



Rijkswaterstaat
Ministerie van Infrastructuur en Milieu

Master thesis

**More return from innovative ideas
from innovation contests**



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UNIVERSITY OF TWENTE.

“Daring ideas are like chessmen moved forward; they may be beaten
but may start a winning game.”

Johann Wolfgang von Goethe
(1749-1832)

Master thesis

**Why innovative ideas from innovation contests
do not get realized**

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Management summary

Rijkswaterstaat (RWS) has organized different kinds of *innovation contests* in the past decennia. An innovation contest is a competition of innovators who use their skills, experience and creativity to provide a solution for a particular challenge defined by the organizer. Hundreds of ideas came up, but unfortunately a small share was actually realized. The question is *why* these ideas from innovation contests were rarely realized? RWS and the participants of the contest spent time and money on the creation and development of innovative ideas, and it leads to incomprehensibility and even frustration when it became clear that the ideas did not find a way towards application. Eventually, the potential users were not able benefit from these innovative ideas. By analysing twenty-seven innovation contests and performing five case studies, this research gives answers to the question *why* the innovative ideas did not get exploited.

One of the results of this research is the categorization of three types of innovation contests: *Idea*, *design* and *problem contests*. *Idea contests* focus on generating fresh and ‘crazy’ ideas and do not have the propagated intention to actual realize the ideas. These contests have a broad focus group and the prize money is relatively low. *Design contests* focus more on the architecture and design, but have propagated intention to be realized. These contests have a narrowed focus group (architects, artists and designers) and the prize money is also relatively low; publicity is especially important in this sector. The *problem contests* focus on innovative solutions for a certain concrete problem and do also have the propagated intention to find a way towards application. The focus group is also narrowed, but the prize money is much higher compared to the other two types. *Idea* and *design contests* do not seem to be the right method to realize innovations, but *problem contests* have more potential. However, the premeditation of the *idea contests* is not to realize innovations. *Design* and *problem contest* do have this intention. What is the reason why these two types, despite these intentions, do not succeed in realizing the innovative ideas from the innovation contest?

The first answer to this question can be attributed to the dominant role of the contextual factors in the process during and after the innovation contest. The innovation contests consist of two or three selection rounds where the selected ideas are further developed ‘on paper’. When the contest is over, the winners are awarded with a prize and publicity. After the contest, the (winning) ideas start to falter soon after. Three problems can be identified that cause the standstill of the innovation process: The main problem is the *conflicted interests of other governmental organizations and divisions*. Other governmental organizations or divisions are required to develop the winning ideas further after the innovation contest. These organizations often have different interest than realization of innovation. The second problem is the *lack of development resources*. None of the involved parties are prepared to invest in the innovative ideas, because there are no guarantees that the main buyer, often RWS, will buy the innovations. The third problem is *legislation*. Strict legislation may retain innovative ideas from realization and makes it difficult for governmental organizations to stimulate the development.

This research puts the innovation contest in an organization context and competences that are necessary to successfully realize its innovations, which results in the second answer: Many different organizations are involved in a project in the construction sector, and in an innovation contest as well. Small companies and R&D divisions are specialized in generating innovative ideas, where research institutes, universities and consultancies help to develop and

prove these ideas. Eventually, experienced contractors and manufacturers realize and commercialize these innovations. However, the *owner* and/or *initiator* (RWS) plays the binding factor in the stimulation of innovation and have a *network function*. RWS lacks the capability to arrange their *network function* concerning the stimulation of innovation and to 'guide' the innovation process. RWS did not arrange a decent planning, organization, control and staffing *after* the contest, RWS struggled with the coordination with other projects and programs and was not very generous with the exchange of (financial) resources and information. The specific knowledge and people needed to perform in such a position were not always at the right place and the right time. This can be explained by the lack of guidelines to set up an innovation contests, information and coordination systems. This makes it difficult for managers to set up a decent innovation contest.

These findings result in the question why these problems (dispersed government roles, lack of development funds and legislation) are experienced *after* the contest, and are not overcome before an innovation contest is set up by RWS. First of all, it can be the lack of network competence discussed in the previous paragraph, but it can also be a more conscious decision. Two other clarifications can be attributed to this question: An extra development process is required to overcome these problems. This process does not fit within the policy of RWS to leave as much as possible to the market, this can include the follow-up of the innovation contest and. Besides, it requires more money, specific expertise, coordination and time to arrange such a process. The second clarification is that RWS uses the innovation contests for publicity purposes. This interest is fulfilled when the contest is finished; the innovative ideas are generated and promoted towards the users and the market, and RWS has shown that they are working on innovations. Thus there is no real need to arrange a follow-up process.

The main recommendations to make innovation contest more successful regarding the realization of innovative ideas and to allow the contests to be more remunerative for participants are: Embed a follow-up process in the innovation contest to overcome the problems that occur right after the contest; categorize the innovation contests to provide more openness and clarity ; set up guideline for each category to organize a contest to support potential organizers of innovation contests; and invest in the so-called '*network competence*', by setting up a central knowledge and coordination system, training and special development fund.

This research puts the innovation contest in a broader process context. Creative ideas are not innovations; they need to be developed further. For that reason the innovation contest is placed in perspective of the whole innovation process to better understand the difficulties in this process and how this related to the innovation contest. The link between the innovation contest and the innovation process has not been made in the scientific literature, or in practice. This is exactly the reason why many ideas do not find their way towards realization. This research also puts the innovation contest in an organizational context. It shows which types of parties are involved in the process during and after an innovation contest and what the roles and competences of these parties are, in the perspective of the construction sector. It points out that the role of the initiator of the innovations contest has a central and crucial position in the realization of innovation. In case the initiator does not have the right competences to guide the process and to bind the different parties, the chance that innovative ideas will be realized is minimal.

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1. Introduction

Innovation in the Dutch construction sector – The construction cluster is a mature cluster, based on a combination of traditional skills, industrial technologies and a well-established informal culture of the ‘way things are done’. Although it includes highly innovative actors, the Dutch construction industry as a whole is a fairly traditional world with in-built preference for proven technology and organizational concepts. Construction firms are mostly technology followers which absorb innovations originating from manufacturing industries and increasingly from wholesale and service industries (den Hertog & Remoe, 2001). The innovation in the Dutch construction sector is mainly incremental, due most probably to the fact that in general firms are more inward looking with regard to improving their technology and related processes. The market is perceived as price- and cost-driven. Many small and medium-sized firms produce similar products with similar technology and similar materials. Their focus is mainly on projects and project control (Pries & Dorée, 2005).

Discontinuous innovation – Despite the traditional nature of the industry innovation can play an important role. Innovation can be thought of as falling onto a continuum from evolutionary to revolutionary and therefore the ends of both sides of this continuum are categorised into two groups: (1) Incremental or evolutionary innovations that improve the performance of established products, services or business models “along the dimensions of performance that mainstream customers in major markets have historically valued”. (2) Revolutionary breakthroughs lie at the core of the entrepreneurial activity and wealth creation and almost by definition serve the basis of future technologies, products, services and industries (Schumpeter, 1975). Discontinuous new products play an important role in building competitive advantage and can contribute significantly to a firm’s growth and profitability (Ali, 1994; Calantole & Di Benedito, 1988; Kleinschmidt & Cooper, 1991; Robertson, 1971). Organizational growth and renewal are fundamental to any firm’s long-term survival and can be approached in several ways (Jelinek & Schoonhoven, 1993; Morone, 1993). In many ways innovation is the single most important building block of competitive advantage; giving a company something unique that its competitors lack (Hill & Jones, 1998).

Discontinuous innovation process – An understanding of the differences between the *discontinuous* and *continuous* (incremental) new product development *processes* is essential if the development of discontinuous products is to be managed effectively. An appreciation of the unique challenges inherent in managing discontinuous innovation and the key factors is fundamental to the development of radically new products (Veryzer, 1998). Cooper (1990) mentioned that the strategic solution, to prevent the failure of discontinuous innovations, is that management must get better at conceiving, developing, and launching new products – not just extensions and incremental improvement, but new products that give the firm a sustainable competitive advantage. This translates into better management of the innovation process (Cooper, 1990).

Rijkswaterstaat – Discontinuous innovation is important for the (national) market as well as for the companies itself. The construction industry is very traditional and focuses mainly on incremental innovation. Rijkswaterstaat (RWS) is trying to get more discontinuous innovative ideas out of this market by organizing ‘innovation contests’ (Dutch: ‘prijsvragen’). An innovation contest is a competition of innovators who use their skills, experience and creativity to provide a

solution for a particular challenge defined by the organizer (Bullinger, Haller, & Moeslein, 2009). The organizer is in this context RWS, and the innovators are individuals, knowledge institutes, and mainly companies in the construction sector. RWS is an agency of the Dutch government and responsible for procuring and coordinating many of the major infrastructural and civil engineering works. Together with the Rijksgebouwendienst (responsible for the quality of public buildings) RWS is an important player in the construction industry (den Hertog & Remoe, 2001). Romijn (2000) indicated that there were several reasons for the highly interventionist government involvement in the construction sector during the 1945-1970 period. These include rebuilding the country after the war, population growth and the expansion of production capacity to fuel economic growth, especially after 1985 government involvement was wound down (Romijn, 2000). Present-day procurement policy of RWS is called 'Market, unless...' whereby as much as possible is left to the market. RWS set up several innovation contests to get creativity 'out of the market' the last two decades. Many different innovative ideas came up and are rewarded, but a large share of the winning ideas is never exploited. Hence, the level of disappointment and scepticism grows towards innovation contests and RWS, because private organizations cannot eventually apply the innovative ideas (RWS.nl, 2010).

Innovation contests – Innovation is defined as “the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order” (Van de Ven, 1986). This definition is sufficiently general to apply to a wide variety of technical, product, process, and administrative kinds of innovations. From a managerial viewpoint, to understand the process of innovation is to understand the factors that facilitates and inhibits the development of innovations (Van de Ven, 1986). Thus, as long as these new ideas are not further developed and eventually realized, we can't speak about *innovation* within RWS and within the construction sector. RWS wants to know where the problems occur in the innovation process and why the new ideas do not get realized. This is the practical relevance of the research, but what is relevance from an academic point of view?

Despite attracting a significant *media attention*, the importance of these innovation contests has been rather small relative to the traditional innovation process. However, this is currently changing. With a growing trend toward outsourcing and off-shoring innovation-related activities, innovation contests and their applications have expanded from creating 'crazy concepts' to solid R&D problem solving in the recent years (Terwiesch & Xu, 2008). Research about innovation contests is limited and focuses purely on different factors of the innovation contest, like the optimal number of competitors in a contest and the importance to select highly qualified contestants (Fullerton & McAfee, 1999), the optimal design of research contests (Che & Gale, 2003; Fullerton & McAfee, 1999; Taylor, 1995), and the allocation of awards in a contest (Moldovanu & Sela, 2001). Some scholars have also performed research about the different types of innovation contests; fixed-prize tournaments versus first-prize auctions (Schottner, 2008), rent-seeking, innovation and patent-race games (Baye & Hoppe, 2003) and comparisons of tournaments and contracts (Green & Stockey, 1983). Terwiesch and Xu (2008) focused on the design of an innovation contest as well, but added the types of products and cost structures that will most likely benefit from the contest approach of innovation.

No research about innovation contests puts it in a *broader perspective*. Despite that some famous examples where innovation contests lead to historical findings, like the steam locomotion, HD television, portable timepieces, and vaccines (Che & Gale, 2003), there is no scientific literature about the process *after* the contests. What happens with the (winning)

ideas? How is the interaction defined between the solvers and the seeker *afterwards*? Answers to these kinds of questions are not given in the current scientific researches. RWS experience just the problems after the contest: The generated ideas from the innovation contest get stuck in the innovation process after the contest is finished. This results in disappointment by the participants and image damage for RWS. More important, the innovative ideas find no way to realization and thus the final users cannot benefit from it. RWS does not know *why* the ideas are not exploited. As mentioned, the current scientific literature is not adequate concerning this problem. In this research RWS will be used as a case to study the problems *during* and *after* an innovation contest. The contribution to the scientific literature will be the research of the problems *during* and *after* the innovation contest and the *interaction* between the seeker and the solver. This research puts the innovation contest in a broader perspective, and links the innovation contests with the whole innovation process. This will give insights to *where* and *why* the ideas get stuck in the innovation process.

1.1. Problem statement

1.1.1. Project context

Rijkswaterstaat (RWS) is an executive organisation of the department of transport and public works (Dutch: Verkeer- en Waterstaat). RWS' procurement policy is called 'Market, unless...' whereby as much as possible is left to the market. RWS set up several innovation contests to get creativity 'out of the market' the last two decades. Many different innovative ideas came up and get rewarded, but the level of application is still low. Hence, the level of disappointment and scepticism grows towards the innovation contests and RWS, because external organisations cannot eventually apply the innovative ideas. The presumption is that this results in a decrease of the level of innovativeness in the market and damaging the image of RWS. After all, the citizens do not benefit from the innovative ideas from the market, which could be cost reducing, reduce of congestion, reduce of nuisance, and reduce of travel time or an increase of comfort and welfare.

The process after an innovation contest is not determined in advance. This process and the interaction between the former solver and seeker are fuzzy. In the context of the new strategy 'Market, unless...' RWS is curious how to make innovation contest more remunerative for the market. To make innovation contest more remunerative, it is important to know what happens with the ideas *afterwards* and the interaction between RWS (the seeker) and the solvers.

An example of an innovation contest is the most recent innovation contest, called 'Renovatie stalen bruggen' (Renovation steel bridges), which started in January 2009 and ended in October 2009. A large amount of participants (165) sent in their ideas. After the first round ten finalists remain and get the possibility to elaborate their ideas (by €100.000, - cost reimbursement). The final winner won half a million euro's. The content of the contest was about steel bridges: RWS has 274 fixed and movable bridges with steel deck space in management. Currently, the lifetimes of fixed bridges is extended by replacing the asphalt by High Strength Concrete (HSB). This technique is gradually tested and recently used. The method has one major disadvantage: The implementation is complex and the user is experiencing much hindrance during execution. This is the reason why RWS set up an innovation contest; to challenge the market to come up with ideas that reduce the traffic hindrance during the renovation of the steel bridges.

In the previous innovation contests the ideas came from the participants, but RWS keeps the IP rights. The participant keeps the IP right in the recent innovation contest 'Renovation steel

bridges'. This is probably one of the reasons for the large amount of participants, in combination with the large award. This remarkable change is in line with the procurement policy of RWS, called 'Market, unless...'. Thus, the market gets more freedom to develop their ideas further. They are not depending on RWS, who had the IP-rights. In this new situation solvers can also approach other parties to develop the idea further, by setting up pilot projects for example. Various difficulties or challenges occur after the innovation contest and this differs for each party. Common problems are the lack of financial resources, the lack of pilot space (a space to set up a pilot) or the lack of expertise and experience. The winners have to work together with contractors, research institutes and/or municipalities and provinces. This is a long and fuzzy way which takes often five to seven years before there is a first pilot project. This also applies to the role of RWS.

1.1.2. Parties involved in the innovation contests

Actually, the parties involved in an innovation contest can be divided in two broad groups: On the one hand the *seeker* (the initiator of the innovation contest) and on the other hand the solvers (the participants of the innovation contest). In this research the seeker is always RWS and the solvers are *external organization*, or '*the market*'.

Rijkswaterstaat – RWS is the executive governmental authority that manages and develops the main national infrastructure facilities on behalf of the Minister and State Secretary for Transport, Public Works and Water Management. RWS works to ensure that the Dutch have: Dry feet, sufficient clean water, and a smooth and safe flow of transport on nation's roads and waterways and reliable and useful information.

RWS is founded in 1798 and has around 9,000 employees on 240 locations throughout the entire country. The organization is structured in ten regional departments, five nationwide specialized departments and three project departments. The annual budget of RWS is about four to five billion euro's. RWS manages: 65,250 km² of surface water, forty-four kilometres of dunes, 325 kilometres of dykes and dams, 2,706 kilometres of banks, sixteen weirs, the Afsluitdijk and Houtribdijk and four storm surge barriers.

In 2003 more political and social pressure is put on RWS and a radical organizational reform was necessary. The external reasons for this reform were: Social issues (increasing mobility and rising sea levels); RWS is too large, too expensive and does too much on its own. Citizens want better value for money; the market wants RWS to have a more defined role and the Court of Audit demands more efficient operational management.

There were not only external reasons for the radical reform, but also internal:

RWS is not 'in control', resulting in greatly reduced commitments; an 'island culture' (high degree of fragmentation/waste of resources); overcapacity and inefficiency; an imbalance in staff age distribution; a mismatch in staff qualities and management culture in which problems are evaded. In the current situation, RWS is focusing more on core tasks, its attention on the network users, has become a Departmental Agency and is doing more work with fewer people (RWS.nl, 2010).

External organizations – The external organizations are the organizations in the construction sector, entrepreneurs, inventors and research institutes.

- *Companies in the construction sector*: A very broad sector, which can be divided into smaller sectors, like contractors, suppliers, architects/consultants and others (Pries & Dorée, 2005). *Contractors* are businesses which provide goods or services to another entity under terms specified in a contract. Unlike an employee a contractor does not work regularly for a company. Suppliers are businesses that supply parts to another company. The *architects* are businesses or professions that are qualified to design buildings and to superintend their erection. *Consultants* are specialists who give expert advice of information.
- *Entrepreneurs and inventors*: An inventor is a person who has come out with a new idea and wants to pursue its development. This distinction has been made, because these are often one or two persons with a new idea, but without the (financial) resources of a company as described above.
- *Research institutes*: A research institute is an establishment endowed for doing research. Research institutes may specialize in basic research or may be oriented to applied research. A well-known Dutch research institute is TNO.

1.1.3. Perspectives

The perspective of the organizations involved in the innovation contests are:

Rijkswaterstaat – Innovative ideas from innovation contests find no way to real application, which leads to frustration by the participants and image damage for RWS. In the end, the user can not provide from this innovative ideas.

External organizations – External organizations consider innovation contests as a method to show their innovative character and ideas to the market and the users. However, they find the efforts associated with the innovation contests are not proportional to the rewards. The costs of these efforts accumulate to large amounts, because the throughput time is unknown. Innovation paths have a particular risk; it is not a guarantee that an innovation will be successful, thus it have to serve a goal, like knowledge development. In some cases legislation blocks innovative ideas. For some organizations an innovation contest seems a bit unprofessional, with the character of an act of desperation: *'RWS do not know how to resolve a problem and do not have the expertise and money, so ask the market.'*

1.1.4. Problem definition

Ideas from innovation contests stuck in the innovation process and do not get realized. This makes innovation contests *not remunerative* for the market, and puts the innovativeness of the contests and ideas under pressure. Lastly, the final user of these potential innovations cannot provide from it.

1.1.5. Research objective

The goal of this research is to put the innovation contest in a *broader perspective* and to establish a diagnosis of *why* innovative ideas from innovation contests do not get realized. This should lead to concrete recommendations to make innovation contests more successful considering the realization of the ideas, and more remunerative for the market.

1.2. Research question

Dozens of innovation contests are organized by RWS the last decades. Twenty-seven of them are included in this research of which five are actually exploited. The reason why only 19% is realized and where in the innovation process the other 81% stuck, will be become clear in this report. It is important to know *which* innovation contests are held by RWS and the *characteristics* of these contests. This information can be used to start the research of *what* and *where* the difficulties are in the innovation process. This will be the starting point to research what the problems are in the innovation process *during* and *after* the innovation contest and *why* many ideas are not realized. This results in the following central research question:

- **Why do innovative ideas from innovation contests, held by executive governmental agencies, not get exploited?**

This research question can be divided into two sub-questions:

- *In which phase of the innovation process do innovative ideas from innovation contests falter?*

Answering this question will give an understanding *where* the ideas falter in the process. It will result in an overview of innovation contests and the phases where the innovative ideas falter. The phases of faltering can be linked to the characteristics of innovation contest, which will be the basis for the next sub-question:

- *What are the reasons behind the faltering of the innovative ideas?*

The reasons of faltering can be linked to the innovation process phase of faltering, which eventually result in the answer to the central research question.

1.3. Concept definition

In this research, this is meant by the following terms:

- *Innovation contest* – In an innovation contest, a firm (the seeker) facing an innovation-related problem (e.g., a technical R&D problem) posts this problem to a population of independent agents (solvers) and then provides an award to the agent that generated the best solution (Terwiesch & Xu, 2008). Sometimes only mentioned as *contest*.
- *Exploit* – To achieve the value or usefulness of an idea. In this research it is also mentioned as the *realization* of the innovative ideas.
- *Executive governmental agency* – Broadly responsible for the implementing, supporting and enforcing of the decisions made by the national government. In this research Rijkswaterstaat is always the executive governmental agency/authority *and* the seeker in the innovation contest. The seeker is the initiating firm with a clear problem that organizes the innovation contest.
- *Innovative ideas* – Selected ideas in the innovation contest, classified by the seeker as promising.
- *Innovation process* – A consistent, logical process in the development of innovations.
- *Falter(ing)* – Losing drive and effectiveness.

Conclusion and structure – The construction sector is a conservative market concerning the development of innovations. RWS, an executive governmental agency, is trying to get more innovative ideas out of this market by organizing innovation contests. In an innovation contest, a firm (the seeker) facing an innovation-related problem posts this problem to a population of independent agents (solvers) and then provides an award to the agent that generated the best solution (Terwiesch & Xu, 2008). However, when the contest is over, RWS faces the problem that a small share of the ideas are actually realized. The consequences are that the potential user can not benefit from these innovative ideas and that participants become frustrated when their ideas are not further developed. Unfortunately there is no scientific literature about what happens with the ideas from an innovation contests afterwards and no literature puts the innovation contest in a broader perspective. This research will give answers to the question why innovative ideas from innovation contests are not realized and will give recommendations to make these contests more remunerative for the participants as well as for the organizers.

After this introduction, the theoretical framework will give the scientific context of this research. These scientific theories will help to answers the research questions. Next, the methodology describes the way this research is performed, the choices made and their consequences. After the methodology, the first research question will be discussed; *where* the ideas falter in the innovation process. When it's clear *where* these ideas falter, chapter 5 will be used to discuss five cases and show *why* these ideas are faltering. A cross-analysis (chapter 6) is necessary to compare the cases with each other and to draw conclusions. In chapter 7, the conclusions of this report will be represented, followed by the recommendations. The research ends with the discussion and reflection regarding this research.

2. Theoretical framework

This theoretical framework is build up in two broad sections. The first part (2.1) addresses the process level of discontinuous innovation in the construction sector. The stages of a discontinuous innovation process will be summarized including the main factors which affect this process. Additional attention will be given to the role of the champion (or visionary) (2.2) and the contextual factors (2.3) that affect this process. The second section (2.4) focuses on the organizational level of discontinuous innovation in the construction sector. Some general characteristics of the construction sector will be discussed as well as the actors participating in construction (projects). Eventually, the competences will be discussed which are needed to succeed discontinuous innovation, or rather make it more likely to succeed.

2.1. Innovation process within the construction sector

Veryzer (1998) developed a descriptive model of the discontinuous product development process, and offers insights into the requirements for effective management of discontinuous innovation projects. Generally, firms do not employ a formal, highly structured process for managing discontinuous new product development (NPD) efforts. However, the firms do follow a consistent, logical process in the development of radical innovations, and their process differs significantly from incremental NPD processes. These processes are more exploratory and less customer driven than the typical, incremental process. The *impetus* for the projects comes from the convergence of developing technologies, various *contextual or environmental factors* (for example government regulations), and a *product champion or visionary*. Innovation in construction remains to be technology- rather than market-driven (Pries & Dorée, 2005), just as the process model of Veryzer (1998).

Starting from these drivers the NPD process focuses on formulating a product application for the emerging technologies (Veryzer, 1998). Although Veryzer (1998) reveals that for the most part development of these discontinuous products was not managed using a formal, highly structured process, this is not to suggest that there is no process or logical progression in how these discontinuous innovation projects were managed. The various phases of the process observed by Veryzer (1998) across the sample of firms are described below and in figure 1:

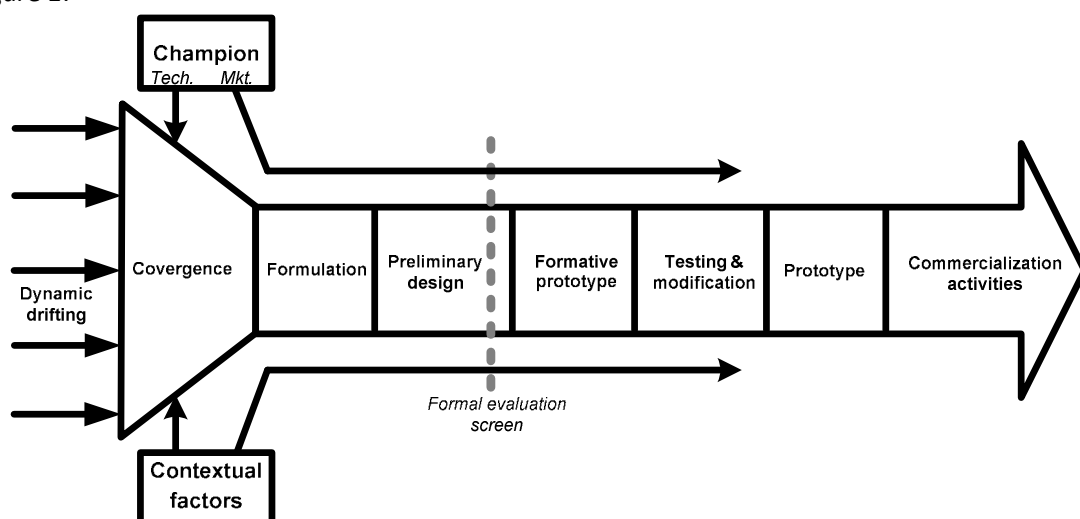


Figure 1: Discontinuous innovation process by Veryzer (1998) (adjusted)

2.1.1. Dynamic drifting phase

The first phase of the process involves the exploration of various technologies. Although this period may appear to be one of aimless expenditure of resources and effort, it is a critical phase in the emergence of discontinuous innovation. The explorations during this phase provide an opportunity for expanding the boundaries of technical feasibility and serve as a basis for the incubation of new technologies (Veryzer, 1998).

