manager needs to be competent enough to motivate personnel, keep the project on track and provide the necessary technical expertise and skills. As urgent and unexpected projects are inevitably subject to high levels of uncertainty, risks need to be assessed, addressed and managed at multiple levels. Managers need to be aware that suppliers can provide access to difficult to source parts, extra capacity and a more comprehensive range of solutions to reduce lead time. Finally, managers need to consider freeing up time to invest in a good relation with the customer and end user, as it may prevent a project from falling into a negative spiral of backroom politics, lack of trust and willingness to communicate.

The results of this study should be evaluated taking a number of limitations into account. The cases were selected based on the senior managers recommendations and subjective view on project success. Part of the data was collected through interviews with respondents who may not have been the most well informed individuals on the project. The data was also collected and largely analysed by a single, first time and inexperienced rater of qualitative data.

1 Introduction

Asset[2] driven companies face many challenges today, in addition to overall rising costs, economic volatility and increasing focus on safety, companies have to keep their technical assets operational while maintenance budgets shrink. Companies strive for high asset utilization in order to achieve efficiencies and therewith operate assets at a lower cost to gain competitive advantage (Porter, 1985). Assets, and especially aging assets which are more common in Western countries, are prone to unexpected failure leading to huge financial losses.

Industry studies show that large complex assets typically achieve a 85-95 per cent availability (Bell, 2001). Non-availability is the result of both planned downtime (scheduled maintenance) and unplanned downtime (breakdowns). The cost of downtime compose of lost revenue, carrying excess capacity, and disruption and recovery costs. For typical heavy process industries, these costs can represent 1-3 per cent of revenue and potentially 30-40 per cent of annual profit (Bell, 2001). As companies are increasingly integrating their supply chain and reduce inventories along the way, the effects of a breakdown can far exceed the initial event. Telfon AB L.M. Ericsson, a mobile phone manufacturer from Sweden reported a $ 400 million loss in sales, as its production process was disrupted for months on end as their sole supplier for microchips was unable to supply critical parts following a severe damage to their factory (Eglin, 2003).

When a breakdown occurs, immediate action is required as downtime costs increase in a staggering rate. As asset owners often lack the in-house resources and knowledge to resolve a breakdown, original equipment manufacturers (OEM) or independent service providers (ISP) are called for urgent and immediate support. The supporting company, here referred to as the 'contractor', generally initiates a project and commences with the repair within hours of arrival. These urgent and unexpected projects substantially differ in approach from best practice project management, as they do not start after an extensive feasibility study and completion of a detailed scope, budget and risk analysis (Meredith & Mantel, 2006). With millions of euros in downtime at stake, it is relevant to know which factors are critical to the success of these projects.

Since the 80s, many researchers have focused their agendas on identifying the critical success factors (CSF) of projects (Müller & Jugdev, 2012). Despite several decades of research, there is still little consensus on the CSFs that lead to project success (Pinto & Slevin, 1987). Research has to date facilitated in generating an abundant lists of CSFs, however discussions remain (Müller & Jugdev, 2012) in several areas. A first debate is concerned with the definition of project success. A prerequisite to determine CSFs is knowing if a project is successful. For over fifty years project success has been linked to cost, time and quality. Critics however argue that these criteria are too limited and therefore suggest alternatives, i.e. benefits for the stakeholder, organization or environment (Turner & Zolin, 2012; Westerveld, 2003; Atkinson, 1999). Other scholars have suggested a more comprehensive approach by assessing project success at different levels, i.e. the project itself, tactical or strategic (Shenhar, et al., 2002) and during different time frames (Shenhar, et al., 2001). It is also suggested that the success of projects may vary from one stakeholder to another. Depending on the project at hand, stakeholder success criteria may need to be incorporated into the overall project assessment (Westerveld & Gayá Walters, 2009). A second debate focuses on the

[2] The term asset refers to production plant, installation and (part of) equipment (Schuman & Brent, 2005)

universality of project management theory. The search for a universal theory may be inappropriate seen the fundamental differences that exist across projects. Several scholars (Dvir, et al., 1998; Söderlund, 2004) propose to distinguish between different types of theories. Some theories should focus on universal aspects (grand theories) while others should focus on specifics. Scholars therefore call to conduct further research on CSFs in certain industries, fields or sectors (Shenhar, et al., 2002; Söderlund, 2004). This call has to a certain extent been answered with studies which have predominantly taken place in the product development (Cooper & Kleinschmidt, 2007; Gemünden, Salomo, & Krieger, 2005), construction (Chua, Kog, & Loh, 1999; Hughes, Tippett, & Thomas, 2004; Chan & Chan, 2004; Shahu, Pundir, & Ganapathy, 2012) and IT industry (Ang, Sum, & Yeo, 2002; Snider, da Silveira, & Balakrishnan, 2009; Nah, 2006). Urgent and unexpected projects have however received little to no attention from academics.

Urgent and unexpected projects represent a distinct part of the domain, in which success criteria and critical success factors have only been studied to a very limited extent. With the costs of asset downtime in mind, it is relevant for the field of operations management to understand which factors are critical for the success of these specific projects. As contractors are believed to have the greatest impact on project success, this study will adopt a contractors perspective. The objective of this study is therefore to contribute to the development of theory regarding urgent and unexpected projects by identifying the success criteria and critical success factors for contractors and specify their relation.

This leads towards the following research question:

What are the success criteria and critical success factors for contractors of urgent and unexpected projects in the maintenance & repair sector, and what is their relation?

This thesis is structured as follows. In the next chapter the theoretical exploration is presented. Hereafter, chapter 3 outlines the research methodology, followed by the case descriptions in chapter 4. The empirical results are summarised and analysed in chapter 5. Subsequently, chapter 6 discusses the major theoretical and practical implications. This study concludes with the references in chapter 7.

2 Theoretical exploration

"A project is a temporary endeavour undertaken to create a unique product, service, or result" (PMI, 2013, p. 3). Projects are therefore commonly used in business to achieve predefined goals and create competitive advantage. Project success is not surprisingly among the top priorities of business leaders and project stakeholders today (Müller & Jugdev, 2012). The success of projects is however influenced by many factors, it is ambiguous and can be viewed from multiple perspectives. To provide a further backbone to this study, this chapter will review the existing literature on factors attributing to project success. The review starts-off by making a clear distinction between project success criteria and project success factors. Hereafter, both topics are individually discussed. The contextual influence on project success is described in the fourth paragraph. The final section explores the characteristics of urgent and unexpected projects.

2.1 Success criteria and success factors, two different but related concepts

"There are few topics in the field of project management that are so frequently discussed and yet so rarely agreed upon as that of the notion of project success" (Pinto & Slevin, 1988, p. 67). Project success is a complex and ambiguous concept. It consists of various dimensions, it is commonly confused and oversimplified, its outcome is highly dependent on by whom and when assessed, and its criteria are furthermore dependent on the context. All in all, a further elaboration seems in place.

In the project management literature, two main concepts of project success are commonly referred to: (1) project success criteria and (2) project success factors (Müller & Jugdev, 2012). Despite these concepts being dissimilar, some literature confusingly uses the terms interchangeably as synonymous (Lim & Mohamed, 1999). In order to avoid confusion, both items are discussed here, and will remain largely separated during the subsequent theoretical exploration.

1. Project success criteria, are the set of principles, standards or measures used to judge the success or failure of a project. These are the dependent variables that measure success. Success criteria answer the question: how do you determine if a project is a successful?
2. Project success factors, are the set of circumstances, facts, or elements which, when influenced, increase the likelihood of success (Kerzner, 1987). Success factors contribute to the success or failure of a project, but do not form the basis of the judgement. Success factors are the independent variables that make success more likely. Success factors answer the question: what are the few key things that must go right for a project to be successful?

To illustrate the difference, consider the following example. A company is extending its production capacity. The success of the project may be assessed using the criteria: time and budget. If these criteria are realised will depend on many factors, including weather, available finance, skills of personnel, economic climate and others. Although these factors could significantly influence the project, they do not determine its success or failure.

2.2 Project success criteria

2.2.1 Project success beyond the traditional criteria

During the early years of project success research, success was measured in both subjective and objective ways. Project success was measured with easy to use metrics, such as time, cost, and quality/performance (Atkinson, 1999; Cooke-Davies, 2002). Project managers had a narrow focus trying to complete a project on time, within budget and according to the predefined quality

specifications. Customer contact was predominantly kept to a minimum, both during and after project completion. Both academics and practitioners viewed "the iron triangle" criteria as a solid foundation to determine project success (Atkinson, 1999, p. 337).

Slevin and Pinto (1986) were among the first to recognise that this long practised approach was too simplistic and started addressing success as a multidimensional concept. In their influential study, they assess project success based on a variety of criteria, including utility of the final project, client satisfaction, and the likelihood of making use of the finished project. These criteria remained unchanged during most of their following research (Pinto & Slevin, 1987, 1988; Pinto & Prescott, 1988; Pinto & Covin, 1989), and continue to be dominant in the work of many researchers today (Lim & Mohamed, 1999; Atkinson, 1999; Belassi & Tukel, 1996; Shenhar & Dvir, 2007; Westerveld & Gayá Walters 2009; Turner, 2014).

Atkinson (1999) explains why project management has been hesitant to adopt alternative success criteria. He does this by demonstrating that two kinds of errors can arise when making an assessment. "Type I errors are made when something is done wrong, while a Type II errors occur when something has not been done as well as it could have been or something was missed" (Atkinson, 1999, p. 341). When a project is assessed using incomplete success criteria, a type II error is made. As pointed out by many scholars (Morris & Hough, 1987; Pinto & Slevin, 1988; de Wit, 1988), cost, time and quality should be used as success criteria, but not as a single dimension. Atkinson (1999) therefore suggests three additional criteria and represents them in a model. These new criteria are: success of project outcome (i.e. reliability, validity), organization benefits (i.e. improved efficiency, profits), and benefits for the stakeholder community (i.e. satisfied users, personal development). Atkinson (1999) concludes by stating that these categories are not exhaustive and merely serve to indicate the existence of other success criteria.

In the years that follow, numerous other success criteria emerge. Lim & Mohamed (1999) for example suggested, safety as an additional criterion, Al-Tmeemy, Abdul-Rahman, & Harun (2011) reported product and market success to be important measures, and Shahu, et al., (2012) found flexibility to be a criterion in addition to the widely acknowledged previous findings. Other authors have also identified success criteria not mentioned thus far. As part of the theoretical exploration, the success criteria of 16 articles were reviewed, summarised and tabulated, with the aim of providing a comprehensive overview of the current body of knowledge. The results are presented in Table 1.

Success Criteria	Source reference	Source	
Project efficiency	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16	[1]	Atkinson, 1999
		[2]	Pinto and Slevin, 1986
Stakeholder satisfaction	1, 2, 8, 9, 10, 12, 13, 14, 15, 16	[3]	Belassi & Tukel, 1996
Stakeholders overall	1, 10, 12	[4]	Lim & Mohamed, 1999
Client	1, 2, 10, 12, 13, 16	[5]	Al-Tmeemy, et al., 2011
Contractor	10, 12, 14, 16	[6]	Shahu, et al., 2012
User	10, 15, 16	[7]	Shenhar, et al., 2001
Project team	8, 9, 10, 12	[8]	Shenhar, et al., 2007
Public	12	[9]	Freeman & Beale, 1992
		[10]	Westerveld & Gayá Walters, 2009
Business success	1, 2, 3, 7, 8, 9, 13, 16	[11]	Baccarini, 1999
		[12]	Turner and Zolin, 2012
Product success	1, 4, 9, 11, 12, 14	[13]	Kerzner, 1984
		[14]	Morris & Hough, 1987
Other	4, 6, 8	[15]	Waterige, 1998
		[16]	Sadeh, et al., 2000

Table 1: Success criteria derived from literature

2.2.2 The assessment of project success over time

Inspired by the work of Pinto & Slevin (1987), who among others studied the variation of success factors during different project life cycle phases, Shenhar, et al., (2001) decided to incorporate the influence of time in their study on project success criteria. Using a combination of qualitative and quantitative methods, they identified four distinct success criteria: project efficiency, impact on the customer, direct business and organisational success, and preparing for the future. While the first three criteria had been identified by prior research, the fourth, preparing for the future, emerged as a new concept. The study which was conducted along multiple time frames indicates several major findings. First of all, project success can only be assessed holistically after a certain time has passed (Figure 1). While project efficiency (i.e. meeting schedule and budget, yield performance functionality, and other defined efficiencies) can be assessed both during and post project completion, preparation for the future (i.e. creating a new market, product line or technology), requires two to five years to pass.

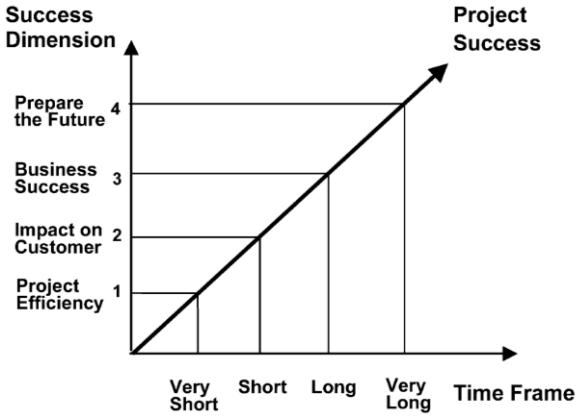

Figure 1: Time frame of success dimensions (Shenhar, et al., 2001)

A second major contribution came from the suggestion that the relative importance of success criteria is subject to change over a projects time frame (Figure 2). Project efficiency was found to be an important success criterion up to the project completion phase, thereafter its relevance started to decline and became irrelevant after about one year. The relative importance of impact on the customer however grew, followed by business success after one or two years. Although the criterion preparing for the future required more time to become relevant, it became the prevailing criterion after three to five years.

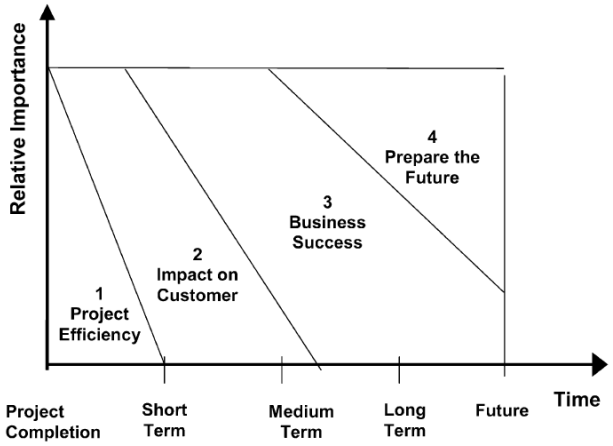

Figure 2: Relative importance of success dimensions (Shenhar, et al., 2001)

In light of this, one can conclude that depending on the time frame of the assessment, the applicability and relative importance of success criteria may vary. Projects which are assessed shortly after project completion may predominantly be evaluated by meeting time and budget constraints, while older projects, which are assessed in retrospect, may well be rated by their contribution to the current state of technology or changes to the organisation. The unstable nature of project success criteria indicates the complexity of success assessment.

2.2.3 Project success from the eyes of the beholder

Projects can have a multitude of stakeholders. The contractor and client are just two who are widely acknowledged. Projects however have many other stakeholders that can have a major interest in a projects outcome. Project success may be perceived differently by different stakeholders. It is important to take the interests of these stakeholders into account as they can negatively influence a project or in a worst case even destroy it (De Wit, 1988). Recently, the Dutch bank ING initiated a project as it wanted to commercially exploit personal data from their customers. The project was found to be highly controversial and received extensive negative feedback from both customers, politics and even regulatory bodies. Within a week after announcing the plan, the ING board decided to abandon the project and apologized to its clients as it had not foreseen the controversy (Munsterman, 2014). ING clearly omitted to consult their stakeholders before initiating the project, therefore not only making the project a failure, but also losing their credibility as a bank. It is common in projects that stakeholders have opposing success criteria. A projects success criteria are seldom identical to all affected. According to Freeman and Beale "Success means different things to different people. An architect may consider success in terms of aesthetic appearance, an engineer in terms of technical competence, an accountant in terms of dollars spent under budget, a human resource manager in terms of employee satisfaction. Chef executive officers rate their success in the stock market" (1992, p. 8). During any project it is therefore essential to identify all stakeholders and determine success from their perspective (De Wit, 1988). Endorsing the stakeholder dependent view, Lim and Mohamed (1999) propose to classify perspectives into two categories: the macro and micro viewpoints. The macro viewpoint represents the perspectives of the owner, users, and the public. They determine project success based on completion (e.g. on time delivery) and satisfaction criteria (e.g. utility and operation). On the other hand, the micro viewpoint embodies the view of the developer and contractor. Success from their perspective can be assessed by completion criteria alone. The respective set of completion criteria and corresponding factors may differ between the macro and micro viewpoints. Other authors (Shenhar, et al., 2002; Westerveld, 2003; Westerveld &

Gayá Walters, 2009; Turner & Zolin, 2012) advocate a more comprehensive approach as grouping all the stakeholders into two viewpoints could result in missing the interests of some stakeholders. Westerveld (2003) and Westerveld and Gayá Walters (2009) therefore suggest that depending on the scale, complexity and further nature of a project, success can be measured by appreciation by the: client, project team, users, contractors, and other involved parties. For each of these stakeholders, the success criteria should be established and ranked according to their relevance at the beginning of the project. Based on these criteria, the project organisation can be shaped and analysed both during and post project completion. While Westerveld (2003) and Westerveld and Gayá Walters (2009) model suggests incorporating the success criteria of all stakeholders, it does not suggest that these criteria may be subject to change over time. Turner and Zolin (2012) therefore integrate these concepts into a single model, clarifying how different stakeholders rate project success over time. Each of the potentially relevant stakeholders for this study is discussed briefly using Turner and Zolin's (2012) model.

- *The project manager and project team.* A project is executed by a team of people being led by a project manager. When a project is completed, the project manager and project team are concerned with whether the result was completed on time, budget and meets the quality criteria. A further concern involves possible future career opportunities and other personal well-being related items. Shortly after project completion, their reputation and relationship become an item of concern, including whether they will receive future business. In the long-run, job security, future projects, development of new technology and competence is something they are concerned with.

- *The lead contractor*. Projects, and especially large projects are realised under the management of a lead contractor. A lead contractor may come from within the owners organisation or they may be an external managing contractor. When a project is finished, the lead contractor is concerned with whether the project was completed within time and made a sufficient profit. Both during and post project completion, the senior supplier is also interested in the safety and risk record. In order to maintain reputation and improve investor loyalty, the lead contractor will be concerned with the projects outcome and meeting performance during the operational phase. In the years following, the lead contractor will be interested in whether the project increased their chance of future work.

- *Other suppliers.* The senior supplier oversees the work of the other suppliers. These are the people or companies who provide goods, materials, or services. Directly after the project, the interests of the other suppliers will focus on getting paid on time and making a profit. In the months and years that follow, the suppliers will be concerned with their reputation and future business.

- *The owner or investor*. A project requires resources and finance, these are generally supplied by the owner or investor with an aim of recuperating the investment with a surplus at the end. At project completion, the owner will judge success based on time, budget and performance measures. Hereafter, when the project is in place, the owner will be concerned with the continuing performance of the projects outcome and its resulting profit. In the long run, the reputation of the project outcome and loyalty of customers is of interest as they continue to generate revenue. The preceding post project completion interests will continue to remain prevailing during the remaining project life cycle.

- *The operators or users*. A product may be purchased by one party and used or operated by another. When the project is handed over, the operator is interested in the performance of the product, the technical manuals and their training. During the operational phase, the operator will most likely be interest in the ease of operation & maintenance, it reliability and uptime.

The diversity in stakeholder perspectives and opposing success criteria may be incommensurable and provide substantial challenges to projects. To limit the scope of this study, this research will only consider the success criteria relevant for the lead contractor, here referred to as 'the contractor', as it is believed that this stakeholder may have the greatest influence on project success.

2.2.4 Project success and project management success

A substantial part of the general project management literature tends to view project success as a single homogeneous concept, which is achieved when project management is performed successfully (Baccarini, 1999). Looking at the influential Project Management Body of Knowledge (PMBOK) definition, this view is not surprising. Project management is defined as "the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project" (PMI, 2013, p. 5). Project success should therefore be realised when the needs and expectations of the stakeholders are met or exceeded. However, as noted before, meeting the needs of all stakeholders is near to impossible due to the diversity in perspectives. As will be shown subsequently, project success is not exclusively the result of successful project management.