2.1.2. Convergence phase

It is out of the technical exploration that the discontinuous products begin to emerge. This convergence of various technologies toward an application is driven by two forces:

1. A determined *champion* or *visionary*.
2. A critical mass of *contextual factors*.

It is the *champion* who first sees how the all pieces fit together into a particular application for the technology. This requires a good *sense of the technology* and how it may be applied, as well as a general *sense of market* for the application of the technology. The vision for a product application can come from one individual or different individuals who work closely together. In either case, a number of judgments about the market for the application are implicitly being made at this point (Veryzer, 1998). Convergence is also driven by a variety of *contextual factors* that include technology interactions that push the technology to the next stage, company turbulence, cross-fertilization, failed or discontinued projects with subsequent personnel reassignments, funding and resource availability that encourage work done in special areas, alliances with other firms or suppliers, and competitive pressures. These two initiating forces play a critical role throughout the development process, especially the early phases where they exert a substantial influence upon the project and provide direction for it (Veryzer, 1998). In subchapter 2.2 and 2.3 these two forces will be discussed further.

2.1.3. Formulation phase

During this phase the focus is on how to *formulate* the technology into a product. Product requirements, potential product approaches, components, and specifications are examined. In addition to conceptualizing product requirements, some initial distinctions are made regard to likely applications and customers. Direct input from customers or market research is little up to this point. While conventional new product development is often (but not always) customer driven (Calantole & Di Benedetto, 1988; Cooper, 1990; Crawford, 1994; Von Hippel, 1988), the process for these discontinuous products does not seem to be driven (directly) by the customer (although sensitivity to customer needs is important). Attention is focused on the technical differential advantages that the new product will offer over existing products and technologies rather than customer benefits and commercial opportunities (Veryzer, 1998).

2.1.4. Preliminary design phase

This phase involves the development of preliminary designs of the product. The question concerning what the product will be with respect to the initial application begins to be earnest. Specifications are further developed and some information is gathered concerning user requirements and product use. This information is collected using informal market research methods such as observation or in some cases by conducting internal tests with equipment that relates to the product under development in certain respects or along certain dimensions (Veryzer, 1998).

2.1.5. Evaluation preparation phase

This phase is actually a continuation of the *preliminary design phase*; however, as the project approaches the formal project review that will determine whether or not it is allowed to continue, certain aspects surrounding the development of the product receive a great deal of attention. In preparation for the formal review, the design for the product becomes more specified. The basic product architecture is determined and the product application is refined. The technical differential of the proposed product over existing products and technologies is elaborated. In order to make a strong case for continuing the project (and to meet the formal project review requirements) a cursory market or business analysis is put together (Veryzer, 1998).

2.1.6. Formative prototype phase

After the project has successfully passed through the formal review, the focus shifts to the building of a prototype. Prior to beginning this phase, however, more design work may be required. The formative prototype phase is a period of protracted technical development. The project is now much more focused on the application of the technology in order to produce a specific product than it was before. This is due to the refinement and delineation necessitated by the formal project review, which requires that attention be paid to market and commercialization issues (Veryzer, 1998).

Discontinuous innovation involves the development of a prototype that precedes the alpha prototypes that mark the beginning of the development effort in continuous innovation. The formative prototype that is built during this phase is much more exploratory than subsequent prototypes. It is used to help determine the suitability of new technologies for particular product applications as well as to further develop ideas. It is during this phase that the need for additional information concerning specifications and customer needs is acutely felt (Veryzer, 1998).

The products (bridges, buildings, roads, etc.) are often location bounded, have a very long life span, high costs and a great influence on the quality of life (Pries & Dorée, 2005). These characteristics affect the prototype phases as well.

2.1.7. Testing and Design modification phases

As the formative prototype is developed there is an opportunity to test and modify the technology. The focus is on *evaluation* and *validation* of the technical solution. Adjustments are made, specifications may be re-evaluated, and development continues. As the prototype reaches a stable point, testing with customers may be undertaken. This can involve an arrangement with lead users or alliances with a key company. Information from limited customer tests is used primarily to modify or redesign the technical approach to the product. However, it also allows a range of non-technical issues as well as some assumptions concerning customer use of the product to be raised and explored. The development process may cycle through these phases until a technical solution has been validated that seems to satisfy the requirement and specifications that have emerged during the process (Veryzer, 1998).

As described by Nam and Tatum (1997) the (lead) user is often the owner and has a participating role in the innovation process. The user can also be the *practical user* of the construction, like a (car) driver (roads and bridges), citizen (dikes) or skipper (canals or bridges). In this research the user is the *owner*, for example the government.

2.1.8. Prototype and Commercialization phases

Over the course of the preceding phases a product is produced by refining technology for a specific application. During this process many of the questions concerning the product and the customers who will use it have been raised and to certain extent addressed. The development process now shifts toward producing a commercial product. The 'product' produced during the preceding phases is refined and fabrication requirements and considered. However, a number of important product development activities that precede true commercialization have yet to be undertaken. Marketing activities such as customer trails and the development of marketing plans are undertaken and play an important role in shaping the refined product. At this point the development process begins to flow into a more conventional new product development process (Veryzer, 1998).

Although on the surface the process for discontinuous innovation might appear to resemble the process for continuous innovation, there are some important differences. Discontinuous innovation involves an *extreme high degree of technological uncertainty*, a *sequence of innovations*, and *long development times* (Ali, 1994; Morone, 1993). Additional factors such as the *uncertainty of suitable applications* for the technology and the *greater distance from the market* in terms of time and customer familiarity with the product also affect the nature of the development process. As a result of the influence of these factors, the development of discontinuous innovation does not seem to proceed in the manner described by either conventional or stage-gate-like development systems, nor does it seem particularly amenable to being managed according to such approaches. Instead, the discontinuous product innovation process proceeds as mentioned above. Although, the phases are shown in discrete events, there is an overlap among them, especially in later phases. There also seems to be a certain degree of informality with respect to how the development process for these discontinuous products is managed, even though the activities occur in a consistent sequence (Veryzer, 1998).

Ritter and Gemünden (2003), Nam and Tatum (1997), and Veryzer (1998) all agree upon the fact that a visionary (or champion) is of great importance to realize discontinuous innovation. Burgelman describes not only the stages of pushing a new innovative concept through a major diversified firm, but include the different organizational levels as well.

2.2. Visionary or champion

Championing behaviour is defined as making a decisive contribution to any innovation by actively and enthusiastically promoting its progress through the critical development stages (Howell & Sheab, 2001). In large technical systems, the relevance of championing behaviour increases when government is the system builder or when there is no obvious beneficiary of the new developments. As a system builder, the government is the primary actor to champion new developments. When the government is not the system builder, the partially non-rival nature of large technical systems requires a champion to encourage investments (Jacobsson & Bergek, 2004).

The owner plays an indispensable role in the execution of a construction project. Nam and Tatum (1997) suggest characterizing construction champions as well-prepared individuals who not only have extensive experience but also adequate resources and power. Giving power to employees and creating slack resources is not an easy decision in the highly competitive construction market; it requires prudent management based on a long-term strategy. To give technical discretion to employees appears to loosen control of a business and may undermine

the reputation of the firm. This is why construction firms are reluctant to provide power and slack resources to employees. However, Nam and Tatum argue that managers should do this if they want to make their firm innovative (Nam & Tatum, 1997).

Burgelman (1983) researched the process through which a *diversified major firm* transforms R&D activities at the frontier of corporate technology into new businesses through 'internal corporate venturing' (ICV) (Burgelman, 1983). These new businesses enable the firm to diversify into new areas that involve competencies not readily available in the operating system of the mainstream businesses of the corporation (Salter & Weinhold, 1979). Successful ICV efforts depend on the availability of *autonomous entrepreneurial activity* on the part of operational level participants, on the *ability of middle managers to conceptualize* the strategic implications of these initiatives in more general system terms, and on the capacity of top management to allow *viable entrepreneurial initiatives* to change the corporate strategy (Burgelman, 1983).

As Nam and Tatum (1997) mentioned the innovation supporter is often the owner (or buyer) in the construction industry. In many cases the owner is the government or a governmental agency. Caerteling et al. (2008) showed that government championing is of great value for technology development projects, even more important than a firm's strategic orientation.

2.3. Contextual factors

Pries and Janszen (2005) mention that the construction industry is dominated by very severe price competition. However, this market is somewhat peculiar because it faces certain aspects or regulation. The government has an especially dominant influence on this market. Caerteling (2008) set up a model based on the literature of Moon and Bretschneider (1997) and Rothwell and Zegveld (1981). They distinguish *supply-* and *demand* oriented government policies to direct the rate and direction of innovation and *conditions to appropriate returns*. These three aspects are described below and illustrated in figure 2 (p.22).

2.3.1. Supply-oriented policies

Supply-oriented policies are the provision of *funding, technological assistance* and *human resources* (Moon & Bretschneider, 1997). The motives behind government funding private R&D are twofold: First, the social returns of R&D are much greater than the returns to the firms because of knowledge spillovers (Lerner, 1999). Second, public funding can compensate for the market failure of profit-maximizing firms, because it funds projects that otherwise would not be undertaken (Hall, 2002; Klette, Moen, & Griliches, 2000).

Another supply-oriented policy is that governments can act as a *champion*; this is analogue to the role of product champion in the NPD literature (Morris & Hough, 1987). Caerteling (2008) defines government championship as a supply-oriented policy to provide technical assistance, political support and human resources to firms engaged in technology commercialization. Government championship can create favourable demand conditions and help in obtaining planning approvals. Particularly, in projects that do not have obvious initial beneficiary, a government's championship is vital. However, there is also a downside to government championship. Political and social motives or prestige might enter into the decision-making process. Governments can be committed to a certain course of action, even if success is not likely. In contrast, *withdrawal* of government championship can be a direct cause of failure (Caerteling, 2008).

2.3.2. Demand-oriented policies

Demand-oriented policies are carried out through the *public procurement of new technologies* (Moon & Bretschneider, 1997) and have a direct effect on their variation and selection. Examples of factors that induce governments to adopt new technologies are improving public goods and services, cost-reduction and the changing needs of the society (Bingham, 1978; Rothwell & Zegveld, 1981). In mainly or exclusively public markets, such as transport infrastructure and defence, government procurement can dominate the adoption and diffusion of technology. In the case of innovation-oriented procurement policies the procurement can also provide an opportunity for experimentation and demonstration of new technology (Rothwell & Zegveld, 1981; Seadan & Manseau, 2001). Providing this type of procurement can include technical assistance during the phase of final adjustment or technical support for prototype development (Dalphé, DeBesson, & Xiaoping, 1992). This looks like the championship role, but then at the demand-side, and can complement *and* interrelate each other (Caerteling, 2008).

2.3.3. Appropriability conditions

The government can affect the *efficacy of legal instruments* in several ways, by tax incentives, laws and regulation what can be protected by intellectual property rights (IPR), the standard-setting behaviour of government can affect the appropriability conditions. That standard will self-evidently dominate other technology options in an industry (Schilling, 1998) and limit the viability of other technologies. In large technical systems, such as telecommunication, the need to ensure compatibility in technology often warrants governments' intervention (Shapiro, 2001; Schilling, 1998).

MacMillan (2001) points to the central role that governments have in supporting innovation via the regulatory framework. Pries and Dorée's analysis shows that this role of governmental regulation is indeed a very important one; over 30% of all innovations in the construction sector are the result of *new regulations* (Pries & Dorée, 2005).

Decisions about *size* and *timing* of demand do affect the appropriability conditions as well. As a major customer for a certain innovation, government has a vested interest in promoting the conditions for long-term implementation success (Morris & Hough, 1987). The promotion of these conditions is not always easy and a real challenge for governments. Governments' roles are dispersed across different organizations and offices at national, regional and local levels. There exists a danger that governments promote diverse and possibly even conflicting policies and regulations (Ring, Bigley, D'Aunno Insead, & Khanna, 2005). As mentioned before the policy making and policy implementation are usually separated to prevent the arbitrary exercise of power. In this case coalition building among policy making and executive agencies at different levels of government is important for the developing and implementation of new required technologies. Another threat is elections and political agreements that could have a disruptive influence on operations. Last but not least, the decision making processes within governments cannot easily be adjusted to the uncertainties in innovation. Administrative decision making processes that are regulated by procedures are imposed by legislation, court decisions and often subjected to public pressures (Ring & Perry, 1985).

Caerteling (2008) came up with a model that combined the separated roles of government and provides the relevant dimensions to study the combined effect of those roles on technology commercialization. What is notable is the absence of innovation contest in this model. Innovation contests provide a kind of funding (for the winners), branding (promotion of ideas), and stimulate the private market to think about solutions for certain problems. The government also provides (technical) assistance. It seems logic to line this approach among the supply-oriented policies.

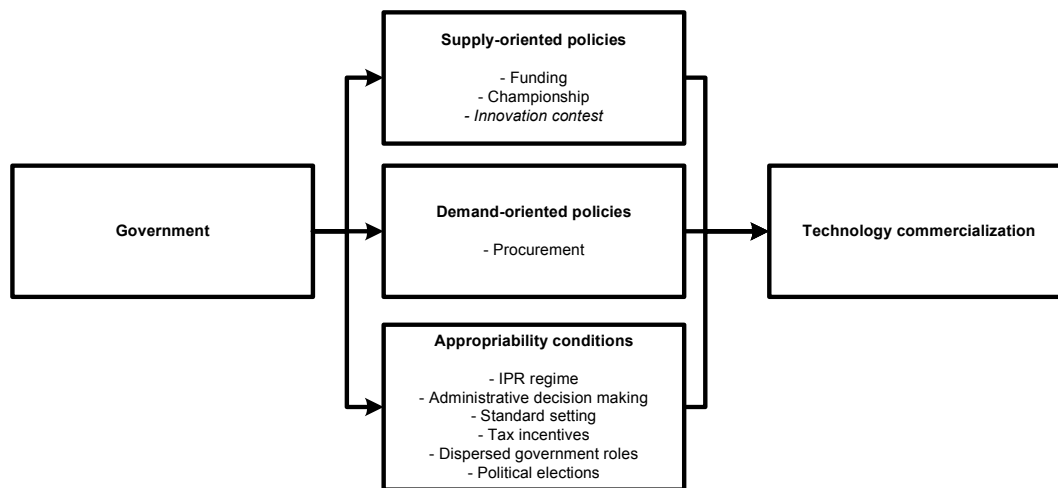


Figure 2: Improved model of government roles in technology commercialization by Caerteling et al. (2008) (adjusted)

2.4. Organizational context and competences

The construction industry is known as a mature traditional industry. Building processes in most European countries look much alike (Pries & Janszen, 1995). This traditional building process has several characteristics:

Design and production are executed by *various parties* and are thus *separated*. Traditionally an architect, assisted by one or more consultants, produces a design (for a customer). In this plan a thorough description of materials and products and a detailed prescription for the execution is stated. The contractor then executes the design, assisted by suppliers and subcontractors. Because every project is unique (few possibilities for repetition) there is little reason for a contractor to invest in innovation, other than the optimization of their own process. There are neither *economies of scale* nor *learning effects* (Pries & Janszen, 1995).

The products (bridges, buildings, roads, etc.) can be *clearly distinguished*. They are *location bounded*, have a very long life span, high costs and a great influence on the quality of life. In particular, the long life span compels customers to stick to proven methods and avoid radical changes (Pries & Janszen, 1995).

The construction sector can be characterized by the *great number of small enterprises* and varying collaborations. The emphasis lies on operational (project) management. Because projects are the result of varying collaborations between various parties good communication is essential (Pries & Janszen, 1995).

Finally, the *weak patent possibilities*, the *low barriers of entry* and the *poor image* of the construction industry can be mentioned. In combination, these characteristics have a great effect on the innovative behaviour of the sector (Pries & Janszen, 1995).

The construction industry is dominated by very severe price competition. However, this market is somewhat peculiar because it faces certain aspects of regulation. The government has a dominant influence in this market. Due to technical regulations the quality for a major part of the production is strictly determined.

Pries and Janszen (1995) mention the various, separated parties of which a great number are small enterprises. Nam and Tatum (1997) categorize these organisations based on the roles played by key individuals in construction projects. This will give a clear understanding of the different types of parties participating in the construction sector and construction projects:

2.4.1. Actors in the construction sector

Organizations' participation in innovative projects does not necessarily imply that all of these organizations are characteristically innovative. However, while some organizations oppose the new ideas or passively participate in the projects, some forms commit themselves to the innovations. Nam and Tatum (1997) identified them as progressive organizations; usually, the innovative projects are accomplished through the *combined effect* of a couple of such *progressive organizations*. Nam and Tatum (1997) classified three types of firms based on the roles played by key individuals in the organizations: *Driving forces*, *technical collaborators* and *innovation supporters*:

Key individuals in the '*driving force*' type of organization carried ideas from conception through to development into a viable process or product. They persuade other organizations to participate in the project and lead the innovation process (Nam & Tatum, 1997). A driving force is comparable with a 'champion' or 'visionary', described by Veryzer (1998) in chapter 2.1.2. and Burgelman (1983) in chapter 2.2., who has a key role in the discontinuous innovation process.

The second type of progressive organization is identified as a '*technical collaborator*'. Upon receiving the initiative from the driving force, members of these organizations provide technical expertise for the project. These technical collaborators neither initiate the ideas nor lead the innovation process. Nevertheless, without their technical consultation advice or even encouragement, the projects would not have been innovative (Nam & Tatum, 1997).

The third type of progressive organization is recognized by Nam and Tatum (1997) as an '*innovation supporter*'. With enough understanding of the background technology involved, they sponsor the new idea at the highest level and protect them. The innovation supporters are generally the *owners* of the projects (Nam & Tatum, 1997).

Whereas in manufacturing the buyer's role takes the generally passive form of market demands, in the construction industry the role of the buyer (or owner) is generally more active. Rather than being just buyers of finished products, owners in the construction industry are often major participants in the projects. They establish the mechanism by which the involved parties communicate and collaborate, make decisions on important technical matters throughout the project execution and sometimes share a high proportion of the risk. Thus, the owner may play an indispensable role in the execution of a construction project. For better results in

construction innovation, a high level of owner involvement in the project appears critical. Constructed products are generally costly and they have serious consequences of failure. These characteristics may be responsible for the owner's technical conservatism. Sometimes, however, conservatism stems from a limited knowledge of the technology in question; thus, the ability to understand the technology usually alleviates the conservative attitude and sometimes even leads to an unusually progressive stance (Nam & Tatum, 1997).

The ability to handle, use, and exploit inter-organizational relationship is very important for these different types of organizations, considering the necessity to work together in the construction sector. Ritter and Gemünden (2003) call this skill 'network competence':

2.4.2. Network competence

Ritter and Gemünden (2003) suggest that companies, which have close relationships with customers, suppliers, research institutions and competitors, are more likely to have higher product and process innovation success. The underlying reason is a company-specific ability to handle, use, and exploit inter-organizational relationship. Ritter and Gemünden (2003) call this skill *network competence*. Their results reveal that network competence has a strong positive influence on the extent of inter-organizational technology collaborations and on the *firm's product and process innovation success*. With regard to network competence, Ritter and Gemünden (2003) distinguish between the *tasks* that need to be performed in order to manage a company's technological network and the *qualifications*, skills, and knowledge that are needed in order to perform these tasks. They use the term 'qualifications' as an umbrella for skills, knowledge and formal qualifications, like certificates. These elements are described below:

2.4.2.1. Network management tasks

A distinction can be made between tasks which are relevant to managing a *single* relationship (a dyad) and tasks which are necessary to manage a *portfolio* of relationships or a network as a whole (Ford, 1980; Ritter & Gemünden, 2003).

Relationship-specific tasks – Relationship-specific tasks refer to activities to establish and maintain a single relationship. Three types of relationship-specific tasks can be distinguished:

Initiation – Inter-organizational relationships do not start by themselves. They are the result of specific investments. Changing political, social, economic, and technological circumstances may necessitate the break-up of existing relationships and the initiation of new ones.

Exchange – Exchange of products, services, money, information, know-how, and personnel can be seen as an essential part of an inter-organizational relationship. Focusing on technological-oriented relationships, Ritter and Gemünden (2003) distinguish between technology-related exchange, personnel-exchange, and organizational-related exchange activities.

Coordination – Normally, a simple exchange between organizations is not sufficient for a relationship. The two involved organizations need to synchronize their activities of both organizations are in tune with each other (Mohr & Nevin, 1990; Ritter & Gemünden, 2003).

Cross-relational tasks – Four different cross-relational tasks can be identified:

Planning – The targeting of a desirable state in the future involves internal analysis, network analysis, and environmental analysis. These generate a better understanding of a

company's internal resource situation as well as more realistic expectations concerning partners' contributions.

Organizing – The contributions of each party to achieving the plans must be assigned to specific partners. Also, resource allocation to specific relationships needs to be specified as well as the ways of communicating between people dealing with relationships inside the firm. Furthermore, adaption issues need to be addressed, which means the degree to which the focal company is able and willing to meet an individual partner's needs. It is necessary to evaluate this form of network perspective because adaption to one partner's requirements may mean not being able to adapt to other (potential) partners' requirements.

Staffing – Personnel need to be allocated to specific relationships in tune with planning and organizational needs. This network management tasks involves guidance and coordination of employees involved in relationship management activities. Conflicts between employees can occur and must be solved when several relationships compete for the same resources within a company.

Controlling – Controlling is both the final and the first stage of the management cycles. Control activities can be internally oriented as well as externally oriented.

2.4.2.2. Network management qualifications

The execution of the network management tasks is a complex process and it requires various types of qualifications. A distinction can be made between *specialist* and *social qualifications*:

Specialist qualifications – Specialists qualifications include those, which are necessary to handle 'the technical side' of relationships: Technical skills are important to understand partners in terms of their technical needs, requirements and capabilities. Economic skills are required to define inputs and set prices. This is of particular interest in collaborative innovation as the division of rewards can be a source of some conflict between partners. This also leads to the importance of skills in *legal matters*. These are of interest for setting up contracts but also critical in collaborative innovation developments where it is hard to define the outcome from the beginning.

Knowledge about the other actors is an important resource. This knowledge includes information about the operations of partners, their personnel and resources, which are important for understanding their behaviour and the developments of the network. In addition, experimental knowledge resulting from interactions with external partners is crucial. Such knowledge can be used to anticipate and evaluate critical situations and to select appropriate action (Helfert, 1998; Ritter & Gemünden, 2003).

Social qualifications – Social qualifications are the extent to which a person is able to exhibit independent, prudent, and useful behaviour in social settings (Helfert, 1998; Ritter & Gemünden, 2003). It includes several dimensions such as communication ability, emotional stability, self-reflectiveness, sense of justice, and cooperativeness. Social qualifications are of special interest because of the importance of interpersonal interactions and relationships in business relations. Figure 3 provides a summary of the components of network competences:

Ritter and Gemünden (2003) distinguish four *organizational antecedents*, which have an impact on a company's network competence: *Access to resources*, *network orientation of human resource management*, *integration of inter-organizational communication*, and *openness of corporate culture*. Access to resources (like financial, physical, personnel, and informational resources) enables people to execute the network management tasks intensively in a goal-

oriented manner and helps them develop their qualifications. Through a high degree of network orientation of human resource management in terms of personnel selection, development, and assessment, a firm is able to enhance their network competence by hiring and developing necessary human resources. A high integration of formal and informal communication structure makes important information available to those dealing with an external partner. That information may support task execution and qualification development. Finally, openness of corporate culture increases network competence by giving employees the necessary flexibility, spontaneity, and responsibility to develop inter-Organizational relationships.

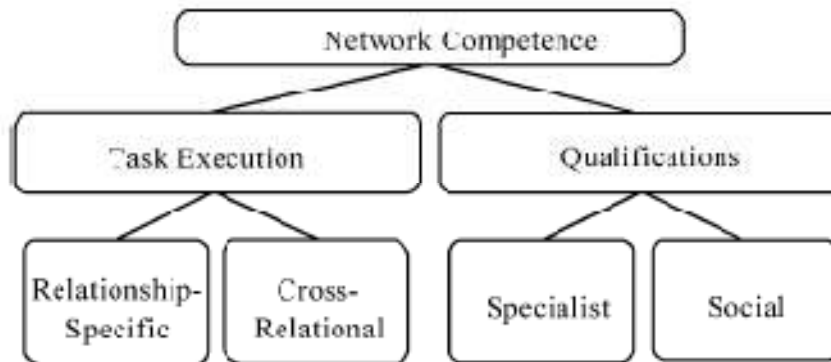


Figure 3: Elements of a company's network competence by Ritter and Gemünden (2003)

Besides network competence, there are more important competences which are required to develop a mature discontinuous innovation capability. O'Connor and DeMartino (2006) suggested three competences, which are more internally focused than the network competence described above.

2.4.3. Discontinuous innovation competencies

O'Connor and DeMartino (2006) provided insight into the competencies required to develop a mature discontinuous innovation capability. Three competencies were identified: *Discovery*, *incubation*, and *acceleration*, each of which requires distinctive types of expertise and processes:

2.4.3.1. Discovery competence – A discovery capability involves activities that create, recognize, elaborate, and articulate discontinuous innovation opportunities. The skills needed are *exploratory skills*, *conceptionalization skills* (in terms of technical and scientific discovery) and *external hunting for opportunities*. Ideas come not just from the scientist's bench but also from groups of creative people within the organization, from idea hunters who uncover ideas inside and outside the organization, and from single creative individuals who may be maintained outside the company, but whose efforts are dedicated to the organizations needs. A broad spectrum of structural mechanisms exists to ensure a rich discovery competency for the organization (O'Connor & DeMartino, 2006).