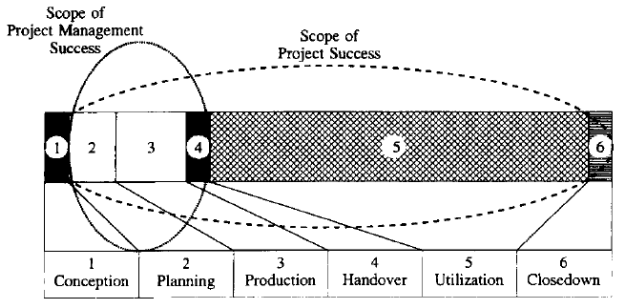

Figure 3: Project and project management success (Munns & Bjeirmi, 1996)

A distinction should be made between project success and project management success, as although the two are similar, they may be very different (de Wit, 1988; Cooke-Davies, 2002; Munns & Bjeirmi, 1996; Baccarini, 1999). Figure 3 demonstrates the scope of both project management and project success. Projects are generally aimed at achieving wide and long-term objectives, e.g. increasing ROI, profitability and competition, which can only be assessed long after the completion of a project. Project management however is aimed towards achieving specific and short-term objectives, e.g. meeting budget, quality and timely project delivery, which is assessed directly after the completion of a project. As a result, project success will be viewed differently depending on the perspective. Within literature, there are many examples of projects, e.g. the Thames Barrier, the 1970 North Sea oil projects or the Sydney Opera House, which are viewed as a success, despite project management failing by being late on delivery and considerately over budget (de Wit, 1988; Munns & Bjeirmi, 1996). Alternatively, project management may be successful, but the project itself a failure, due to not meeting the intended profits or market share. Munns & Bjeirmi (1996) attribute this singular and confined view on success to three factors: (1) time frame; project success is commonly assessed when project management has completed their tasks. By then, it will be clear if the project management

criteria have been met, rather than the overall project criteria. As the assessment takes place prior to the completion of the overall project, project success criteria are never accounted for, and the two become viewed as synonyms. (2) Confusion of objectives; the project management success and project success objectives are typically presented as a single set. Budget, a typical project management success criterion, for example, becomes confused with project profitability. (3) Ease of measurement; as illustrated, projects can have many success criteria. Not all criteria can be measured with the same ease as their assessment may require a long-term perspective, or stakeholders such as CEOs may be difficult to approach. As the criteria, budget and schedule are generally only a mouse click away, they tend to be a convenient common measure. With these insights come two implications. First, although project management can contribute to project success, it cannot prevent failure. Second, as a result from the first, placing the full responsibility of project success in the hands of the project team is inappropriate as their involvement is concerned with only a small part of the total project. Delivering project success is inevitably more difficult than delivering project management success, because it spans over a longer time frame and is subject to more external control (Cooke-Davies, 2002).

2.2.5 The emergence of project success frameworks

Following the work of the previous and other authors, project success has become known as a multidimensional concept, dependent on many factors. With this growing complexity, numerous frameworks have started to emerge aiming to clarify the multitude of criteria and their interdependencies. (de Wit, 1988; Belassi & Tukel, 1996; Westerveld, 2003; Westerveld & Gayá Walters, 2009; Shenhar & Dvir, 2007; Turner & Zolin, 2012).

De Wit (1988) is one of the first to develop a comprehensive framework illustrating the relationship among potential success criteria (Figure 4). At the core of the framework are three levels of management which represent the organisation. In this, the top management is concerned with the long term objectives and survival of the organisation. The higher-level organisational success criteria are linked to this level. At a lower level, middle management is actively focussing on company profitability and projects as a whole. This hierarchical level therewith has both organisational and overall project success criteria. The lower department management level is concerned with operations and short term project success. The success criteria are linked to different project life cycle stages. The circle surrounding the triangle separates the organisation and project from the external environment with stakeholders. The external stakeholders range from trade associations to the media, who all have their own success criteria and objectives. Project success is furthermore influenced by the economic climate, as displayed at the outskirt of the model. De Wit's (1988) study makes a significant contribution by clarifying the relationship and interdependencies of success criteria from multiple stakeholders into one model. Its practical use as a tool to assess project success is however limited due to its high-level perspective and abstract nature.

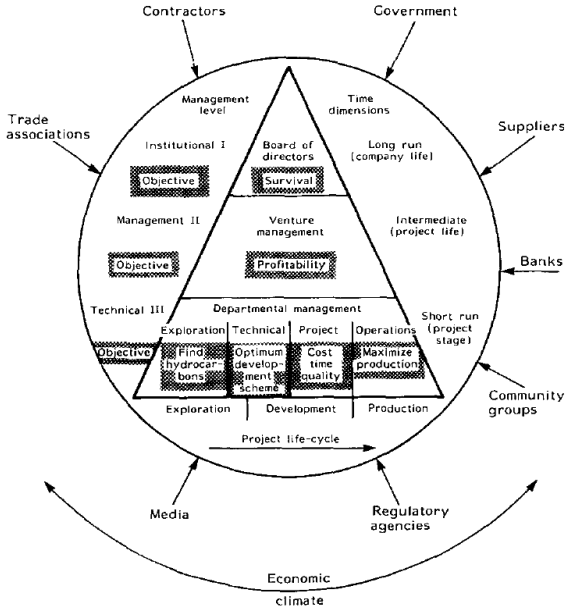

Figure 4: Project success framework (De Wit, 1992)

Westerveld (2003) and Westerveld & Gayá Walters (2009) identified this shortcoming and developed a comprehensive framework named the Project Excellence Model (PEM), aimed to facilitate project success assessment (Figure 5). The PEM-model links six stakeholder dependent project success criteria: project results, appreciation by the client, appreciation by the project team, appreciation by the users, appreciation by the contractors, and appreciation by the other stakeholders, to six organisational success factors: leadership & team, policy & strategy, stakeholder management, resources, contracting and project management. The evaluation process consists of first identifying the project stakeholders and determining their interests and influence. The resulting success criteria are then recorded and rated against performance in a quantitative framework. The second step consists of rating the success factors according to five ideal project types. The ideal project types range from simple task oriented projects to complex multiple stakeholder dependent types. The scores of the criteria and factors are set out in a radar diagram, clearly illustrating performance gaps. The model can be used to structure new projects prior to execution, or evaluate success during different project stages.

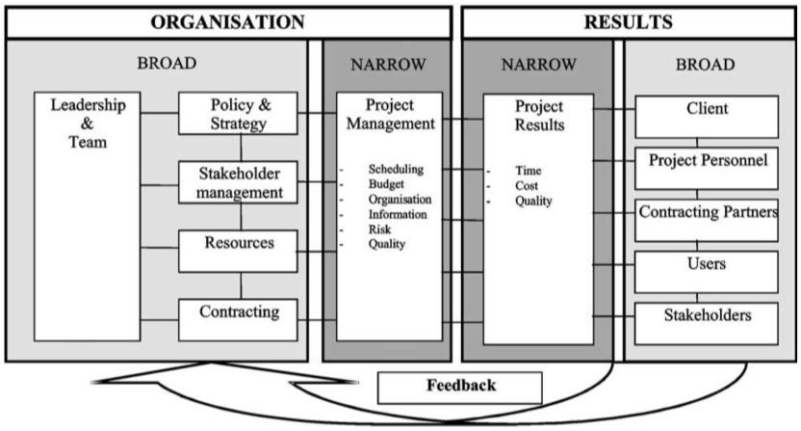

Figure 5: Project Excellence Model (Westerveld, 2003)

Although the Project Excellence Model is a clear and comprehensive framework, it disregards to take into account that different stakeholders may evaluate success differently over different time frames (Shenhar, et al., 2001).

An alternative framework is proposed by Shenhar & Dvir (2007), who after more than a decade of research arrive at a diamond shaped framework (Figure 7). The framework, which is discussed in more detail in paragraph 2.4, uses the following five measures to assess project success, in both the short and long term: project efficiency, impact on the customer, impact on the team, business and direct success and preparation for the future (Figure 6). Despite providing an exhaustive set of measures, Shenhar & Dvir (2007) comment that it may be necessary to define additional success criteria specific to the context of a project. As an example they use Food and Drug Administration (FDA) drug approval as an important success criterion for projects in the pharmaceutical industry.

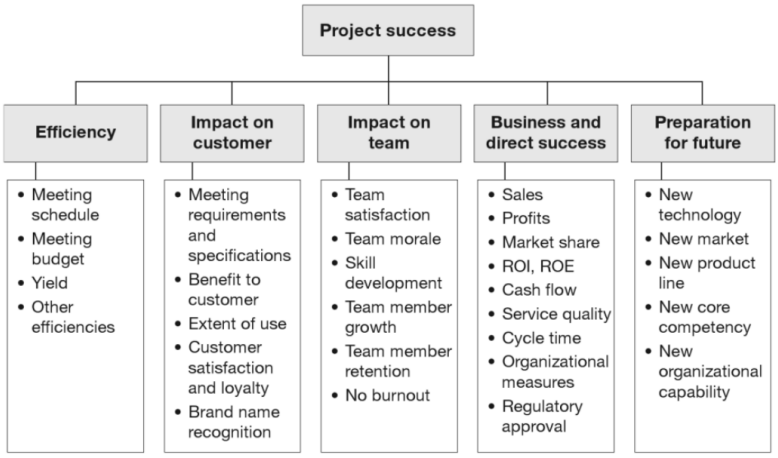

Figure 6: Project success criteria (Shenhar, et al., 2007)

2.3 Project critical success factors

2.3.1 A background on critical success factors

The term critical success factor has its origins in the field of management information systems (MIS). Rockart (1979) first used the term in his article "Chief executives define their own data needs". "Critical success factors are the relatively small number of truly important matters on which a manager should focus her attention" (Bullen & Rockart, 1981, p. 12) and these are "the few key areas where "things must go right" for the business to flourish and for the manager's goals to be attainted" (Bullen & Rockart, 1981, p. 7). Managers are generally confronted with countless tasks, and they need to decide which have priority. Through the CSF-method, critical activities are made explicit aiding the manager in his or her decision making processes. According to Rockart (1979) critical success factors are specific to the context and must be tailored to the industry, company and individual. CSFs are not static and are subject to change as the industry changes, as the company's position changes, or as specific problems or opportunities arise.

The original article from Rockart (1979) and the subsequent primer (Bullen & Rockart, 1981) were directed towards the managers information needs derived from CSFs, but as noted by Boynton & Zmud (1984), the application of the method goes far beyond the field of MIS. During the early '80s critical success factors became popular among academics and soon found their way to other fields of research (Ram & Corkindale, 2014). Although it is unclear who adopted the use and terminology first in the

project management arena, critical success factors are still a vibrant school of thought today (Müller & Jugdev, 2012). A notable difference between the original method and later project management literature is the relative static view on CSFs adopted by the latter. Were Bullen & Rockart comment that "CSFs will certainly differ from manager to manager according to the individual's place in the organisations hierarchy" (1981, p. 13), the project management field seems the be more concerned with finding a universal set of critical success factors applicable to all projects.

2.3.2 Project critical success factors

The field of project management has directed a significant part of their research efforts to identifying the critical success factors of projects. Contributions come from many researchers, though few are as widely acknowledged as Pinto, Prescott and Slevin. Since their early work, countless studies have built on their articles, therewith broadening and refining our understanding of the topic (Müller & Jugdev, 2012). The first major contribution of Slevin and Pinto (1986) was the development of a project management tool, named the Project Implementation Profile (PIP) and identification of ten critical success factors. These ten factors have been commonly used and cited by other researchers (i.e. Atkinson, 1999; Belassi & Tukel, 1996; Cooke-Davies, 2002) and are: (1) project mission, (2) top management support, (3) project planning, (4) client consultation, (5) personnel, (6) technical tasks, (7) client acceptance, (8) monitoring and feedback, (9) communication and (10) trouble-shooting. While this seminal work was a good step in the right direction, Pinto and Prescott soon realised that due to the dynamics and complexities of projects CSFs may exhibit a temporal nature. The PIP tool was used in a following study (Pinto & Prescott, 1988) to investigate the variation in CSFs over different project life cycle phases. Using the framework of Adams & Barndt (1978) and King & Cleland (1983) they distinguished the following phases: conceptualization, planning, execution and termination, therewith viewing a project complete when the team is decommissioned, and study the variation. The study indicated that in the conceptual phase, project mission and client consultation are the dominant CSFs. In the planning phase, this list changes to project mission, top management support and client acceptance. During the execution phase, again project mission and client consultation are critical together with trouble-shooting, scheduling and technical tasks. In the final termination phase, technical tasks, project mission and client consultation were viewed as essential to success. The findings furthermore suggest that project mission, the initial clarity of goals and general directions, are critical across all life cycle phases. Client consultation also has an important role during a substantial part of the project life cycle. These results indicate that the relative importance of various CSFs is subject to change at different project life cycle phases. With these findings, Pinto and Prescott (1988) direct much of the confusion regarding the assessment of CSFs to their temporal nature.

In the same period, Morris and Hough (1987), who are also widely referred to in later research (i.e. Munns & Bjeirmi, 1996; Atkinson, 1999; Lim & Mohamed, 1999), explore the dimensions of project success through the evaluation of CSFs from eight case studies of large projects. Their study reveals that several different kinds of factors appear to contribute to project success. The primary factors identified include: (1) project objectives and their viability, (2) technical uncertainty and innovation, (3) politics, (4) community involvement, (5) schedule duration and urgency, (6) financial, legal and contractual matters, and (7) project implementation.

In the years that follow, research continues to generate new insights and lists with CSFs. Most of these studies were carried out at project level and were aimed at identifying critical success factors applicable to all projects. Significant efforts were also directed towards comparing the multitude of factors with the goal of arriving at a definitive list. A comprehensive study was conducted by Fortune and White (2006), who reviewed sixty-three publications on CSFs. The CSFs identified by their study

were grouped into twenty-seven CSFs and are presented in a decreasing order of citation frequency in Table 2. The overview indicates that there is broad range of CSFs with only limited agreement among authors on which factors influence project success.

Nr.	Critical Success Factor	Counts	Nr.	Critical Success Factor	Counts
1	Support from senior management	39	15	Project sponsor/champion	12
2	Clear realistic objectives	31	16	Effective monitoring/control	12
3	Strong/detailed plan kept up to date	29	17	Adequate budget	11
4	Good communication/feedback	27	18	Organisational adaptation/culture/structure	10
5	User/client involvement	24	19	Good performance by suppliers	10
6	Skilled/suitably qualified/sufficient staff/team	20	20	Planned close down/acceptance of possible failure	9
7	Effective change management	19	21	Training provision	7
8	Competent project manager	19	22	Political stability	6
9	Strong business case/sound basis for project	16	23	Correct choice/of PM methodology/tools	6
10	Sufficient/well allocated resources	16	24	Environmental influences	6
11	Good leadership	15	25	Past experience (learning from)	5
12	Proven/familiar technology	14	26	Project size, level of complexity, duration	4
13	Realistic schedule	14	27	Different viewpoints (appreciating)	3
14	Risks addressed/assessed/managed	13			

Table 2: Critical success factors identified in literature (Fortune & White, 2006)

2.4 The influence of context on critical success factors

In an attempt to develop a universal project management theory, research has largely focused on identifying the CSFs applicable to all project types. Pinto and Covin found that "the prevailing tendency among the majority of academics has been to characterize all projects as fundamentally similar", and, "the implicit view of many academics could be represented by the axiom: 'a project is a project is a project'" (1989, p. 49). Projects however exhibit substantial differences, building a new garden shed, is for example a different endeavour than landing the first man on the moon. Seen the fundamental differences between projects, trying to develop a universal theory may be inappropriate. Some scholars even suggest that this long-term strategy is one of the main reasons why there has been little agreement and convergence on the factors leading to project success (Dvir, et al., 1998).

Numerous recent studies indicate that project success is dependent on the type of project or the context in which it takes place (Pinto & Covin, 1989; Shenhar, et al., 2001; Söderlund, 2004; Müller & Turner, 2007; Howell, et al., 2010; Dalcher, 2012). Project types can be distinguished along many different dimensions, such as size, risk, industry or sector. In contrast to the innovation literature, where a distinction is typically made along the dimensions incremental and radical innovation (Abernathy & Utterback, 1978), the field of project management is far from arriving at a congruent classification scheme (Shenhar & Dvir, 2007).

Project management research recognizing the need for a more comprehensive approach has predominantly progressed in two directions:

1. The first is by studying certain distinctive features, or contingency factors (i.e. technical uncertainty, project scope or criticality) within a wide range of industries, aiming to categorise them into a typology, and link them to a range of critical success factors. Typologies are complex theories containing idealized types or classes that can be subject to rigorous empirical testing (Doty & Glick, 1994).
2. The second is by narrowing the research domain, by exclusively investigating success criteria within a specific industry, field or sector (i.e. public, R&D or military). A bibliometric study performed by Hanisch & Wald (2012) illustrates that construction projects, followed by R&D and IT projects, have thus far received most attention from scholars.

Within both streams of research, the project contingency theory (PCT) view is adopted, which argues that the best way to manage a project is dependent on the context. Different typologies require different project management approaches, and the success of a project is related to how well these fit (Howell, et al., 2010).

Research in the first direction is arguably dominated by a group of scholars from Israel, although it must be noted that others authors have also made considerable contributions (i.e. Cooke-Davies, 2002; Westerveld, 2003; Westerveld & Gayá Walters, 2009; Turner & Zolin, 2012; Turner, 2014). As part of an large research programme, Shenhar, Dvir, Levy, Maltz, Tishler, Lipovetsky and Lechler conducted a range of studies, in different formations, during a more than ten year time span. The programme started off with several studies, identifying elements for the latter developed two-dimensional framework. The framework combined four levels of technological uncertainty (i.e. low, medium, high and super high) with three levels of system scope (i.e. assembly, system and array). Following both qualitative and quantitative testing, Shenhar and Dvir (1996) derived 'ideal project types' (i.e. low-tech to super high-tech) to anchor these categories into the framework. After exploring a range of alternative classifications schemes in another study (Dvir, et al., 1998), Shenhar, et al., (2001) later returned to their prior two-dimensional framework. Although this trend continued during their succeeding research, Shenhar, et al., (2002) call and encourage other researchers to explore new typologies. As a starting point they mention market uncertainty and project complexity as an example. The main high-level findings from these studies corroborate and support the notion that some CSFs are common to all types of projects, while others are project specific to a type.

After more than a decade of research, Shenhar and Dvir (2007) reviewed and structured their previous work into a comprehensive book under the name 'Reinventing project management', arriving at a diamond-shaped framework to distinguish projects according to four dimension: novelty, technology, complexity and pace. Project novelty refers to how innovative a new product is within a certain market. Technology refers to the extent a new technology is used on a project. The dimension complex refers to how a product is positioned in a hierarchy of systems and subsystems. The pace indicates the speed and available time frame for a project. As can be seen in Figure 7, each of these dimensions is further divided into three or four specific project types. Every project is characterised by its own diamond. The framework can be used as a tool to analyse projects and improve their outcome or as a way for stakeholders to communicate about a project.

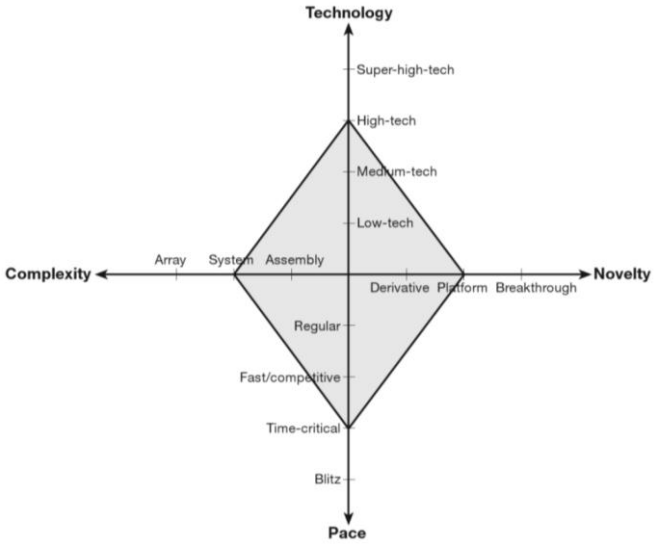

Figure 7: Diamond framework (Shenhar, et al., 2007)

The strength of the diamond framework lies in its wide applicability. It is not restricted to an industry, technology, or a specific organization. It is universal enough to capture a broad range of projects covering multiple dimensions. This wide applicability does however results in a somewhat complex model due to its numerous classification possibilities.