2.4.3.2. Incubation competence – An incubation capability is necessary for discontinuous innovation. The incubation competency involves activity that matures radical opportunities into business proposals. A business proposal is a working hypothesis about what the technology platform could enable in the market, what the market space will ultimately look like, and what the business model will be. Incubation is not complete until that proposal (or more likely, a number of proposals based on the initial discovery) has been tested in the market, with a

working prototype. The skills needed for incubation are *experimentation skills*. Experiments are conducted not only on the technical front but also for market learning, market creation, and testing the proposal's match with the company's strategy intent. A vast majority of projects entering the incubation phase will often be filtered out when the experiments fail for one reason or another, due to the high uncertainty associated with what initially appeared to be a promising opportunity (O'Connor & DeMartino, 2006).

O'Connor and DeMartino (2006) mention that incubation is rarely systematically engaged *in* and *across* a company. Incubation appears to be the most fragile and least understood of the three competencies. Some companies even 'deresource' incubation as their discontinuous innovation mandates evolve toward more aligned projects or as the discontinuous innovation group experience financial pressure.

Evaluation and review is different from incubation. Although boards provide some oversight and help to break down barriers as needed; the competency to coach projects through the incubation period is rare.

2.4.3.3. Acceleration competence – Acceleration activities ramp up the fledging business to a point where it can stand on its own relative to other business platforms in the ultimate receiving unit. Acceleration focuses on building a business to a level of some predictability in terms of sales and operations. The skills needed are those required for managing high-growth businesses. Acceleration involves *exploitation* rather than either exploration, which discovery requires, or experimentation, which incubation requires. The activities of acceleration include:

- Investing to build the business and necessary infrastructure;
- Focusing and responding to market leads and opportunities;
- Beginning to institute repeatedly processes for typical business processes, such as manufacturing and order delivery, customer contact, and support (O'Connor & DeMartino, 2006).

2.4.3.4. Discovery, incubation and acceleration interfaces – Discovery, incubation and acceleration competences are difficult to develop. In addition, they do not ensure a successful discontinuous innovation capability. One of the insights of the research of O'Connor and DeMartino (2006) is that in addition to the criticality of the three competency sets for enabling discontinuous innovation, managing the interfaces across those competency domains and activities is crucial. *This is particular important for firms that do not incorporate all three competencies under the same organizational umbrella, like in the construction sector.* Sometimes organizations can rate high on each of the competencies, but the link between the discovery and incubation functions are weak, which indicates that the pipeline for new ideas had not been developed.

These interfaces (or pipeline) match perfectly with the network competence described by Ritter and Gemünden (2003) in paragraph 2.4.2., especially in the construction sector where firms do not incorporate all three competencies under the same umbrella.

The three different types of progressive organizations and the four competences result in a general context of discontinuous innovation in the construction sector. The construction sector mainly takes place on project level. The next subchapter will give a better picture of the discontinuous innovation *process* and the factors which influence this process.

2.5. Conclusion

2.5.1. Organizational context and competences

Nam and Tatum (1997) classified three types of firms based on the roles played by key individuals in the organizations: *Driving forces*, *technical collaborator* and *innovation supporter*. Nam and Tatum (1997) identified them as progressive organizations; usually, the innovative projects are accomplished through the combined effect of a couple of such progressive organizations. Key individuals in the 'driving force' type of organization carried ideas from conception through to development into a viable process or product. They persuade other organizations to participate in the project and lead the innovation process. Upon receiving the initiative from the driving force, members of the technical collaborators provide technical expertise for the project. The third type of progressive organization is recognized by Nam and Tatum (1997) as an 'innovation supporter'. With enough understanding of the background technology involved, they sponsor the new idea at the highest level and protect them. The innovation supporters are generally the owners of the projects.

These three general organization types are the main actors in a construction project. The competences they need to develop a mature discontinuous innovation capability are identified by O'Connor and DeMartino (2006): *Discovery*, *incubation*, and *acceleration*, each of which requires distinctive types of expertise and processes. A *discovery* capability involves activities that create, recognize, elaborate, and articulate RI opportunities. The skills needed are exploratory skills, conceptualization skills and external hunting for opportunities. The *incubation* competency involves activity that matures radical opportunities into business proposals. *Acceleration* activities ramp up the fledgling business to a point where it can stand on its own. One of the insights of the research of O'Connor and DeMartino (2006) is that managing the *interfaces* across those competency domains and activities is crucial. *This is particular important for firms that do not incorporate all three competencies under the same organizational umbrella.*

The interface can be defined as the *network competence* of Ritter and Gemünden (2003). They show that organizations, which have close relationships with customers, suppliers, research institutions and competitors are more likely to have higher product and process innovation success. The underlying reason is a company-specific ability to handle, use, and exploit inter-organizational relationship. Their results reveal that network competence has a strong positive influence on the extent of inter-organizational technology collaborations and on the firm's product and process innovation success. With regard to network competence, Ritter and Gemünden (2003) distinguish between the *tasks* that need to be performed in order to manage a company's technological network and the *qualifications*, skills, and knowledge that are needed in order to perform these tasks.

Combining the three main actors and four main competences to realize discontinuous innovation in the construction industry, results in the research model illustrated on page 27:

2.5.2. The discontinuous innovation process

The discontinuous innovation *process* takes place in the context described above and illustrated on page 27. Veryzer (1998) developed a descriptive model of the discontinuous product development *process*, and he offers insights into the requirements for effective management of discontinuous innovation projects. Generally, firms do not employ a formal,

highly structured process for managing discontinuous innovation efforts. However, the firms do follow a consistent, logical process in the development of radical innovations, and their process differs significantly from incremental NPD processes. These processes are more exploratory and less customer driven than the typical, incremental process. The *impetus* for the projects comes from the convergence of developing technologies, various *contextual or environmental factors* (for example government regulations), and a *product champion or visionary*.

Caerteling et al. (2008) mentioned the value and importance of government champion behaviour. Championing behaviour is defined as making a decisive contribution to any innovation by actively and enthusiastically promoting its progress through the critical development stages (Howell & Sheab, 2001). Nam and Tatum (1997) suggest characterizing construction champions as well-prepared individuals who not only have extensive experience but also adequate resources and power.

The contextual factors are described by Caerteling et al. (2008). They distinguish *supply- and demand oriented government policies* to direct the rate and direction of innovation and *conditions to appropriate returns*.

The application of the framework – This theoretical framework and research model will be used to chart all the relevant *actors* in an innovation contests and the *roles* they play in these contests. If the actors are clear, this framework can be used to research *if* all of the four *competences* are present in the project and which actors feature these competences. This gives a clear picture over all the actors and competences present in the innovation contest and thereafter.

In this context the course of the innovation process will be researched and in which phase the idea(s) falter(s).

The process is mainly driven by two forces:

Contextual factors and a *champion*. The influence of these two forces on the (faltering of) the process will be researched. This is important to understand *which* of those two forces is the reason for failure and which of those two forces is the most *dominant* force concerning innovation contests in the construction sector. Thus, the innovation contests will be put in a broad perspective of the whole *innovation process*, its *drivers*, and the *actors and competences* needed to *exploit* innovation.

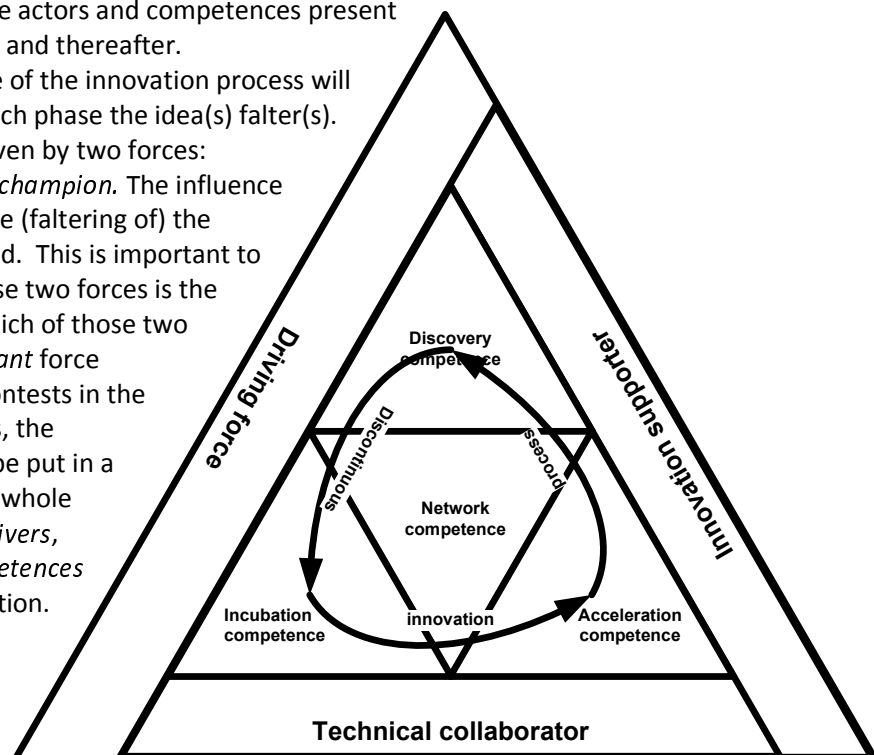


Figure 4: Theoretical model - 3 actors, 4 competences and the discontinuous innovation process

3. Methodology

Research type: This research is divided in two stages. The first stage will be a descriptive survey research to answer the first research question: “In which phase of the innovation process do the innovative ideas from innovation contests falter?” This survey is based on a multiple-case study of twenty-seven innovation contests held by RWS and mainly sustains a qualitative character. The second stage will be an exploratory survey research to answer the second research question: “What are the reasons behind the faltering of the innovative ideas?” This will be a multiple-case study based on five innovation contests and also has a qualitative character. The methodology differs for each stage and can be visualized as a funnel. For this reason this chapter is split up in two sections based on the sub-research questions.

Stage 1: *Where do the ideas falter in the innovation process?*

Demarcation: The first stage is set up broadly. This results in a broad picture of the characteristics of innovation contests organized by RWS. The following demarcation is used in the first stage:

- **The innovation contest is organized by RWS** – The innovation contests needed to be initiated and/or organized by RWS. This demarcation is set because the problems seem to occur in the context of RWS.
- **The innovation contest is acquainted in the RWS’ intranet database** – To make sure that the contests are held and recognized by RWS as such, this demarcation is set.

Unit of analysis: The unit of analysis is the *innovation contest* organized by RWS. In the first stage of this research the phase in which the idea falters will be analysed based on twenty-seven innovation contests. These phases are based on the innovation process model described in the theoretical framework.

Method of data collection

Approach – The most important aspect of this stage is to get a good understanding *where* the ideas falter in the innovation process. This stage is used to get as much possible information about the innovation contest to get a good picture of the characteristics of the contests. The phase of faltering is based on the innovation process described in the theoretical framework. To determine this phase two methods of data collection will be used: *Document search* and (*short*) *semi-structured interviews* with participants and organizers, held over the phone. The qualitative character of the research also requires qualitative data collection approaches. The reasons to choose these methods are:

- 1) *Provides more information about the contests* - Open interviews in combination with document search provides information which can be overlooked in closed questionnaires or completely structured interviews. Open interviews invites interviewees to talk about the innovation contests and where it went well and where it went wrong.
- 2) *Avoids jargon* – The winning ideas need to be categorized based on the scientific literature. The scientific terms are often not familiar for the interviewees. Explaining the terms could cause misunderstanding. The researcher makes the categorization based on the information from the open interviews and document search.

The consequences are that the researcher needs to categorize the ideas from the innovation contests into the different phases described in the theoretical framework. There is a risk that the researcher misjudges the situation and categorizes the ideas into the wrong phase. However, it should be expected of the researcher that he has more knowledge of the different phases described in the scientific literature than the interviewees. The chance of misjudgement is thus smaller using these methods of data collection.

Besides the phase of faltering, these twenty-seven innovation contests are analysed on the following characteristics: Name, initiator, type of innovation contest, internal or external contest, period, number of rounds, focus group, number of participants, selected ideas, (number of) winners, awards, implemented 'yes or no', jury and (number of) criteria.

Reliability – Document search is used to control the facts from the interviews. Open interviews also allow the interviewer to question contradictions in the answers given by the interviewees. Unlike the question *why* the ideas falter, there is no real chance that the interviewee does not tell the truth about *where* the ideas faltered, because these facts are easily traceable and there is no direct interest to lie about it. This may differ for the 'why' question, but this shall be discussed in the second stage of this chapter.

The interviewees are participants or organizers of the contests. Thus, they are directly involved in the innovation contest. It should be expected that they have the most actual and accurate information.

Internal validity - "The validity of inferences about whether observed co variation between A (the presumed treatment) and B (the presumed outcome) reflects a casual relationship from A to B in the form in which the variables were manipulated or measured" (Shadish, Cook, & Campbell, 2002). In popular words this means that the main objective of internal validity is to make sure that the obtained data is a *good representation of the reality*.

Case selection: All the innovation contests that appear in the internal database of RWS ('Kennisplein') are adopted in this first stage. Since there is no distinction made between the innovation contests adopted in this stage of the research, there is no real threat concerning the internal validity. The only aspect that could threaten the internal validity is that the internal database is not accurate, but there are no indications for this statement.

Data collection: The first method concerns indirect data collection to gain a basic insight into the process and the problems that occurred. This includes evaluation report, (newspaper) articles and websites of participants of the contest. The second method is interviewing. Interviewees are confronted with statements from other interviews and documents concerning the same case. Interviews are ideally suited to examining topics in which different levels of meaning need to be explored. Another advantage is that most of the research participants accept this method readily. This is partly due to familiarity with interviews in general and that most people like talking about their work. A disadvantage could be the data overload as a result of the huge volume of rich data by even a moderate-sized study (King, 2004).

External validity - "The validity of inferences about whether the cause-effect relationship holds over variation in person, setting, treatment variables, and measurement variables." (Shadish, Cook, & Campbell, 2002) In other words; to what populations, settings, and variables can this effect be generalized? Generalizability is not the most important objective within this research. The problem context is unique in the Netherlands, because of the special role of the executive government agency RWS. The only generalizability could be that it is also applicable for other countries with the same governmental structure.

Method of analysis

The analysis of the phase of faltering in the innovation process is based on innovation process model described in the theoretical framework (chapter 2). Based on the characteristics of the phases of the innovation process a classification is made. The innovation contests are categorized in a certain phase based on how far the winning ideas are elaborated or developed. If these ideas were still ideas on paper it is clear that it needs to be categorized in the early phases. The level of elaboration determines in which of the early phases the innovation contest is categorized. The comprehensiveness of the plans in combination with number and kind of technical collaborators gives indications of the level of elaboration. Another aspect that helps to determine the phase of faltering is the reason *why* the innovative ideas are not further developed. The involved people often refer to the next phase when the question is asked why the idea faltered during the innovation process. For example: There was no money for tests; or no support to set up a pilot; or no market to commercialize the innovations. This approach is used to categorize the innovation contest into the innovation process phases.

Besides the phase of faltering, basic characteristics are analysed using a simple template described in appendix 1. These basic characteristics are used to get a better understanding of the innovation contest and to categorize different types of contests. This resulted in three different types of innovation contest, which are briefly described in the next paragraph and in chapter four.

Stage 2: *Why* do the innovative ideas falter?

Demarcation: Including the demarcation of the first stage, the second stage is stricter defined. To get a better understanding concerning the reason *why* ideas from innovation contests falter, it is important to focus on the types of contests where the problems occur and where the problems are more accurate. Using the information from the first stage, the following demarcations are set to get closer to the core of the problem:

- **The innovation contest is an ‘external’ contest** - This means that external parties can participate in the contest. Internal innovation contest are only for the employees of RWS. The problems occur between the external parties and the organizer/initiator of the innovation contest. This means it is self-evident that only *external* contests will be selected.
- **The innovation contest is a ‘problem’ or ‘design’ contest** - Based on the document search and interviews three types of innovation contests can be distinguished: ‘Idea contests’, ‘Design contests’ and ‘Problem contests’. The different contests are described in chapter 4, but the main differences between the three types are based on the *focus* of the innovation contest and the *propagated intention* of the innovation contest. Not all of the three types have the propagated intention to actually realize the ideas from the innovation contests, like the ‘idea contests’. Thus, the research will mainly be focused on the ‘problem’ and ‘design’ contests, because these contests do have the propagated intention to realize the ideas. Considering the research question *why* the ideas from contests are not being exploited, these types of contests are relevant for this research. More information about the different types of contests and the characteristics can be read in chapter 4. The classification of the three types is made by the researcher to structure the twenty-seven innovation contests in stage one. This structure contributes to a more targeted search to the reasons why innovation contests

- falter in the second stage. The categorization allows the researcher to specify the reasons why some innovation contests do realize ideas and why some do not.
- **The innovation contest is organized after the year 2000** - There seems to be a lack of information about the innovation contest before the year 2000. Comprehensive information will contribute to a more reliable research and conclusions; this is the reason why the contests need to be organized after the year 2000.

Unit of analysis: In the second stage the unit of analysis are the *external 'problem' innovation contests* and the *external 'design' innovation contests organized by RWS*. The reasons of faltering will be researched by analysing the competences of the different parties involved in the innovation contest, the role of the champion(s) and the contextual factors. Five innovation contests are used as case studies.

Method of data collection

Approach –In the second stage multiple semi-structured interviews will be held, which are more comprehensive and are held with more involved people than in the first stage. The interviewees are the *drivers* of the innovation (winners) and the *supporters* and/or *owners* of the innovation (RWS). A list of the functions of the interviewees can be found in appendix 5. On the 'solvers' side the interviewees are all the winners of a certain contest. On the side of the seekers, the interviewees are all part of the organizing team and/or involved soon when the contest was over to take over the 'championship' role. In all five cases the seeker as well as the solver(s) is/are interviewed.

The interviews are based on the theoretical framework described in chapter two. In the interviews strong focus lies on the *innovation process* and the actors involved in this process. It includes the *contextual factors* and the role of the *champion* that strongly affect this process. As soon as it becomes clear *where* and *why* the process falters, extra attention is paid to the causes and effects. Less attention is paid to the competences in the written questions of the semi-structured interview, described in appendix 2. The competences need to become clear during the interview when the interviewee is talking about what went well and what went wrong *during* and *after* the innovation contest. Specific question about the competences (described in the theoretical framework) could overwhelm the interviewee with scientific jargon *and* there is also a chance that the interviewee will exaggerate or minimize the competences when the interviewee is aware that the competences are included in the research. The scientific literature gives concrete descriptions of actions that can be linked back to certain competences. Thus, the competences can be measured and assessed.

Reliability – The interviews must be recorded with a speech recorder. The registration of the interviews improves the reliability of this qualitative research, because it minimizes the subjective interpretation of the researcher. Data triangulation is used to improve the reliability: For each case at least one participant of RWS (the organization of the contest) and at least one of the participating parties in the contest is interviewed. These interviews will be supported by documented data and the data acquired in the first phase. As the interviews are finished, the cases are sent back to the interviewees to give them the opportunity to comment on it. This feedback loop minimizes the mistakes in cases (described in chapter 5) and discussion about the conclusions afterwards.

Internal validity – This means that the main objective of internal validity is to make sure that the obtained data is a good representation of the *reality*.

Data collection: Through the negative character of the main research question it is quite conceivable that participants palliate the proceedings in the past in case they or their organization has made mistakes. The opposite is also possible; participants can exaggerate the proceedings in the past because they are disappointed that the project is cancelled. To get a good representation of the reality, data triangulation is used as described in the first stage.

Case selection: Five innovation contests are selected (of the twenty-seven from the first stage) as case studies. Besides the demarcations, the following sampling strategy is used to get a good representation of the reality:

- **At least one of the selected contests has to be a ‘success case’** - When an idea from an innovation contest eventually results in a real application the innovation contest is labelled as ‘successful’. When the idea falters in the innovation process and does not result in any kind of application, the contest will be marked as ‘failed’. At least one ‘success case’ is needed to compare with the other ‘failure cases’. This will enhance the reliability of the conclusions.
- **A presentable mix of ‘design’ and ‘problem’ contest** – The problems occur in both types of innovation contests. It is important to include both types in the multiple case studies to give a good representation of the reality.
- **The selected contests are organized by a different department and/or different programs within RWS** - The innovation contests are organized by different programs or different departments. The one department organizes much more contests than the other. To get an all-round perspective it is important to select contests of different programs/departments.
- **The amount of selected contests must be manageable in the given amount of time** - The research has to be accomplished in about half a year, so there is no time for all (or many) innovation contests. A selection has to be made to keep this manageable. A number of five innovation contests seem to be reasonable.

Five cases seem to be manageable in the given amount of time. Four cases are so-called fail-cases and one is a success-case. Two cases represent ‘design’ contests and three cases represent ‘problem’ contests. The five innovation contests are held by three different programs/divisions. This distribution gives more or less an average of all the design and problem contests described in the first stage:

- 28% of the problem and design contest were successful regarding the realization of innovation. In the sample 20% (one out of five). This research focuses on the question why innovative ideas are not realized; for this reason the focus of the cases is on the fail-cases, compared with one success case. The consequence is that there is less attention for the success factors of an innovation contests, because there is only one success-case.
- The ratio design-problem is 4/14. In this sample: 2/3. The decision to have a sharper focus design case is because none of this type of innovation contest ever succeeded. By adopting two design contests this gives a better understanding why these contests are not successful.
- Three (out of five) innovation contests are organized by the same program, called ‘Wegen naar de Toekomst’ (Roads to the Future). This program organizes significantly

more innovation contests than other programs and divisions. For this reason three contests are in the sample; one of them is the success-case. Although it is not an exact average of the twenty-seven innovation contest from the first phase, the mix gives a representation of the reality.

External validity – To what populations, settings, and variables can this effect be generalized? Within this research generalizability is not the most important objective. The situation is unique in the Netherlands, because of the special role of the executive government agency RWS. The only generalizability could be that it is also applicable for other countries with the same governmental structure.

Method for analysis – A *template analysis* is used to create structure and find patterns in the data. Template analysis refers to a group of methods to thematically organize and analyse data (King, 2004). After the template analysis, the five cases are cross-analysed.

Cross analysis between the five cases – The five cases will be mutually compared. Thus, conformities become clear as well as discrepancies. The success case is used to assay the findings in the fail cases. The aspects that are cross-analysed are based on the template derived from theoretical framework and the analysis model can be found in appendix 3. Not all the interviews are completely transcribed and coded, because of the amount of data. Only the useful parts that directly link to the template are used. This prevents deviation from the research problem and a lot of extra work. The consequences are that relevant data can be overlooked. However, in every case at least two different actors are interviewed, which reduces the chance of overlooking essential data.

The analysis starts with course of the innovation contest and the determination of the phase of faltering, like in the first sub-research question. Then, the factors will be analysed that affected the innovation process and the role of the organizational and technical champion. Attention will be paid to the question if the problems could be prevented before the innovation contest was set up. After the process is clear, the different actors participating in the innovation contest will be analysed including the competences they have or just lack. This will give a broader understanding of the context of the innovation contests and the competences available. Thus, the cases are analysed on two levels: on a process level and on an organizational context level.

Template – ‘Template analysis’ does not describe a single, clearly delineated method; it refers to a varied but related group of techniques for thematically organizing and analysing textual data. The essence of template analysis is that the researcher produces a list of codes (template) representing themes identifies in their technical data (King, 2004). The template is based on the theoretical framework and can be found in appendix 3. The template analysis is a highly flexible approach that can be modified for the needs of any study in a particular area. It works very well in studies which seek to examine the perspectives of different groups within an organizational context and is a well-structured approach to handling data (King, 2004). The disadvantage of this technique is the lack of substantial literature, which could result in templates that are too simple to allow any depth of interpretation or too complex to be manageable (King, 2004). Three main themes are identified in the template: The actors in the construction sector, the competences or capabilities and the discontinuous innovation process. These themes are all split up according to the theoretical framework.

4. Where do the ideas falter?

In this chapter the first sub-research question will be discussed: “In which phase of the innovation process do the innovative ideas from innovation contests falter?” Answering this question will give an understanding *where* the ideas waver in the innovation process. The knowledge *where* the innovation process stops can give leads to the question *why* the process stops. However, the ‘why’ question will be discussed comprehensively in the chapter five and six.

Twenty-seven innovation contests – Twenty-seven innovation contests held by RWS are analysed. This list can be found in appendix 4. The number of contests is based on the internal database of RWS (intranet: Kennisplein) and the search results that appear in this database. (This does not mean that this number represents *all* the innovation contests held by RWS.)

Internal vs. External contests – Two of the twenty-seven contests (7%) were *internal* contests, which indicate that these contests are especially for employees of RWS. The other twenty-five of innovation contests (93%) are *external* innovation contests, which focus on external parties, like companies, students and architects. This research focuses on the external contest because the problems described in the problem statement occur in these external contests.