Research in the second direction is widespread with some industries, fields and sectors receiving considerable attention, while others remain largely untouched. The construction industry is an example of an embranchments which, within a distinct field, continues to build on the a priori project management literature. A review of the work of Chua, et al., 1999; Hughes, et al., 2004; Chan & Chan, 2004; Shahu, et al., 2012; Elattar, 2009, indicates that the success dimensions within the construction industry both coincide (e.g. capabilities of personnel, communication, budget) and deviate (e.g. site inspections, constructability, design meetings) from those found in the general project management literature. These findings are supported by a prior study from Pinto and Covin (1989) who researched CSFs in two distinctly different areas (construction and R&D). The study indicated that while some factors appear to be common to both polar type projects (i.e. project mission and client consultation), there also exist significant differences. The factor 'personnel' for example, was perceived to be considerately more critical to the success of R&D projects that to construction projects. Seen these results, it is expected that studies in other fields will express the same outcome, indicating a need for a more project specific approach. Consequently, project managers must identify success dimensions specific to their project or industry instead of relying on generic critical success factor lists.

The two research directions exhibit many similarities, although approaching the issue from different angles. The findings strongly support the contemporary view that success criteria and critical success factors are not universal to all projects. Different projects relate to different sets of success factors, highlighting the need for future studies to focus on the domains and contingency factors not covered by current research.

2.5 Urgent and unexpected projects

The domain of interest, urgent and unexpected projects, is distinctly different from most other types of projects in that it rarely follows best practise project management, as it does not start after an extensive feasibility study and completion of a detailed scope, budget and risk analysis (Meredith & Mantel, 2006). During urgent and unexpected projects, goals and plans tend to be unclear, as needs are not always known or apparent. In addition, detailed planning is generally perceived as a waste of time due to the dynamics of the environment (De Meyer, Loch, & Pich, 2002). Urgent and unexpected projects represent a far end of the project domain explaining why relatively little is known about the factors that may contribute to their success. In this section urgent and unexpected projects are first characterised, and then an explanation is given on why conventional project management methods and therewith success factors may not be appropriate for these types of projects.

2.5.1 The characteristics of urgent and unexpected projects

An unexpected project is one that is "not expected or regarded as likely to happen" (Oxford Dictionaries, 2014). People are generally surprised with its occurrence and therewith immediately assess its causes, its significance for well-being, and its relevance for on-going actions (Meyer, Reisenzein, & Schützwohl, 1997). Literature often refers to unexpected projects or events as low probability, high impact situations (Geraldi, Lee-Kelley, & Kutsch, 2010). Unexpected events have also been named and conceptualized in various other ways. Deviations, exceptions, surprises, unforeseen, and emergent events are among the few highlighted by Tukiainen, Aaltonen and Murtonen (2010). Unexpectedness results in uncertainty, a dominant theme in the contingency theory. Reviewing the research on the project contingency theory, Howell, et al., found that uncertainty is "referred to either as a general factor, or linked to goals or methods, market or technology, or external influences" (2010, p. 258).

An urgent project is one that "requires immediate action or attention" (Oxford Dictionaries, 2014). A time constraint is placed on the project activities and decision-making processes. Urgent projects are frequently surrounded by uncertainty as time pressure restricts the assessment and comprehension of all relevant aspects. Decisions are made based on limited information, introducing all kinds of unforeseen risks, which in turn increases the changes of unexpected events from happening (Howell, et al., 2010). Although unexpected and urgent projects exhibit similarities, they are not necessarily the same. A project can for example be unexpected, but not be urgent. Consider the situation when a company decides it wants to reduce its equipment downtime risk. An asset management consultancy firm may be asked to make an assessment of the risks and costs involved. The project may be substantial and come as an unexpected surprise to the consultancy firm, but not be urgent, as it will undoubtedly not need to be carried out overnight. On the other hand, a project can be urgent but not unexpected. An example of this might be the replacement of technical equipment during a factory shutdown. Prior to the shutdown, the condition of the old equipment was assessed, highlighting the need for replacement during the next planned downtime. As downtime is costly, time frames are restricted, increasing the urgency of the work, while the project was planned and expected upfront. Despite these differences and their effects on projects, the urgency theme has received little consideration in literature. Shenhar and Dvir (2007) are the most notable exception with their 'pace' representing the final dimension in their framework.

2.5.2 Why urgent and unexpected projects need to be managed differently

As illustrated above, urgent and unexpected projects are characterised by high levels of uncertainty. The mainstream project management literature proposes to prepare and respond to uncertain situations in a rational way using procedures, protocols and processes set out in a risk management plan. The objective of project risk management is to decrease the chance and impact of negative events during a project. Project risk management processes consist of: identifying risks, performing a qualitative and qualitative risk analysis, planning how to respond, and finally preparing how to control risk (PMI, 2013). Risk management therewith tries to prevent uncertain events from occurring, or contain their effect in case they are inevitable to occur. This risk management approach has several shortcomings. First of all, it assumes that sufficient time is available to perform a thorough risk analysis. Clearly when a catastrophic event happens, a project needs to be initiated at once. Based on the information at hand, decisions are made and actions are initiated, weighing pro's, con's and prior knowledge along the way. Secondly, due to the inevitable complexity of projects, not all risks and situations can be predicted upfront. During a study on failure modes in process industry projects, Braaksma, Klingenberg and Veldman found that "identifying the failure modes was […] one of the main challenges for conducting an FMEA" (2013, p. 1063). The researchers attribute the difficulties associated with the identification of failure modes to the multitude and complexity of all the failure modes, which represent potential risks. Thirdly, as argued by Loosemore (1998), a danger rests on relying too much on proactive risk management techniques. Organisations nowadays increasingly rely on risk management and omit themselves from building resilience needed to react to unexpected events. As a result, organisations may end up becoming paralysed or start running in opposite directions when confronted with unforeseen situations. In light of the previous, business leaders and project managers need to accept that urgent and unexpected projects are inevitable to occur. Knowing which factors are critical to those situations could contribute their success.

3 Methodology

3.1 Research strategy

In the early stages of research on a topic, or when freshness on a perspective is required, theory building case study research is the most appropriate research strategy according to Eisenhardt (1989). Since several decades of project research has not led to a comprehensive understanding of project success factors and success criteria (Müller & Jugdev, 2012), and certain types of projects consistently remain disregarded, theory building case study research is seen as the preferred research strategy for this study. Building theory from case studies is a research strategy that involves using one or more cases to create theoretical constructs, propositions and/or midrange theories from case-based empirical evidence (Eisenhardt, 1989). Case studies are rich empirical descriptions of particular instances of a phenomenon that are typically based on a variety of data sources. In contrast to hypothesis-testing research, which relies on statistical sampling of cases, case study sample selection is based on theoretical sampling. Cases are chosen to replicate previous cases, extend emergent theory, or to fill in theoretical categories (Eisenhardt, 1989).

The unit of analysis in this research is urgent unexpected projects within the domain of the maintenance & repair sector. Urgent projects are defined as those that are time constraint and require continuous additional attention from the project organisation to minimize the overall lead time. Without this additional attention, lead times would most likely be substantially longer. Unexpected projects are those which were not expected or regarded as likely to happen when planning resources in advance.

Identifying cases is challenging as no widespread list with urgent and unexpected projects exist within industry. The difficulties associated with the identification of cases may be a reason why prior research has been reluctant to investigate these projects. The cases in this study emanated from a globally active technical service provider called Stork. Stork maintains and services a wide range of technical assets and is occasionally contracted to perform urgent and unexpected projects when unexpected breakdowns or failures have occurred. The company Stork was established in 1868 and has over a dozen product lines, operating both on and offshore, offering a diverse range of generic (e.g. daily mechanical & electrical maintenance) and specialised services (e.g. OEM supply and service of industrial boilers, turbo machinery and gearboxes) for projects with varying time frames. The company is predominantly active in highly demanding industries (e.g. oil & gas, chemical and power), with capital intensive assets and employs 14.500 employees worldwide.

To enhance generalizability, accuracy and robustness of theory, this study is based on a multiple case study research design (Yin, 2014; Dul & Hak, 2012; Eisenhardt & Graebner, 2007). While there is no ideal number of cases, four to ten cases usually works well (Eisenhardt, 1989). This study rests on evidence collected from six cases at three different Stork product lines. At each product line, a perceived successful and a perceived unsuccessful case (polar types) was studied. The research design allows for both literal and theoretical replication (Yin, 2014). Having three instances of each polar type allows for a literal replication, i.e. to verify whether akin results occur for projects representative of the same context. Having instances representing both contexts allows for theoretical replication, i.e. to verify whether contrasting results occur across contexts.

3.2 Case selection

The cases were selected with a focus on projects which were executed by specialist product lines as their services tend to focus on critical equipment[3], therefore increasing urgency in the event of a breakdown. A further consideration for selecting cases from the specialist product lines was the presumed similarity among projects, therewith ensuring a good interrelation between the perceived project success and the critical success factors, isolating potential confounding factors. For practical reasons, this study only included product lines located in the Netherlands. Both successful and unsuccessful cases were selected through a subjective process as company records proved to be unreliable, incomplete, and did not discriminate between urgent and unexpected, and non-urgent and expected projects. The case selection process started off by contacting the vice presidents and/or managing directors of the three product lines involving the most critical plant equipment. The selected product lines were Stork Gears & Services, Stork Turbo Services and Stork Thermeq. Table 3 summarizes the main characteristics of each of these product lines. During a telephone call, the senior managers were informed about the research and asked to participate and provide access to the project team and project files. All of the senior managers agreed to participate. A follow up meeting was arranged at the facilities of the product lines. During the meeting the senior managers were asked to describe the criteria by which they would assess the success of urgent and unexpected projects. Hereafter the managers were requested to state the top three most successful and unsuccessful urgent and unexpected projects which had taken place over the last two years. A two year time frame was chosen for a number of reasons. First of all, it was assumed that sufficient project details could still be recalled over this period. Secondly, it was expected that enough candidate cases would be available for the study, as urgent and unexpected project are not widespread. Thirdly, following from the theoretical exploration, project success is believed to be assessed differently over different time frames. In order to replicate and compare cases, it was mandatory to have at least two, and preferably more alike cases in a time frame. The senior managers were then asked to rate each project against their prior success criteria, using a five point Likert scale. A score of one indicated a very poor, a three a neutral and a five a very high performance on the criteria. The most successful and unsuccessful case were selected and studied during the remainder of this research. The senior managers were thought to be the most appropriate individuals to consult for the selection of cases, as it was presumed that they would have the broadest view on project success and know which exemplar projects would have taken place over the last two years. The senior managers direct project involvement was also believed to be limited. It was furthermore expected that senior managers would be subject to less bias, than for example a sales manager who may overemphasize customer satisfaction, a financial controller who could highlight the importance of profitability, or a project manager who may be biased to his own projects. The cases selected for this study are detailed in chapter 4. Table 4 provides a summary overview.

3 Critical equipment are machines that are vital to the plant or process and are a key part of a production process (Onawoga & Akinyemi, 2010).

		Gears & Services	Turbo Services	Thermeq
Workforce	FTE	162	175	282
Markets		All heavy industries	Power generation, Oil & Gas Chemical, Process	Power generation, Oil & Gas Chemical, Process
Main services		Gearbox repair Gear manufacturing OEM gearbox manufacturing	Turbine repair Compressor repair Reblading	Process equipment inspections Process equipment testing Process equipment repair
Geographically active		World wide	The Netherlands Belgium Germany Middle East	The Netherlands Belgium Western Germany

Table 3: Product lines in study

Case	Product line	Project description	Perceived success	Lead time
A	Gears & Services	Repair of a ball mill gearbox at a cement manufacturing plant	Success	4 weeks
B	Gears & Services	Disassembly, inspection and root cause analysis of four pickle line gearboxes at a steel manufacturing plant	Failure	5 days
C	Turbo Services	Emergency repair of steam turbine rotor shaft at a waste to energy power plant	Success	3 weeks
D	Turbo Services	Hot path gas inspection on a gas turbine at a cacao manufacturing factory	Failure	3 weeks
E	Thermeq	Inspection and installation of multiple boiler sections at power plant	Success	16 days
F	Thermeq	Leakage repair of a heat exchanger at a waste to energy power plant	Failure	9 days

Table 4: Cases in study

3.3 Data collection

One strength associated with case study research is that it allows evidence to come from many sources. Yin (2014) discusses six sources of evidence: documentation, archival records, interviews, direct observations, participant observations and physical artefacts. In this study multiple sources of evidence were used and triangulated in order to strengthen construct validity. Data was primarily collected by interviews, direct observations and reviewing of project documentation. The data collection and analysis process is detailed in Figure 8.

3.3.1 Interviews

Face-to-face semi-structured interviews were held using predefined data collection procedures to maintain consistency and reliability in the data collected from each project. Although the data collection focused on specific research variables, other issues were also addressed enabling a better

understanding of the observed patterns. The data collection procedures and questions were refined in a pilot study to make sure that the questions were sufficiently clear and the interview could be held within a one to one and a half hour time frame. Appendix II and III illustrate the interview protocols. At the beginning of each interview, the interviewer gave a personal introduction, elaborated on the main research concepts and shared the objectives of the study. Hereafter, the respondent was asked to have any objections to recording the conversation. Most respondents had no objections and agreed with the recording. Three of the eleven respondents however declined to have the interview recorded, as it made them feel uncomfortable. In these cases, extensive notes were taken to ensure accurate recording of data. The interviews were held with the most well informed available personnel. The respondents were selected based on feedback from the senior manager and review of project files. The key informants came from various positions in the organisation (i.e. sales, project management, operations). The first part of the interview was directed at identifying the project success criteria. Respondents were openly asked to state by which criteria they would assess project success. The answers were summarized and the interviewer subsequently asked if several potentially alternative success criteria, derived from literature (see Table 1), would also be applicable. The phased funnelling approach was chosen to broaden the perspective of the respondents and elicit success criteria not considered before. The respondents were then asked to rate the success of the project against their own prior success criteria. The scores from the respondents indicated a high level of agreement (max std. dev. 0,7), therewith increasing confidence in the initial case selection. The second part of the interview took a similar approach to the identification of critical success factors. Respondents were first asked to state the critical success factors of their projects, and were then confronted with a list of twenty-seven CSFs (see Table 2) and asked if any additional factors would also be applicable. The phased approach proved successful as the second question elicited new insight in part of the interviews. Following each interview, a summary transcription was drawn up within twenty-four hours. All the interviews were held at the facilities of the respondents with the goal of obtaining direct observations and making the respondent feel as comfortable as possible.

3.3.2 Documentation

Documents from multiple sources were used to corroborate and augment primary evidence from the interviews. The documents originated from the following sources and were myriad: digital project files, records in ERP system, saved e-mail communication, CRM files, corporate website and hard copy project files. The documentation was used at three stages during the research. In the first stage, several documents were used to identify and validate potential interview candidates. The post project cost specification for example illustrated the amount of hours each person spent on the project. The more hours a project member spent, the greater the confidence in his knowledge of the project. Printed e-mail communication also indicated which project members had a pivotal role in some cases. The second stage took place following the identification of preliminary success criteria and critical success factors from the interviews. The documents were reviewed with the goal of finding supportive evidence for the preliminary success criteria and critical success factors. For instance, the detection of signed measuring, inspection and testing reports indicated supportive evidence for the success criterion quality. In the third and final stage, documents were used as supportive or contradictory evidence as a basis for rating the critical success factors in the cases.

3.3.3 Direct observations

Following the interview with the second respondent, the interviewer asked to receive a factory tour. The second respondent was thought to be the best candidate to show the interviewer around as the first was the senior manager, who was most likely restricted in time. The three factories were toured with the intent to gain a better understanding of the context in which the projects took place. Maffei

and Meredith (1995) found that direct observations via a plant visit can be an important source of information for case studies. As time at the factories was limited and impressions were manifold, the findings were structured along the eleven categories as described in Goodson's Rapid Plant Assessment (RPA) tool (2002). The categories were used as a framework to structure and concisely describe the observations from the factories.

3.4 Data analysis

The empirical data of this study was analysed in two phases. The first phase was directed towards deriving the success criteria and critical success factors from the cases. The second phase focused on assigning a score to the derived concepts in order to develop propositions.

3.4.1 Phase one: defining the concepts

The first step of the data analysis consisted of a within-case analysis, aimed at investigating and understanding each individual project in full detail. The data from the interview summaries was marked and tagged with a series of descriptions, using suggestions from Miles, Huberman and Saldaña (2013). These descriptions were then revised and optimized based on an iterative process of testing and comparing sample qualitative data, within and across cases, until the descriptions were considered reliable. Hereafter the descriptions were grouped into similar concepts (success criteria and critical success factors) allowing for a quantitative visual inspection of the data. The next step consisted of systematically reviewing all project documents, with the aim of finding supporting evidence for the prior identified concepts. The coherent findings were summarized and tabulated into two tables per case (Appendix IV). The first table illustrated the derived success criteria including their sources of evidence, the second the critical success factors. To further increase construct validity, each preliminary success criterion and critical success factor was triangulated and had to have a minimum of three independent data sources. Evidence from the documents counted for no more than one source, disregardless of the amount of evidence found. All preliminary concepts not meeting this criterion were excluded from the further analysis. The remaining concepts were reviewed in a cross-case analysis, leading to a further refinement of the concepts. The prior steps resulted in the identification of five success criteria and six critical success factors. The overall results were tabulated leading to the recognition of various patterns across the cases (Table 5 & 7).