Types of innovation contests – By analysing the contests different types of innovation contests became clear. The characteristics of the different types of contests will be discussed to get a better understanding of the research problem and the case studies. This distinction is made to make clear in which type of innovation contests the problems occur. Three types of contests can be distinguished: *Idea contests*, *design contests* and *problem contests*:

Idea contest – *Nine* of the twenty-seven contests (33%) focus particularly on the ideas. There was *no* concrete problem context (like specific place, period of realization or realization budget). RWS was just looking for ‘crazy’ ideas to trigger, for example students. The awards were low compared with the *problem contests*; the highest award was €5.000,-. Prior to the contest, it was clear that the project would take one stage (ideation) and after this stage the winners would be awarded and the contest was over. There were no real propagated intentions to develop the ideas further to a product or process on short notice. The winners were satisfied with the award and attention and there was no frustration regarding the absence of a follow-up phase. This type of contest is labeled by the researcher as ‘*idea contest*’. An example is ‘Lieverdjes kweken op de weg’ (‘Cultivate sweeties on the road’), where students can come up with ideas to make the road user more social, friendly and safer towards other drivers.

Problem contest – A different type of contest is labeled as ‘*problem contest*’. These contests focus on concrete problems which request innovative solutions. This concrete problem context is reflected in a specific *place* (for example a national road, groynes or service area), a specific *period* (needs to be handled before year X) and/or realization *budget* (X euro to execute the plans). The awards are much higher in this type of contest; ranging between €20.000 up to even €1 million. The participants are mainly professional organization, like constructors, inventors or architects. Prior to the contest, the intention to develop the (winning) ideas further is clearly present. This is also an important reason why professional organizations participate in the contest. This way they can develop new products and/or new knowledge. These contests consist, besides an ideation phase, of a phase where a selected group of participants may

develop and prove their ideas further. After this phase the winner(s) is/are announced and the contest is over. Frustration grows among participants when it becomes clear that after the innovation contest no follow-up phase will be realized. Fourteen of the twenty-seven (52%) can be labelled ‘problem contest’. An example is ‘Minder hinder tijdens renovatie stalen bruggen’ (‘Less hindrance during renovation steel bridges’) where participants need to come up with practical solutions to reduce the hindrance for road users during the renovation of steel bridges. The winning idea is stated in appendix 6.

Characteristic:	Idea contest (9 contests, 33%)	Problem contest (14 contests, 52%)	Design contest (4 contests, 15%)
Focus	Fresh (crazy) ideas	Innovative solutions	Architecture
Problem context	Not concrete	Concrete	Concrete
Focus group	Broad (students – contractors)	Narrowed (market)	Narrowed (Architects, designers, etc.)
Prize money	Relatively low (<€5.000,-) or a product	Relatively high (>€20.000,- until max. € 1 million)	Relatively lower (<€30.000,-) <i>Publicity is awards</i>
Development phase(s)	One (Ideation)	Two or three (Idea + elaboration)	Two or three (Idea + elaboration)
Propagated intention	No intention for further development	Intention for further development	Intention for further development

Table 1: Main characteristics of innovation contest types

Design contest – The last type of contest is in some ways similar to the ‘problem contest’, but focuses much more on the design or architecture of the case. The aesthetic part is of greater value than the innovative part. The context is concrete as well (a specific bridge or road house), but the rewards are often lower compared with the *problem contests*, because publicity is one of the awards. Publicity is especially important in the design and architectural sector. Despite the fact that the awards are lower, the winners will often get a compensation for further development of the designs. The participants are often architects, designers and artists. Prior to the contest (even as the problem contests), the intention to develop the (winning) ideas further is clearly present. These contests consist, besides an ideation phase, of a phase where a selected group of participants may develop and improve their plans further. After this phase the winner(s) is/are announced and the contest is over. Frustration grows among participants when it becomes clear that after the innovation contest no follow-up phase will be realized. This type of contest will be labelled as ‘*design contest*’.

The difference between a *normal tender* and a *design or problem contest* could seem vague, but there are some significant differences. The main difference in perspective of this research is that there is not any guarantee that the proposals will be realized in an innovation contests. Tenders do guarantee the realization. The legislation is also less strict concerning innovation contests compared to the tenders. However, by integrating a follow-up process in the innovation contest the legislation about European public procurement need to be taken into account. This was the case with the fifth case study, described in chapter 5. Another difference is that the input (ideas) for these contests is unknown, while in tenders the input is often familiar and competes (mainly) in costs. The main differences are regarding legislation, but the choice to organize an innovation contest is because these contests are non-committal and also easier to arrange.

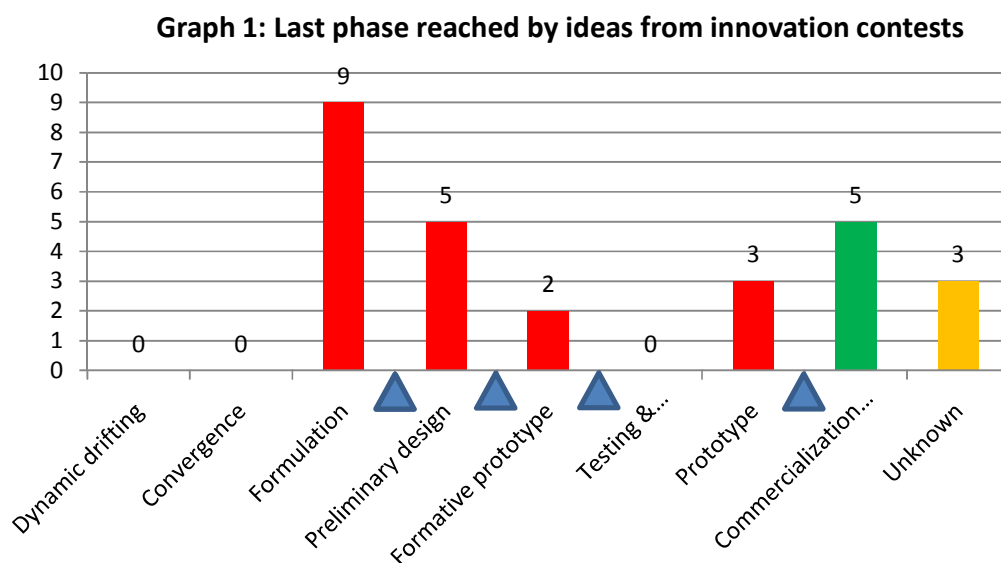
Successful versus Failed – An important characteristic concerning the innovation contests is if the contests are ‘successful’ or ‘failed’. In this research ‘successful’ means; if the innovative ideas from an innovation contest are eventually realized. ‘Failing’ means that the innovative ideas from the contests somewhere falters in the innovation process and are never exploited. Of course, an innovation contest can be very successful in other respects like commencement, number of participants, number of innovative ideas, etc. but this does not apply to the main research question. Only five of the twenty-seven (19%) are successful and nineteen of the twenty-seven failed (70%). Three of the contests (11%) are unknown. However, this picture will be different when the *idea contests* will be excluded. These *idea contests* do not have the intention to result in actual innovative solutions. Five of the fourteen *problem contests* (36%) are still successful, but seven failed. However none of the design contests were ever successful; four out of four failed.

These numbers show that there is indeed a problem concerning the development of innovative ideas from innovation contests, but the type of contest needs to be taken into consideration to get a better picture of the situation. The consequences of these numbers will become clearer in the next two paragraphs:

Type:	Success:	Fail:	Unknown:
Idea	0 / 9	8 / 9	1
Problem	5 / 14	7 / 14	2
Design	0 / 4	4 / 4	0
TOTAL	5 / 27	19 / 27	3

Table 2: Distribution successful vs. failed

Phase of faltering – Now the question is; *where* in the innovation process do the ideas falter? The answer is plural and illustrated in the graph 1. The phases of the innovation process are described on the horizontal axis and the number of contest on the vertical axis. The ideas from the contests are classified using a *positive approach*, which means that the numbers above the bars illustrate the last phase the ideas reached. The points of faltering are illustrated by the blue triangles. For example: Five (winning ideas from) innovation contests reached the preliminary design phase, but faltered after it and did not reach the formative prototype phase. This also means that reaching the commercialization activities phase is equal to the contests that were successful (described in the previous paragraph). This results in the following graph:



What stand out are the following points:

1. Many innovative ideas falter in the early phases of the innovation process. Before the ideas on paper can be transformed in reality into any form. Nine contests are cancelled after the *formulation phase*, five contests are cancelled after the formulated ideas were elaborated (*preliminary design phase*). Two contests were cancelled after the formative prototype, where the plan was fully developed to realize it in a kind of test or pilot. The ideas are still ideas on paper, simulations and/or miniatures. There appears to be a threshold to bring the ideas into practice. Reasons for this threshold can be attributed to the lack of development resources and to legislation.
2. Three innovative ideas reached the penultimate phase, the prototype phase. Cancellation after this phase can mean two things:
 - a. The idea was not that good in reality as on paper. After tests a monitoring, the results were not as promising as they seem to be in the early phases of the innovation process.
 - b. The idea is tested and proven, but there is no market for it. In some cases the results of the tests and pilots were promising, but the innovation could not find any interested party to commercialize it. An important reason for this lack of interest is legislation. For example: An innovative solution to make the asphalt quieter and cleaner *for a longer time span*, did not find a market, because legislation prescribes that the noise and pollution level needs to be measured after the construction (and not after 10 years). The need to invest in this innovation is missing due to this law. However, this can also mean that when legislation changes, this could innovation could be successful.
3. Five contests can be labelled as successful and are exploited. (Commercialization activities). Reaching the commercialization phase implies that the innovation process did not stop and that the innovation process was successful regarding the realization of innovation

Not all the types of innovation contests have the *propagated intention* to realize the ideas from the contest, like the *idea contest* (See: Types of innovation contests). It does not (always) have to be a problem that a contest stops in an earlier phase, because this can save time, money and energy. Information need to be specified to point out the core of the research problem: Combining the *different types of contests* and the *phases of faltering* gives this specified picture:

Relation between Contest Type and Phase of faltering – Combining the *type* of innovation contest with the *phase* of faltering results in the following cross-table:

	DD	CONV	FORM	PRE	F.PRO	T&M	PROT	COMM	UNK	TOTAL
Idea	0	0	7	0	1	0	0	0	1	9
Design	0	0	1	3	0	0	0	0	0	4
Problem	0	0	1	2	1	0	3	5	2	14
TOTAL	0	0	9	5	2	0	3	5	3	27
<i>Innovation contest</i>			<i>Early phases</i>			<i>Final phases</i>			<i>Unknown</i>	

Table 3: Phases of faltering of the 27 innovation contests

In the previous paragraph the phases of faltering are discussed. A closer look to the types of contest results in the graph above and what stands out are the following points:

Idea contests – Seven of the nine *idea contests* falter in the formulation phase. However, the propagated intention of an idea contest is not the realization of new ideas, but to come up with original, ‘crazy’ ideas. It’s a rather logical thing that the contests are stopped in an early phase, because otherwise it would cost extra money, time and energy without a tangible result. However, one of the ideas from an idea contest ‘slipped through’ and reached the formative prototype phase. The reason behind this further development of an idea from an idea contest is that a *fair* was coming up about the same topic as the innovation contest. The organizational champion of RWS thought it was a good initiative to show the winning idea on this fair. However, the idea needed to be further developed to give a good impression. Unfortunately, on this fair there were no investors that would like to invest in this idea and it faltered soon after.

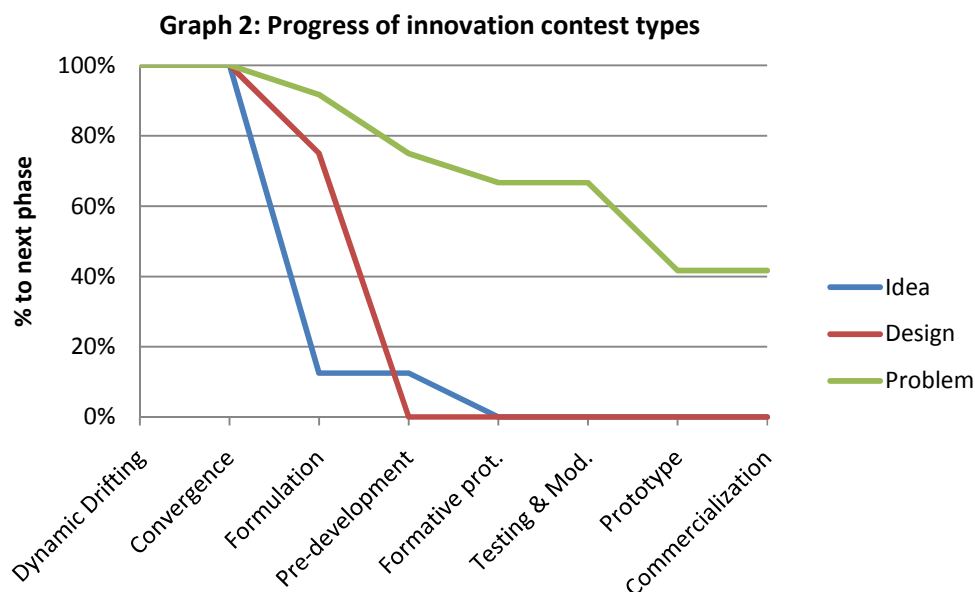
Design contests – All the ideas out of the *design contests* (four out of four) never get realized and falter in the early phases of the innovation process (formulation and preliminary design phase). This results in concerns, because this type of contest has the intention to develop the ideas further. However, none of them reached the commercialization phase. The ‘innovation contest’-method does not seem to be a useful instrument to realize new innovative architectural plans or ideas. However, the question still remains *why* these contests falter in these early phases. This question will be handled in the next chapter.

Problem contests – This picture is more diffuse: Four of the fourteen *problem contests* falter in the early phases of the innovation contest (formulation, preliminary design and formative prototype phase). Five of the fourteen *problem contests* reached the commercialization phase. Three of the fourteen *problem contests* falter after the prototype phase. This means that the chance that an idea from a problem contest will be realized is: 5/12 (42%). (See table: Probability of realization.) Despite most of the problem contests are eventually not realized, also a large share is realized. Thus, the ‘innovation contest’ is not necessarily an unusable method to *realize* innovations, like for the other two types.

Probability of realization	
Idea contest	0 %
Problem contest	42 %
Design contest	0 %

The innovation process is not equipped to actually realize the ideas from idea contest. This is not the case for the other two types. Nevertheless, the design contests are not successful regarding the realization of innovation, while some of the problem contests are. A clarification can be that the final product and especially the benefits much clearer for design contest: The winning design will not much differ from the final product, and the benefit is an architectural improvement. However, this architectural improvement is often a more expensive option than the conventional option. In case there is no (internal) support and/or money to realize this plan, the idea will be cancelled when it is still a plan on paper. In case of the problem contest the final products and the benefits are less clear. The benefits of the innovation can be new or better features, better quality, faster realization time, or most important can be cheaper. However, whatever the promised benefits are, the innovative ideas need to be tested and proven in reality. So, if the benefits of an innovative idea are attractive and there is sufficient (internal) support and financial resources the chance is much higher that the innovation process continues.

Progress of innovation contest types – Graph 2 (below) is a clarification of table 3; it shows the progression of the innovation contests. It confirms that *all* the *idea* and *design contests* falter in the early stages of the innovation process. These kinds of contests are not suitable for the ‘innovation contest’-method regarding the *realization of innovation*. However, the problem contests seem to be better suitable for this method, but still sixty percent of the ideas from this kind of contest do not get to the realization of innovation.



Conclusion – Twenty-seven innovation contests have been researched to obtain a better understanding *where* in the innovation process the ideas from innovation contests falter. Two different categories can be made: *Internal/external* contests and the *type* of innovation contest: *Idea, design or problem* contest. Most of the innovation contests are external contests besides two of them.

Almost all the ideas from *idea contests* falter after the formulation phase. Considering these types of contests do not have the propagated intention to realize the ideas, it is rather logic to stop the process in an early phase to save money, time and energy. The ‘innovation contest method’ does not seem to be a good method to realize innovations, but could be a good tool for publicity. It is a method to let people think about the problems or challenges RWS has, and in this way positively contribute to the image of RWS as an employer and/or facilitator. The awards are also relatively low to justify this type of innovation contest as a publicity tool.

This does not count for the ideas from *design contests*. These contests do have the propagated intention to be realized, but none of them ever did. All the ideas from this kind of contest falter in the phases where the ideas are mere plans on paper. Based on the numbers it does not seem to be a good idea to realize innovations or architectural improvements. Although in these contests publicity also plays an important role, and it has the intention that the ideas will be realized. Thus, based on publicity it could be a good tool, but this is not the case for realizing innovations or architectural improvements. The reason *why* the ideas from these contests never are realized will be answered in the next chapter.

The phase of faltering concerning the *problem contests* is more diffuse. A third of this kind of contests falter in different kinds of early stages in the innovation process, where the ideas are ideas on paper (just as the design contests) and two third get to the end of the innovation contest where the ideas are tested and proved by a pilot project. The difference between *if* an innovation falters after the *pilot phase* and an innovation that get *commercialized* depends on the success of the idea. There is a chance that the idea is not as good as assumed in the beginning of the contest or there is no market for the innovation.

It is rather logical that the ideas from *idea contests* are stopped early on. However this is not the case for *design* and *problem contest*. RWS spends a lot of money on these contests and participants become frustrated when the development stops soon after the contest. It is difficult to tell exactly the costs of the innovation contest. The prize money differs for each type of innovation contest as mentioned earlier. For idea contest it is less than €5.000; for design contests less than €30.000; and for problem contests it ranges from €20.000 to a maximum of €1 million. However, the prize money is just a part of the total costs of an innovation contest. For design and problem contest a lot of other costs are involved, besides prize money:

- *Compensation for further elaboration* – The contests consist of different rounds. The costs regarding the first round are paid by the participants. However, ideas are selected after the first round for further elaboration. The elaboration of the ideas are paid by RWS. This can amount to €100.000 per selected candidate. In some case there is also a third round or a possibility for the winner to further develop the idea. These costs will also be compensated by RWS
- *Costs regarding symposia & meetings* – Meetings with participants are organized to introduce the innovation contest, to present the winners or to discuss about follow-up. Sometimes even symposia are organized to present the selected and winning ideas. There is no information available about these costs.
- *Promotion and publicity costs* – The innovation contest are promoted to attract participants by advertisement in papers and magazines, and special websites. During the contest it is important to keep the focus on the contest. After the contest books, websites and CD-roms are made to advertise the most promising ideas. There is no information available about these costs.
- *Jury costs* – In many cases the jury are not paid for their work, but do get compensated. There is no information available about these costs.
- *Human resources costs* – An innovation contest needs a team to organize it. The team has to prepare and guide the whole process. They have to organize the actions described above and expand the whole contest. They have to explore the legislation and IP-right concerning the specific topic. There is no information available about these costs.
- *Consultancy costs* – In some cases external expertise and experience is invoked about processes and legislation.

Despite the little information about the exact costs, it is clear that these contests have cost millions of Euro's. This does not even include the costs made by the participants. Hundreds of participants put effort and money in the ideas that never won a contest. These participants took this into account, but it increases the frustration if they notice that also the winning ideas do not get much further in the innovation process.

5. Why do ideas falter? - Five case studies

Five cases will be discussed in this chapter. Each case represents an innovation contest. At three of the five cases the ideas never reached the realization phase. One case, the most recent innovation contest, is still in development, but is also starting to falter at the moment. The fifth case is a so-called 'success case' where *some* of the winning ideas are realized and still used on a daily basis.

Case 1: 'Verzorgingsplaats van de Toekomst'

Service area of the future

Introduction – The objective of the innovation contest was to design a service area that will improve the provisioning along the national roads and more responsive to the needs of the road users. RWS was primarily interested in the ideas like the 'abri-concept'; where commercial parties may use their ability to exploit their advertisement space in exchange for providing facilities.

The contests consisted of two rounds where eventually two of the 40 participants were allowed to develop their plans further. Eventually, architect Noordwestzes won the innovation contest with their idea called 'Ripple in the landscape' (Rimpeling in het landschap). The idea is described in appendix 6.

Organizer:	RWS
Program:	WnT*
Type:	Design
Period:	Jun 04 – okt-04
Focus group:	Everybody
Rounds:	2
Participants:	40
Selected:	2
Winner:	Noordwestzes
Award:	€30.000,-
Exploited?	<u>No</u>

Actors – Besides the 39 other participants the main actors were in, and mainly after, the contest:

- **Driving force:** Noordwestzes (Architect) – They developed the plans further, contacted the technical collaborators and stimulated realization.
- **Innovation supporter:** RWS – WnT* - They organized the innovation contest and *tried* to arrange a pilot space to realize the plans of Noordwestzes.
- **Technical collaborator:** VBK Group (civil constructor) , Public Use (sanitary service and maintenance) and De Kruijter (lightning) – These parties gave insight to the (costs of) realization (VKB), the maintenance of the facilities (Public Use) and the way of lightening the service area (De Kruijter).

The course of the innovation contest – It started with the idea to set up an innovation contest about service areas, because of all the reasons described in the introduction. The first phase of the contest was to come up with well-described, but general, plans. Two participants were selected and received the opportunity to develop their plans further to an exploitation plan.



Figure 5: Impression of the winning design

After Noordwestzes won the contest, the plan should have been realized by doing a pilot project. However, the mayor of the municipality where the pilot space was located did not agree with this plan: The service area was already inhabited for crime and homo-erotic activities, and using this area it would only get worse, according to the mayor. By looking for other

pilot spaces another obstacle appeared; the plan was also in conflict with the 'gasoline law' which meant that it was not allowed to advertise and to exploit vending machines and advertisement in the service area. Surrounding service areas were already auctioned to other parties who obtain the right of selling and advertising in the region. This was a nationwide problem, and thus the idea would not be profitable and in conflict with this specific law.

Analysis

Innovation process – The following phases of the discontinuous innovation process described by Veryzer (1998) can be identified: The drifting phase matches with the forty ideas that applied for the contest as well as the brainstorm sessions within the organizations of the participants. The convergence phase is identical to the first phase including the selection. The technical champion plays an important role, because he had to convince the jury with an innovative solution and a convincing representation. Contextual factors did not play an important role at this particular moment (see 'Champions'). After the first round, two parties got the opportunity to elaborate their ideas. Eventually, the jury decided that the idea of Noordwestzes was the most promising idea and won the contest. This phase is similar to the formulation phase. After the formulation phase, the winner made an exploitation plan together with the technical collaborators, and prepared the design for the next phase; formative prototype. After this 'preliminary design phase', the problems occurred and the innovation process faltered, because of the reasons described by 'Contextual factors' and 'Champion(s)'. Although the organization of the innovation contest had the *will* and *intention* to set up a pilot, the *follow-up process* was not *anchored* decently in the innovation contest.

Innovation process falters:	Between 'preliminary design' and 'formative prototype'
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Champions – The main champion in the whole process was the architect of Noordwestzes who convinced the jury during the 'convergence phase' and the 'formulation phase'. In the preliminary design phase he contacted the other parties and tried to stimulate the realization of their project by contacting RWS several times. He was mainly a technical champion but also an organizational champion. The organizational champions within RWS were the organizer of the contest *during* the innovation contest and someone else *after* the contest. The organizer of the innovation contest got another position within RWS and the aftermath of the contest was taken over by somebody else. He was now saddled with the job to set up the first pilot. A pilot space was already arranged, according to his information. The manager responsible for the project *after* the contest mentioned: "*In the first instance, I was assuming that a pilot location was available...*"

However, the mayor of the municipality where the pilot space was located did not agree with the plan (see 'Contextual factors'). Meanwhile, another problem became surfaced: The plans were in conflict with the 'gasoline law', which made it almost impossible to implement this plan anywhere in the Netherlands. These findings brought the final blow to the project. Despite the change of organizational champions, they could not prevent that this plan would not be exploited.

Cause of faltering:	Not due to technical or organizational champions
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However, the change of the organizational champions within RWS made communications with the innovation support much more difficult for the driving force Noordwestzes. The architect of

Noordwestzes mentioned: *“RWS are all islands on their own, was my finding. People transfer to other positions or just disappear and this results in a kind of knowledge vacuum. Thus, a lot of knowledge gets lost and other people have to dig in again and make new contacts. That was quite difficult for us and required considerable time.”*

Remark:	Change of champions within RWS deteriorated the communication
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Contextual factors – The two main reasons why this idea faltered can be found within to the contextual factors: The first reason is the disagreement of the mayor (of the municipality where the pilot space was located). Out of fear that more crime would take place he would rather be rid of the whole service area than to improve it. This event can be grouped under the term ‘dispersed government roles’, described by Caerteling (2008). The manager responsible for the project *after* the contest mentioned: *“It turned out that the underlying reason was that they want to abolish the location, because all kind of illegal activities were happening at that place. That was a thorn in the eye of the local governors.”*

Another contextual problem was the ‘gasoline law’. The plans were in conflict with this law, where service areas are auctioned, including the (commercial) rights of the tank stations in the area. Thus, advertisement and exploiting vending machines are not allowed by upgrading the service areas, because it is in conflict with the rights of the nearby petrol stations. The caseholder ‘service areas’ mentioned: *“I think it would be very hard to realize the plan, even if they had the opportunity, because of the gasoline law and the auction of service area locations.”*

Cause of faltering:	<ul style="list-style-type: none"> - In conflict with interests of the mayor. - In conflict with gasoline law.
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Competences – A broader perspective can be obtained by looking at the competences of the different actors. The competences (needed to realize innovations) by the different actors are discussed in the context of this case:

- **Discovery competence:** The *driving force* Noordwestzes created an innovative plan, convinced the jury, involved technical collaborators and stimulated realization by exciting the innovation supporter. The innovation contest itself, organized by the *innovation supporter* RWS, was also satisfactory according to the participants. There is no proof that there was a lack of *discovery competence*.
- **Incubation competence:** A contractor, lightning expert and sanitary service and maintenance company were involved in the project to exploit the plan. Initially, they would realize the pilot and, if successful, the 20 – 30 service areas suggested by RWS. Despite that the plan never reached the pilot phase, there are no clues of a lack of *incubation competence*. The organizations having this competence did not have the opportunity or authority to realize it. They can be illustrated as ‘technical collaborators’.
- **Acceleration competence:** Nothing meaningful can be mentioned for this competence, because the project never came that far, but a contractor was already on board.
- **Interface – Network competence:** RWS as an innovation supporter plays an important role as buyer. The owners in the construction sector are often major participants in the projects. They establish the mechanism which involved parties to communicate and collaborate, make decisions on important technical matters throughout the project execution and sometimes share a proportion of the risk (Nam and Tatum, 1997). This

kind of 'network competence' is not well executed by RWS. Ritter and Gemünden (2003) divided this competence in *network management tasks* and *network management qualifications*. Especially, the *qualifications* are underdeveloped in this case.