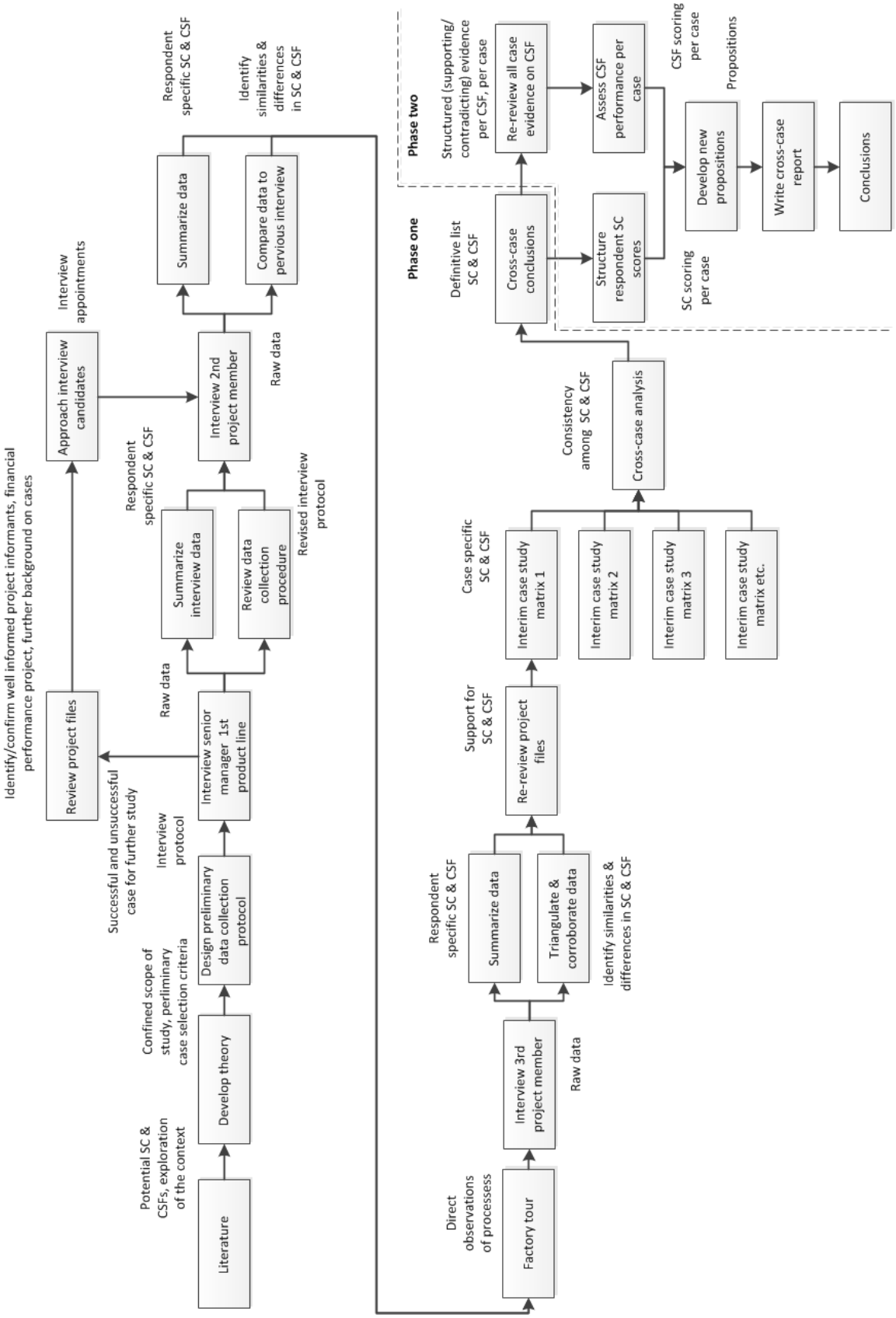

Figure 8: Data collection & analysis process

3.4.2 Phase two: defining the relations

Following the identification of success criteria and critical success factors, the concepts were provided with a score using different methods. The success criteria scores originated from the respondents feedback. During the interviews, the respondents were asked to rate the success of the projects against their own success criteria, using a five-point Likert scale. As the criteria corroborated to a high extent, the scores could be used as a measure for product success. Each case received a success criteria score from three respondents. These scores were aggregated into a mean success criteria score per case (Appendix V). The scores of the successful and unsuccessful cases were further consolidated into an overall success criteria value (Table 6). The scores were used as a basis for the development of propositions as detailed later in this paragraph. The scoring of critical success factors was less straightforward as the factors only emerged following the iterative data reduction process. Scores could not be obtained from the respondents as the data collection had already finished and various respondents were unavailable for feedback. The original case data was therefore revisited with the goal of extracting evidence on each CSF. The comprehensive evidence was structured in a table and divided in a column suggesting either a high and low performance of the factor. The evidence was subsequently reviewed, assessed and provided with a high, medium or low score, using the assessment reference points set out in Appendix VI. A high rating was given to those factors which had clear evidence supporting its presence. A low rating was given to those factors which had clear evidence supporting its absence. In the cases where evidence was contradictory or inconclusive, a moderate rating was awarded to the CSF. No evidence could be found on one CSF, this factor did therefore not receive any rating. Sufficient evidence, three or more sources, was found on all other CSFs, therewith facilitating data triangulation. The tabulated evidence was also presented to a second rater with an academic background. In order to increase reliability, the rater was asked to score each CSF based on the evidence in the table, using the same procedure. There was a high degree of overlap between the two raters scoring. The instances of disagreement were identified and discussed, and a final success criteria scoring was agreed upon. The results are presented in Table 8. The matrixes with SC and CSF scores formed the basis for the development of the propositions. The scores were systematically reviewed following the procedure for proposition development suggested by Dul and Hak (2008, pp. 189-195). The data matrixes were first examined for the presence of deterministic relations (i.e. sufficient and necessary condition), before being tested for probabilistic relations. The rationale for this procedure is that it is more important to discover strong casual relations (if they exist), as they explain more of the variance. Each type of relation was tested by first rearranging the variables of interest i.e. success, failure, communication & feedback quality, and then visually inspecting the results for the presence of patterns. The derived patterns led to the development of new propositions. The procedure and the step by step results are detailed in appendix VII and VIII.

3.4.3 Chain of evidence

A chain of evidence was maintained to increase reliability, construct validity and make it possible for external observers to trace the analytical steps in either direction (from conclusion to the primary data, or from the data to conclusions). All primary data and evidence originating from the interviews, document reviews, factory tours and field notes are stored in a separate case study database. The database contains a myriad of pages and is saved on a USB and attached to this report. As the case study database contains confidential company data, the USB is only available to the thesis coach and co-reader.

4 Cases descriptions

The product lines and cases studied during this research are briefly discussed hereafter. Table 3 provides an overview of the product lines and key facts in which the cases took place. The cases and a brief description thereof are additionally presented in Table 4. In general, all the projects were carried out in the Netherlands, were relatively small of size and were subject to severe time pressure. The lead time varied between five days to four weeks. The companies are to some extent experiences with dealing with urgent and unexpected projects and have special procedures or guidelines in place to deal with such events. The project teams were small and flexible, and the most important roles (i.e. project manager, site supervisor) were carried out by permanently employed Stork personnel. Employee compensations (e.g. over hours, call-in, sleeping hours) was the same in all cases, as Stork uses a companywide HR policy. KPI reporting standards were also uniform as all product lines report to the same Senior Vice President. The contract price ranged from € 88K to € 200K, and the gross margin varied between 0% to 45%. Although the projects greatly differ in terms of equipment served and field of expertise, all product lines use the same materials and manufacturing technologies.

- *Case A*. Case A was perceived a successful project and was conducted by Stork Gears & Services. Stork Gears & Services is a specialised gearbox manufacturing and repair company. With 162 employees, the company generates € 25 Mil. revenue in a wide range of industries. Urgent and unexpected projects are carried out all over the world on a 24/7 basis. The first case consisted of the fast repair and overhaul of a ball mill gearbox at a cement producing factory. A tooth of one of the gearwheels had unexpectedly broken and got caught between two meshing gears, leading to the abrupt standstill of the installation and dislocation and fracture of the gearbox casing. The ball mill gearbox is used to crush iron ore slag (base product) and turn it into cement (final product). As a result of the gearbox failure, the complete factory had to be taken out of operation leading to huge downtime cost and pressure to repair the gearbox within the shortest possible lead time. Stork came to site, disassembled the gearbox, took it back to their workshop and continued with the full disassembly on a nonstop basis. Simultaneous to the disassembly, the engineering department started with the evaluation of the gearbox design and development of improvements. New parts were manufactured in-house and sourced all over Europe. The gearbox was reassembled and taken back into operation within four weeks of the catastrophic breakdown.

- *Case B*. Case B was perceived an unsuccessful project and was also conducted by Stork Gears & Services. The second case consisted of the fast disassembly (on site), inspection (workshop) and root cause analysis of four pickle line gearboxes at a steel manufacturing plant. The production plant was newly installed, after it burnt down one and a half years earlier. The pickle line applies a coating to sheet metal roles to protect them against corrosion. Before the coating is applied, the sheet metal is first stretched to improve mechanical properties. The stretching is done by an installation consisting of five gearboxes. One of the gearboxes, the main gearbox failed and caused the entire drive line to collide and halt the production process. All but one of the gearboxes needed to be disassembled and inspected as their condition was uncertain. Stork worked around the clock and provided an inspection report and basic quotation for the repair and supply of new components within five days. Despite the fast response and actions from Stork, the customer decided to place an order for the further refurbishment and installation at a competitor company.

- *Case C*. Case C was perceived a successful project and was conducted by Stork Turbo Services. Stork Turbo Services is a specialised turbo machinery repair company. With 175 employees, the company generates € 37 Mil. revenue, predominantly in the power and oil & gas industry. Urgent and unexpected projects are mainly carried out in the Western Europe and the Middle East. The third case consisted of an emergency repair on a steam turbine at an energy for waste power station. The steam turbine is part of an installation used to produce electricity and city heat. At the core of the steam turbine is a rotor shaft with blades which transforms energy from steam into rotational speed. Some of the final stage rotor blades had broken, therewith negatively influencing the reliability of the installation. Continuing operation could cause severe or even catastrophic damage to the installation. The power station was therefore immediately taken out of operation leading to substantial financial losses. Stork initiated a project and commenced with the disassembly of the turbine within 24 hours. The rotor shaft was dismantled, refurbished, balanced in a vacuum bunker abroad, and re-installed shortly after. Within three weeks, the power station was back into operation.

- *Case D*. Case D was perceived an unsuccessful project and was also conducted by Stork Turbo Services. The fourth case consisted of a hot path gas inspection on a gas turbine at a cocoa and oilseed processing company. Stork had previously tendered for two projects during a factory turnaround and won one of them. Stork prepared for this project and commenced with the work as planned. During the work, Stork was however requested to also take on the other project which they initially lost, as the winning company cancelled their order last moment. Stork had no time to prepare but decided to help the customer by accepting the order. The gas turbine is part of an installation used to produce electricity and heat for the production process of cacao. The inspection had to be carried out during the factory shutdown, which was already in process, leading to significant time pressure. The inspection was carried out on a 24/7 basis and required the turbine to be fully disassembled, cleaned, inspected and reassembled. The disassembly and inspection turned out to be challenging, leading to significant delays, costs and a prolonged shutdown of the factory.

- *Case E*. Case E was perceived a successful project and was conducted by Stork Thermeq. Stork Thermeq is an OEM builder of process equipment (i.e. boilers, deaerators). With 282 employees, the company generates € 55 Mil. revenue in a wide range of industries. Urgent and unexpected projects are carried out in the Netherlands and Belgium on a 24/7 basis. The fifth case consisted of a repair on a boiler at an energy from waste power station. The factory was taken out of operation because the boiler was leaking water into the system and disrupting the process. Stork was requested to perform an emergency repair on the damaged pipes. At arrival the boiler was first inspected indicating the need for a more substantial repair. Multiple large sections of the boiler wall had to be replaced as their condition was poor and unreliable. Stork rapidly manufactured the new sections at their factory and subsequently installed them on site. The installation was taken back into operation two weeks after the initial inspection.

- *Case F*. Case F was perceived an unsuccessful project and was also conducted by Stork Thermeq. The sixth and final case consisted of an emergency repair project on a heat exchanger at a power station. The heat exchanger was severely leaking water and therewith disrupting the production process. The heat exchanger is part of the exhaust fume cleaning system used to reduce toxic emissions. In order to safely repair the heat exchanger, the power station had to be taken out of production unexpectedly. The equipment was opened and numerous attempts were made in continuous shifts to try and repair the leakage. Each attempt was unsuccessful and did not result in a satisfying solution. After more than a week of trial and error attempts, Stork was forced to withdraw from the project.

5 Results

In this chapter the data is analysed to answer the two components of the research question: what are the (1) success criteria and (2) critical success factors for contractors of urgent and unexpected projects and what is their relation. The results are, in line with the research question, presented in two sections. The derived model and propositions are the main outcome of this study. The results are derived from the empirical data collected by this study.

5.1 Success criteria

In the subsequent paragraph, the results of the within-case and cross-case analysis are presented. Hereafter, the relation between the concepts is explored. To check whether the results can be attributed to the concepts, a rival explanation is investigated. In the final section, the success criteria scores are presented leading to the development of new propositions.

5.1.1 The success criteria for contractors of urgent and unexpected projects

Table 5 presents an overview of the success criteria derived from the qualitative data. The criteria emerged following the within-case and cross-case analysis.

	Respondent	Job function	Product line	Profit	Customer satisfaction	Lead time	Quality	Safety	Most important success criteria
1	Resp. 1	Managing director	Gears & Services	2[1]	1	3	4	-	Customer satisfaction
2	Resp. 2	Sales manager	Gears & Services	3	1	2	4	-	Customer satisfaction
3	Resp. 3	Project manager	Gears & Services	3	4	1	2	-	Customer satisfaction
4	Resp. 4	Project manager	Gears & Services	2	3	4	5	6	Customer satisfaction
5	Resp. 5	Sales manager	Gears & Services	3	2	4	1	-	Profit
6	Resp. 6	Managing director	Turbo Services	2	1	3	4	5	Safety
7	Resp. 7	Production manager	Turbo Services	2	5	4	3	1	Safety
8	Resp. 8	Project manager	Turbo Services	1	-	2	3	-	Quality
9	Resp. 9	Managing director	Thermeq	4	1	2	3	5	Safety
10	Resp. 10	Production manager	Thermeq	5	1	2	3	6	Safety
11	Resp. 11	Project manager	Thermeq	3	4	1	2	5	Safety

[1] The numbers indicate the sequence in which the respondents stated the success criteria.

Table 5: Success criteria

The results indicate that the perceived success of urgent and unexpected projects can be determined by evaluating performance against the dimensions: profit, customer satisfaction, lead time, quality, and safety.

5.1.2 A cross-case analysis of the success criteria

Table 5 illustrates a number of important results. First and foremost, the respondents feedback corroborates to a high extent, therewith increasing confidence in the findings. All respondents indicate profit, lead time and quality as success criteria. Customer satisfaction is referred to as a success criterion by all, but one of the respondents. The one aberrant respondent commented: "*You can do a great job, but the customer can still be unsatisfied with the result. If the project meets the goals in accordance with the agreement, that is when a project is a success*". The respondent therewith takes a traditional perspective by solely adopting the iron triangle success criteria (Atkinson, 1999; Cooke-Davies, 2002). The success criterion safety is referred to by six of the eleven respondents. It is believed that this criterion may have been overlooked by the non-referring respondents. This criterion emerged during the course of the study and was therefore only brought forward during the subsequent interviews. One respondent, who initially did not mention safety as a success criterion commented: "*Safety is our number one priority. It is so obvious that I did not mention it straight away*". Secondly, when reviewing the respondents overall feedback, safety is most frequently referred to as the most important success criterion, followed by customer satisfaction. These criteria therefore seem to be of a higher relative importance. Thirdly, when analysing the sequence in which the success criteria are mentioned, customer satisfaction appears as the most frequently cited first criterion. This again indicates a higher level of relative importance of this criterion. Although profit is never mentioned as the first criterion, it is frequently mentioned second or third. Despite safety commonly being referred to as the most important criterion, in sequence it is generally cited last. This last result supports the prior finding that safety is a thus obvious success criterion that it may be overlooked easily.

5.1.3 The relations among success criteria for contractors of urgent and unexpected projects

A cross-case analysis of the data results in the identification of various relations between the success criteria. These relations have been outlined in Figure 9. The success criteria are shown as ellipses, the direct results thereof as boxes, and the relationship among them in arrows. The dotted lines indicate that some support was found for the relation, although insufficient to triangulate and therewith validate the relation.

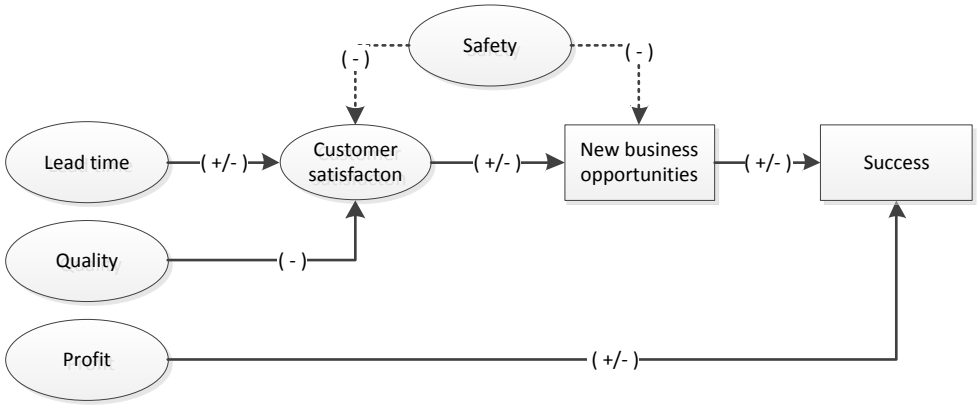

Figure 9: Success criteria interaction

The results indicate that lead time, quality and safety performance influence customer satisfaction. A satisfied customer is believed to be loyal and promote the services of the company. As a result new business opportunities arise, which in turn contribute to project success. Project success is

furthermore directly influenced by the criterion profit. Profit ensures that a business is sustainable and can continue to operate in the long term. The success criterion lead time is not surprisingly of the essence in urgent and unexpected projects, as customer satisfaction is largely influenced by the concept. Lead time can have both a positive and negative effect on customer satisfaction. If a project is delivered prior to the pre-communicated deadline or time schedule, then it is believed to have a positive effect. If the deadline is however not met or exceeded, then it is assumed to be negative. A projects outcome needs to meet certain characteristics, features or standards. These items are represented in the concept quality. The success criterion quality is found to be imperative for customer satisfaction. If a projects quality is not met then, this is assumed to negatively influence customer satisfaction. The next criterion, safety, is commonly referred to as a prerequisite for project success. According to the production manager of Turbo Services "*A project is only successful if it is completed without any safety issues*". The data indicates that project success is influenced by safety through customer satisfaction and new business opportunities. A poor safety performance is believed to have a direct negative effect on customer satisfaction. As poor safety is associated with alike safety statistics, contractors may be omitted from new business opportunities, as (potential) customers are increasingly demanding a certain level of prior safety performance in order to prequalify for new orders. The model above is by no means comprehensive, nor is it intended to. The model merely indicates the relations found among the success criteria in this study and can be used by future research to further explore the connections. Only limited support was found for some of the relations, therewith restricting the validity of part of the model.

5.1.4 A robustness check on the effects of job functions on results

An additional analysis is carried out in order to check whether the prior results are driven by a person's job function. One possible explanation could be that the results hinge on the fact that a person's response is a consequence of his or her job function, so that the observed pattern may in the end be the result of different job functions. To rule out this rival explanation, the results are checked for this effect. If the results could be attributed to a person's job function, than one would expect a high level of conformity within such a job function group. The robustness check shows no pattern indicating support for this rival explanation. A persons job function is therefore not assumed to explain the observed results. To limit the length of this study, the analysis and results are presented in Appendix IX.

5.1.5 The rating of success criteria and development of propositions

Following the identification of the concepts, the respondents were asked to rate the cases using their own success criteria. Each concept received a score ranging from 1 to 5, with 1 indicating a very poor performance and 5 a very good. Table 6 on the next page, summarises the mean success criteria scores. The cases have been classified along the perceived success dimensions.

Several conclusions can be drawn from Table 6. First of all, the mean overall success criteria score is 4,5 (good performance) on all successful, in contrast to 2,5 (poor performance) on the unsuccessful cases. The mean score of each of the independent success criteria is also higher at the successful than at the unsuccessful cases. The success criteria therefore seem an appropriate measure for project success. Second, the largest difference in mean success criteria scores is found at the dimension customer satisfaction (3,5). In the successful cases, respondents rate customer satisfaction 4,8 (very good performance) on average, as opposed to 1,3 (very poor performance) in the unsuccessful cases. This result, together with the prior evidence indicates a higher relative importance of this criterion. Third, in both successful (4,0) and unsuccessful cases (3,3), safety performance is rated above average and has the smallest standard deviation (0,7). In the cases studied by this research, safety

performance did not emerge as a discriminating success criterion. However, as indicated by various respondents during the interviews, safety is an important success criterion. If a project scores low on safety performance, it is believed to be perceived unsuccessful by definition. None of the cases studied by this research however exhibit a low safety score, therewith forming a plausible explanation for its lack in discrimination.

Perceived success	Case	Customer satisfaction	Profit	Lead time	Quality	Safety	
Successful	A	5,0	4,7	5,0	4,3	-	
	C	4,5	3,7	4,3	3,7	3,7	
	E	5,0	4,7	5,0	5,0	4,3	
	Mean	4,8	4,3	4,8	4,3	4,0	4,5
	Std. Dev.	0,3	0,6	0,4	0,7	0,5	0,5
Unsuccessful	B	1,0	1,3	5,0	3,0	3,0	
	D	1,0	1,0	2,3	3,0	3,5	
	F	2,0	3,0	2,0	2,3	3,3	
	Mean	1,3	1,8	3,1	2,8	3,3	2,5
	Std. Dev.	0,6	1,1	1,6	0,4	0,3	0,8
	Δ mean scores	3,5	2,6	1,7	1,6	0,7	2,0

- Scores 1 = very poor performance, 3 = medium performance and 5 = very good performance
- Appendix V, illustrates a comprehensive breakdown of all the respondent success criteria scores.
- No score is obtained on the success criterion safety at case A, as the respondents did not indicate safety as a criterion.

Table 6: Case success criteria scores

Fourth, no notable pattern differences are found among the success criteria of the successful cases. Some variance is however found amid the unsuccessful cases. Varying scores are found on both profit (std. dev. 1,1) and lead time (std. dev. 1,6). Case F expresses a medium score on profit (3,0), while case B (1,3) and D (1,0) score low. The difference in rating can be explained by reviewing the rich empirical data. The customers are unsatisfied in all cases, but this only leads to a retainment of payment in case B and D. The management of these cases decided to settle on a less profitable agreement in order to ensure payment. Despite the dissatisfaction, the customer of case F did not withhold payment. Two plausible explanations are derived from the data. The first, the product line of case F has a long term relationship with its customer, withholding payment could result in damaging the relationship and reducing the customers chance of receiving fast support during future urgent and unexpected projects. The product lines of case B and D lacked such a relation, as they worked for their customer for the first time. A second explanation could be that the customer is not willing to be accused of breaching contract as the project is subject to a signed strict service agreement. Postponing payment could result in financial penalties. The projects of cases B and D did not rely on a such strict legally binding contract. In fact, the failure of case B is largely attributed to the lack of clear commercial agreements. A further notable finding on the unsuccessful cases is the divergent scores on lead time performance. While case B receives the highest possible lead time score (5,0), cases D (2,3) and F (2,0) obtain a low score. The projects of case D and F, are subject to delays as a result of lacking knowhow and experience of personnel with the equipment. The lack of expertise

results in a trial and error approach consuming costly down time at the customers expense. The perceived failure of case B is not the result of poor lead time performance. The product line is familiar with the equipment, reacts fast and performs the project in a limited time frame. The good lead time performance does however not compensate for the poor performance on the dimensions customer satisfaction and profit. Fifth, all successful cases score high on customer satisfaction, profit, lead time, quality and safety. All unsuccessful cases however score random on these criteria, with the exception of customer satisfaction, which scores low in all cases, in conjunction with a low score on at least one of the success criteria profit, lead time or quality. As a result, a project is believed to be perceived successful if it performs high on all success criteria and unsuccessful if it performs poor on customer satisfaction and one of the success criteria profit, lead time or quality.

The following propositions have been derived from the scores in Table 6. See appendix VII for the analytical process underlying the development of propositions.

(Sufficient conditions)

Proposition SC 1: *Urgent and unexpected projects with a high level of customer satisfaction, profit, quality and safety performance are perceived as successful by contractors.*

Proposition SC 2: *Urgent and unexpected projects with a low level of customer satisfaction, and a low or medium level of profit, quality and safety performance are perceived as unsuccessful by contractors.*

(Necessary conditions)

Proposition SC 3: *Urgent and unexpected projects require a high level of customer satisfaction, profit, lead time, quality and safety performance in order to be perceived successful by contractors.*

Proposition SC 4: *Urgent and unexpected projects require a low level of customer satisfaction, and a low or medium level of profit, quality and safety performance in order to be perceived unsuccessful by contractors.*

(Probabilistic relation)

Proposition SC 5: *The higher the lead time performance, the more likely an urgent and unexpected project is perceived as successful by contractors.*

5.2 Critical success factors

This paragraph will first detail the critical success factors identified by this study. Hereafter, the universality of the concepts is explored and discussed. Subsequently, the results are checked for robustness and rival explanations. The last section will exhibit the critical success factor scores, specify the CSF relation and illustrate the derived propositions.

5.2.1 The critical success factors for contractors of urgent and unexpected projects

Table 7 presents a summary overview of the cross-case analysis leading to the identification of the critical success factors. The critical success factors that emerged from the analysis are discussed hereafter.

Perceived	Case	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation
Successful	A	•	•	•		•	
	C	•	•	•	•		
	E	•	•	•			
	Applicable CSF	•	•	•	•	•	
Applicable to all successful cases		•	•	•			
Not applicable to any successful case							•
Unsuccessful	B	•			•		•
	D	•	•		•		
	F	•	•	•			
	Applicable CSF	•	•	•	•		•
Applicable to all unsuccessful cases		•					
Not applicable to any unsuccessful case						•	

- The dots indicate that the respondents have referred to the factor as critical to the success of the case. Appendix X, provides further details on each respondents input, including the sequence in which the CSFs were mentioned. The appendix further reveals the respondents most important CSFs.

Table 7: Critical success factors

- *Communication & feedback quality:* Urgent and unexpected projects are subject to high levels of uncertainty, ambiguity and changing circumstances. At project initiation, scopes tend to be ill-defined and conceptual as the condition of equipment is not always known or apparent. As a scope is subject to change, a project is generally initiated without any form of formal planning. Through an iterative process of revising and fine tuning, a scope gradually becomes more concrete as new information becomes available and is shared among those involved. The success factor communication & feedback quality is the only CSF that emerged in all cases. In the perceived successful cases, information is continuously shared with all stakeholders. The

informed stakeholders consist of those of the internal project organisation (e.g. sales, engineering, procurement and production), but also include the customer, the end user and (potential) suppliers. Communication and feedback is found to contribute to understanding the customers' needs, reduce uncertainty, improve decision making processes, and align expectations and activities. Communication is generally found to be informal, frequent and typically takes place on short notice (e.g. same or next day). Findings, project activities, progress and repair options are common discussion themes during meetings. Various respondents stress the importance of managing the expectations of the customer, especially at the beginning of the project. The product line director of Thermeq notes: "*It is important to continually inform the customer so that he does not get the wrong expectations. If you provide the customer with the wrong assumptions at the beginning of the project, then you will be sure to have an issue at the end*" The perceived unsuccessful cases lacked in their communication and feedback. Reactive participation of stakeholders, lacking mutual trust, misalignment of communication channels, the exclusion of stakeholders from discussions and contradictory communication are sources of poor communication and feedback identified by this study. In the unsuccessful cases communication and feedback tends to be less frequent, late or inadequate. Late or lacking communication and feedback is found to result in reduced possibilities to revise plans, frustrations, unfavourable decisions, misinterpretation of expectations and unclear goals. The site manager of Turbo Services commented: "*The project had a lead time of three weeks, and I only learnt after one and a half week that the project would be a disaster. After only two days, our people on site knew that the project would fail, but this was never communicated to us. We were therefore not able to get the project back on track*".

- *Sufficient flexible & skilled personnel*: A project is built up out of a range of activities. These activities are carried out by contractor or subcontractor personnel. The interviewees commonly referred to personnel as a discriminating critical success factor. In cases A, C and E, personnel is found to be flexible, skilled and available in sufficient quantities to carry out the work. Flexible personnel enables direct action, fast response and quick upscaling of operations. Flexible personnel is willing to stop what they are doing, at any moment of the day, both at work and at home, and give priority to the emergent situation. In order to carry out the work efficiently, personnel needs to be skilled as there is insufficient time to draw up a plan detailing all tasks, tools and required resources. Skilled personnel knows what needs to be done, who to involve and inform, and has solutions to arising problems. Executing a project with sufficient own personnel has various advantages. Own personnel is found to be more willing to go the extra mile and be committed to the job. Carrying out a project with sufficient own personnel also enables the contractor to react and upscale fast as there is less need to coordinate activities. Another reported advantage is related to the quality of work. Executing a project with own personnel is stated to result in less quality issues. The project manager of case D: "*The people knew what needed to be done. We reacted fast and the project was completed ahead of schedule. If we would have had to do the job with external people, it would have taken longer to complete*". In the perceived unsuccessful cases D and F, personnel is described as being less flexible, skilled and sufficiently available. The less skilled personnel did not always know what to do or how to assess a situation and did therefore not anticipate issues ahead. As a result a trial and error approach was adopted and ad-hoc situations occurred, leading to delays in the project. The production manager of case F: "*We just did not know what we were doing. Maybe we needed other tools, I do not know. I still do not know what the best method should have been. We did not have the knowhow and expertise to do the job correctly*". The lack of sufficient own personnel resulted in the hiring of external personnel in case D, and the complete abandoning of the project in case F.

- *Competent project manager:* The project manager has an important role in urgent and unexpected projects. The success factor emerged in cases, A, C, E and F. The presence of a competent project manager therefore seems to predominantly play an important role in the cases which are perceived as successful. An analysis of these cases indicates that a competent project manager is experienced, has sufficient equipment knowhow and has the technical skills to bring a project to a successful end. A competent project manager is also found to able to take on multiple roles. The project manager of case A carried out all procurement activities, next to managing the project. The project manager of case C also had a second role as design engineer, and the project manager of case E developed and executed the QA/QC plan. The less component project manager of case F lacks the required knowhow, technical skills and experience with the equipment to do the same. A competent project manager oversees the project, identifies issues before they occur and places priorities on both his own and the projects activities. The project manager of case A commented: "*I first look for the parts which are critical to the lead time of the repair. I know that I need to focus on these first before paying attention to anything else. Managing an urgent and unexpected project is all about thinking one step ahead*". When confronted with issues, the competent project manager explores his options instead of trying to repeat the prior unsuccessful steps. By continually communicating with the customer and project team, the project manager keeps up to date and motivates personnel. A competent project manager is furthermore found to be fully engaged with the project and request support when this is needed, rather than being occupied with other things and wait until it is too late to explore alternative options. The project manager of case F mentioned: *"At the end I was so tired. I told my men that I would go […]. Everybody was completely exhausted. I called the office to inform them of the situation"*.

- *Risks addressed, assessed and managed:* As outlined before, urgent and unexpected projects are subject to high levels of uncertainty. The mainstream project management proposes to prepare and respond to uncertain situations in a rational way using procedures, protocols and processes set out in a risk management plan. The objective of project risk management is to decrease the chance and impact of negative events (PMI, 2013). Risk management is aimed at preventing uncertain events from occurring, or contain their effect in case they are inevitable to occur. Risk management emerged as a critical success factor in three cases. In case C it is believed to have contributed to the success of the project, while it was the opposite in case B and D. In case C, the company managed the risk well by agreeing to perform the project at cost price, send a clear order confirmation, using multiple documents (e.g. planning, scope description) from prior work on the equipment to reduce uncertainty, openly discuss repair scenarios and risks, and agree to limit the warranty conditions. The project manager of case C noted: "*We had a start document in place from the previous project that only required minor adjustments. The project scope was already detailed and could be used as a guidance for the work. The start document also contained a detailed cost calculation, risk analysis and planning, so we could start without to many grey spots*". Although case B was also presumed to be carried out at cost price, it did not have any formal documents supporting this verbal agreement. The contractual roles of the stakeholders were unclear and changed in due course, eventually leading to discussions with regards to the scope and commercial rates. The product line director of case B: "*The role of the customer and asset owner was unclear, despite several requests to clear the situation. Somewhere during the project we heard that our contracting party would shift from [user] to [customer] as the project was a warranty issue*". The contractor did not postpone the project following the shift in contracting parties, trusting that all costs would be accounted for. After the cost specification was sent, a long discussion involving legal departments and lawyers arose. These discussions eventually ended in a financial settlement between the companies. In case D, risks were insufficiently managed prior to accepting the project. The contractor

assumed that they would be able to carry out work on equipment with which they had no prior experience. During the course of the repair, the contractor however learnt that the skills of the personnel did not match those required. The contractor also neglected to perform a site visit and assess the condition of equipment before accepting the order. The equipment turned out to be in a very poor condition leading to substantial foreseeable technical issues and delays. Following project closure, discussions arose between the customer and contractor finally also leading to a settlement of the contract price.

- *Sufficient flexible & skilled suppliers*: Suppliers provide the contractor access to certain services or commodities in order to execute a project. The critical success factor sufficient flexible & skilled suppliers comes prominently forward in case A. The suppliers in case A enable the contractor to get access to difficult to source parts, extra machine capacity and a wider range of solutions to support the customer. The advantages related to the suppliers have resulted in a reduced and limited lead time of the project. The relationship between the contractor and its supplier can be qualified as close, informal and based on mutual trust. The contractor, for example, purchased a semi-finished product from another gearbox OEM and received detailed production drawings to finish the product. This kind of cooperation is unusual in industry as production drawings are perceived as highly classified documents. The contractor has short leads to numerous suppliers which allow it to attain information fast and make weighted decisions on the in house production or outsourcing of parts. The suppliers are flexible and keen to support the contractor as they know they will be well compensated for their support. The project manager of case A commented: "*We have a group of close and flexible suppliers who are the same as us and know what it takes to be in our business. If I give them a call, they will be here within hours*".

- *Quality of customer/user relation*: The main stakeholders of a project are the customer, the end user and the contractor. These parties interact with one and other in order to realise the project. The quality of the customer and end user relation is dependent on the extent to which these stakeholders cooperate and interact in a positive manner. The success factor quality of customer and user relation emerged from the within-case analysis of case B. All interviewees attribute the lack of project success to the poor relation with the customer and end user. The project is initiated by the user, but the contract is later transferred to another company due to warranty obligations. The roles of the stakeholders are unclear as the end user takes on the role of customer, and the customer takes a reactive approach despite the urgency of the situation. The product line manager of case B states: "*I was even called by the managing director of [the end user] telling me that we had to do everything possible to reduce the lead time and be creative. [The customer], our final contracting party was however reactive and was only asking for prices for the repair of the gearbox and root cause analysis*". The communication coming from the customer and user is ambiguous, directive and non-cooperative. Instead of collaborating in order to reduce lead time, stakeholders are involved in backroom politics as the customer and end user have to agree on a non-disclosed settlement for the downtime and repair costs. The ambiguity of the situation is found to result in lack of trust among all stakeholders. When the contractor submitted its offer for the subsequent repair of the damaged parts, the customer decided to place the order at another company. During the project there are various tense discussions between the stakeholders, eventually involving legal personnel and top management executives. The sales manager of case B indicated: "*[The customer] tried to purposely withhold money from us. As soon as we threatened to start a court case they soon changed their attitude and paid, because they knew we were going to win*".

5.2.2 A cross-case analysis of the critical success factors

An inspection of the data of Table 7 illustrates the following. First, none of the cases exhibit the same set of critical success factors. When making a cross-case comparison, a pattern does however emerge. Each case has a number of common and less common critical success factors. This finding suggests that some CSFs may be applicable to all cases, while others may be specific to the context of the case. Second, the most common critical success factor is communication & feedback quality. This CSF is the only factor which is present in all cases. Sufficient flexible & skilled personnel and a competent project manager are furthermore common to all successful cases. The only common CSF among the unsuccessful cases, is the before mentioned communication & feedback quality. Third, both the successful and the unsuccessful cases have one CSF only applicable to their specific cluster of cases. Quality of customer & user relation is a CSF specific to the unsuccessful cases. Sufficient flexible & skilled suppliers is however a distinctive factor among the successful cases. Fourth, although communication & feedback quality is the most common CSF, it is not the most important factor according to the respondents. A review of the more comprehensive data, as outlined in Appendix X, illustrates that sufficient flexible & skilled personnel is the most important CSF. The criterion has both the highest frequency of citation as 'the most important CSF' (9 times), and has the highest frequency of being mentioned as the first criterion.

5.2.3 A robustness check on the effects of job functions on results

As with the success criteria, an additional analysis is carried out in order to check whether the prior results are driven by a person's job function. The results are rearranged in line with the respondents job functions to facilitate data comparison and pattern matching (Appendix XI). The analysis indicates a spread in results and further reveals that none of the job functions exhibit a distinct set of CSFs. The analysis therewith provides no support for the rival explanation. Hence, a person's job function is not assumed to explain the observed results.

5.2.4 The rating of success criteria and development of propositions

Following the identification of the critical success factors, all case data is revisited with the aim of finding both supportive and contradictory evidence on the concepts, in order to assign scores and deduce propositions. Each CSF received a high, medium, low or no score based on the assessment of the pre-structured evidence. Table 8 presents an overview of the scores assigned to each CSF. The cases have been ordered along the perceived success dimensions.

Perceived	Case	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation
Successful	A	H	H	H	H	H	H
	C	H	H	H	H	H	H
	E	H	H	H	H	-	H
Unsuccessful	B	L	M	H	L	H	L
	D	L	L	L	L	L	L
	F	L	L	L	M	L	L

Table 8: Case critical success factor scores

The following conclusion are drawn from Table 8. First of all, the successful cases illustrate a highly consistent pattern. All successful cases score high on each critical success factor. One exception to this pattern is the CSF sufficient flexible & skilled suppliers at case E. This CSF received no score due to its lack of evidence. A further review of the rich empirical data indicates that the CSF is of minor importance in this case, as only limited use was made of non-critical suppliers. The pattern indicates, that in order for a project to be perceived successful, it needs to score high on all CSFs. Second, the unsuccessful cases also show a pattern, although less consistent. In general the unsuccessful cases score low on most CSFs. The scores of case B deviate from the other unsuccessful cases in that high scores are obtained on the CSFs competent project manager and sufficient flexible & skilled suppliers. Case B further deviates with a medium score on the CSF sufficient flexible & skilled personnel. Case F also breaks pattern by scoring medium on the CSF risks addressed, assessed and managed. The findings suggest that a project does not need to score low on all CSFs in order to be perceived unsuccessful. A low score on communication & feedback quality, quality of customer and user relation, and low or medium score on risks addressed, assessed and managed and sufficient flexible & skilled personnel is sufficient reason for a project to be perceived unsuccessful. Third and finally, a review of the independent CSFs suggests that the perceived success of a case can be determined based on the scores of the concepts: communication & feedback quality, sufficiently flexible & skilled personnel, risks addressed, assessed and managed, and quality of customer and user relation. A high score on each of these factors leads to a perceived successful case, while a low score inevitably results in failure. A medium score on the factors sufficient flexible & skilled personnel and risks addressed, assessed and managed will also lead to project failure. Scores on the concepts: competent project manager and sufficient flexible & skilled suppliers provide insufficient ground to determine if a case is successful, as both high and low scores are obtained in the unsuccessful cases.

The following propositions have been derived from the scores in Table 8. See appendix VIII for the analytical process underlying the development of propositions.

(Sufficient conditions)

Proposition CSF1: *Urgent and unexpected projects with a high level of communication & feedback quality, sufficient flexible & skilled personnel, risk addressing, assessing and managing, and quality of customer/user relation are perceived as successful by contractors.*

Proposition CSF2: *Urgent and unexpected projects with a low level of communication & feedback quality, project manager competency, sufficient flexible & skilled suppliers, quality of customer/user relation, and a low to medium level of sufficient flexible & skilled personnel and risk addressing, assessing and managing are perceived as unsuccessful by contractors.*

(Necessary conditions)

Proposition CSF3: *Urgent and unexpected projects require a high level of communication & feedback quality, sufficient flexible & skilled personnel, risk addressing, assessing and managing, sufficient flexible & skilled suppliers, and quality of customer/user relation in order to be perceived successful by contractors.*

Proposition CSF4: *Urgent and unexpected projects require a low level of communication & feedback quality and quality of customer/user relation, and a low to medium level of sufficient flexible & skilled personnel and risk addressing, assessing and managing in order to be perceived unsuccessful by contractors.*

(Probabilistic relations)

Proposition CSF5: *The higher the competency of the project manager, the more likely an urgent and unexpected projects is perceived as successful by contractors.*

Proposition CSF6: *The higher the access to sufficient flexible & skilled suppliers, the more likely an urgent and unexpected projects is perceived as successful by contractors.*

The propositions have been presented to several members of the Stork Gears & Services management team. The feedback obtained from the members is regarded as further support for the idea that the developed propositions are relevant when initiating and executing an urgent and unexpected project.

6 Discussion

Project success and project success factors have been a dominant theme in project management research for over 50 years. To date research has not led to a full understanding of these concepts, despite the widely acknowledged need (Turner & Zolin, 2012). Recent research indicates that project success is very much dependent on its context. “One size does not fit all” (Shenhar, et al., 2001, p. 704). Different projects are influenced by different factors and their success is assessed along different criteria. Urgent and unexpected projects are believed to be a district category of projects, as they, in contrast to most other types projects, do not start after an extensive feasibility study and completion of a detailed scope, budget and risk analysis (Meredith & Mantel, 2006). Urgent and unexpected projects represent a far end of the domain, which to date has received little to no attention. The objective of this study was therefore to build new theory by identifying the success factors and criteria for contractors of urgent and unexpected projects and specify their relation. In the subsequent paragraphs, the major theoretical and practical implications, limitations, suggestions for future research and conclusions of this study will be discussed.

6.1 Theoretical implications

This study makes several contributions to literature.

First of all, it identifies the success criteria for contractors of urgent and unexpected projects, during the post project completion phase. The results of the cases studied by this research suggest, that the perceived success of urgent and unexpected projects can be determined by evaluating performance against the dimensions: (1) profit, (2) customer satisfaction, (3) lead time, (4) quality, and (5) safety. All five success criteria have been identified by prior research, however this study is believed to be the first to explicitly relate the prior set of criteria to a distinct category of projects, namely those that are both urgent and unexpected. The findings indicate that project success is a multidimensional concept and therewith corroborates with prior research (Wateridge, 1998; Baccarini, 1999; Cooke-Davies, 2002).