In advance, the innovation supporter was unaware of the objections of the municipality and unaware of the legislation related to this subject. Having this knowledge about the pilot space, but especially about the legislation concerning this topic, may be expected of RWS. The winner of the contest mentioned: "*Then you think afterwards: 'Is RWS not able to realize that this kind of problems could occur before they set up an expensive innovation contest including all the activities around them, like symposia?'*"

When the innovation contest was over and the organizational champions within RWS changed, the communication diluted. This lack of communication can be grouped under *social qualifications* and the lack of knowledge under *specialist qualifications*.

Underdeveloped competence(s):	Network competence by innovation supporter (RWS): <ul style="list-style-type: none"> - Lack of <i>specialist</i> qualifications - Lack of <i>social</i> qualifications
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Conclusion – The innovative idea wavered between the 'preliminary design' and 'formative prototype'. Although RWS has the *intention* to set-up an follow-up phase, they did not anchor this well enough during the innovation contest. Despite changing *organization champions* on the side of the innovation supporter RWS, the causes of failure can be dedicated to the *contextual factors*. Dispersed governmental roles and interests made a pilot impossible. By setting up a pilot space somewhere else the innovative plan would be in conflict with the 'gasoline law'. However, by performing comprehensive initial research about legislation and interest before setting up the innovation contest, these problems would be clear in advance. This is in line with the theory of Veryzer (1998) where these factors play an important role in the convergence phase. By ignoring this initial research, RWS can be blamed for a lack of *specialist qualifications*.

Positive effects of this contest were; publicity for the winners and RWS, and put the adverse effects of the gasoline law on the agenda. Although, this last effect is minimal seeing how after five years the legislation has not changed. Nevertheless, directives and policies are still busy developing solutions development to prevent similar problems in the future. The actors are positive of the method 'innovation contest', because it triggers the market to innovate and can be used as a promotion tool.

Cause(s) of failure:
> In conflict with <i>interests</i> of the municipality
> In conflict with <i>legislation</i> ('Gasoline law')
Remarks:
> Poor communication of RWS, because of changing project controllers
Reason(s) of failure:
> Lack of initial research (legislation and (local) interests)

* WnT means 'Wegen naar de Toekomst' (Roads to the future) and is an innovation program of RWS. This program realizes pilot projects and demonstrations, which could contribute to the improvement or solving of mobility issues, based on a future vision of 2030.

Case 2: 'Uitbreiding Hollandse brug'

Expansion Dutch bridge

Introduction – The objective of the innovation contest was to design a bridge that accentuates the passageway between the *old* land (Amsterdam) and the *new* land (Almere). The design had to be aesthetic, innovative and sustainable.

The contests consisted of two rounds where eventually two of the 72 participants were allowed to develop their plans further. Thirty participants were rewarded with a publication in a special 'idea book'. Eventually architect Achterbosch won the innovation contest with his idea called 'AAAA'. (Described in appendix 6)

Actors – Besides all the participants of this design contest, the main actors are:

- **Driving force:** Hans Achterbosch Architectuur (architect)
- **Innovation supporter:** RWS – IJsselmeergebied
- **Technical collaborator:** Alle Hosper (Landscape office), Lünning (Wood manufacturer), Grontmij (Consultancy specialized in urban and natural environment, mobility, water and energy) and Oak Onix (architect)

Organizer:	RWS
Division:	IJsselmeergebied
Type:	Design
Period:	sep-08 – jan-09
Focus group:	Designers and engineers
Rounds:	2
Participants:	72
Selected:	3
Winner(1):	Hans Achterbosch Architectuur
Award:	Publicity + compensation
Exploited?	No

The course of the innovation contest – The process started with the idea to set up a design contest for the Dutch Bridge because of the reasons described in the introduction. The first phase of the contest was to come up with a well-described, but general, design. Two plans were selected and received the opportunity to develop their designs further to an exploitation plan. Between the first and the second round the preconditions changed; the bridge had to be designed 20% wider, within the same budget. After Achterbosch won the contest a formal



Figure 6: Impression of the winning design

decision-making process about the infrastructure (of which the bridge was a part) was taken place. Later that year the Minister decided for a traditional and cheaper alternative due to political issues (international financial crisis). Before this decision Achterbosch had sent a letter to inform about the possibilities to make the design much cheaper, but he was informed by a letter about cancelling the plan without reference to his proposal. In the end Achterbosch and the partners had great frustration about the whole process.

Analysis

Innovation process – The following phases of the discontinuous innovation process described by Veryzer (1998) can be identified: The drifting phase matches with the 72 ideas that applied for the contest as well as the brainstorm sessions within the organizations of the participants. The convergence phase is identical to the first phase including the selection. The technical champion

plays an important role, because he had to convince the jury with an innovative design and a convincing representation. Contextual factors did not play an important role at this particular moment (see 'Champions'). After the first round, three parties got the opportunity to elaborate their ideas. Eventually, the jury decided that the idea of Achterbosch Architectuur was the most promising idea and he won the contest. This phase is similar to the formulation phase. After the formulation phase, the winner made an exploitation plan together with the parties described by 'actors', and prepared the design for the next phase; formative prototype. After this 'preliminary design phase', the problems occurred and the innovation process faltered, because of the reasons described by 'Contextual factors' and 'Champions'. Although RWS had the *intention* to organize a *follow-up process*, they did not anchor this phase in the innovation contest. RWS and the follow-up were dependent of the Ministerial decision about the infrastructure.

Innovation process falters:	Between 'preliminary design' and 'formative prototype'
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Champions - The main champion in the whole process was the architect of Achterbosch Architectuur who convinced the jury in the 'convergence phase' and the 'formulation phase'. In the preliminary design phase he contacted the other parties and tried to stimulate realization by contacting RWS several times. He was mainly a *technical champion* but also an *organizational champion*. The organizational champion within RWS was the organizer of the contest during the innovation contest. After the contest, the minister has to decide if the design would be executed. It was the same minister (Camiel Eurlings) who set the ambitions on a high level by writing the foreword of the start of the innovation contest: *"The ambition is to make the 'switching function' more visible. With a design of permanent aesthetical value, a design that is sustainable and innovative."* This gave the suggestion that minister really wanted to realize the winning design. But new political issues became dominant influencing the whole process. This is typical for politics and can't be the responsibility of the organizational champion. This does not mean that political sensitivity is not an important competence, but this cannot all be attributed to the organizational champion. Eventually the minister decided to choose for the simple solution, which was much cheaper. In the meantime, Achterbosch Architectuur came up with a cheaper alternative of the winning bridge, but the minister did not take this into account. Although the organizational champion of RWS could not convince the minister, it is hard to say that the innovation process faltered due to the organizational champion. There is no proof that this is the case.

Causes of faltering:	Not due to technical or organizational champions
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However, the absence of reacting on an alternative option, and the lack of communication resulted in a high degree of frustration and incomprehensibility within the driving force. The architect of Achterbosch mentioned: *"They (red. RWS) know that the plan could be cheaper; they just do not want to know how much. We do not get a jury report, so we have a very bad feeling about it after all. I find that, and I say it nuanced, scandalous. The government should be ashamed of themselves to death."*

Remark:	Lack of communication and explanation by RWS
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Contextual factors - The main contextual factor that influenced the innovation process was the 'financial crises'. This was the main reason that there was no money to realize the design. The minister wanted to save money, and ordered a regular bridge.

Cause of faltering:	No money due to financial crisis
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Although RWS –IJsselmeergebied was the initiator and organizer of the innovation contests, the minister had to decide about the realization of the plan. The minister is responsible for the whole ministry and so has more and maybe other interests than the regional department of RWS. These interests seem to conflict at the moment the minister has to decide about the realization of the bridge, due to the financial crisis. The overall contextual factor that can be attributed to the main cause of the cancellation of the realization is ‘dispersed government roles’. However, this may seem a common thing for internal people within RWS, but it is often difficult to understand for the external parties that participated in the contests. They often seem RWS, the ministry or even the national government as one entity. It results in incomprehensibility and frustration when becomes clear that the ambitions set in the start of the contest by a department of RWS are not pursued by another government entity that has the decision power, in this case the minister.

Competences – A broader perspective can be obtained by looking at the competences of the different actors. The competences (needed to realize innovations) by the different actors are discussed in the context of this case:

- **Discovery competence:** The *driving force* Achterbosch created an innovative plan, convinced the jury, involved technical collaborators and stimulated the realization by exciting the innovation supporter. They took the initiative to adjust the plan and make it more affordable. The innovation contest itself, organized by the *innovation supporter* RWS, was also satisfactory according to the participants. There is no proof that there was a lack of discovery competence.
- **Incubation competence:** A contractor, landscape office and wood manufacturer were involved in the project to exploit the plan. Initially, they would realize the bridge. Despite that the plan never reached the next phase, there are no clues as to why a lack of incubation competence occurred. The parties experiencing this competence did not have the opportunity or authority to realize it. They can be illustrated as ‘technical collaborators’.
- **Acceleration competence:** Nothing meaningful can be mentioned for this competence, because the project never came that far, but a contractor and wood manufacturer were already involved in the project.
- **Interface – Network competence:** RWS as an innovation supporter plays an important role as buyer. The owners in the construction sector are often major participants in the projects. They establish the mechanism which involved parties communicate and collaborate, make decisions on important technical matters throughout the project execution and sometimes share a proportion of the risk (Nam and Tatum, 1997). This kind of *network competence* is not executed well by RWS. Ritter and Gemünden (2003) divided this competence in *network management tasks* and *network management qualifications*. Especially, the *qualifications* are underdeveloped in this case. The innovation supporter was unaware of the objections of the minister and unaware of the new and cheaper plan of Achterbosch. Setting the ambitions concerning realization does also means that RWS has to take responsibility towards the participants of the innovation contest. Despite that the government did not use the results of the contest, it did have the responsibility to be clear, honest and respectful towards the participant, especially the winners who elaborated the plan to a next stage. The winner of the contest mentioned: “We did not get any substantive response to our plan.”

This lack of communication, social justice, self-reflectiveness and cooperativeness can be grouped under *social qualifications*. The lack of sharing information the rejection and about the handling of the newest proposal can be grouped under the lack of *managing relational specific tasks*.

Underdeveloped competence(s):	<i>Network competence</i> by innovation supporter (RWS) <ul style="list-style-type: none"> - Lack of <i>social qualifications</i> - Lack of managing <i>relational specific tasks</i>
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Conclusion – The process faltered between ‘preliminary design’ and ‘formative prototype’. Although *ambitions* and *intention* to organize a *follow-up* after the contest were made, this follow-up process was not anchored in the innovation contest. There are no clues that the cause of faltering can be dedicated to the technical or organizational champion. The official cause of faltering is that there was no money, due to the financial crisis. Participants of the innovation contest often see RWS, the ministry or even the national government as one entity. It results in incomprehensibility and frustration when becomes clear that the ambitions set in the start of the contest by a department of RWS are not pursued by another government entity that has the decision power, in this case the minister.

By performing comprehensive initial research about the willingness and available budget before setting up the innovation contest, these problems could be clear in advance. This knowledge can be used to a) conclude that this innovation contest would not be successful or b) to set up a different kind of innovation contest where the contest focuses only on the idea and not the exploitation (so, an idea contest). This would have prevented dissatisfaction by the different actors and spending tax-money on this innovation contest and the aftermath.

Positive effects of this contest were; publicity for the winner as well as RWS, The participants of the contests are still positive on the method ‘innovation contest’. RWS is moderately positive due to this contest. An involved employee of RWS mentioned: “*I am not very enthusiastic about innovation contest, because I think: You (red. RWS) ask a lot from the market, you suggest that there is a chance that they may realize it and you do not pay anything. Thus, you let work out all the ideas for free, and then you have all the freedom to decide whether you want to realize it or not.*”

Cause(s) of failure:
> No money for realization due to financial crisis
Remarks:
> Poor communication and sense of social justice
Reason(s) of failure:
> Lack of initial research (willingness and budget)

Case 3: 'Minder verkeershinder bij renovatie stalen bruggen'

Less hindrance during renovation steel bridges

Introduction – This innovation contest is the most recent and largest innovation contest held by RWS. The objective of the innovation contest was to come up with solutions to reduce the hindrance during the renovation of steel bridges. A new kind of concrete was already developed to increase the lifetime of concrete on steel bridges, but the implementation process takes more time with this type of concrete and results in hindrance on crucial points in the Dutch infrastructure. The innovation contest was set up to trigger the market to come with innovative ideas to reduce this hindrance.

Actors – Besides the 164 other participants the main actors were in, and mainly after, the contest:

- **Driving force:** Bureau Angenent (inventor) and Hurks Beton (concrete specialist) – the winners of the contest
- **Innovation supporter:** RWS – WnT*
- **Technical collaborator:** Strukton (contractor), Adhesion institute of University of Delft, KOAC NPC (Research facility), Van Steenis Geodesie (3D-measurement), Takke Breukelen (metal construction), Alleid Patents (patent law office) and Haas Video.

Organizer:	RWS
Program:	WnT*
Type:	Problem
Period:	Feb-09 – okt-09
Focus group:	Everybody
Rounds:	2
Participants:	165
Selected:	10
Winner (1):	Bureau Angenent & Hurks Beton
Award:	€500.000,-
Exploited?	<u>Not yet</u>

The course of the innovation contest – A lot of participants (165) came up with ideas and ten of them get rewarded with a selection. The ten selected parties got €100.000,- to develop their ideas further. After this second round, one winner was selected and won €500.000,-. If one of the ten selected parties really implements their idea on a bridge of RWS *within five years*, they would be rewarded with another €500.000,-. The winner of the second round was an inventor named Bureau Angenent together with a company specialized in concrete, named Hurks Beton. The winning idea is described in appendix 6. After the winner was announced, the innovation

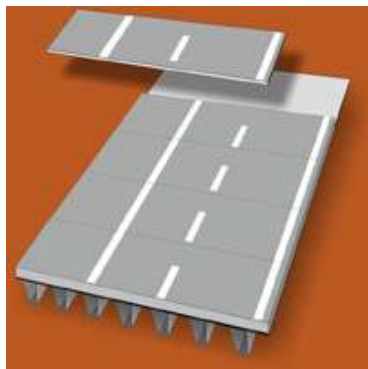


Figure 7: Impression of the winning idea

contest was finished and the innovation process was beginning to falter soon after. The ideas needed to be tested and proved 'in theory', before they are eligible for a pilot project. None of the main actors (the winner, RWS or Strukton) wanted to invest in this 'pre-pilot research' because Strukton and Bureau Angenent had no guarantees that it will be applied on the bridges. RWS did not want to subsidize this project because they argued 'that it was now the turn of the market', in line with the policy of RWS 'Market, unless...'. At the moment, the participants in the project are waiting for a graduate student to research this idea further.

Analysis

Innovation process – After the idea was born to set up an innovation contest the preparation began by the organizational champion of RWS. Important aspects were, besides budget and planning, the constitution of the jury and that all the members of the organizing team are on the same line (see next paragraph ‘Champions’). The innovation contest consisted of two rounds: In the first round all the ideas were judged by the jury and ten ideas were selected. (Convergence phase) The ten selected parties received a budget of €100.000 to elaborate their ideas (Formulation phase). Between the first and second round the selected parties (including the winner) involved other parties to make a solid impression towards the jury and create opportunities to develop the idea further. The jury picked inventor Bureau Angenent and concrete specialist Hurks Beton. The inventor received €500.000 (Preliminary design phase). Officially, the innovation contest was finished now, but if one of the ten selected ideas would be applied on a RWS’ steel bridge (excluding pilots) within five years, this organization will receive another €500.000,-. After the contests, RWS advised the winner to look for a large contractor to develop the idea further. Without a large reputable constructor it would be impossible to be eligible for a pilot project and certainly for a tender. Strukton got involved (a company that also participated in the innovation contest), but won’t invest in ‘pre-pilot research’. The winner mentioned: *“Actually none of these parties is willing to pay three or four hundred thousand euro’s. Why not? Because the risks are too high.”* The constructor even as the inventor considered the risks too high, because there were no guarantees that it eventually would be applied on a steel bridge. In the meantime, a large share of the steel bridges in the Netherlands is already tendered and including the research and pilots it seems impossible to apply the innovative idea on the RWS’ bridges within five years. The inventor mentioned: *“The problem is: It is possible to develop something, but RWS determines if you may apply it on a bridge. Maybe RWS says: ‘It is faster, but too expensive, so we will not do it.’ Thus you (red. developer) do not have any guarantees that it will be bought. When RWS says: ‘We will apply it on a bridge’, everybody is prepared to invest money, because it will come back.”* Although RWS’ intention to transform the innovative ideas eventually to useful innovations, they did not anchor a follow-up phase to stimulate this process, because they argued that this would reduce the amount of participants (and ideas). Individuals or small companies are not interested in a follow-up and would not participate if there was a follow-up added to the contest, is RWS’ opinion. After the contest it was the turn of the market to invest in the innovative ideas.

Innovation process falters:	Between ‘preliminary design’ and ‘formative prototype’
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Champions – The main champions in the process were the organizer of the innovation contest and the winner of the contest. The technical champion focused on the development of the idea and the involvement of parties that could develop this idea to a real product. The organization champion of RWS pointed the importance that everybody was on the same line and that the objectives and interests of RWS were clear. The objective of the contest was to generate ‘fresh ideas’, but the underlying interest was *publicity* for RWS as a facilitator. RWS is judged on the opinion of the user (the road user in this case) in the form of a mark. Even by *showing* the people and the market that RWS is concerned about innovations that reduce hindrance, this would improve the image of RWS. This does not mean that the ideas need to be realized, because the public have already seen *the concerns*. This interest has consequences for the design of the innovation contest and the reason *why* the innovation process falters. The reason ‘*why*’ will be explained in the next paragraph ‘Contextual factors’.

Cause of faltering:	Not due to technical or organizational champions
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Despite that there are no clues that the cause of the faltering is due to the organizational champion within RWS, the interest of the innovation contests (set in the preparation phase) do not contribute to the realization of the innovative ideas. The explanation can be read in the next paragraph 'Champion(s)'.

Remark:	The interest of the contest did not contribute to the realization of the innovative ideas.
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Contextual factors – The main reason why the innovation process falters is due to a lack of funds to support 'pre-pilot' research. RWS does not want to subsidize the pre-pilot research and Strukton, Hurks or Bureau Angenent does not want to take the risk to invest in it. There are no useful external funds that support research in this phase. Neither the winner was prepared to invest their prize money. The main reason that causes this deadlock is: *No follow-up process and budget*. The contest is organized as a two-round innovation contest that stops when the winner is announced. Within this project there is no (financial) room created that supports pre-research. It is not fair towards other market organizations to arrange this research *after* the contest; this was not the case if this was determined before the contest was initiated. Another difficulty is to arrange a follow-up afterwards is to find *internal support*. The winner of the contest mentioned: *"RWS do want to realize a pilot, but we have to pay the research to demonstrate that can be applied safely on a bridge. If this was demonstrated to the satisfactory of RWS, we would get the opportunity to construct a little piece on a bridge. This surprised us very much, because we already made plans en budgets based on the assumption that RWS would pay. Thus, they want to pay the pilot, but do not want to pay the pre-pilot research."*

The high number of participants can be dedicated to the high awards, good publicity possibilities, but also the arrangement regarding the IP-rights. The IP-rights of the ideas stays with the creator instead of RWS. In this innovation contest Bureau Angenent has the IP-rights and gets royalties when the idea is used. The amount of the royalties is secured in the innovation contest agreements. The decisions made in the preparation phase of the contest made this innovation contest a success regarding to the number of ideas, the publicity concerning the contest and the well-known jurors. The innovation contest cannot be labeled as 'success' regarding the realization of innovation. No preconceived *follow-up process* does not contribute to the realization of the ideas from this innovation process. However, RWS built in a trigger for selected parties to stimulate realization by awarding them with €500.000,- (by realizing the idea on a RWS' bridge within five years).

Cause of faltering:	- No funds available for pre-pilot research
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Competences – A broader perspective can be obtained by looking at the competences of the different actors. The competences (needed to realize innovations) by the different actors are discussed in the context of this case:

- **Discovery competence:** The *driving force* Bureau Angenent created an innovative plan, convinced the jury, involved technical collaborators and stimulated realization by exciting the innovation supporter. The innovation contest itself, organized by the *innovation supporter* RWS, was also satisfactory according to the participants. No clues are found that there was a lack of discovery competence.

- **Incubation competence:** A couple of research and manufacturing experts (see actors) were involved by the project to exploit the plan. Despite that the plan never reached the pilot phase, there are no clues of a lack of incubation competence. The parties having this competence did not have the opportunity or authority to realize it. They can be illustrated as ‘technical collaborators’.
- **Acceleration competence:** Nothing meaningful can be mentioned for this competence, because the project never came that far, but a large contractor Strukton was already involved in the project.
- **Interface – Network competence:** RWS as an innovation supporter plays an important role as buyer. The owners in the construction sector are often major participants in the projects. They establish the mechanism by which involved parties communicate and collaborate, make decisions on important technical matters throughout the project execution and sometimes share a proportion of the risk (Nam and Tatum, 1997). This kind of ‘network competence’ is not executed well by RWS. Ritter and Gemünden (2003) divided this competence in ‘network management tasks’ and ‘network management qualifications’. After the contest, RWS had a ‘facilitating role’ and a few of the network management tasks were performed. RWS made also decisions that positively affect the innovation process, like the IP-rights that stays with the creator (instead of RWS). However, there was no real intention to perform as a network manager *after* the contest.

Underdeveloped competence(s):	<i>Network competence</i> by innovation supporter (RWS): <ul style="list-style-type: none"> - Lack of network management tasks <i>after</i> the contest
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Conclusion – This innovation contest is successful in many ways, but the ideas are starting to falter as soon as the contest was over (between ‘preliminary design’ and ‘formative prototype’ phase). The cause of faltering is the lack of available funds. None of the involved parties want to invest because the guarantees to apply it on the steel bridges were not there. Afterwards it is hard to financially support the winning companies, because of legal reasons and internal support. However, realizing the ideas was not actually the interest of this innovation contest. The *objective* was to come up with a lot of innovative ideas, which succeeded. The *interest* was to promote RWS towards the market and the (road) users. In this light the contest succeeded, but the choices made by RWS to fulfil this interest have negative consequences for the realization of innovative ideas. The choice to not link a follow-up process to the contest, results in ambiguity towards the application of the ideas. The market does not want to invest in the ideas, because the risks are too high. It resulted in a deadlock whereby none of the participants want to invest in the development. However, the choice to let the market keep the IP-rights stimulated participation in the innovation contests.

Cause(s) of failure:
> No funds available for pre-pilot research
Remark:
>Objective and interest of RWS do not support realization of innovative ideas
Reason(s) of failure:
> No follow-up process after the contest

* WnT means ‘Wegen naar de Toekomst’ (Roads to the future) and is an innovation program of RWS. This program realizes pilot projects and demonstrations, which could contribute to the improvement or solving of mobility issues, based on a future vision of 2030.

Case 4: 'Kribben van de Toekomst'

Groynes of the future

Introduction – RWS East-Netherlands set up an innovation contest to come up with innovative solutions for groynes. In the Netherlands, since 1830, river groynes have been needed to fix the fairway in the river bed and improve the (safe) discharge of ice. These conventional groynes have proven to be reasonably effective up until today. However, the current context of the river groyne has changed significantly and their performance must now be considered in a modern and far more complex context. This new context comprises contradictory demands such as reduction of peak water levels and improvement of the fairway in terms of navigability. Additionally, it is considered necessary to restore and improve ecological values, spatial quality and to halt the ongoing bed degradation of the river caused primarily through river normalization and training.

(Source: Presentation Consortium Kribben, one of the winners) Eventually four winners were selected and awarded with €20.000,-. None of the four winners developed the ideas further.

Organizer:	RWS
Program:	East-Netherlands & RvR*
Type:	Problem
Period:	jun-06 – sep-06
Focus group:	Everybody
Rounds:	2
Participants:	11
Selected:	4
Winners(4):	Consortium Kribben DN Urbland Robusta – Tébézo Alkyon
Award:	€20.000,-
Exploited?	No

Actors – Besides the seven other participants the main actors in, and mainly, after the contests were:

- **Driving forces:** Royal Haskoning, DN Urbland, Robusta-Tébézo and Alkyon
- **Innovation supporter:** RWS – East Netherlands
- **Technical collaborator:** CUR Infra & Bouw (Support for initiating and relaunching of projects, searching for the right business partners and arrangement of financial resources) University of Delft, Radboud University of Nijmegen, Bureau Stroming, Struiksma River Engineering

The course of the innovation contest – The regional division of RWS East-Netherlands and CUR Infra & Bouw set up this innovation contests because of the reasons described above. Eventually eleven participants came up with concrete ideas of which four were selected and awarded and two got a 'special mention'. The organization suggested that the ideas would be realized in a



Figure 8: Winning idea of Consortium Kribben

pilot, but *during* and mainly *after* the contest it became clear that a pilot would not be executed. The regional division did not have the financial resources and authority to realize pilot projects and for this reason the winning ideas needed to be integrated with the national program 'Ruimte voor de Rivier' (Room for the River; RvR). Another organizational champion was appointed to integrate this project into the national program. Shortly thereafter the projects were cancelled because it was in conflict with the objectives of the

program. A year after this decision, RWS invited one of the winners (Consortium Kribben) to see what the opportunities were. However, the conclusion was about the same; they do not want to spend money on research concerning this project.

Analysis

Innovation process – RWS East-Netherlands *initiated* the contest and asked CUR to *execute* the innovation contest. CUR is an organization which brings the demand and supply sides in the field of innovative knowledge together in a safe, independent environment, where common interests are the central issue (Source: website CUR). The innovation process started with the set up of the contest and a briefing. A lot of potential participants dropped out because there were no ‘hard’ guarantees that a development/research phase was included and the rules concerning IP rights were disadvantageous. However eleven participants came up with concrete ideas and the hope that the ideas would get a follow-up. Four of them get a reward and won the contest. One of the winners mentioned: *“Prior to the innovation contest we have spoken with the coordinator of RWS about when an innovation contest is interesting for us. It is interesting if you win the contest that you get the possibility to do something with it afterwards. Only winning a contest does not matter to us, it does nothing for us. The publicity in the Netherlands is very limited, it is nice, but the possibility to execute is important for us. If it is finished after the contest itself, we cannot make any business case of it.”* These phases are comparable to the drifting, convergence and formulation phases. The regional division did not have the financial resources and authority to develop the ideas further and to organize pilots. The winning ideas needed to be integrated in the national program ‘Ruimte voor de Rivier’ to realize these pilots including research. A new organizational champion of RWS was appointed to integrate the ideas into this program, but noted that RvR was not enthusiastic about the plans. The managers in this program were afraid that these new ideas (including the development) would threaten the objectives of the program. An important objective in this case was that all the groynes needed to be lowered before 2015. The new ideas could jeopardize this objective and also result in extra costs (for development activities). The organizational champion of RWS mentioned: *“I took over the project and within the program RvR they said: ‘For this kind of jokes we do not have time and money. We have a tight time schedule.’”*

This decision was disappointing for the winners and the new organizational champion, especially because RWS made the suggestion that there would be a follow-up phase. The director of Water and Navigation of East Netherlands, mentioned: *“A real innovation is not finished until it comes to execution. We have to work very hard concerning further research to eventually realize optimal groynes. Because that is what we want!”*

After about a year, Royal Haskoning (the leading organization within Consortium Kribben) got the invitation to come to RWS and talk about the possibilities of their idea. After one session, RWS concluded that they do not want to invest in research and development of this particular idea, actually because of the same reasons (but stated more vague) as why this project was cancelled a year earlier; no money and in conflict with national program. This was the final deathblow of the project. In the meantime, Alkyon and Robusta (both winners) started to work together to develop the idea of Alkyon. Together with Deltaris (independent research institute) and IPC (patent centre) they develop Alkyons idea further. At the moment they are executing tests. Instead of focussing on the Dutch groynes, they are now focused on the foreign market.

Innovation process falters:	Between ‘preliminary design’ and ‘formative prototype’
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Champion(s) – The main technical champions in the whole project were the four winners. The main technical champion within Consortium Kribben was Royal Haskoning. CUR was the organizational champions *during* the contest and an advisor of the national division of RWS *after* the contest. The participants were satisfied with the procedure during the contest and the level of knowledge of the jury. After the contest, neither CUR nor the regional division of RWS had the authority (and financial resources) to arrange a follow-up phase, like research and a pilot. An adviser of RWS was appointed to integrate the innovative idea into the national program RvR. However, the managers of the national program had other plans and objectives which did not match with the innovative ideas of the contest. The organizational champion did not have the ability or the authority to convince the managers of the program. Nevertheless, the conflicting interests of the program and the contest cannot be dedicated to the organizational champion within RWS. He mentioned: *“The management of RvR was actually not that enthusiastic. East-Netherlands was not unsatisfied if RvR would take over the project, because this would be good for the continuity of the project. East-Netherlands actually want to cancel it. My opinion was that this was not correct. We were owed to continue the project, because the participant put time, money and energy in this project.”* Unfortunately, these good intentions did not result in a follow-up phase.

Cause of faltering:	Not due to technical or organizational champions
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Contextual factors – The project faltered because it was in conflict with the national program RvR. The managers of the program did not want to invest in this project because they were afraid that this would threaten the objectives of the program. The organizational champion did not have the authority and financial resources and was dependent on this national program. Dispersed government roles and interested can be mentioned as the main cause of failure. A winner of the contest mentioned: *“They told us a couple of times that it does not fit within the process”*

Despite the high level of expertise within the jury, but also of the technical collaborators, the management of RvR was not sensitive for the advantages of the innovative ideas.

Cause of faltering:	- In conflict with objectives national program (according to the managers of the program)
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Competences – A broader perspective can be obtained by looking at the competences of the different actors. The competences needed to realize innovations by the different actors are discussed in the context of this case:

- **Discovery competences:** The *driving forces* were the four winners and they created an innovative plan, convinced the jury, involved technical collaborators and stimulated realization by exciting the innovation supporter. The innovation contest itself, organized by the *innovation supporter* RWS and executed by CUR, was also satisfactory according to the participants. No clues are found that there was a lack of discovery competence.
- **Incubation competence:** Universities and specialists were involved to support the ideas and to show that the innovative ideas probably have a lot of potential. This could not convince the program managers of RvR, despite the large amount of scientific expertise.

- **Acceleration competence:** Nothing meaningful can be mentioned for this competence, because the project never came that far. Although a large contractor (Royal Haskoning), one of the winners, was already involved in the project.
- **Network competence:** RWS as an innovation supporter plays an important role as buyer. The owners in the construction sector are often major participants in the projects. They establish the mechanism by which involved parties communicate and collaborate, make decisions on important technical matters throughout the project execution and sometimes share a proportion of the risk (Nam and Tatum, 1997). This kind of 'network competence' is not executed well by RWS. Ritter and Gemünden (2003) divided this competence in 'network management tasks' and 'network management qualifications'. The *management tasks* are underdeveloped in this case, and especially the *coordination*. The innovation supporter did not coordinate the innovation contest well with the national program, or better; did not coordinate it at all. Coordination with the national program before setting up an innovation contest would probably make clear the problems in advance and saves a lot of disappointment. The organizational champion after the contest mentioned: "...there was insufficient reflection on the follow-up" A year after the project was cancelled; one of the winners was invited to scan the opportunities again. More or less the same reasons were mentioned by RWS why they do not want to invest. Inviting a winner again to reject the plans is a strange decision and does not prove strong *network qualification* of RWS.

Underdeveloped competence(s):	Network competence by innovation supporter (RWS): - Lack of <i>managing network tasks</i>
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Conclusion – The ideas falter short after the innovation contest is finished. Transform the idea from 'an idea on paper' to the reality was the intention of some people within RWS. However, the contest was not coordinated well with the national program. When the organizational champion of RWS wanted to integrate the innovative ideas into the program, he encountered different interests. The program wanted to achieve their goals and integrating the ideas would cost extra time and money. Despite the large amount of expertise and the potential of the ideas, this was not in the same line as the objectives of the program. The program RvR had the resources and authority in this case. This was not well coordinated by the regional division, as the organizational champion after the contest mentioned: "*The sphere and setting (condition that are necessary to complete an innovation contest successfully) were insufficient thought trough, is my analysis.*"

Cause(s) of failure:
> in conflict with <i>national policy</i>
Reason(s) of failure:
> Lack of initial research (national policy)
> Lack of coordination

* RvR is a national program of RWS. They let water flow more freely along 39 spots along the Rijn, IJssel en Maas, while making more opportunities for recreation. This should be realized between 1995 – 2015. The goal is to protect 4 million people against flooding.

Case 5: 'Schoner, stiller en homogener asfalt'

Cleaner, quieter and more homogeneous asphalt

Introduction – This innovation contest consisted of three different parcels, with each a different research question. The objective of the innovation contest was to improve the pavements by making them *cleaner* (improve air quality), *quieter* (sound reduction) and *more homogeneous* (increase lifetime).

The contests consisted of three rounds; the idea phase, development phase and implementation phase. Three winners were selected for each parcel, which resulted in nine ideas that went to the second phase. After the second phase, many ideas are executed in a pilot. Fortuitously, the nine winning ideas came from three parties, so for each parcel the same parties won.

Actors - Besides the 24 other participants the main actors in, and mainly after, the contest were:

- **Driving forces:** Heijmans, Dura Vermeer and BAM Roads
- **Innovation supporter:** RWS – innovation program 'Air quality' and 'Sound'
- **Technical collaborator:** KOAC-NPC, Nedmag, Nido, (*together with BAM in consortium SSH) M+P Consultancy, Van Kleef Engineering, TNO, Technical University of Delft, University of Twente and Witteveen+Bos (Consultancy and engineers)

The course of the innovation contest – It started with the idea to set up an innovation contest about new kinds of pavements or pavement processes, because of the reasons described in the introduction. After a comprehensive preparation phase, the contest started and the winners were announced after the first round. These winning ideas can be found in appendix 6. They get a budget to elaborate their ideas and afterwards the opportunity to exploit it in a pilot project. When the tests and monitoring was over a detailed rapport is made of all the pilots, which gave the winner the opportunity to apply for tenders in the future. Some of the innovations are used on daily basis nowadays; others not found a market (yet).

Organizer:	RWS
Programs:	Air quality and Sound
Type:	Problem
Period:	apr-06 – feb-07
Focus group:	Market
Rounds:	3
Participants:	27
Selected:	3
Winners (3):	Dura Vermeer Heijmans SSH*
Award:	3x €150.000,-
Exploited?	<u>Yes</u>



Figure 9: One of the successful innovations: the Shuttle Buggy

Analysis

Innovation process – A preparation phase was organized to gain clarity about the objective of the contest, budget, planning, awards, tenders and tender procedure, as described in the evaluation report. The organizers explicitly mention this as the first phase and the 'idea' or 'tender' phase as the second phase. The second phase was the tender procedure. This was the phase where the 30 participants could present their plans, ideas or designs, comparable to the convergence phase. After the jury decided which ideas won the contest, this phase was finished

and the tender was awarded to the winners. The jury decided that the ideas of Heijmans, Dura Vermeer and consortium SSH were the most promising ideas. This was the start for the development phase, which began with the elaboration of the winning ideas, comparable to the formulation phase and preliminary design. The winner got a budget to develop their ideas. When this preliminary design phase was finished and the ideas were well-proven, the winning parties got the opportunity to demonstrate and monitor their ideas by pilots. The budgets for the pilots were determined in the tender documents in advance. When the pilots were completed comprehensive reports were written which supports the ideas to join a tender procedure for other projects in the near future. In the end a detailed evaluation report is created.

Remarkable is the extensive preparation phase to determine and realize the objectives of the contest, the budget, the (tender) procedure and planning for the whole innovation process, including pilot spaces. In this phase the follow-up was anchored in the innovation contest. A second remarkable phase is the evaluation phase, which treated the whole process from preparation until realization. Most of the public evaluation report only threat the innovation contest itself.

Innovation process did not falter:	Comprehensive preparation, anchored follow-up process and evaluation phase
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Champion(s) – The main champions in the whole process were the organizational champion of RWS-DVS and the technical champions of the winning companies.

- **Technical:** Heijmans, Dura Vermeer and BAM – All large contractors and have a lot of experience with tender projects.
- **Organizational:** RWS – Dienst Verkeer en Scheepvaart (Division Transport and Navigation)

The technical and organizational champions participated in the whole project. The organizational champion involved different specialists in the different phases. He paid extra intention to the preparation phase to overcome problems in the future, the organization champion mentioned: *“Actually, you (red. initiator) start with an empty page. You determine the period in which the project needs to be realized and which parties you need to involve. First, you need a very internal view: How do I get sufficient support within my own organization? Thereafter, you have to think about the organization of the tender itself.”* The technical champions focused on the technical development of the innovative ideas.

Causes of success:	Good <i>preparation</i> of the innovation contest by the organizational champions within RWS
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Contextual factors – As mentioned before, not all of the nine ideas result in a useful solution for the future. The reason that can be found why these ideas are not applied is that there is *no market* for them. Thus, no parties are really interested to buy the product. This is due to a simple clarification: Legislation. A case example: If the law tells; pavement must have a noise level of X and this have to be measured when the road is constructed (year = 0). This does not mean that the noise level is the same after 3 or 5 years; the contrary. A innovative solution that keeps the pavement on the same noise level for about 10 years, would be a good innovation, but won't be applied, because there is no law that tells to control the noise level after a couple of years. The solution is probably more expensive and does not have benefit *for the buyer*. This also means, when the legislation changes concerning this topic, this may be a wanted solution

and thus a market is created. 'Legislation determining the market' is a common fact in the construction industry and is the factor that can be mentioned why some of the innovations are successful *at the moment*. As a winner mentioned: *"If the market does not ask for it and does not want to spend the money on it, then it will die in beauty."*

Other critics on the innovation contest that influences the process were the regulations concerning IP rights and the underlying interest of RWS. A winner mentioned: *"The regulations concerning the IP rights were unilaterally. Everything should become into the hands of RWS. I understand the issue about licences and that it is tax-money and that the government have to protect this etc. However, it is not fair that a market party have to transmit all the information and then another party earns the revenues. That's impossible. But this discussion is over because it is all well managed now by RWS."*

Besides stimulating innovation there were also political issues that played a role in this contest. Topics like *air quality* and *noise hindrance* were popular topics those days. The pressure on the government (and so RWS) increased to deal with pollution and mental health. One of the interests of the innovation contest was to show the stakeholders that they were dealing with the problem. On the question; was the contest actually used as a publicity tool, instead of an innovation tool, the answer of one of the winners was: *"I think it was a publicity tool for RWS, but this is also part of the identity of RWS; RWS does not exist actually. RWS are different entities and they all have to deliver products. The products (and this was literally mentioned by the project leader of the contest) were reports. That was his product and he needed to give publicity to the achievements as much as possible. We had to take care of the content. I would like to see that there was better balance between them. However, we learned as well. We were part of the 'Dutch school': Show by your actions what you are worth. Nowadays, first you announce, so the eyes are on you, and then you will be followed. That's a different situation. That is what I have learned."*

Competences – A broader perspective can be obtained by looking at the competences of the different actors. The competences needed to realize innovations by the different actors are discussed in the context of this case:

- **Discovery competence:** The *driving forces* Heijmans, Dura Vermeer consortium SSH created an innovative plan, convinced the jury, involved technical collaborators and stimulated realization by exciting the innovation supporter. Although large companies are not known for their discovery competence, they do have a R&D division, like 'Breijn' the R&D division of Heijmans. The innovation contest, organized by the *innovation supporter* RWS, was also satisfactory according to the participants. No clues are found that there was a lack of discovery competence.
- **Incubation competence:** TNO (research organization), technical universities, and consultancies were involved by the project to exploit the plan. They can be illustrated as 'technical collaborators' and had an important role in the testing and proving of the ideas. Including the experiences of the winners, which are large constructors and contractors, there is no clue that there was a lack of incubation competence.
- **Acceleration competence:** Companies like Heijmans, BAM and Dura Vermeer have a lot of experience with constructing and contracting of large a multiple projects. They know better than anyone to accelerate (new) products in the construction sector.
- **Interface – Network competence:** RWS as an innovation supporter plays an important role as buyer. The owners in the construction sector are often major participants in the

projects. They establish the mechanism by which involved parties communicate and collaborate, make decisions on important technical matters throughout the project execution and sometimes share a proportion of the risk (Nam and Tatum, 1997). This kind of 'network competence' is well executed by RWS. Ritter and Gemünden (2003) divided this competence in 'network management tasks' and 'network management qualifications'. The *(cross-) relational tasks* were executed and the necessary *qualifications* were available in this case.

RWS communicated and collaborated well with the participants, created clarity about the process which reduces the risks for the participants, but more important; RWS set budgets for each phase and each party to develop their ideas further. This result in risks reductions for the participants, because they know in advance that, if they prove their idea well enough, that they may exploit it in the following phase. This means that especially the tasks described by Ritter and Gemünden (2003) are well executed, like initiation, exchange, planning, organizing and staffing. It is also the case for the network management qualifications, like the specialist and social qualifications. A comment concerning the *tasks* was the coordination. One of the winners mentioned: *"Organizing the innovation contest around the holidays was difficult for us. We were not waiting for it, but we wanted to participate. However, I have experienced that working under pressure result in a kind of 'pressure cooker reaction' where there is no space for elaborations. You have to perform on that particular moment. In the first phase (tender) the time is limited, but afterwards we get more time."*

Strong competence:	Network competence by innovation supporter (RWS): <ul style="list-style-type: none"> - Well executed <i>tasks</i> - <i>Specialist</i> and <i>social</i> qualifications presented
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Conclusion – RWS set up a well-organized innovation contests which resulted in a couple of innovations that are still used in the daily business. A lot of attention is paid to the preparation and evaluation phase by which the organization champion reduced the risks for the participants and a good coordination and planning along the process. All the competences needed to realize innovation were available. The R&D divisions of the winning companies appoint the discovery competence; the research institutes, universities and consultancies have the incubation competence. The winning companies are especially good in acceleration. The network competence was present in the form of (the champion of) RWS. The only blemish is that some ideas have not found a market yet, due to legislation. This could maybe be foreseen in the early phases of the innovation contest by RWS or the participant of the contest. On the other; when legislation would change these innovations can still be exploited.

Cause(s) of success:
> Good preparation/initial research
Remarks:
> All innovation competences were present.
Cause(s) of (some) failures:
>No market due to legislation

6. Cross-analysis

Introduction – In this chapter the five case cases will be cross-analyzed to research the *relationships* and *differences* between the cases. These relationships lead to the conclusion and the answer of the research question. The analysis is split up in two parts; a part describing the process and related affecting factor, and a part about the discontinuous innovation *competences*. Finally, the question will be discussed if the faltering of the innovation process is a kind of unwillingness (there is no real intention to realize innovative ideas) or a kind of inability (there is a lack of competences to realize innovative ideas). The first part starts with a cross-model of the five cases and the characteristics of the innovation process:

	Innovation process:	1.Service area of the future	2.Expansion Dutch bridge	3.Less hindrance renovation	4.Groynes of the future	5. Quieter, cleaner & hom.
A	Phase of faltering	after preliminary design	after preliminary design	after preliminary design	after preliminary design	Did not falter
B	Follow-up anchored?	No decent follow-up	None	No decent follow-up	None	Yes, until pilot phase
C	Contextual factors	Dispersed government roles	Dispersed government roles	No development resources	Dispersed government roles	No market for some ideas due to legislation
D	Champions (Organiz.)	Replaced after IC	Not the authority to decide	Stopped after IC as champion	Replaced after IC	Guided whole process
	Champions (Technical)	Participated the whole process	Participated the whole process	Participated the whole process	Participated the whole process	Participated the whole process

Table 4: Cross-model of the five cases and the characteristics of the innovation process

A. Phase of faltering – The fail-cases falter in the early phases of the process. This equals the outcome of the first sub-research question. In the four fail-cases, the process faltered (right) after the contest, between the ‘preliminary design’ and ‘formative prototype’ phase. The success-case did not falter and made it to the ‘commercialization phase’. It should be noted that not all the ideas of this successful contest were commercialized; some of the ideas finished the pilot phase, because they did not find a market for their innovation.

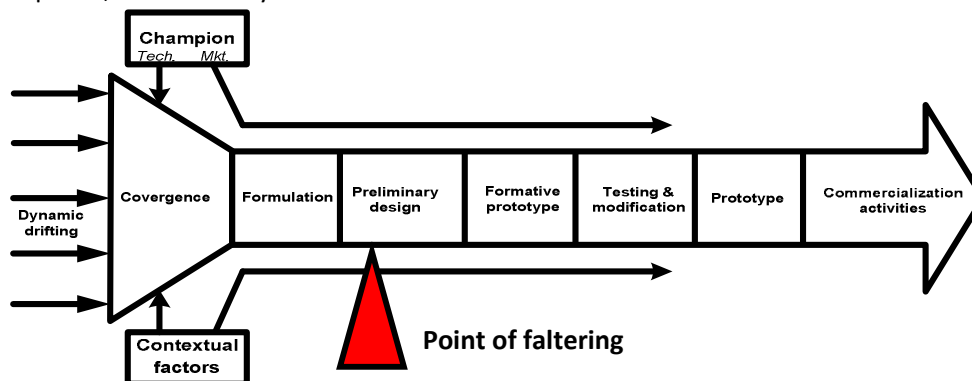


Figure 10: Point of faltering in the innovation process

B. Follow-up anchored in innovation contest - In all the fail-cases there was *no decent follow-up process anchored* in the innovation process. Although in all the cases the *propagated intentions* to further develop the innovative ideas were present, none of the four fail-cases *anchored* the follow-up in their innovation contest. However, the success-case *did* anchor a follow-up process in their contest. A 'follow-up' means that an extra process is added to the innovation contest, where the winner(s) get(s) the opportunity to develop their idea further by performing practical tests and/or pilot-projects. It is comparable with the *formative prototype, testing & modification*, and *prototype phases*. However, this requires more and other knowledge and resources than arranging (only) an innovation contest: Financial development resources are needed; human resources are needed with knowledge and experience about development and legislation; and test and pilot spaces to monitor and test the innovative ideas. 'Decent' means (in this context) that these aspects are arranged and *internally supported* in the organization.

The 'follow-up' can be arranged *in advance* (before the innovation contest is officially started) and thus *anchored* in the innovation contest, or can be arranged *after* the contest is finished. However, the cases show that this last option is very difficult, due to the following:

- *Legal reasons*: It is not allowed for governmental organizations to favour commercial parties by 'sponsoring' research and development. It does not matter if they are a winner of a contest or not, because this follow-up process is not announced in advance as part of the innovation contest. It would not be fair if the winning parties get the possibility to develop their ideas in practice, while this was not pre-arranged. This is illustrated in *case 3* where RWS hoped/expected that the winners would develop their ideas further. At the time it became clear that the winners would not take the risk to invest in the development, RWS did not have the possibility to sponsor this follow-up phase, because of the tender legislation.
- *Arranging internal support (within RWS) for a follow-up*: To organize a follow-up process it is important to embed this project in the organization and thus find internal support for the plan. For example financial resources for development come from other budgets than innovation contests; pilot spaces are the responsibility of project managers; and expertise needs to be arranged at other departments or externally. Arranging internal support *after* the contest seems to be much more difficult than *before* the contest. The obstacles become clearer in this phase. At the beginning of the contest everybody is enthusiastic to solve a problem or create something new, but when the new plans are formed it becomes easier to mention the disadvantages and difficulties. The uncertainties seem to be much more apparent in this phase. This is well illustrated in *case 2* where the organizers of the contest were very enthusiastic about setting up an innovation contest to design a new and modern bridge. However, at the time the plans were submitted, the minister chose to realize a simple and cheaper bridge.

By anchoring a follow-up in the innovation contest these difficulties can be overcome, like in the success-case (*case 5*). Before the innovation contest is actually set up, the organizational champion arranged the *internal support, budgets* for the development process, involved external *expertise* about (tender) legislation and arranged *pilot-spaces*. Thus, the main obstacles that appear right after the innovation contest were overcome in advance. However, anchoring a follow-up requires more money and more (and different) expertise in the different phases. Besides, (tender) legislation plays a more important role. The case showed that its investment paid off concerning the realization of innovation. The participants were pleased to join the

contest, because they can not only win a prize (money and publicity) but can also gain knowledge and experience concerning innovation. The organizational champion of the last and biggest innovation contest (*case 3*) argued that this method only attracts (large) professional organizations, like constructors. Individuals and small companies are not interested in a follow-up process and would not participate in the contest. There are no direct clues found in the cases that support this argument. In the same case (*case 3*) the winner was an individual inventor, who would have loved to develop the idea further together with a constructor. However, both parties (inventor and constructor) would not take the risk to invest in the follow-up, because they did not have any guarantee that the idea would be applied in the (near) future.

The success-case showed that a follow-up anchored in the innovation contest is very important concerning the realization of innovation. On the other hand, when it became clear that there was no internal support for the innovation contest, the contest was prematurely be cancelled. This saved money and problems later on. The fail-cases confirm this actually, because they falter right after the contest is over and mainly because of factors that can be overcome in advance:

C. Contextual factors – The contextual factors have a dominant role in the innovation contest. In all the five cases (including the success-case) many contextual factors influenced the innovation process in a negative way. The main contextual factors that appear to be the causes of faltering are:

Dispersed government roles – In three cases (*case 1, 2 and 4*) dispersed government roles were the main cause of faltering. The programs or department who set up the contest want to stimulate innovation and get innovative ideas out of the market. The governmental authorities (minister, major or program manager) that were needed to develop the idea further had different interests. They had their own deadlines and were afraid that innovation development would take too much time (*case 4*); did not want to invest in architecture in times of economic crisis (political issue in *case 2*); or the innovative improvements had negative effects for their region (*case 1*). It is important to notice that not only the difference in government roles illustrated in separated government organization; also in the organization itself (in this case RWS) are different roles, interests and objectives, as illustrated in *case 4*. It is difficult for participants of an innovation contest to understand this aspect, because they often see RWS or even the government as ‘one’ organization. This results in frustration and incomprehensibility when a certain division wants to stimulate the project, while another division (with the authority and power) does not want to invest in it, like in *case 1, 2 and 4*.