Second, although the success criterion safety has been identified by prior research (Lim & Mohamed, 1999), it is infrequently referred to by literature. It is believed that this criterion is of specific importance to the context of the projects studied by this research. The cases in this study are believed to be subject to an environment with high levels of safety risk. Safety as a success criterion may therefore not be applicable to projects which are carried out in less risky environments. The evidence leads to believe that some success criteria (i.e. profit, customer satisfaction, lead time, quality) are universal to all projects, while others (i.e. safety) are believed to be contingent on a specific type. Scholars studying project success should consider accounting for the context in which the projects of their study take place. In an environment with a high level of safety risk it is advisable to incorporate safety as a success criterion.

Third, the results of this study also provide evidence supporting the existence of several relations between the success criteria. The identified relations are presented and outlined in an interaction model in Figure 9. The findings suggest that the success criterion customer satisfaction is influenced by the criteria safety, lead time and quality. Although no evidence was found supporting the existence of other relations, they are assumed to exist. Contractors for example, may try to exploit the urgency of a situation in attempt to maximize profit and as a result reduce customer satisfaction. Other relations between the success criteria are also assumed to exist, although they have not been identified by the present study.

Fourth, this study has furthermore identified the critical success factors for contractors of urgent and unexpected projects. The results of this study suggest, that the following six factors are critical to the success of urgent and unexpected projects: (1) communication & feedback quality, (2) sufficient flexible & skilled personnel, (3) risks addressed, assessed and managed, (4) quality of customer/user relation, (5) competent project manager, and (6) sufficient flexible & skilled suppliers. The factors identified by this study correspond with those found in prior research (Fortune & White, 2006), suggesting that none of the identified success factors is exclusive to the context of urgent and unexpected projects. Although this study does not contribute by identifying new success factors, it does however provide evidence supporting a set of success factors, critical to a specific type of projects. In addition, the findings suggest that prior research has been fruitful in identifying success factors, potentially critical to the success of urgent and unexpected projects.

Fifth, the set of critical success factors varies among the projects studied by this research. Table 7 shows that the list with CSFs is far from universal to all urgent and unexpected projects. Each project has a number of corresponding and non-corresponding factors. The differences in CSFs may be attributed to the following. Although urgent and unexpected projects exhibit many similarities in the way they are initiated, managed and executed, they are inherently dissimilar and innovative. Projects are by their very nature complex and subject to a wide range of relations, with among them many idiosyncrasies. Uncertainty therefore materializes in different forms, which evokes the use of novel approaches to emergent situations. Despite the commonalities between urgent and unexpected projects, differences within remain to exist. The evidence suggests that some critical success factors may be applicable to all urgent and unexpected projects, while others may be specific to a certain, more distinct type. As a result, some success factors may be more potent in contributing to project success than others.

Sixth, literature is ambiguous about the nature of CSF relations. While some research indicates that CSFs express a probabilistic relation, as they 'increase the likelihood of project success' (Kerzner, 1987), other research regards the relation to be deterministic (Ang, Sum, & Yeo, 2002). The results of this study provide evidence for both types of relations. Four of the initial six critical success factors express a deterministic relation, suggesting that the success of urgent and unexpected projects can be determined by assessing the performance against the dimensions: (1) communication & feedback quality, (2) sufficient flexible & skilled personnel, (3) risks addressed, assessed and managed, and (4) quality of customer/user relation. The prior factors are found to be truly 'critical' to the success of urgent and unexpected projects. The evidence suggests that a high performance on each of these factors results in project success, while a poor performance inevitably leads to failure. A probabilistic relation is found at the factors: (5) competent project manager and (6) sufficient flexible & skilled suppliers. The higher the performance of these factors, the more likely a project will be perceived successful.

In summary, this study contributes to theory by providing qualitative empirical evidence for a set of potential success criteria and factors, for a distinct category of projects, namely those that are both urgent and unexpected, and specifies their relation. This study is believed to be the first research (known by the author) to exclusively investigate project success within the defined domain, and therewith contributes by refining the theory on project management success.

6.2 Managerial implications

The results of this study may have several implications for managers and practitioners at large. If the propositions are tested and support the findings of this study, then managers should adopt a multidimensional approach to the concept of project success. Managers should try to specify the

project objectives based on the criteria identified by this study and direct project member attention to the expected results. As the findings suggest that safety and customer satisfaction are of a higher relative importance, these objectives should receive extra attention. The concepts identified by this research can also be used as a benchmark measure to evaluate project success and learn from the factors that attributed to it.

The research furthermore suggests that if companies wish to increase the success or urgent and unexpected projects they need to ensure good communication and feedback between all stakeholders. Information should continuously be shared with all involved and customer expectations needs be managed, especially during the early phases of a project. Personnel carrying out a project needs to be flexible, skilled and available in sufficient quantities to make sure that lead time is kept to a minimum and the desired quality is met. The assigned project manager needs to be competent enough to motivate personnel, keep the project on track and provide the necessary technical expertise and skills. As urgent and unexpected projects are inevitably subject to high levels of uncertainty, risks need to be assessed, addressed and managed at multiple levels. Commercial risks may be reduced by negotiating cost price contracts, sending clear order confirmations and outlining the contractual roles of stakeholders before commencing with any activities. Technical risks on the other hand can be diminished by openly discussing repair scenarios including their exposure, assessing the condition of equipment onsite and checking if the skills of personnel match with those required. Managers need to be aware that suppliers can provide access to difficult to source parts, extra machine capacity and a more comprehensive range of solutions to support the customer by reducing lead time. Suppliers do however need to be selected based on their flexibility and skills in order for them to make a substantial contribution. Finally, managers need to consider freeing up time to invest in a good relation with the customer and end user, as it may prevent a project from falling into a negative spiral of backroom politics, lack of trust and willingness to communicate.

6.3 Research limitations

The results of this study should be evaluated taking the following limitations into account. The cases in the study were selected based on the senior managers recommendations and subjective view on project success, as more reliable and objective project data was either not available or incomplete. As a result, the case selection process is biased in two ways. First of all, not all viable candidate cases were considered due to the senior managers selective memory. Although it is unlikely that the manager will be able to recall all successful projects, it is presumed that the most successful cases will have come to mind first. Nevertheless, even highly successful and unsuccessful cases may have remained unconsidered. Secondly, the manager could have purposively concealed certain (controversial) projects for a number of reasons. A project may have been a success despite the lacking support or cooperation of the senior manager. Political motives may have also played a role. Furthermore, although assumed unlikely, the investigation of certain financially successful projects may uncover unethical trade practices.

A substantial part of the data was collected by interviews with key informants. Informants were selected based on their presumed knowledge of the project. Some of the preselected candidate informants could not be interviewed as they were either abroad, unable to free up time due to other more pressing priorities, or had left the company for a carrier elsewhere. As the selected informants may in some cases not have been the most well informed personnel, emphasis may have been given to factors not necessarily corresponding to the view of their better informed co-worker. Seen the high level of consistency among the respondents at case level, the last is not seen as a major concern for the study's validity.

Data on all cases was collected in the post project completion phase, up to two years after the project was handed over to the customer. Literature indicates that the relative importance assigned to success criteria and factors is subject to change over time (Pinto & Prescott, 1988; Shenhar, et al., 2001). Consequently, the findings of this study need to be assessed within this context. Researchers investigating project success over other time frames (i.e. during execution, or several years post completion) may therefore arrive at dissimilar results. The assessment of project success based on the success criteria and factors identified by this study, may at best provide a partial assessment within the restricted time frame.

Despite attempts to reduce bias, this study is limited by the typical problems of interpreting qualitative data. In particular, there is potential bias due to all data being collected and largely analysed by a single, first time and inexperienced rater of qualitative data. An attempt was made to counteract this bias by applying an interview protocol, triangulating findings and having part of the evidence assessed by a second rater.

The author is employed by one of the product lines of the company in which the study was conducted. This connection has both advantages and drawbacks. A major advantage was the relative ease of getting access to confidential financial and other data. A second advantage is the familiarity with the company, its culture and the markets in which it operators. As a result, the interviewer could generally relate to the interviewees situation, views and examples given. The drawbacks of the relation may however include exaggeration and dishonesty by the respondents over the factors leading to project success, in an attempt to either profile oneself or downplay another, in case one thinks this will lead to improvement in personal well-being. Alternatively courtesy bias could have played a role as respondents may not have wished to offend the interviewer or be impolite and therefore agree or provide corresponding answers. Despite these drawbacks, the interviewer was under the general impression that the interviewees were sincere, open and willing to discuss and elaborate on all items. By acknowledging the above risks early in the study, the author maintained a sensitive and alert attitude towards any inconsistencies during the data collection phase.

Finally, despite utilizing a research strategy which focusses on understanding the dynamics present within a single setting, allowing new themes to emerge and not be confined by pre structured responses, it is stressed that the theory developed here may not have identified all criteria and factors critical to the contractors success of urgent and unexpected projects. This study offers a range of proposition that can be used for future research, either theory building or theory testing. Some suggestions for further research are discussed hereafter.

6.4 Future research

The findings from this study may be a good starting point for further research on the success of urgent and unexpected projects. The propositions may be tested and replicated in alike or other industries to enhance robustness and generalizability of theory. It is however recommended to assess the availability of reliable data sources at the beginning of the study, to facilitate the case selection process and avoid introducing bias to the research. Future research may also consider studying project success over different time frames, especially focussing on the project execution and later post completion phases. This study was restricted to the contractors perspective of project success. Other studies could contribute by incorporating the perspective of alternative stakeholders, such as the client, the end users, the public or, more comprehensive a combination of stakeholders. In the present study, safety emerged as a success criterion for contractors of urgent and unexpected projects. The criterion was scored and studied, but did not exhibit sufficient variance among the

cases. Future research could study this relation by selecting cases with varying safety performance and assess its effects on the perceived project success.

6.5 Conclusion

This research explored the success criteria and critical success factors for contractors of urgent and unexpected projects, at six cases in the maintenance & repair sector, with the objective to build new theory. In order to realise this objective, this study utilised a multiple case study research strategy, relying on multiple sources of evidence (i.e. interviews, document reviews and direct observations) to develop concepts, study their relation and derive propositions. The findings of the study suggest that the success of urgent and unexpected projects can be determined by the following success criteria: (1) profit, (2) customer satisfaction, (3) lead time, (4) quality and (5) safety. The results furthermore indicate that the subsequent factors are critical to project success: ((1) communication & feedback quality, (2) sufficient flexible & skilled personnel, (3) risks addressed, assessed and managed, (4) quality of customer/user relation, (5) competent project manager, and (6) sufficient flexible & skilled suppliers. The first four success factors exhibit a deterministic relations and therewith account for project success, while the last two express a probabilistic relation and can thus at best increase the likelihood of success. Besides these results, this study makes a contribution by presenting an interaction model which explains the relations between the identified success criteria. Finally, this study provides various propositions for future research to test and refine.

7 References

Abernathy, W., & Utterback, J. (1978). Patterns of industrial innovation. *Technology Review*, 40-47.

Adams, J., & Bardt, S. (1978). Organizational life cycle implications for major R&D projects. *Project Management Quarterly*, 32-39.

Al-Tmeemy, S., Abdul-Rahman, H., & Harun, Z. (2011). Future criteria for success of building projects in Malaysia. *International Journal of Project Management*, 337-348.

Ang, J., Sum, C., & Yeo, L. (2002). A multiple-case design methodology for studying MRP success and CSFs. *Information & Management*, 271-281.

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management*, 337-342.

Baccarini, D. (1999). The logical framework method for defining project success. *Project Management Journal*, 25-32.

Belassi, W., & Tukel, O. (1996). A new framework for determining critical success/failure factors in projects. *International Journal of Project Management*, 141-151.

Bell, D. (2001, July 01). The hidden cost of downtime: A strategy for improving return on assets. *Maintenance Technology*.

Boynton, A., & Zmud, R. (1984). An assessment of critical success factors. *Sloan Management Review*, 17-27.

Braaksma, A., Klingenberg, W., & Veldman, J. (2013). Failure mode and effect analysis: a multiple case study in the process industry. *International Journal of Production Research*, 1055-1071.

Bullen, C., & Rockart, J. (1981). A primer on critical success factors. *Center for Information Systems Research, Sloan School of Management*, 1-64.

Centraal Bureau voor de Statistiek. (2014, Juni 29). *Central Bureau for Statistics*. Retrieved from Website Central Bureau for Statistics: www.cbsvooruwbedrijf.nl/ihduhandleiding2014

Chan, A., & Chan, A. (2004). Key performance indicators for measuring construction success. *Benchmarking*, 203-221.

Chua, D., Kog, Y., & Loh, P. (1999). Critical success factors for different project objectives. *Journal of Construction Engineering and Management*, 142-150.

Cooke-Davies, T. (2002). The "real" success factors on projects. *International Journal of Project Management*, 185-190.

Cooper, R., & Kleinschmidt, E. (2007). Winning businesses in product development: The critical success factors. *Research-Technology Management*, 52-66.

Dalcher, D. (2012). The nature of project management: A reflection on the anatomy of major projects by Morris and Hough. *International Journal of Managing Projects in Business*, 643-660.

De Meyer, A., Loch, C., & Pich, M. (2002). Managing project uncertainty: From variation to chaos. *MIT Sloan management review*, 60-67.

De Wit, A. (1988). Measurement of project success. *International Journal of Project Management*, 164-170.

Doty, H., & Glick, W. (1994). Typologies as a unique form of theory building: toward improved understanding and modeling. *Academy of Management Review*, 230-251.

Dul, J., & Hak, T. (2008). *Case study methodology in business research.* New York: Routledge Taylor & Francis Group.

Dvir, D., Lipovetsky, S., Shenhar, A., & Tishler, A. (1998). In search of project classification: a non-universal approach to project success factors. *Research Policy*, 915-935.

Eglin, R. (2003, November 23). Can suppliers bring down your firm? *The Sunday Times*.

Eisenhardt, K. (1989). Theories from case study research. *Academy of Management*, 532-550.

Eisenhardt, K., & Graebner, M. (2007). Theory building from cases: Opportunities and challanges. *Academy of Management*, 25-32.

Elattar, S. (2009). Towards developing an improved methodology for evaluating performance and achieving success in construction projects. *Scientific Research and Essay*, 549-554.

Fortune, J., & White, D. (2006). Framing of project critical success factors by a systems model. *International Journal of Project Management*, 53-65.

Freeman, M., & Beale, P. (1992). Measuring project success. *Project Management Journal*, 8-17.

Gemünden, H., Salomo, S., & Krieger, A. (2005). The influence of project autonomy on project success. *International Journal of Project Management*, 366-373.

Geraldi, J., Lee-Kelley, L., & Kutsch, E. (2010). The Titanic sunk, so what? Project manager response to unexpected events. *International Journal of Project Management*, 547-558.

Goodson, R. (2002). Read a plant fast. *Harvard Business Review*, 3-11.

Hanisch, B., & Wald, A. (2012). A bibliometric view on the use of contingency theory in project management research. *Project Management Journal*, 4-23.

Howell, D., Windahl, C., & Seidel, R. (2010). A project contingency framework based on uncertainty and its consequences. *International Journal of Project Management*, 256-264.

Hughes, S., Tippett, D., & Thomas, W. (2004). Measuring project success in the construction industry. *Engineering Management Journal*, 31-37.

Kerzner, H. (1987). In search of excellence in project management. *Journal of Systems Management*, 30-40.

King, W., & Cleland, D. (1983). *Project management handbook*. New York: Van Nostrand Reinhold Co.

Lim, C., & Mohamed, M. (1999). Criteria of project success: an exporatory re-examination. *International Journal of Project Management*, 243-248.

Loosemore, M. (1998). The three ironies of crisis management in construction projects. *International Journal of Project Management*, 139-144.

Maffei, M., & Meredith, J. (1995). Infrastructure and flexible manufacturing technology: Theory development. *Journal of Operations Management*, 273-298.

Meredith, J., & Mantel, S. (2006). *Project management: a management approach*. New York: John Wiley & Son.

Meyer, W.-U., Reisenzein, R., & Schützwohl, A. (1997). Towards a process analysis of emotions: The case of suprise. *Motivaton and Emotion*, 251-274.

Miles, M., Huberman, A., & Saldaña, J. (2013). *Qualitative data analysis: A methods sourcebook (third edition)*. Beverly Hills, CA: Sage Publications Inc.

Morris, P., & Hough, G. (1987). *The anatomy of major projects*. UK: John Wiley & Sons.

Müller, R., & Jugdev, K. (2012). Critical success factors in projects: Pinto, Slevin, and Prescott - the elucidation of project succes. *International Journal of Managing Projects in Business*, 757-775.

Müller, R., & Turner, R. (2007). The influence of project managers on project success criteria and project success by type of project. *European Management Journal*, 298-309.

Munns, A., & Bjeirmi, B. (1996). The role of project management in achieving project success. *International Journal of Project Management*, 81-87.

Munsterman, R. (2014, 7 25). *ING stopt big data-plan terug in de kooi*. Retrieved from Follow the money: http://www.ftm.nl/ing-trekt-big-data-plan-terug/

Nah, F. (2006). Critical success factors for enterprise resource planning implementation and upgrade. *Journal of Computer Information systems*, 99-113.

Onawoga, D., & Akinyemi, O. (2010). Development of equipment maintenance strategy for critical equipment. *The Pacific Journal of Science and Technology*, 328-342.

Oxford Dictionaries. (2014, May 1). Retrieved from Oxford Dictionaries: http://www.oxforddictionaries.com/definition/english/unexpected

Oxford Dictionaries. (2014, May 1). Retrieved from Oxford Dictionaries: http://www.oxforddictionaries.com/definition/english/urgent

Pinto, J., & Covin, J. (1989). Critical factors in project implementation: a comparison of construction and R&D projects. *Technovation*, 49-62.

Pinto, J., & Prescott, J. (1988). Variations in critical success factors over the stages in the project life cycle. *Journal of Management*, 5-18.

Pinto, J., & Slevin, D. (1987). Critical factors in successful project implementation. *IEEE Tranactions on enginering Management*, 22-27.

Pinto, J., & Slevin, D. (1988). Project success: definitions and measurement techniques. *Project Management Journal*, 67-73.

PMI. (2013). *A guide to the project management body of knowlegde (fith edition)*. Pennsylvania: Project Management Institute Inc.

Porter, M. (1985). *Competitive advantage: creating and sustaining superior performance*. New York: The Free Press.

Ram, J., & Corkindale, D. (2014). How "critical" are the critical success factors (CSFs)? *Business Process Management Journal*, 151-174.

Rockart, J. (1979). Chief executives define their own data needs. *Harvard Business Review*, 81-93.

Schuman, C., & Brent, A. (2005). Asset life cycle management: towards improving physical asset performance in the process industry. *International Journal of Operations & Production Management*, 566-579.

Shahu, R., Pundir, A., & Ganapathy, L. (2012). An empirical study on flexiblility: A critical success factor of construction projects. *Global Journal of Flexible Systems Management*, 123-128.

Shenhar, A., & Dvir, D. (1996). Toward a typological theory of project management. *Research Policy*, 607-632.

Shenhar, A., & Dvir, D. (2007). *Reinventing project management: The diamond approach to successful growth and innovation*. Harvard Business School Press: Boston.

Shenhar, A., Dvir, D., Levy, O., & Maltz, A. (2001). Project success: A multidimensional strategic concept. *Long Range Planning*, 699–725.

Shenhar, A., Tishler, A., Dvir, D., Lipovetsky, S., & Lechler, T. (2002). Refining the search for project success factors: a multivariate, typological approach. *R&D Management*, 111-126.

Slevin, D., & Pinto, J. (1986). The project implementation profile: new tool for project managers. *Project Management Journal*, 57-71.

Snider, B., da Silveira, G., & Balakrishnan, J. (2009). ERP implementation at SMEs: analysis of five Canadian cases. *International Journal of Production Management*, 4-29.

Söderlund, J. (2004). Building theories of project management: past research, questions for the future. *International Journal of Project Management*, 183–191.

Tukiainen, S., Aaltonen, K., & Murtonen, M. (2010). Coping with an unexpected event: Project managers' contrasting sensemaking in a stakeholder conflict in China. *International Journal of Managing Projects in Business*, 526-543.