Lack of development resources – The lack of development resources to stimulate innovations made organizations decide that they would not be able to develop their ideas any further. This is especially the case in *case 4*, but also more or less in *case 2*. It can interweave with the previous point, but the lack of resources also concern the winning parties which do not want to make resources available, or concerns the lack of (inter)national funds to stimulate development of innovation. These are not only financial resources, but also expertise and pilot-spaces. A deadlock occurs when the *innovation supporter* (seeker) does not want to sponsor the development, while the *driving forces* (winning solvers) does not want to take the risk to invest in it. The argument of the seeker to not invest in the development is mainly because of policy reasons: It is now the turn of the market to invest, because they are one who eventually benefit from it (by making profit out of it). The argument of the solvers is that they do not want to invest, because there are no guarantees that RWS would apply it in the future, while RWS is (one

of) the main buyer(s). Besides, the restraint of the solver also results in a kind of distrust in the innovative ideas. This creates a deadlock, which is clearly illustrated in case 4.

Legislation – Legislation made it difficult (or even impossible) to develop the plans. This especially became clear in *case 1*. As described in the theoretical framework, legislation plays an important role in the construction sector. It is quite simple: If the realization of an innovative idea is forbidden by law, it is not permitted to realize it. However, legislation can also play another role, which is illustrated in *case 5*. The legislation can create or demolish a market. If the innovative idea has higher qualities, but there are no laws that tell that a certain construction needs to meet these qualities, the innovations will not be bought, unless the innovation is the same prize or cheaper. On the other hand, when legislation changes it can also create markets.

All the reasons of failure can be attributed to one or more of these contextual factors. The organizational champions of the innovation contests had not foreseen these factors *or* chose to accept them in advance. However, this does not mean that these problems could not be prevented.

D. Champion – In *none* of the fail-cases clues are found that the faltering of the innovation process can be attributed to the *technical or organizational champion*. This supports the assumption that the contextual factors play a dominant role in innovation processes in the construction sector. However, other statements can be made regarding the technical and organizational champions:

Technical champions depend (heavily) on the organizational champions – Technical champions triggered RWS to continue the project and/or adjusted their plans to the wishes of RWS. The *key* champions in these projects were the *organizational champions* of RWS. They were in a position to design the contest, to oversee the threats during *and* after the contest, and are the link to the higher level managers who make the resources available. They represent RWS as an innovation support and have the power and authority to stop the process. RWS is in these cases also the most important buyer and asset holder on the market. This means that the winning parties are not able to build a groyne, bridge or national road in their backyard to test and monitor the innovation. This is illustrated in case 2, 3 and 4. The technical champions do not have this power or authority, but can find other alternatives. In case 4, two winners of the contest are developing the idea further for foreign markets. In other cases, the winners do not have international contacts or innovation would not be attractive for foreign markets.

Replacement of organizational champions does not contribute to the realization of innovation – In the first and fourth case the champions changed after the contest was finished. Another employee became responsible for the aftermath of the contest. However, the new champion had to reinvent the wheel, and set up the contacts with the other actors. For the other actors it was not always clear to get in contact with the right people after the contest. Although this is not the cause of faltering, it is important that the process is guided by the same organizational champion, because he/she can keep the overview and contacts with other actors.

The organizational champions are not well supported by RWS – In the first case, but also the success-case (case 5) it became clear that the organizational champions were not well supported by the organization. This means that there are no guidelines for managers to set up an innovation contest and it is unclear to them where they can find relevant information, for

example about legislation or related projects. This means that each manager that wants to set up an innovation contest has to start with an empty paper. In the success-case the organizational champion already had experience with innovation contest, but this is certainly not the case for all the champions. Information and guidelines about innovation contests is not only important for the organizational champion, but also to be clear and transparent towards other internal or external parties.

Overall, the processes *during* the contests were well organized. Sometimes some small problems occurred, but these did not compromise the innovation process. However, *after* the contest the problems did transpire. Having the knowledge of *legislation* and *dispersed government roles* may be expected of an organization like RWS. These aspects need to be clear before setting up an innovation contest, and should not be ‘experienced’ afterwards. This is also the case for *development resources*; if RWS wants to realize or stimulate innovation, the resources need to be in order. Financial resources, pilot spaces and staffing for a follow-up process need to be arranged *before* an innovation contests even starts.

Sub-conclusion – The ideas from innovation contests falter soon after the contests are finished (between the preliminary design and formative prototype phase). The main reasons are contextual factors: Dispersed government roles, lack of development resources and legislation. There were no follow-up processes anchored in the fail-cases to overcome these problems. The consequences of the decision to keep from anchoring a follow-up are the difficulty to find internal support, and legislation makes it almost impossible to arrange such a process after the contest. Thus the chances are high that the ideas falter after the contest. The contextual factors have a dominant influence on the innovation process, but the champions are still important. Especially, the organizational champion has an important role to guide the process. Unfortunately, the champions are often switched after the contest and RWS does not support them by guidelines and a comprehensive information system.

Competences – The *discovery*, *incubation* and *acceleration* competences were present in all the cases. The discovery competence was represented by the creator of the innovative idea. This creator was the *driving force* of the project and involved other participants to develop the idea further as soon as it became clear that they were selected. These involved participants play an important role concerning the *incubation* competence and could be illustrated as *technical collaborators*. These were often universities, research institutes and consultancies. Besides these kinds of parties, the driving force also involved (large) contractors, which have experience with the *acceleration* of the innovation. Although the fail-cases never reached the commercialization phase, there are no clues that one of these three competences were lacking. As mentioned in the cross-table below:

	Service area of the future (C1)	Expansion Dutch bridge (C2)	Less hindrance renovation (C3)	Groynes of the future (C4)	Quieter, cleaner & hom. (C5)
Discovery	✓	✓	✓	✓	✓
Incubation	✓	✓	✓	✓	✓
Acceleration	✓	✓	✓	✓	✓
Network	X	X	X	X	✓

Table 5: The presence of the innovation competences in the five cases

However, the interface between these three competences and different types of parties could be much better. This interface is mentioned as *network competence*. A third party played

an important role here: *The innovation supporter*. In these cases the *innovation supporter* was represented by RWS. This interface between the three competences is especially important when more than one party works on the innovation, like in the cases. This network competence can be divided in four categories: Relational specific tasks, Cross-relational tasks, Specialist qualifications and Social qualifications. These tasks and qualifications were present in the cases and are illustrated in the cross-table below:

	Service area of the future (C1)	Expansion Dutch bridge (C2)	Less hindrance renovation (C3)	Groynes of the future (C4)	Quieter, cleaner & hom. (C5)
Relational	✓	X	X	X	✓
Cross-rel.	✓	✓	X	X	✓
Specialist	X	✓	✓	X	✓
Social	X	X	✓	✓	✓

Table 6: The presence of network tasks and qualifications in the five cases

Depending on the case at least two tasks and/or qualifications were lacking regarding the fail-cases. The aspects that cause most of the frustration among participants will be discussed here:

- *Relational specific tasks*: The main comments regarding these tasks consider the lack of *exchange* of resources and information, as well as the *coordination* with other ongoing projects. Overall, the interviewees were satisfied with the *initiation* of RWS to set up an innovation contest. The *exchange* of resources and information is especially a concern *after* the contest, because there are, for example, no budgets and pilot spaces for a follow-up, or there is a lack of information as to why the project was cancelled.
- *Cross-relational tasks*: The main comments regarding these tasks are the deprivation of planning, organizing and staffing *after* the innovation contest. These aspects were often well organized *during* the contest, but *after* the contest they disappear. This is in line with the lack of a follow-up process, described in the first part of this chapter.
- *Specialist qualifications*: The main criteria was about the absence of knowledge concerning *legislation* and *dispersed government roles*, but also the lack of expertise about the technical side played a role in one case. Participants expect that RWS has this knowledge, especially when the contest is already set up. Internally, guidelines are missing to set up a decent innovation process in combination with a comprehensive information system to support managers who want to set up an innovation contest.
- *Social qualifications*: The aspect that causes a lot of frustration, and in some cases even anger, was the lack of '*taking responsibility*'. This means that in every case, RWS had the intention to develop the ideas further and carry out these ambitions, which were sometimes sky-high. This resulted in a lot of expectations among participants; expectations that the ideas will be developed further and eventually will be applied in large numbers. When it became clear that the project stops soon after the contest, frustration and disappointment takes part within the participants. The settlement after the innovation contest is not well-organized.

Changing organizational champions after the contest in combination with the aspect that the new champion does often not know what to do further, results in a determination of the *communication* with the driving force.

Especially the lack of the specialist and social qualifications causes the frustration among participants, while the lack of managing the (cross-) relational tasks causes mainly a kind of incomprehensibility. As mentioned in the previous table, not all the *tasks* and *qualifications* are

lacking. Many *tasks* and *qualifications* are managed well, but it is obvious that RWS have to invest in this competence.

Sub conclusion – While the discovery, incubation and acceleration competences are covered by the driving forces and technical collaborators, the network competence were lacking in the fail-cases. It is mainly the role of the *innovation supporter* to fulfil this competence. Depending on the cases, RWS lacks to manage the network management tasks and/or qualifications, especially after the innovation contest. This is in line with the findings in the first part: the lack of a decent follow-up process, anchored in the innovation contest.

Unwillingness or inability – The main cause of faltering is due to the lack of a decent follow-up process anchored in the innovation contest to overcome the contextual factors that can negatively influence the process. However, is the lack of such a follow-up a conscious choice or is it due to a lack of competence or ability? If the innovation process is falters because of a conscious decision by RWS or deliberately not anchored a follow-up in the innovation contest, this is labelled as ‘unwillingness’. If the process is faltered because of events that go beyond the power and authority of RWS or because of a lack of competences, this is labelled as inability.

The cases are selected out of a pool with problem and design contests. These contests have the characteristic that they have the *propagated intention* to be realized. However, in the fail-cases this did not happen. Two explanations can be attributed to the reason why RWS should be ‘unwilling’ to arrange a follow-up, while the propagated intentions are to actually realize the innovative ideas:

1. Anchor a follow-up process in the innovation contest requires more resources (money, personnel and pilot spaces) and expertise (about legislation and development), than it is to keep from organizing a follow-up. RWS policy is called ‘Market, unless...’. This is the motto of the policy whereby RWS leaves as much as possible to the market. This also concerns the follow-up processes in these cases. It is the responsibility of the market to organize the follow-up, because the market also benefits from it when it is successful. Thus, ‘Not anchor a follow-up process’ can be a conscious choice supported by financial and organizational arguments, but can also have another reason:
2. In the cases 3 and 5 the objective was to generate as much as possible *ideas*, but the underlying interest was *good publicity*, instead of propagated intention to realize innovation. The cases 2 and 4 have also this appearance. By the propagation of the innovation contest and the generated ideas, RWS shows the market and the users that they are working on innovative solutions. They display their concerns and/or show they are an innovative organization. However, after the ideas are generated and the contest (including the ideas) are propagated, the interests are actually fulfilled. The users and market have seen where RWS is working on and show their concerns. There is no real need for RWS to add an expensive and difficult follow-up process, because the objective and interest is already fulfilled. By adding a follow-up the ideas need to be concealed for a longer time, and in case the innovative ideas are not as good as expected, the publicity will decrease. One of the organizers of an innovation contests mentioned: “*There are objectives and interests. The objective is to generate new ideas [...]. But the interest behind the contest is mainly to show the stakeholders that we try. Actually, it was more important to show the stakeholders that we are prepared to invest in it then to really find a solution.*” This means that the propagated intentions are to stimulate and realize

innovation, but the underlying intention of an innovation contest is good publicity for the organization RWS. This does not necessarily have to be in conflict, as mentioned in case 5, but the choices made before the start of the innovation contests in combination with the faltering soon after the contest indicates that publicity is the main intention of the innovation contests. These *underlying intentions* are thus paradoxical to the *propagated intentions*.

Both reasons affect each other, but it is clear that RWS does not necessarily want to realize innovation as stated in the beginning of the innovation contests. Three out of four fail-cases did not continue when the innovation contest was over due to a lack of internal support within RWS. Two of the four cases did not integrate a follow-up to stimulate the development of the innovative ideas and overcome obvious obstacles. Besides, managers of RWS acknowledge that *publicity* is a very important underlying interest of an innovation contest, as illustrated in case 2 and 3. However, it is too harsh to conclude that RWS is *really* unwilling to realize innovation, because there are also examples of successful innovation contests, and a lack of competences can also play an important role as mentioned earlier in this chapter and in case 1. The lack of network management tasks and qualification does not contribute to the realization of innovation either. Besides the interest are paradoxical, this does not mean they have to be in conflict, like in case 5. It is often difficult to conclude after something went wrong if it was unwillingness or inability. However, a combination of both does certainly not contribute to the realization of innovative ideas.

Conclusion – The ideas from the innovation contest falter soon after the contest is finished due to contextual factors. These factors could often be foreseen and overcome by an organizational champion to anchor a follow-up process in the contest. However, only in the success-case a follow-up was arranged. Anchoring such a follow-up may be more difficult and more expensive, but arranging it after the contest appears to be even more difficult because of legislation and arranging internal support. The main reasons why a follow-up process is not anchored is because of two reasons: 1) it is more *expensive* and *difficult*. Besides, it is the task of the market to develop the ideas further after the contest, regarding to the policy ‘Market, unless...’ 2) The innovation contest is used as a *publicity tool* and when the innovation contest is finished the objectives and interests are accomplished. Thus there is no real need to invest in a follow-up.

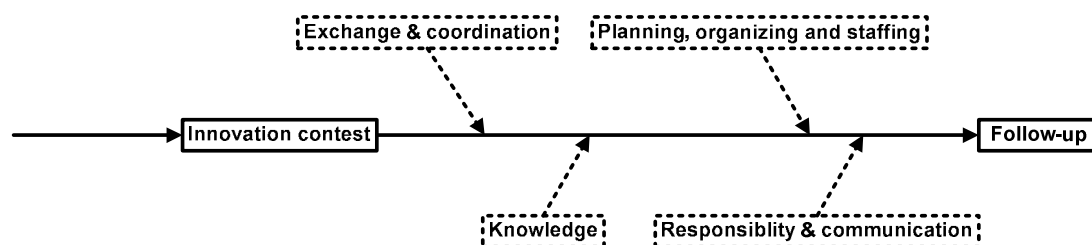


Figure 11: Importance of network competence concerning the follow-up process

The focus on the competences in the market results in the conclusion that RWS lacks the network competence; depending on the case tasks and/or qualifications lacked. This resulted in frustration and incomprehensibility among participants. However, the underdeveloped network

competence had a close link with the previous point about the absence of a follow-up, because these network competence characteristics, described earlier, are the main tasks and qualifications to set-up a follow-up process. Setting up a follow-up process requires initiation of the process, exchange of resources and coordination with other projects or programs (relational tasks). It requires planning, organizing, staffing and controlling of the process. RWS needs knowledge about legislation, government roles and technical knowledge within the organization. Last but not least, the social qualifications are important for a good working relationship. This is illustrated in figure 11.

The lack of network competence in the realization of innovations breaks up the innovation process. This network competence is especially important if there are different progressive actors involved. The innovation supporter/owner has an important role in this network competence and by not performing as one the innovation supporter dangers the innovation process and thus the realization of innovation. This is illustrated in the theoretical model by the striped areas. The arrow represents the completed first phases of the innovation process.

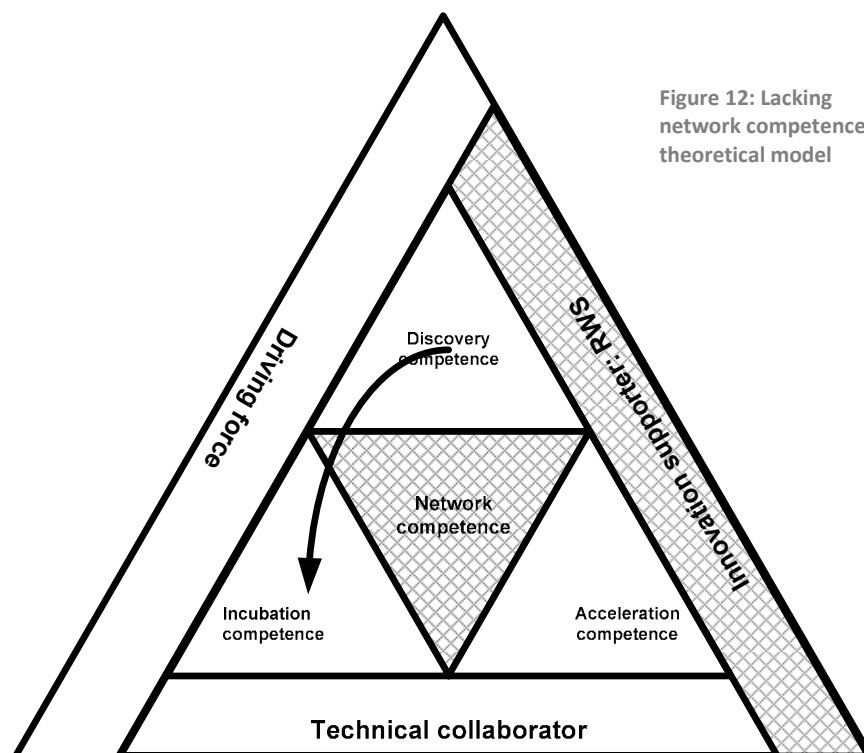


Figure 12: Lacking network competence in theoretical model

7. Conclusion

RWS organizes all kinds of innovation contests in the past decennia. From internal contests meant for employees to large-scale contests for anyone with a good idea. Many ideas came up, but unfortunately a small share was actually realized.

Three different types of innovation contests became clear during this research: *Idea*, *design* and *problem contests*. The *idea contests* (mainly focussed on 'crazy ideas' and no propagated intention to get realized) do not seem to be the right method to realize innovations. This also counts for the *design contests*. These types of contests mainly focus on the architectural part of the ideas, but *do* have the propagated intention to get realized. However, none of the ideas from these two types of contest are actually realized. The 'innovation contest'-method seems better suitable for the *problem contests*. These contests focus on the innovative aspect of the solution for a certain problem and have the intention to be realized. A significant part of the ideas from these problem contests are actually realized. Nevertheless, most of the ideas from these contests are not realized. The focus of this research is the innovation contests which are meant for the *external parties* and had the propagated *intention* to be further developed (problem and design contests) towards an innovation and/or architectural improvement. The question is *why* these ideas from innovation contests, despite this intention, never got realized.

These two types of innovation contests consist of two or three selection rounds where the selected ideas are further elaborated on paper. When the contest is finished, one or more winners are awarded with a prize and publicity. The (winning) ideas start to falter soon after the contest is finished. This is a phase of the development process where the ideas are still ideas on paper and need to be tested and proved in practice. Three contextual factors are *the main problems* and make the next step towards realization difficult or even impossible. The three factors that negatively influence this development are: *Legislation, conflicted interests with other governmental organizations or divisions* and the *lack of development resources*, like money and decent pilot space. The champions, the persons who lead the innovation process, have a less dominant influence, but are still important. No clues are found that the innovation process faltered due to these champions, but this does not mean that these problems could not be prevented. RWS did not support these champions well by guidelines, information or coordination systems.

In the unsuccessful cases, there was *no decent follow-up process* embedded in the innovation contest. The successful contest did embed such a follow-up process. It meant that an extra process had to be added to the innovation contest, where the winner(s) got the opportunity to develop their idea further by performing practical tests and/or pilot-projects. The three factors, which threaten the innovation process, need to be foreseen and overcome *in advance*; before the innovation contest is put together. This requires *internal support*, the right people with the right knowledge and connections and extra money. This is the first reason why RWS decided to not anchor such a follow-up. It is expensive, takes extra time and staff, and does not fit with the motto of the policy 'Market, unless...' This policy leaves as much as possible to the market. However, the participants of the contests do not often take the risk to invest in such a follow-up process by themselves. They argue that RWS 'owns' the market and as long as RWS does not want to stimulate these innovative ideas they do not want to take the risks. A winner of a contest mentioned: "*We cannot build a groyne in our backyard.*" This is also the case for

steel bridges, national roads and service areas along these roads: These assets all belong to the local and national governments. The different attitudes result in a deadlock, where innovation and the user are the victims.

The second reason to not anchor a decent follow-up process is because RWS uses the innovation contest as a *publicity tool*. The underlying interest of an innovation contest is that RWS wants to show the users and the market that they are working on certain problems; that they are looking for innovative solutions, and that they are an innovative organization. However, this interest is fulfilled when the contest is over; the innovative ideas are generated and these are well propagated. The message is conveyed towards the users and the market, so there is no real need to arrange a follow-up process. This *underlying intention* and the *propagated intention* are paradoxical and can result in incomprehensibility and even frustration by external parties.

These are the two main reasons why RWS chooses not to anchor a decent follow-up process in the innovation contests. This is the case when a *conscious* choice is made, but it can also be a kind of *inability*, or a lack of the right *competence*. Four different competences are researched to obtain a broader look of the competences needed to realize innovative ideas. RWS is insufficient capable to arrange their *network function* concerning the stimulation of innovation:

Many different organizations are involved in a project in the construction sector, and in an innovation contest as well. Small companies and R&D divisions provide innovative ideas, where research institutes, universities and consultancies help to develop and prove these ideas. Eventually, experienced contractors and manufacturers realize and commercialize these innovations. However, the *owner* and/or *initiator* plays the role as a *stimulator* and has *network function*. The owner and initiator of the innovation contests is RWS. They have a concrete problem with *their* assets and they are the *initiator* of the innovation contest to solve this problem. The capability to 'guide' this innovation process by RWS is lacking.

RWS did not arrange a decent planning, organization, control and staffing *after* the contests, which is in line with the absence of a follow-up process. RWS struggled with the coordination with other projects and programs and were not very generous with the exchange of (financial) resources and information. The qualifications needed to perform in such a position were also not always at the right place and the right time. RWS lacked the knowledge about legislation and about the interests of other governmental organizations and divisions. These aspects caused frustration among the (winning) participants, but most of the frustration came from the lacking *social* qualifications. RWS did not act according to their *propagated intentions* set in the beginning of the contest. RWS set the ambitions high, but do not take the *responsibility* to properly handle *after* the contests. Examples are the absence of a promised follow-up process and not being clear about the real reasons of cancellation.

The causes why the ideas from innovation contests do not get realized are *contextual factors*, like conflicted interests, legislation and lack of development resources. However, these factors can be overcome in advance by embedding a *follow-up process*. The decision to not arrange such a process is because this process requires extra money and is in conflict with the RWS' policy. Another reason is because it is also in conflict with the interest to use an innovation contest as a *publicity tool*. This may be a deliberate decision, but can also be an inability of RWS. RWS as a network manager did not manage the tasks and qualification well concerning their function. They lacked the right capabilities and did not act according to their intentions.

Recommendations

In this chapter four recommendations will be discussed. The objective of the recommendations is to make innovation contests more successful regarding *the realization of the ideas* and to make the innovation contest *more remunerative for participants*.

- **Embed a follow-up process in the innovation contest** – If RWS really wants to stimulate innovation by an innovation contest, it is essential to anchor a follow-up process in the contest. This research shows the importance of such a follow-up to actually realize innovation. However, this will require more money, time and expertise, *but* it stimulates organizations to participate in the contest, stimulates the development of the innovation and give (when successful) a *real* contribution to the problem. Eventually, the user and the market will benefit from these developments. If the case is that there is not enough money, time and/or expertise and the *main* interest is *publicity* instead of '*solving a problem by an innovation*'; one should be honest about it. This will save a lot of time, money and frustration.

The organization of a follow-up requires internal and external support and the right resources at the different phases. Expertise is needed about tender legislation and about the development of the specific innovation; tests and pilot spaces are required to monitor and test the innovation; and of course the financial and human resources to organize the process. These aspects need to be arranged before the innovation contest is set up. When it becomes clear that these aspects are impossible or difficult to arrange, the organizer has to decide to not even start an innovation contest, because it will falter later on in the process. This saves time, money, energy and frustration.

However, this preparation process should be supported by the organization. Guidelines concerning innovation contests are needed as well as supporting information and coordination systems. This is in line with the third recommendation.

- **Categorize innovation contests** – At the moment many innovation contests are organized with all kinds of different characteristics, intentions and objectives. This creates confusion. By categorizing innovation contests it is clear for the participants, but also for people within RWS, what kind of contest the organization is dealing with. The categorization defines the focus, intentions and expectations, so that participants will not be disappointed during and after the contest. A lot of disappointment and frustration comes from false *intentions* and *expectations*. If RWS organizes a kind of contest where the intention is to come up with real innovations to solve a certain problem, it has to be reflected in the whole process and contest. On the other hand; when participants know that the main interest is *publicity* and RWS only expects *ideas* (instead of innovations) they can anticipate on this. By categorizing the contests, like in this research, this will immediately become clear for participants and people within RWS. This research proposes three categories which can be used: *Idea*, *Problem* and *Design contests*. This categorization can be maintained or can be chosen for other categories. However, it is important to keep in mind that each category reflects a different focus of the contest. This also has to be reflected in the maximum amount of prize money, the course of the innovation process (number of development phases) and the focus group. A proposal is made in the following table, based on the findings in chapter 4:

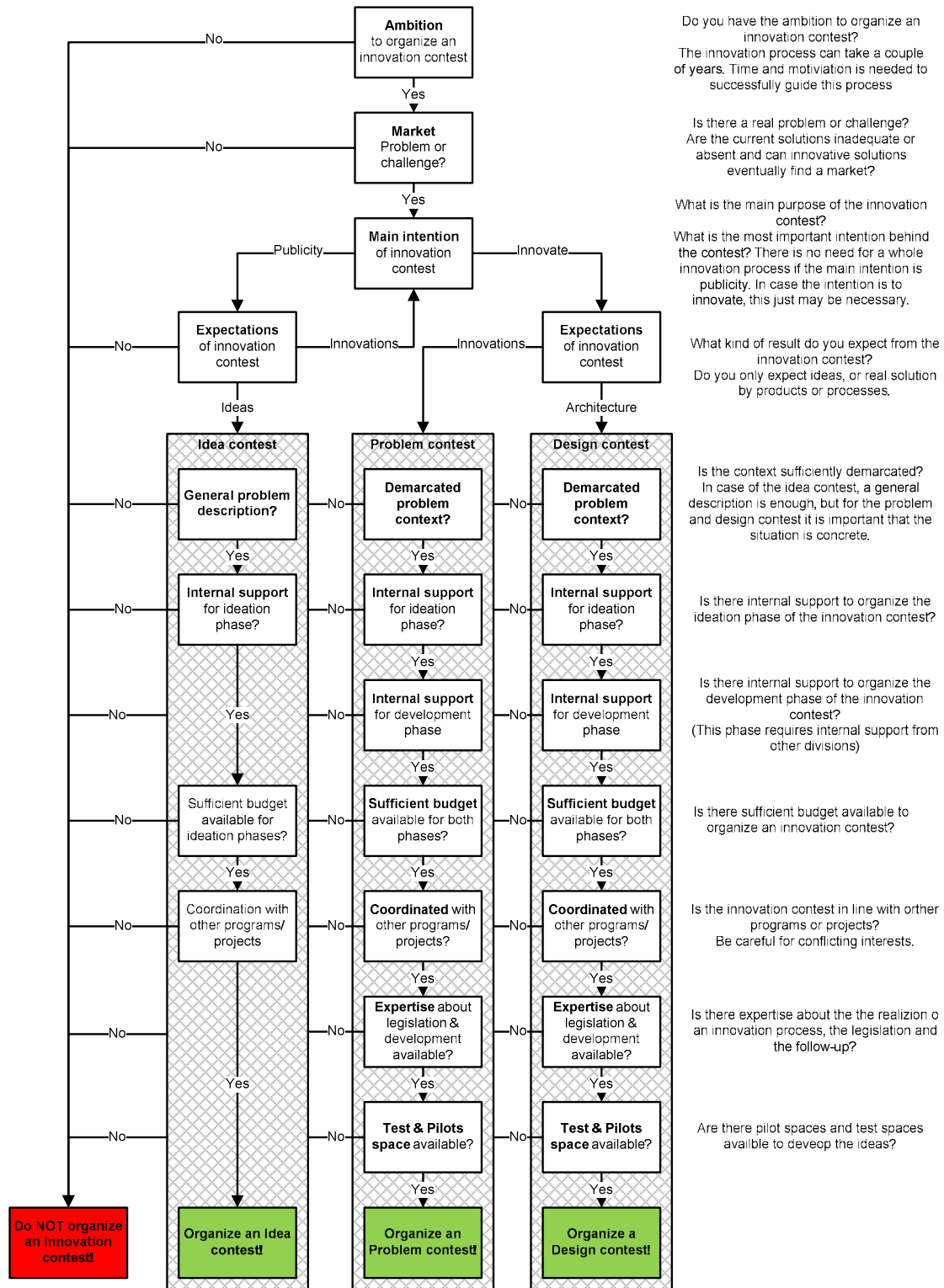
Characteristic:	Idea contest	Problem contest	Design contest
Intention	Publicity and promotion	Realize innovative solutions	Realize architectural improvements
Expectation	Idea (book)	(Prototype) product and report	Product
Problem context	Not concrete (general problem context)	Concrete (Place, max. costs, realization time)	Concrete (Place, max. costs, realization time)
Focus group	Broad (students – contractors)	Narrowed (market)	Narrowed (architects, designers, artists)
Prize money	<€5.000,-	>€20.000,- and compensation	<€18.000,- and compensation
Development phase(s)	Ideation	Ideation and development	Ideation and development

Table 7: Three types of innovation contests

A participant of a certain type of contest or an employee from another department immediately knows what RWS expect from them, but also what they may expect from RWS. This prevents a lot of incomprehensibility and frustration and provides a framework for the organizers of a contest. However, to organize an innovation contest, more support is required that needs to be provided by RWS:

- **Set up guidelines for innovation contests** – Only categorization is not enough for the *organizers* (champions) of an innovation contests. During the interviews it became clear that there were no concrete guidelines to set up an innovation contest. Every organizer started with a blank paper. There is also a lack of evaluation reports that can help to learn from previous experiences with innovation contests. This lack of available knowledge and information resulted in the fact that every organizer had to reinvent the wheel. Involved participants in the contests mentioned that they did not know where to collect the knowledge and expertise. The organization of an innovation contest actually requires three phases: *A preparation phase*, *a realization phase* and an *executive phase*. Each phase needs to be supported by the organization. The preparation phase is about to decide *if* an innovation contest is a useful method to a certain problem or challenge and which *type* of innovation contest is the best method to use? One of the options can be a decision tree to support the decision-making process. If an innovation contest is a useful method, the contest can be realized. It has to be clear which knowledge and resources are needed, and even more important, *how* to provide these resources and knowledge. The third phase is the innovation contest itself; information is needed how to guide this process, the organization of meetings and symposia. The guidelines concerning the last two phases have to be embedded in the knowledge system, because it is not very hard to imagine which resources and information are needed, but how to acquire them and coordinate them with other programs and projects is the difficult part. The preparation phase can be established by a decision tree, which can give answers to the questions *if* and which *type* of innovation contest is a right method to use. A proposal for such a decision tree for the preparation phase is described below:

Decision tree: Preparation before organizing an innovation contest



- **Invest in network competence** – The management of the *tasks* and *qualifications* needed to function as a network manager are insufficient regarding the stimulation of innovation. RWS needs to invest (more) in this competence to prevent problems in the future but also to maintain the bond with the market. With the current policy '*Market, unless...*', where as much as possible is left to the market, the risk of RWS is that they will lose the contact with the market. External organization receive much more freedom to perform their work, but it is still the task of RWS to be clear and honest about the framework, provide information (for example about legislation), and bring organizations together.

This recommendation is quite broad and can be executed in many ways. In some ways RWS is already working on it, for example by setting up a *comprehensive knowledge system*. Another improvement is the change in attitude concerning the IP-rights. In former times the IP-rights were kept by RWS, but nowadays the creator keeps the IP-rights and RWS only receives a licence. Many aspects have improved over the last decades, but there is still a lot of work to do concerning the stimulation of innovation by RWS. Ways to improve the network competence regarding the stimulation of innovation are:

- *Link the (new) knowledge system to innovation contests* – This is in line with the previous recommendation. Managers must have easy access to all the information and experience that is needed to set up an innovation contest. It has to be clear which contests are organized in the past, evaluation reports, guidelines, related projects and programs, contacts, information about legislation, etc.
- *Set up a central coordination system* – In a large organization like RWS, many projects and programs are going on. On the one hand, the (potential) innovation contest can come in conflict with the other projects and programs. This became clear during this research. On the other hand, the other projects and programs can just support the (potential) innovation contests. It is also better to work together. A central coordination system is needed to get a better understanding of the (ongoing) projects and programs and which of them is relevant for (potential) innovation contests.
- *Special funds for research and development* – To overcome the deadlock that can occur after the innovation contest is finished, RWS needs to set up R&D funds to stimulate development of the ideas. The organizers of the contests can use these funds to anchor a follow-up in the innovation contest.
- *Training* – Problems occur when managers have to deal with conflicting or paradoxical interests. Workshops are needed to communicate in an open and honest way with external parties. Often the communication deteriorates after the innovation contest, because the organizer is replaced by someone else, but also because the process after the innovation contest is not really clear. In case that it is clear that the innovation contest does not get a follow-up, it is hard for managers to be honest and open about it, because they were the ones who set the ambitions high and were enthusiastic about the potential results. Training is needed to set realistic and honest expectations and to deal with them during and after the innovation contest. This will save a lot of frustration and incomprehensibility by the external parties (the market).

More research is needed on how to improve network competence and how to organize and implement the recommendations described above.

8. Discussion

The contributions and limitations of this research regarding the current scientific literature will be discussed in this chapter. This will also give insight on which aspects further research is needed.

Contribution – This research put the ‘innovation contest’ in a broader perspective; in the perspective of the whole innovation process and the innovation competences. Scientific research about innovation contests is minimal and only focuses on the innovation contest *itself*. This research shows that implementing an innovation contest in the whole innovation process is essential to *realize* innovations. Embedding a follow-up in the innovation contest is not only important to develop the idea further, but also to *attract* serious participants. A follow-up process (to develop their ideas) is a great way to generate knowledge, develop innovative ideas and gain publicity. This might be more important than a high award, but it should be researched further. This research can also help potential participants of innovation contests to decide if they should participate in the innovation contest. The research gives conditions that are necessary to realize innovation from innovation contests. The potential participants can assess if the innovation contest meets these conditions and thus decide if it is attractive to participate.

However, as this research shows, *publicity* is still one of the underlying, but main interests behind an innovation contest. Realizing innovation is often subordinately. This is in contrast with Terwiesch and Xu (2008) who argue: “Despite attracting a significant *media attention*, the importance of these innovation contests has been rather small relative to the traditional innovation process. However, this is *currently changing*. With a growing trend towards outsourcing and off-shoring innovation-related activities, innovation contests and their applications have expanded from creating ‘crazy concepts’ to *solid R&D problem solving* in the recent years. (Terwiesch & Xu, 2008)” This ‘*current change*’ is not explicitly found in this research: The innovation contest organized by RWS only seem to be a *solid R&D problem solving* method under certain conditions and media attention (or publicity) is still the main interest. This research shows that innovation contests are still in the early phase of this suggested *change*.

Another contribution of this research is that it shows the *deadlock* between (executive) government and the construction sector concerning the development of innovative ideas. Governmental authorities ask for innovative solutions concerning problems with their assets. However, RWS is reticent to invest in the development of the solutions for a different number of reasons. The construction sector does not want to take the risks to invest in the innovative solutions because there are no guarantees that these same governmental authorities will apply it in the (near) future. Since these authorities are often the only or major buyer/owner, they fully depend on them. This is certainly the case for the process after an innovation contest and strengthen the recommendation to embed a follow-up process, but further research is needed to know how *broad* this problem is and how this problem can be resolved.

The last contribution of this research is the link between the *competences* needed to realize a mature innovation capability with the progressive *actors* in the construction sector. The *driving forces* appoint the *discovery competence*, the *technical collaborators* (like universities and research institutes) are involved because they have the *incubation*

competence and large contractors and manufactures (also involved as technical collaborators) have the *acceleration competence*. It is up to the *innovation supporter*, often the *owner*, to perform the *network competence*. This gives more insight on how the competences are divided in the construction sector and how important the network competence is in this context.

Limitations – This research focuses especially on the interaction between an *executive governmental authority* and the *construction sector*. On the one hand, as mentioned in the introduction, the construction sector is a very conservative market that does not invest much in innovation. On the other hand, RWS as an executive government authority, fully depends on the ministry and thus the central government. This may indicate that the political motives prevail in some cases. Thus, the generalizability is limited and further research is needed to get a broader understanding of *innovation contests* and the *realization of the ideas*. For example, large companies also organize innovation contest, but do not have to be concerned about tender legislation, tax-money or political motives. Further research is needed to know *if* similar problems occur in other markets, *if* these problems occur for the same reasons, and the role of the government in these markets. In other words; the generalizability of the research is quite low, but definitely gives leads for further research.

The second limitation is the unilateral view of the research, namely the view of the initiator of the innovation contest; RWS. Since RWS initiates and organizes the innovation contest it is not illogical to take this view and make clear what improvements are needed concerning the innovation contest and the process after. However, as mentioned before, the construction market is a very conservative market concerning innovation. Undoubtedly, many improvements can be made concerning the realization of innovation. This research does not focus on these aspects. Further research is needed to get a better understanding about the problems concerning realization of innovative ideas in the construction market.

A third limitation is the *absence of the organizational view* within an organization like RWS. This research focuses on the *contextual* and *process view* and gives reasons why innovative ideas from innovation contests are not realized, it does not give answers on how this process behaves in the *organizational context*. In other words; how the structure of the organization influences the innovation process and especially the process *during* and *after* an innovation contests. Dispersed government roles appear to be one of the main reasons why innovative ideas do not find a way towards application. Further research is required to get a better understanding on how these different roles conflict or stimulate each other concerning the stimulation of innovation. This can be on different levels: on an organizational level (RWS) or a national level (government system).

Another limitation of this research is that the 'potential of the ideas' is excluded from this research, which means that this research paid less attention to the potential of the innovative ideas from the innovation contests. The ideas are not assessed on their potential in this research, because this research mainly focussed on the *winning* ideas. RWS constituted the jury, which included a lot of expertise and the criteria. By organizing an innovation contest RWS was looking for innovative ideas and design to solve *their* problems. By awarding the ideas, RWS showed that these were the best and most promising ideas. There was no reason to doubt the potential of the ideas. Further research is needed if the innovation contest is the right method for gaining useful and potential innovative ideas.

A negative research question asks for negative answers. This research focuses on the reason why innovative ideas from innovation contest do not get realized and what the problems are during the innovation process. The consequences are negative conclusions and the appearance that everything is wrong within RWS concerning the stimulation of innovation. However, a lot of progression is visible in the last years.

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Appendix 1: Template 1 - Main characteristics innovation contest

Title:			
Initiator:			
Type:			
Rounds:			
Round 1:		till:	
Round 2:		till:	
Round 3:		till:	
Focus group:			
Participants:			
Selected:		Name(s):	
Winner(s):		Name(s):	
Prize/award:		Awards:	
Implemented:			
Jury:		Name(s):	
Organizers:		Name(s):	
Criteria:		Name(s):	
Status:			
Links:			

Appendix 2: Interview (Dutch)

Doel:	Interview om te achterhalen hoe het proces omtrent de prijsvraag is verlopen, waar de pijnpunten liggen en (eventueel) waarom het idee niet tot uitvoering is gekomen.
Middel:	Interview met betrokkenen van verschillende partijen.
Tijd:	Ongeveer één uur.
Opbouw:	Introductie, rollen van partijen, innovatieproces, Champions/trekkers, contextuele factoren, afsluiting.
Gebruik:	Analyse, citaten
Opname:	Digitale spraakrecorder

Introductie

- Wat was uw functie binnen de prijsvraag/project?
- Welke bevoegdheden had u tijdens het project?
- Voor welk bedrijf en afdeling was u werkzaam?
- Was u het gehele proces betrokken bij het project?

Rollen van de partijen:

- Welke partijen waren/zijn betrokken bij het project?
- Wat voor type partijen zijn dat?
- Wat was hun rol in het project?
- Hoe zag u de rol van RWS in het project
- Hoe waardeert u deze rol?

Proces:

- Is het idee geboren uit marktoverwegingen of vanuit technische overwegingen?
- Zou u gedetailleerd het proces kunnen uitleggen van het ontstaan van het idee tot waar het nu is?
- Op welk moment in het proces is het project stopgezet?
- Wat waren de voornaamste redenen om niet door te gaan met het idee?
- Was er een go/no go beslissingsmoment?
- Hoe zou u het proces *tijdens* de prijsvraag waarderen? Hoe zou het verbeterd kunnen worden?
- Hoe zou u de rol van RWS *na* de prijsvraag waarderen? Hoe zou het verbeterd kunnen worden?

Champion:

- Wie waren de voornaamste 'trekkers' van het project?
- (Richtte deze trekkers zich voornamelijk op het ontwikkelen van het product, de organisatie of beiden?)
- Wat deden deze trekker?
- Op welke moment ondervonden deze trekkers hinder?
- Wat voor hinder was dat?
- Hoe is er omgegaan met deze hinder?

- Op welke momenten werden deze trekkers ondersteund door andere partijen, bijv. RWS?
- (Op welke hiërarchische niveaus is er hinder ondervonden?)
- Hoe waardeert u de rol van de trekker?

Omgevingfactoren (wetgeving, subsidies, octrooirecht, standaarden, procedures):

- Welke omgevingsfactoren heeft u als hinderlijk ervaren? (Uitleg)
- Hebben deze factoren ertoe bijgedragen dat het project zou gaan stokken?
- Welke omgevingsfactoren heeft u als ondersteunend ervaren?
- Hebben deze factoren ook bijgedragen aan een beter proces?

Tot slot:

- Loont de prijsvraag?
- Vindt u de prijsvraag een goede methode om innovatie in de markt te stimuleren
- Wat voor cijfer zou u de prijsvraag geven en wat zou er anders moeten volgens u?
- Wat vindt u sterk aan de methode prijsvragen?
- Heeft u ook nog aan andere prijsvragen deelgenomen?

Appendix 3: Template 2

1. Actors in construction sector

- a. Driving force
 - i. **Initiate** the idea
 - ii. **Carry** ideas through the whole process
 - iii. **Persuade** other organizations to participate
 - iv. **Lead** the innovation process
- b. Technical collaborator
 - i. Provide (technical) **expertise**
 - ii. **Encouragement**
- c. Innovation supporter
 - i. **Sponsor**
 - ii. **Protect**
 - iii. **Owner** (mostly)

2. Competences/capabilities

- a. Discovery
 - i. **Create** RI opportunities
 - ii. **Recognize** RI opportunities
 - iii. **Elaborate** RI opportunities
 - iv. **Articulate** RI opportunities
 - v. **Exploratory** skills
 - vi. **Conceptualization** skills
- b. Incubation
 - i. **Matures** RI opportunities
 - ii. **Learning**
 - iii. **Experimentation** skills
- c. Acceleration
 - i. **Exploitation**
 - ii. **Predictability**
 - iii. **Managing** (high-) growth business skills
- d. Network
 - i. **Task** execution
 - 1. Relationship specific
 - 2. Cross-relational
 - ii. **Qualifications**
 - 1. Specialists
 - 2. Social

3. Discontinuous innovation process

- a. Visionary
 - i. Product champion
 - ii. Organizational champion
 - iii. Impetus
 - iv. Definition
 - v. Strategic context

- vi. Structural context
- b. Contextual factors
 - i. **Supply** oriented policies
 - 1. Funding
 - 2. Championship
 - ii. **Appropriability conditions**
 - 1. IPR regime
 - 2. standard setting
 - 3. Tax incentives
 - 4. Political elections
 - 5. Dispersed government roles
 - 6. Administrative decisions
 - iii. **Demand** oriented policies
 - 1. Procurement

Appendix 4: Innovation contests

- 2009 **Renovatie stalen bruggen met minder verkeershinder**
- 2008 **Uitbreiding Hollandse Brug**
- 2008 Kerend tij -2-
- 2007 Afsluitdijk van de toekomst
- 2006 **Schoner, stiller en homogener asfalt**
- 2006 **Kribben van de toekomst**
- 2005 INSIDE
- 2004 Nieuwe snellere bouwmethoden die de verkeershinder tijdens de bouw verminderen
- 2003 Lieverdjes kweken op de weg
- 2003 De reinigende weg
- 2002 **Verzorgingsplaats van de toekomst**
- 2002 IMAGO
- 2002 Kerend tij Terpen van baggerspecie
- 2001 Snelweghuis
- 2001 Uw signaal voor de toekomst
- 2001 Geluid
- 2000 Waterlandschap van de toekomst
- 2000 Geluidwerende voorzieningen langs rijkswegen
- 2000 Modulair wegdek
- 1998 Rijkswaterstaat 2013
Zuiderzeegebied geheel opnieuw inrichten, gebruik makend van de techniek zoals die nu
1996 voorhanden is.
- 1996 Nieuwe inwintechnieken van de MD
- 1996 Het ei van Columbus
- 1995 Het zuiverste water
- 1995 Duurzaam bouwen
Ontwikkel een methode of ontwerp een voorziening waardoor zeiljachten met een minimaal
1994 oponthoud voor water-, weg- en railverkeer bruggen kunnen passeren.
- 1993 Van bermgras tot duurzame bodemverbeteraar

Appendix 5: Interviewees (functions)

Role in the innovation contest:	Case:	Function:
Winner/technical champion	Case 1	Architect
Winner/technical champion	Case 2	Architect
Winner/technical champion	Case 3	Inventor
Winner/technical champion	Case 4	Project manager at construction company
Winner/technical champion	Case 4	Manager
Winner/technical champion	Case 4	Director
Winner/technical champion	Case 5	Innovation manager
Winner/technical champion	Case 5	Innovation manager
Winner/technical champion	Case 5	Innovation manager
Organizational champion RWS (after the contest)	Case 1	Advisor/manager
Case holder Service areas	Case 1	Advisor/manager
Manager responsible for financial conditions of the submitted plans	Case 2	Advisor/manager
Organizational champion RWS	Case 3	Advisor/manager
Organizational champion RWS (after the contest)	Case 4	Advisor/manager
Organizational champion RWS	Case 5	Advisor/manager

Appendix 6: Winning ideas from innovation contest cases

Case 1: Innovation contest: Verzorgingsplaats van de Toekomst (Service area of the future)

- **Noordwestzes – Rimpeling in het landschap (Ripple in the landscape)**

The designed facility mediates between the continue, linear movement of traffic and the flat Dutch landscape. The result is landscape integration and the provision of a parallel orientation relative to the road. A small ripple in this landscape provides the space for the desired facilities.

Case 2: Innovation contest: Uitbreiding Hollandse Brug (Extension Dutch Bridge)

- **Achterbosch Architectuur – AAAA**

The originality of a fallen tree over the water combined with the consideration of the contest. The emphasis was on a clever connection of both river banks. Two identical constructions carry the road between the pilasters. A space between the roads gives the opportunity for half arms that take the forces. The result is a couple of these constructions in a row, which partly slid into each other, and forms one piece.

Extra attention is paid to an efficient routing; drive up, parking, separation of trucks and cars. The route to the facilities is based on the 'pitch stop idea'.

Case 3: Innovation contest: Less hindrance during renovation steel bridges

- **Bureau Angenent and Hurks Beton – Prefab HSB overlaging (Prefab HSC overlay)**

Ultra HSB (High Strength Concrete) plates are prefabricated by using an innovative measurement method and individual contra molds.

Case 4: Innovation contest: Groynes of the future

- **Consortium Kribben – De Eilandkrib (The Island Groyne)**

The Island groyne is an excising groyne which will be lowered nearby the head of the groyne and extended in the direction of the downstream. Thus, the extended 'groyne nose' is most of the time an island. The 'high water safety is sufficient guaranteed and has a positive effect on the navigability of the ships: The local shoals around the groynes decrease, the flow figure is calmer and the groyne plane is better protected against streams and waves. Better shelter of the groyne plane strengthens the river banks as well and increases the beach area. The solution results in better ecological, recreational and landscape values.

- **DN Urbland – Jack the Kribber**

Jack the Kribber is an existing groyne which will be bent, extra anchored and provided with some spillways. The groyne gets some extra modules with a soft and elastic core in the top of the groyne body. These modules will be pushed in case of high water and thus the groyne body will be lowered. The 'drop formation' decreases by the combination of the curve and a gentle

slope in the armpit of the groyne head. The solution results in better ecological, recreational and landscape values.

- **Robusta-Tébézo – De Module Krib (The Module Groyne)**

The Module groyne is a combination of a lowered standard groyne with gentle slopes and gabions placed on the crown. The substructure consists of a concrete blocks mat with a low hydraulic roughness, which increases the drainage. The superstructure consists of modular gabions system which will be attached to the substructure. The Module groyne blocks relatively a lot in case of low water and permeable during high water which result in less turbulence during ship passage. The degree of permeability is adaptable.

- **Alkyon – De Zelfregulerende krib (The self-regulating groyne)**

This groyne consists of float which is attached to a horizontally placed sheet piling by a vertical hanging waterproof cloth. During low water the float floats and the cloth tightened. During high water the buoyancy of the floater decreases and sinks to the bottom. This results in less hindrance of the flow and leads to a reduction of the water level.

Case 5: Innovation Contest: Cleaner, quieter and more homogeneous asphalt

SSH Parcel 1: Cleaner asphalt

- **Dura Vermeer – Twister**

The resuspension of the dust on the road is forced by a cleaning vehicle. The air will be filtered and the particulates will be caught by guiding an air blast through a filter material.

- **Heijmans – Stofreiniger (Dust cleaner)**

Heijmans developed a kind of large vacuum cleaner for the roads.

- **Combination SSH – Calciumchloridesproeider (Calcium chloride sprinkler)**

By sprinkling a calcium chloride suspension on the road, the road stays moist. The resuspension of dust will be reduced, because the dust will stick together and transported to the side of the road by wind and passing traffic.

SSH Parcel 2: Quieter asphalt

- **Dura Vermeer – Steam cleaner**

The steam cleaner cleans the top layer of the two layered ZOAB asphalt, by using steam, detergent and air. The dirt will be moved to the lower layer and here it can be rinsed to the sewer or road bank.

- **Heijmans – Vacuum reiniger (vacuum cleaner)**

This cleaning principle is focused on 'sucking' instead of 'blowing'. The relatively closed interface between the two layered ZOAB asphalt is blown open instead of closed.

- **Combination SSH – Ultra soon reinigen – Ultra soon cleaning**

SSH developed a solution which uses ultra soon sound to clean the two layered ZOAB asphalt. This method results in an increase of the permeability.

SSH Parcel 3: More homogenous

- **Dura Vermeer – Megapave**

EOS-Edelsplit will be applied to in the top layer of the Megapave. Demixing will be prevented and the temperature changes are smaller due to the high 'hook resistance' and the more homogeneous thermal behaviour. Besides an extra control will be executed concerning the gradation and density. By using a thermo-graphical cam the right trucks will be selected. By using an Asphalt Registration System (ARS) aberrant temperatures can be detected.

- **Heijmans – Shuttle Buggy**

The Shuttle Buggy is an extra hopper between the spreader and the truck with warm asphalt. This buggy will be used as intermediate storage, but also to mix the asphalt more homogeneous before it will be transported towards the spreader.

- **Combination SSH – ZOAB+2**

Combination SSH developed nine process improvements. These improvements concern the homogeneity of the mix, the homogeneity of the temperature and the homogeneity of the ZOAB asphalt.