Turner, J. (2014). *The handbook of project-based management: Leading strategic change in organizations (4rd edition)*. Aldershot: The McGraw-Hill Companies, Inc.

Turner, J., & Zolin, R. (2012). Forecasting success on large projects: Developing reliable scale to predict multiple perspectives by multiple stakeholders over multiple time frames. *Project Management Journal*, 87-99.

Westerveld, E. (2003). The project excellence model: Lining success criteria and critical success factors. *International Journal of Project Management*, 411-418.

Westerveld, E., & Gayá Walters, D. (2009). *Het verbeteren van uw project organisatie (Reprint)*. Alphen aan den Rijn: Parels.

Yin, R. (2014). *Case study research: Design and methods (fifth edition)*. Thousand Oaks, California: Sage.

Appendix I: List of abbreviations

Abbreviation	Description
CEO	Chief Executive Officer
CFF	Critical Failure Factor
CRM	Customer Relationship Management
CSF	Critical Success Factor
ERP	Enterprise Resource Planning
FDA	Food and Drug Administration
FMEA	Failure Mode Effect Analysis
FTE	Full-time equivalent
HR	Human Resources
ICT	Information and Communication Technology
ISP	Independent Service Provider
KPI	Key Performance Indicator
MIS	Management Information Systems
OEM	Original Equipment Manufacturer
PCT	Project Contingency Theory
PEM	Project Excellence Model
PL	Product Line
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
QA/QC	Quality Assurance / Quality Control
ROI	Return On Investment
RPA	Rapid Plant Assessment
SC	Success Criterion
Std. Dev.	Standard Deviation

Appendix II: Interview protocol senior manager

1. Interview objectives

The following objectives are set for the interviewer to accomplish during the interview:

- To understand the interviewees product line, its mission and the role of the interviewee.
- To elicit the success criteria used to assess project success.
- To elicit a short list with the most successful recent urgent and unexpected projects.
- To elicit the critical success factors specific to the selected case.

2. Pre interview

Prior to the interview, the product line (PL) will have received an e-mail with a brief personal introduction to the interviewer, the objective of the e-mail, a description of the thesis topic, and a notice indicating when the interviewer will call to discuss the options to conduct the study at the company of the senior manager.

3. Interview

Details interview
Date:
Location:
Product line:
Name interviewee:
Job title:

Introduction

Thank interviewee: First of all, I would like to thank you for taking the time for this interview. Before going into any questions, it might be useful for me to introduce myself.

Personal introduction: My name is Gert Korbijn, I have been with Stork for over eight years. I started at Stork as a project manager when we still had a small workshop for our railway business in Haarlem. After about one year later I was asked to work for our gearbox revision business, and manage a relatively large project at Tata Steel IJmuiden. During the project, the sales manager resigned his job, and I was then asked to also take on the sales role, which I did. After completing the project one year later, I did both the sales and project management for several projects. As at the time Stork needed additional sales capacity, I joint the sales team. Since then I have been at Stork managing the commercial side of projects with different markets (i.e. wind industry, laser cladding, rotating equipment diagnostics).

After completing a post-bachelor in business administration, I decided to continue studying and started with a master in business administration about one and a half years ago. As part of this study, I am currently writing a thesis on the critical success factors of urgent and unexpected projects. I chose this topic because I believe that we as Stork have a competitive advantage when it comes to these projects and relatively little is known about the subject in literature.

Thesis background: I will be studying three successful and three unsuccessful projects at different Stork product lines. At each product line, I will look at two projects to account for factors specific to the context. During the study I will look at how projects are managed and rated, and investigate the similarities and differences. I have chosen to focus on the specialised 'solution' companies as the projects they are active in are generally subject to more urgency. As I believe your business unit sometimes carries out urgent and unexpected projects, I would like to study two of your successful exemplar projects. All the findings of the study will be shared with you and all the people who participated. The findings can be used to increase the chances of an urgent and unexpected project becoming successful. If you participate, I would like to interview two to three team members. The interviews will take approximately one and a half hours each, and will take place at your production location. I will also need access to the project files as I wish to review the financial performance among others.

Explain concepts: During the interview, I will focus on two topics, namely success criteria and critical success factors. SC are the measures used to judge project success. See it as selecting the appropriate type of measuring tool to determine if a part is made according to the right dimensions. SC answer the question: 'how do you determine if a project is a success?'. CSFs are the factors that lead to success. CSFs answer the question: 'what are the few key areas where things must go right for an urgent and unexpected project to flourish and be a success to the company?'. In this study urgent and unexpected projects are defined as those that are not regarded as about to happen when planning the resources. They are furthermore in need of continuous attention to reduce the project lead time.

Structure interview: What I would like to do today is understand how you would assess project success, compile a short list with recent successful projects and discuss which factors lead to their success.

Approval recordings: As it is easier for me to follow the conversation and not be writing all the time, would you mind if I recorded this interview? For your information, I am the only person who has access to the tape, and it will be destroyed directly after my thesis is submitted. All information will be held confidential, and after the interview, I will send you a summary with the answers to the questions you gave, and call you shortly after to see if I understood everything correctly. If you have any reservations to recording the interview, no worries, I will than take some extra time for notes. [Thank the interviewee, regardless of his/her choice].[If the interviewee has no obligations to the recording, state that you will start recording now.]

<u>Interviewee background</u>

1. How long have you been with the company?
2. How long have you been in your current role?
3. What kind of services does your product line offer?
4. What is your product lines turnover?
5. How many full time equivalents work for your product line?
6. What are your most important markets?
7. Is your product line also active outside the Netherlands?

Success criteria

SC are the measures used to judge project success. SC answer the question: 'how do you determine if a project is a success?'

1. By which criteria would you assess the success/failure of urgent and unexpected projects?

Nr.	SC	Why?
1		
2		
3		
4		
5		
6		
7		

2. Would [select from SC list] also be a criteria for you to assess project success/failure?
    a. Efficiency
        i. Profit
        ii. Time
        iii. Quality
    b. Stakeholder satisfaction
        i. Customer
        ii. Supplier
        iii. End user
        iv. Project team

Summarize the SC and ask if the list is conclusive

8. If one, two or three of the SC were not met, which would have the greatest impact on success?

Case selection

9. Can you give me three examples of exemplary successful and unsuccessful urgent and unexpected projects from the last two years? Please take your time, as this is important!
10. Can you rate the performance each project against your success criteria with a five item scale (1 = very poor performance, 5 = very high performance)?
11. [Refer to the list] Count the points. Would you agree that these are the most successful and unsuccessful cases?
    a. Why?

Success factors Case 1: successful case

CSFs are the factors that lead to success. CSFs answer the question: 'what are the few key areas where things must go right for an urgent and unexpected project to flourish and be a success to the company?'.

12. What were the factors that were critical to the success of the project?

Nr.	CSF	Why?
1		
2		
3		
4		
5		
6		
7		

Summarize the CSFs and ask if the list is conclusive

13. From literature, the following list with CSFs was derived. These CSFs can be applicable to a wide range of projects (i.e. ICT, etc.). If you go through the list, are there any CSFs/FFs that come to mind that were also critical during either projects?
14. If one, two or three of the CSFs were not met, which would have the greatest impact on success?
15. Can you think of a successful urgent and unexpected project were the most important CSF was missing?

Success factors Case 2: unsuccessful case

16. What were the factors that were critical to the failure of the project?

Nr.	CFF	Why?
1		
2		
3		
4		
5		
6		
7		

Summarize the CFFs and ask if the list is conclusive

17. From literature, the following list with CSFs was derived. These CSFs can be applicable to a wide range of projects (i.e. ICT, etc.). If you go through the list, are there any CSFs/FFs that come to mind that were also critical during either projects?
18. Which factor had the greatest impact on the failure of the project?

19. Can you think of an unsuccessful urgent and unexpected project were the CSF [most important] was present?

Round up

20. Have I forgotten anything important that I should have asked?

Again, I would like to thank you for all the information you gave me. It will be very useful for my thesis, which I will share with you in October.

Within a few days, I will send you a summary of what we have discussed. I will call you again a few days later to see if I have understood everything correctly.

If you have any questions or remarks in the meanwhile, you can always call me on my mobile or send an e-mail.

Would it be possible for me to review the case files today? [if not, make an appointment]

Post interview notes

21. Other topics discussed:
22. Documents obtained:
23. Post interview comments or leads:

Appendix III: Interview protocol team member

1. Interview objectives

The following objectives are set for the interviewer to accomplish during the interview:

- To understand the interviewees product line, its mission and the role of the interviewee.
- To understand the goals and objectives of the interviewee during the selected case.
- To elicit the success criteria and critical success factors specific to the selected case.

2. Pre interview

Prior to the interview, the interviewee will have been asked by the senior manager if he or she is willing to participate in the interview. As soon as this is verified (by the interviewer), the interviewee will receive an e-mail with a brief personal introduction (to the interviewer), a description of the interview topic (SC and CSFs), an explanation why the individual was selected, and the estimated duration of the interview. The interviewee will be asked to think of and list the SC and CSFs of the project in question prior to the interview. The e-mail will conclude by indicating that the interviewer will contact the individual to make an appointment at a date and time most convenient to the interviewee.

3. Interview procedure

Interview details
Date:
Location:
Product line:
Name interviewee:
Job title:

Introduction

Thank interviewee: First of all, I would like to thank you for taking the time for this interview. Before going into any questions, it might be useful for me to introduce myself.

Personal introduction: My name is Gert Korbijn, I have been with Stork for over eight years. I started at Stork as a project manager when we still had a small workshop for our railway business in Haarlem. After about one year later I was asked to work for our gearbox revision business, and manage a relatively large project at Tata Steel IJmuiden. During the project, the sales manager resigned his job, and I was then asked to also take on the sales role, which I did. After completing the project one year later, I did both the sales and project management for several projects. As at the time Stork needed additional sales capacity, I joint the sales team. Since then I have been at Stork managing the commercial side of projects with different markets (i.e. wind industry, laser cladding, rotating equipment diagnostics).

After completing a post-bachelor in business administration, I decided to continue studying and started with a master in business administration about one and a half years ago. As part of this study, I am currently writing a thesis on the critical success factors of urgent and unexpected projects. I chose

this topic because I believe that we as Stork have a competitive advantage when it comes to these projects and relatively little is known about the subject in literature.

Thesis background: I will be studying six successful projects at different Stork business units. At each business unit, I will look at two projects to account for factors specific to the context. During the study I will look at how projects are managed and rated, and investigate the similarities and differences. I have chosen to focus on the specialised 'solution' companies as the projects they are active in are generally subject to more urgency.

Explain concepts: During the interview, I will focus on two topics, namely success criteria and critical success factors. SC are the measures used to judge project success. See it as selecting the appropriate type of measuring tool to determine if a part is made according to the right dimensions. SC answer the question: 'how do you determine if a project is a success?'. CSFs are the factors that lead to success. CSFs answer the question: 'what are the few key areas where things must go right for an urgent and unexpected project to flourish and be a success to the company?'. In this study urgent and unexpected projects are defined as those that are not regarded as about to happen when planning the resources. They are furthermore in need of continuous attention to reduce the project lead time.

Interview structure: In this interview I would like to start asking you to describe yourself and your role, move on to the specific project and your role within the project, and then discuss the success criteria and critical success factors that made the project a success.

Last week I spoke to [name business unit manager] and asked him to provide me some details on the most successful urgent and unexpected projects that your business unit has completed over the last three years. [name business unit manager] told me about a project you worked on. He told me that you have a great deal of knowledge of this project, and I would therefore like to ask you some questions about it. Is that OK? [If yes, continue, if no, ask about reservations]

Approval recording: As it is easier for me to follow the conversation and not be writing all the time, would you mind if I recorded this interview? For your information, I am the only person who has access to the tape, and it will be destroyed directly after the most important items are transcribed. All information will be held confidential, and after the interview, I will send you a summary with the answers to the questions you gave, and call you shortly after to see if I understood everything correctly. If you have any reservations to recording the interview, no worries, I will than take some extra time for notes. [Thank the interviewee, regardless of his/her choice].[If the interviewee has no obligations to the recording, state that you will start recording now.]

<u>Interviewee background and role</u>

1. How long have you been with the company?
2. How long have you been in your current role?
3. What was your role during the project?
4. Where you involved during the whole project?

<u>Project background</u>

5. Can you briefly describe the project?
    a. Customer
    b. Scope

c. Why urgent?
d. Why unexpected?

Success criteria

SC are the measures used to judge project success. SC answer the question: 'how do you determine if a project is a success?'

6. Would you rate the project you just described as successful or unsuccessful?
7. By which criteria would you assess the success/failure of the project?

Nr.	SC	Why?
1		
2		
3		
4		
5		
6		
7		

8. Would [select from SC list] also be a criteria for you to assess project success/failure?
    e. Efficiency
        v. Profit
        vi. Time
        vii. Quality
    f. Stakeholder satisfaction
        viii. Customer
        ix. Supplier
        x. End user
        xi. Project team
        xii. General public

Summarize the SC and ask if the list is conclusive

9. How would you rate the success/failure of the project against these criteria? [use template]

	SC1	SC2	SC3	SC4	SC5	SC6
Score						

10. If one, two or three of the SC were not met, which would have the greatest impact on success?
11. Can you think of a successful urgent and unexpected project were the SC [most important] was missing?
    OR
12. Can you think of an unsuccessful urgent and unexpected project were the SC [most important] was present?

Success/failure factors

CSFs are the factors that lead to success. CSFs answer the question: 'what are the few key areas where things must go right for an urgent and unexpected project to flourish and be a success to the company?'.

13. What were the factors that were critical to the success/failure of the project?

Nr.	CSF	Why?
1		
2		
3		
4		
5		
6		
7		

14. From literature, the following list with CSFs was derived. These CSFs can be applicable to a wide range of projects (i.e. ICT, etc.). If you go through the list, are there any CSFs/FFs that come to mind that were also critical during the project?

Summarize the CSFs and ask if the list is conclusive

15. If one, two or three of the CSFs were (not) met, which would have the greatest impact on success?
16. Can you think of a successful urgent and unexpected project were the CSF was missing?
    OR
17. Can you think of an unsuccessful urgent and unexpected project were the CSF was present?

Round up

18. Have I forgotten anything important that I should have asked?

Again, I would like to thank you for all the information. It will be very useful for my thesis, which I will share with you in October.

Within a few days, I will send you a summary of what we have discussed. I will call you again a few days later to see if I have understood everything correctly.

If you have any questions or remarks in the meanwhile, you can always call me on my mobile or send me an e-mail.

Post interview notes

19. Other topics discussed:
20. Documents obtained:
21. Post interview comments or leads:

Appendix IV: Summary findings within-case analysis

Case A

Project success criteria		Interview data			Other data	
Nr.	Success Criteria	Resp. 1	Resp. 2	Resp. 3	Documents	Sources of evidence
1	Customer satisfaction	1	1	4	•	4
2	Profit	2	3	3	•	4
3	Lead time	3	2	1	•	4
4	Quality	4	4	2	•	4

The dot indicates the presence of supporting documents

Project success factors		Interview data			Other data	
Nr.	Critical success factor	Resp. 1	Resp. 2	Resp. 3	Documents	Sources of evidence
1	Sufficient flexible & skilled suppliers	1	1	2	•	4
2	Sufficient flexible & skilled personnel	2		4	•	3
3	Communication & feedback quality		4	3	•	3
4	Competent project manager	3	2	1		3
5	Sufficient budget		5		•	3
6	Urgency of the customer		3		•	2
7	Supportive organizational culture & structure			5		1

The light grey indicates that there is insufficient evidence (< 3) to validate the CSF.

Case B

Project success criteria		Interview data			Other data	
Nr.	Success Criteria	Resp. 1	Resp. 4	Resp. 5	Documents	Sources of evidence
1	Customer satisfaction	1	3	2	•	4
2	Profit	2	2	3	•	4
3	Lead time	3	4	4	•	4
4	Quality	4	5	1	•	4
5	Extent of scope		1		•	2
6	Safety		6		•	1

Project success factors		Interview data			Other data	
Nr.	Critical success factor	Resp. 1	Resp. 4	Resp. 5	Documents	Sources of evidence
1	Quality of customer/user relation	1	3	2	•	4
2	Communication & feedback quality	2	2		•	3
3	Risks, addressed, assessed and managed	3	1	1	•	4
4	Clear realistic objectives	4			•	2
5	Supportive organisational culture & structure			3		1

Case C

Project success criteria		Interview data			Other data	
Nr.	Success Criteria	Resp. 6	Resp. 7	Resp. 8	Documents	Sources of evidence
1	Customer satisfaction	1	5		•	3
2	Profit	2	2	1	•	4
3	Lead time	3	4	3	•	4
4	Quality	4	3	2	•	4
5	Safety	5	1		•	3
6	Extent of scope			4		1

Project success factors		Interview data			Other data	
Nr.	Critical success factor	Resp. 6	Resp. 7	Resp. 8	Documents	Sources of evidence
1	Sufficient flexible & skilled personnel	1	2	2	•	4
2	Risks, addressed, assessed and managed	3		1	•	3
3	Competent project manager	2	1	4	•	4
4	Communication & feedback quality	4	3	5	•	4
5	Clear realistic objectives		4			1
6	Sufficient budget			3	•	1

Case D

Project success factors		Interview data			Other data	
Nr.	Critical success factor	Resp. 6	Resp. 7	Resp. 8	Documents	Sources of evidence
1	Sufficient flexible & skilled personnel	1	1	1	•	4
2	Risks, addressed, assessed and managed	2	2	4	•	4
3	Communication & feedback quality	3	3	3	•	4
4	Competent project manager			5	•	2
5	Sufficient flexible & skilled suppliers			2		1

Case E

Project success criteria		Interview data			Other data	
Nr.	Success Criteria	Resp. 9	Resp. 10	Resp. 11	Documents	Sources of evidence
1	Customer satisfaction	1	1	4	•	4
2	Lead time	2	2	1	•	4
3	Quality	3	3	2	•	4
4	Profit	4	5	3	•	4
5	Safety	5	6	5	•	4
6	Project team satisfaction		4			1

Project success factors		Interview data			Other data	
Nr.	Critical success factor	Resp. 9	Resp. 10	Resp. 11	Documents	Sources of evidence
1	Sufficient flexible & skilled personnel	1	2	1		3
2	Communication & feedback quality	2	1	3	•	4
3	Competent project manager	3	3	2		3
4	Clear and realistic objectives		4		•	2
5	Top management support			4	•	2

Case F

Project success factors		Interview data			Other data	
Nr.	Critical success factor	Resp. 9	Resp. 10	Resp. 11	Documents	Sources of evidence
1	Sufficient flexible & skilled personnel	4	3	1	•	4
2	Competent project manager	1	2	3		3
3	Communication & feedback quality	2	1	4		3
4	Up to date planning	3			•	3
5	Sufficient flexible & skilled suppliers	5				2
6	Project size, level of complexity and lead time			5		1
7	Risks, addressed, assessed and managed	6				1
8	Clear and realistic objectives		4			1
9	Top management support			2		1

Appendix V: Respondent success criteria scores

Case	Respondent	Customer satisfaction	Profit	Lead time	Quality	Safety	Overall score
A	Resp. 1	5	5	5	4	-	19
A	Resp. 2	5	5	5	5	-	20
A	Resp. 3	5	4	5	4	-	18
	Mean score	5	4,7	5,0	4,3	-	19,0
	Std. Dev.	0,0	0,6	0,0	0,6	-	1,0
B	Resp. 1	1	1	5	3	-	10
B	Resp. 4	1	1	5	3	3	13
B	Resp. 5	1	2	5	3	-	11
	Mean score	1	1,3	5,0	3,0	3	11,3
	Std. Dev.	0,0	0,6	0,0	0,0	-	1,5
C	Resp. 6	5	4	4	4	4	21
C	Resp. 7	4	4	5	3	4	20
C	Resp. 8	-	3	4	4	3	14
	Mean score	4,5	3,7	4,3	3,7	3,7	18,3
	Std. Dev.	0,7	0,6	0,6	0,6	0,6	3,8
D	Resp. 6	1	1	2	3	4	11
D	Resp. 7	1	1	2	3	3	10
D	Resp. 8	-	1	3	3	-	7
	Mean score	1	1,0	2,3	3,0	3,5	9,3
	Std. Dev.	0,0	0,0	0,6	0,0	0,7	2,1
E	Resp. 9	5	5	5	5	4	24
E	Resp. 10	5	4	5	5	5	24
E	Resp. 11	5	5	5	5	4	24
	Mean score	5	4,7	5,0	5,0	4,3	24,0
	Std. Dev.	0,0	0,6	0,0	0,0	0,6	0,0
F	Resp. 9	2	3	2	2	4	13
F	Resp. 10	2	3	2	2	3	12
F	Resp. 11	2	3	2	3	3	13
	Mean score	2	3,0	2,0	2,3	3,3	12,7
	Std. Dev.	0,0	0,0	0,0	0,6	0,6	0,6

The mean scores per success criteria, per case are detailed in Table 6.

Appendix VI: Assessment reference points critical success factors

Communication & feedback quality

Definition	The extent to which the project stakeholders are imparting or exchanging information with the goal of improving the projects outcome.
High	The project stakeholders are imparting or exchanging information in such a way that it is contributing to the projects outcome.
Medium	It is unclear if the project stakeholders are imparting or exchanging information in such a way that it is contributing to the projects outcome, as the findings are contradictory or inconclusive.
Low	The project stakeholders are imparting or exchanging information in such a way that it is counteracting the projects outcome.

Sufficient flexible & skilled personnel

Definition	The extent to which the project organisation has access to adequate responsive, knowledgeable and trained employees in order to perform a range of activities well.
High	The project organisation has adequate access to responsive, knowledgeable and trained employees in order to perform a range of activities well.
Medium	It is unclear if the project organisation has access to adequate responsive, knowledgeable and trained employees in order to perform a range of activities well, as the findings are contradictory or inconclusive.
Low	The project organisation has insufficient access to responsive, knowledgeable and trained employees in order to perform a range of activities well.

Competent project manager

Definition	The extent to which the person in charge has the ability, knowledge and skill to successfully plan and execute the project.
High	The person in charge has the ability, knowledge and skill to successfully plan and execute the project.
Medium	It is unclear if the person in charge has the ability, knowledge and skill to successfully plan and execute the project, as the findings are contradictory or inconclusive.
Low	The person in charge lacks the ability, knowledge and skill to successfully plan and execute the project.

Risks addressed, assessed and managed

Definition	The extent to which the project organisation evaluates, deals with and controls situations involving exposure to danger.
High	The project organisation effectively evaluates, deals with and controls situations involving exposure to danger.
Medium	It is unclear if the project organisation effectively evaluates, deals with and controls situations involving exposure to danger, as the findings are contradictory or inconclusive.
Low	The project organisation ineffectively evaluates, deals with and controls situations involving exposure to danger.

Sufficient flexible & skilled suppliers

Definition	The extent to which the project organisation has access to adequate responsive, knowledgeable and trained businesses providing services or commodities, in order perform a certain (range) activity/activities well.
High	The project organisation has adequate access to responsive, knowledgeable and trained businesses providing services or commodities, in order perform a certain (range) activity/activities well.
Medium	It is unclear if the project organisation has adequate access to responsive, knowledgeable and trained businesses providing services or commodities, in order perform a certain (range) activity/activities well, as the findings are contradictory or inconclusive.
Low	The project organisation has insufficient access to responsive, knowledgeable and trained businesses providing services or commodities, in order perform a certain (range) activity/activities well.

Quality of customer/user relation

Definition	The extent to which the cooperation between the project organisation and the organisations financing and operating the projects outcome is positive.
High	The cooperation between the project organisation and the organisations financing and operating the projects outcome is positive.
Medium	It is unclear if the cooperation between the project organisation and the organisations financing and operating the projects outcome is positive, as the findings are contradictory or inconclusive.
Low	The cooperation between the project organisation and the organisations financing and operating the projects outcome is negative.

Appendix VII: Development of success criteria propositions

The propositions of this study have been developed using the procedure suggested by Dul and Hak (2008). The process is detailed below. First the sufficient, then the necessary and finally, the probabilistic relations are tested and presented. It is not possible to determine if a deterministic relation exists among the concepts as the dependent concept can only take on two values.

Sufficient conditions:

Case	Customer satisfaction	Profit	Lead time	Quality	Safety	Successful
A	5,0	4,7	5,0	4,3	-	Yes
E	5,0	4,7	5,0	5,0	4,3	Yes
C	4,5	3,7	4,3	3,7	3,7	Yes
F	2,0	3,0	2,0	2,3	3,3	No
B	1,0	1,3	5,0	3,0	3,0	No
D	1,0	1,0	2,3	3,0	3,5	No

To derive the propositions, the individual success criteria scores have been rearranged, from a high to a low score in five different matrixes. In order to be concise, these matrixes have been consolidated into the above matrix. From the matrix above, the following propositions were derived:

Summary propositions

Proposition 1a:	Urgent and unexpected projects with a high level of customer satisfaction are perceived as being successful by contractors
Proposition 2a:	Urgent and unexpected projects with a low level of customer satisfaction are perceived as being unsuccessful by contractors
Proposition 1b:	Urgent and unexpected projects with a high level of profit are perceived as being successful by contractors
Proposition 2b:	Urgent and unexpected projects with a low or medium level of profit are perceived as being unsuccessful by contractors
Proposition 1d:	Urgent and unexpected projects with a high level of quality are perceived as being successful by contractors
Proposition 2d:	Urgent and unexpected projects with a low or medium level of quality are perceived as being unsuccessful by contractors
Proposition 1e:	Urgent and unexpected projects with a high level of safety performance are perceived as being successful by contractors
Proposition 2e:	Urgent and unexpected projects with a medium level of safety performance are perceived as being unsuccessful by contractors
	Proposition 2e is revised based on the respondents feedback with regards to safety.
Proposition 2e rev:	Urgent and unexpected projects with a low or medium level of safety performance are perceived as being unsuccessful by contractors

Consolidated proposition

Proposition SC1:	Urgent and unexpected projects with a high level of customer satisfaction, profit, quality and safety performance are perceived as successful by contractors
Proposition SC2:	Urgent and unexpected projects with a low level of customer satisfaction, low or medium level of profit, quality, and safety performance are perceived as unsuccessful by contractors by contractors

Necessary conditions:

Data matrix regarding successful urgent and unexpected projects

Case	Customer satisfaction	Profit	Lead time	Quality	Safety	Successful
A	5,0	4,7	5,0	4,3	-	Yes
C	4,5	3,7	4,3	3,7	3,7	Yes
E	5,0	4,7	5,0	5,0	4,3	Yes

Summary propositions

Proposition 3a: Urgent and unexpected project require a high level of customer satisfaction in order to be perceived successful by contractors

Proposition 3b: Urgent and unexpected project require a high level of profit in order to be perceived successful by contractors

Proposition 3c: Urgent and unexpected project require a high level of lead time performance in order to be perceived successful by contractors

Proposition 3d: Urgent and unexpected project require a high level of quality in order to be perceived successful by contractors

Proposition 3e: Urgent and unexpected project require a high level of safety performance in order to be perceived successful by contractors

Consolidated proposition

Proposition SC3: Urgent and unexpected projects require a high level of customer satisfaction, profit, lead time, quality and safety performance in order to be perceived successful by contractors

Data matrix regarding unsuccessful urgent and unexpected projects

Case	Customer satisfaction	Profit	Lead time	Quality	Safety	Successful
B	1,0	1,3	5,0	3,0	3,0	No
D	1,0	1,0	2,3	3,0	3,5	No
F	2,0	3,0	2,0	2,3	3,3	No

Summary propositions

Proposition 4a: Urgent and unexpected project require a low level of customer satisfaction in order to be perceived unsuccessful by contractors

Proposition 4b: Urgent and unexpected project require a low or medium level of customer satisfaction in order to be perceived unsuccessful by contractors

Proposition 4d: Urgent and unexpected project require a low or medium level of quality in order to be perceived unsuccessful by contractors

Proposition 4e: Urgent and unexpected project require a medium level of safety performance in order to be perceived unsuccessful by contractors

Proposition 4e is revised based on the respondents qualitative feedback with regards to safety.

Proposition 4e rev: Urgent and unexpected project require a medium level of safety performance in order to be perceived unsuccessful by contractors

Consolidated proposition

Proposition SC4: Urgent and unexpected projects require a low level of customer satisfaction and a low or medium level of profit, quality and safety performance in order to be perceived unsuccessful by contractors.

Deterministic relation:

It is not possible to determine if a deterministic relation exists among the concepts as the dependent concept can only take on two values.

Probabilistic relation:

No efforts were made to determine if a probabilistic relation exists between customer satisfaction and success, profit and success, quality and success and safety and success, as such a proposition would not add to the prior propositions.

Case	Customer satisfaction	Profit	Lead time	Quality	Safety	Successful
A	5,0	4,7	5,0	4,3	-	Yes
E	5,0	4,7	5,0	5,0	4,3	Yes
B	1,0	1,3	5,0	3,0	3,0	No
C	4,5	3,7	4,3	3,7	3,7	Yes
D	1,0	1,0	2,3	3,0	3,5	No
F	2,0	3,0	2,0	2,3	3,3	No

Summary propositions

Proposition SC5: The higher the lead time performance, the more likely an urgent and unexpected projects is perceived as successful by contractors

Appendix VIII: Development of critical success factor propositions

The propositions of this study have been developed using the procedure suggested by Dul and Hak (2008). The process is detailed below. First the sufficient, then the necessary and finally, the probabilistic relations are tested and presented. It is not possible to determine if a deterministic relation exists among the concepts, as the dependent concept can only take on two values.

Sufficient conditions:

Case	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation	Successful
A	H	H	H	H	H	H	Yes
C	H	H	H	H	H	H	Yes
E	H	H	H	H	-	H	Yes
B	L	M	H	L	H	L	No
D	L	L	L	L	L	L	No
F	L	L	L	M	L	L	No

To derive the propositions, the individual critical success factor scores have been rearranged, from a high to a low score in five different matrixes. In order to be concise, these matrixes have been consolidated into the above matrix. From the matrix above, the following propositions are derived:

Summary propositions

Proposition 1a:	Urgent and unexpected projects with a high level of communication & feedback quality are perceived as being successful by contractors
Proposition 2a:	Urgent and unexpected projects with a low level of communication & feedback quality are perceived as being unsuccessful by contractors
Proposition 1b:	Urgent and unexpected projects with a high level of sufficient flexible & skilled personnel are perceived as being successful by contractors
Proposition 2b:	Urgent and unexpected projects with a low to medium level of sufficient flexible & skilled personnel are perceived as being unsuccessful by contractors
Proposition 2c:	Urgent and unexpected projects with a low level of project manager competency are perceived as being unsuccessful by contractors
Proposition 1d:	Urgent and unexpected projects with a high level of risk addressing, assessing and managing are perceived as being successful by contractors
Proposition 2d:	Urgent and unexpected projects with a low to medium level of risk addressing, assessing and managing are perceived as being unsuccessful by contractors
Proposition 2e:	Urgent and unexpected projects with a low level of sufficient flexible & skilled suppliers are perceived as being unsuccessful by contractors
Proposition 1f:	Urgent and unexpected projects with a high level of quality of customer/user relation are perceived as being successful by contractors
Proposition 2f:	Urgent and unexpected projects with a low level of quality of customer/user relation are perceived as being unsuccessful by contractors

Consolidated proposition

Proposition CSF1:	Urgent and unexpected projects with a high level of communication & feedback quality, sufficient flexible & skilled personnel, risk addressing, assessing and managing, and quality of customer/user relation are perceived as successful by contractors

Proposition CSF2: Urgent and unexpected projects with a low level of communication & feedback quality, low to medium level of sufficient flexible & skilled personnel, low level of project manager competency, low to medium levels of risk addressing, assessing and managing, low levels of sufficient flexible & skilled suppliers, and low levels of quality of customer/user relation are perceived as unsuccessful by contractors

Necessary conditions:

Data matrix regarding successful urgent and unexpected projects

Case	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation	Successful
A	H	H	H	H	H	H	Yes
C	H	H	H	H	H	H	Yes
E	H	H	H	H	-	H	Yes

Summary propositions

Proposition 3a: Urgent and unexpected project require a high level of communication & feedback quality in order to be perceived successful by contractors

Proposition 3b: Urgent and unexpected project require a high level of sufficient flexible & skilled personnel in order to be perceived successful by contractors

Proposition 3c: Urgent and unexpected project require a high level of project manager competency in order to be perceived successful by contractors

Proposition 3d: Urgent and unexpected project require a high level of risk addressing, assessing and managing in order to be perceived successful by contractors

Proposition 3e: Urgent and unexpected project require a high level of sufficient flexible & skilled suppliers in order to be perceived successful by contractors

Proposition 3f: Urgent and unexpected project require a high level of quality of customer/user relation in order to be perceived successful by contractors

Consolidated proposition

Proposition CSF3: Urgent and unexpected projects require a high level of communication & feedback quality, sufficient flexible & skilled personnel, risk addressing, assessing and managing, sufficient flexible & skilled suppliers, and quality of customer/user relation in order to be perceived successful by contractors

Data matrix regarding successful urgent and unexpected projects

Case	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation	Successful
B	L	M	H	L	H	L	No
D	L	L	L	L	L	L	No
F	L	L	L	M	L	L	No

Summary propositions

Proposition 4a:	Urgent and unexpected project require a low level of communication & feedback quality in order to be perceived unsuccessful by contractors
Proposition 4b:	Urgent and unexpected project require a low to medium level of sufficient flexible & skilled personnel in order to be perceived unsuccessful by contractors
Proposition 4c:	Urgent and unexpected project require a low to medium level of risk addressing, assessing and managing in order to be perceived unsuccessful by contractors
Proposition 4d:	Urgent and unexpected project require a low level of quality of customer/user relation in order to be perceived unsuccessful by contractors

Consolidated proposition

Proposition CSF4:	Urgent and unexpected projects require a low level of communication & feedback quality, low to medium level of sufficient flexible & skilled personnel, low to medium levels of risk addressing, assessing and managing, and low levels of quality of customer/user relation in order to be perceived unsuccessful by contractors

Deterministic relation:

It is not possible to determine if a deterministic relation exists among the concepts as the dependent concept can only take on two values.

Probabilistic relation:

No efforts were made to determine if a probabilistic relation exists between communication & feedback quality and success, sufficient flexible & skilled personnel and success, risk addressing, assessing and managing and success, and quality of customer/user relation and success, as such a proposition would not add to the prior propositions.

Case	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation	Successful
A	H	H	H	H	H	H	Yes
C	H	H	H	H	H	H	Yes
E	H	H	H	H	-	H	Yes
B	L	M	H	L	H	L	No
D	L	L	L	L	L	L	No
F	L	L	L	M	L	L	No

Summary propositions

Proposition CSF5:	The higher the competency of the project manager, the more likely an urgent and unexpected projects is perceived as successful by contractors
Proposition CSF6:	The higher the access to sufficient flexible & skilled suppliers, the more likely an urgent and unexpected projects is perceived as successful by contractors

Appendix IX: Robustness check of success criteria

Robustness check on persons job function

To rule out the rival explanation, that the results are a consequence of a person's job function, the results are grouped along the respondents job functions. A high level of conformity within a certain job function could indicate support for the rival explanation.

	Respondent	Job function		Customer satisfaction	Profit	Lead time	Quality	Safety	Most important SC
1	Resp. 1	Managing director	Gears & Services	1	2	3	4	-	Customer satisfaction
6	Resp. 6	Managing director	Turbo Services	1	2	3	4	5	Safety
9	Resp. 9	Managing director	Thermeq	1	4	2	3	5	Safety
7	Resp. 7	Prod. manager	Turbo Services	5	2	4	3	1	Safety
10	Resp. 10	Prod. manager	Thermeq	1	5	2	3	6	Safety
3	Resp. 3	Project manager	Gears & Services	4	3	1	2	-	Customer satisfaction
4	Resp. 4	Project manager	Gears & Services		2	4	5	6	Customer satisfaction
8	Resp. 8	Project manager	Turbo Services	-	1	2	3	-	Quality
11	Resp. 11	Project manager	Thermeq	4	3	1	2	5	Safety
2	Resp. 2	Sales manager	Gears & Services	1	3	2	4	-	Customer satisfaction
5	Resp. 5	Sales manager	Gears & Services	2	3	4	1	-	Profit

The analysis indicates a high level of conformity within certain job functions. The results for example show that all (two) production managers indicate customer satisfaction, profit , lead time, quality and safety as success criteria. These results are however largely found among all job functions. No, one job function exhibits a strong deviating pattern, therewith cancelling out the prior finding. A persons job function is therefore not assumed to explain the observed results.

Appendix X: Cross-case analysis of critical success factors

Case	Perceived	Respondent	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation	Most important CSF
A	Successful	Resp. 1		2[1]	3		1		Sufficient flexible & skilled suppliers
		Resp. 2	4		2		1		Competent project manager
		Resp. 3	3	4	1		2		Sufficient flexible & skilled personnel
C	Successful	Resp. 6	4	1	2	3			Risks addressed, assessed and managed
		Resp. 7	3	2	1				Sufficient flexible & skilled personnel
		Resp. 8	6	3	5	2			Sufficient flexible & skilled personnel
E	Successful	Resp. 9	2	1	3				Competent project manager
		Resp. 10	1	2	3				Sufficient flexible & skilled personnel
		Resp. 11	3	1	2				Sufficient flexible & skilled personnel
B	Unsuccessful	Resp. 1	2			3		1	Communication & feedback quality
		Resp. 4	2			1		3	Communication & feedback quality
		Resp. 5				1		2	Risks addressed, assessed and managed
D	Unsuccessful	Resp. 6	3	1		2			Sufficient flexible & skilled personnel
		Resp. 7	3	1		2			Sufficient flexible & skilled personnel
		Resp. 8	3	1		4			Sufficient flexible & skilled personnel
F	Unsuccessful	Resp. 9	2	4	1				Experience with technology
		Resp. 10	1	3	2				Competent project manager
		Resp. 11	4	1	2				Sufficient flexible & skilled personnel

[1] The numbers indicate the sequence in which the respondents referred the critical success factor.

Appendix XI: Robustness check of critical success factors

Robustness check on persons job function

To rule out the rival explanation, that the results are a consequence of a person's job function, the results are grouped along the respondents job functions. A high level of conformity within a certain job function could indicate support for the rival explanation.

Case	Respondent	Job function	Product line	Communication & feedback quality	Sufficient flexible & skilled personnel	Competent project manager	Risks addressed, assessed and managed	Sufficient flexible & skilled suppliers	Quality of customer/user relation	Most important CSF
A	Resp. 1	MD	GS		2	3		1		Sufficient flexible & skilled suppliers
B	Resp. 1	MD	GS	2			3		1	Communication & feedback quality
C	Resp. 6	MD	TS	4	1	2	3			Risks addressed, assessed and managed
D	Resp. 6	MD	TS	3	1		2			Sufficient flexible & skilled personnel
E	Resp. 9	MD	TM	2	1	3				Competent project manager
F	Resp. 9	MD	TM	2	4	1				Sufficient flexible & skilled personnel
C	Resp. 7	PD	TS	3	2	1				Sufficient flexible & skilled personnel
D	Resp. 7	PD	TS	3	1		2			Sufficient flexible & skilled personnel
E	Resp. 10	PD	TM	1	2	3				Sufficient flexible & skilled personnel
F	Resp. 10	PD	TM	1	3	2				Competent project manager
A	Resp. 3	PM	GS	3	4	1		2		Sufficient flexible & skilled personnel
B	Resp. 4	PM	GS	2			1		3	Communication & feedback quality
C	Resp. 8	PM	TS	6	3	5	2			Sufficient flexible & skilled personnel
D	Resp. 8	PM	TS	3	1		4			Sufficient flexible & skilled personnel
E	Resp. 11	PM	TM	3	1	2				Sufficient flexible & skilled personnel
F	Resp. 11	PM	TM	4	1	2				Sufficient flexible & skilled personnel
A	Resp. 2	SM	GS	4		2		1		Competent project manager
B	Resp. 5	SM	GS				1		2	Risks addressed, assessed and managed

Key: MD = managing director; PD = production manager; PM = project manager; SM = sales manager, GS = Gears & Services; TS = Turbo Services; TM = Thermeq

The analysis indicates that none of the job functions exhibit a distinct set of critical success factors. Most of the job functions illustrate a reasonable spread in results, therewith indicating that a person's job function does explain the observed results.