Governance of large infrastructures

The cases of the canals of King Willem I, the Suez Canal and the Rhine-Main-Danube waterway

An application of new institutional economics

Tom Weijnen

GOVERNANCE OF LARGE INFRASTRUCTURES. THE CASES OF THE CANALS OF KING WILLEM I, THE SUEZ CANAL AND THE RHINE-MAIN-DANUBE WATERWAY. AN APPLICATION OF NEW INSTITUTIONAL ECONOMICS

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Preface

The realization of this thesis could not have been succeeded without the invaluable support of a number of people. This is in the first place of course my supervisor prof. dr. P.B. Boorsma who gave me the opportunity to write this thesis. I value very much his support and the way he guided me through the process of bringing the undertaking to a good end.
Also I would like to mention with a special attention Ben Tommee, who especially in starting up the work for the thesis was very important for me, with his very stimulating encouragements.
Prof. dr. C.J. Rijnvos gave me the idea in the early nineties of the last century to study the history of the Rhine-Main-Danube waterway in relation to the recent German economic history. With this he laid down the fundaments for this thesis. I have appreciated this idea very much because it gave me the opportunity to come in contact with the fascinating subject of the German history.
I am very happy to know that I will have my son Gijs and my dear friend Peter Verschuren at my site when defending this thesis. Throughout the past four years, in working at the thesis, the most important support for me I received from Maria, my dear and life long companion. Love, we did it!
I dedicate this thesis to the remembrance of my parents who unfortunately cannot experience anymore the completion of it.

Dordrecht, August 2010,
Tom Weijnen

"History matters. It matters not just because we can learn from the past, but because the present and the future are connected to the past by the continuity of a society's institutions." (Douglass North. Institutions, institutional change and economic performance. 1990, p. vii)

"The future is not out there waiting to be learned: we create it ourselves." (Robert Skidelsky. Keynes. The return of the master. 2009, p. 88)

Table of contents

1 Introduction

1.1 Central premise: the significance of governance structures

Large infrastructural projects typically take long periods of time to realise, while the subsequent pay back period takes even longer. The central starting point for this thesis is that such long time horizons have consequences for the way decisions are or have to be made. In this respect, the question arises: why not rely on societal cost-benefit analysis (SCBA) when deciding to invest in a large infrastructure? SCBA has the advantage of being a systematic and rigorous approach based on sound economic theory and conducted from a societal viewpoint. This means that in an SCBA all the costs and benefits are taken into account no matter who actually pays. The distribution of costs and benefits among different parties involved in a project is not taken into account. In an SCBA there is assumed to be only one benevolent decision-maker weighing costs against benefits, no matter whether such benefits are monetised or not. With large infrastructures, though, this assumption is very often heavily violated. Different layers of governments and governmental bodies are involved, pressure groups representing different stakeholders can have substantial influence, and private parties like industry or public-private partnerships representing special interests are involved. There is also seldom only one decision; it is more a decision process where interaction between parties slowly leads to a more or less definite situation. It is not a linear decision-making process, but most of the time cyclical in nature. Solutions are found during the process and not decided upon at the outset, except for issues related to the project's main direction (Klaasen and Spaink, 2005).

A consequence of such decision-making processes not being linear is that rational criteria from a SCBA have only limited significance when serving as the basis for decision-making in project realisation. The uncertainty that follows from lengthy construction times and even longer economic lifetimes is simply too large. It is not that cost-benefit analysis is of no use, nor is the SCBA methodology problematic. Rational decision criteria like SCBA can be and must be used, but because of high levels of uncertainty one needs also to look at the governance structures in which the decisions take place. The premise of this thesis, then, is

that the institutional and governance structures through which a large infrastructure project is realised are of great importance for the final result. In studying these structures one can gain insight into the prevailing characteristics of efficient governance structures for the types of infrastructure projects at hand. Fortunately, an economic theory can be used to help identify these prevailing characteristics: new institutional economics (NIE). According to Oliver Williamson, this theory is premised on the hypothesis that the rationale of a governance structure is to economise on transaction costs in order to promote efficient governance.

1.2 Central research question

The central research question of this thesis is:

> Is it possible to determine from NIE the characteristics of an efficient governance structure for investments in large infrastructures and for the operation of these infrastructures?

The question consists of different parts that need to be clarified further. First, it needs to be stressed that the aim of this study is to determine whether insights from NIE can fruitfully be applied to the study of large canal infrastructures. This implies that the testing of possible hypotheses from NIE is not the goal of this study. There are no previous empirical studies found that apply NIE to canal infrastructures, the type of case study to be used in this research, so in a way this thesis is an exploratory study. The other parts to be clarified relate to the definitions of NIE, efficiency and the infrastructures to be studied.

New institutional economics (NIE)

This research question will be answered by applying insights from NIE with emphasis on two of the main NIE directions: property-rights theory and transaction cost economics. (Richter, 2005) In fact, the theoretical part of the thesis is restricted to the so-called Williamson school of the NIE which encompasses mainly transaction cost economics and is about comparison of static situations. (Groenewegen 2008, p. 54.) The more dynamic approach of Douglas North will not be taken into consideration.

Efficiency

In the central research question a specific definition of efficiency connected with NIE is used. Different domains can be discerned in the economic theory dealing with matters of efficiency (Groenewegen 2005, p. 5). In the domain of production efficiency economics, the emphasis is on minimisation of production costs. In standard mainstream neoclassical economic theory, equilibrium market prices inform actors about the efficient allocation of resources. In the domain of institutions, however, efficiency centres on the minimisation of transaction costs. NIE focuses on questions of how to coordinate transactions in such a way as to minimise transaction costs, an approach that will be used in this study. The concept of efficiency in this thesis refers to the minimisation of transaction costs.

Which infrastructures?

A study that focuses on the history of large infrastructures can draw general conclusions about the applicability of NIE in the design of efficient governance. This can have major implications for investment costs of large infrastructures. Therefore, case histories of three large infrastructures will be studied. The advantage of case histories is that the final results of the decision-making process for the specific investments are known. It also provides an opportunity to study different forms of operation of infrastructures. As will be explained in the following sections, three specific projects have been chosen that have characteristics of private goods, so that in principle more diverse governance structures are possible. Canals, as transport infrastructures, seem to be a good candidate because they fulfil the requirements for private goods. The history of these canals will be described using published literature and will thus be based on earlier historical research. The canal projects have, among other reasons, been chosen for the availability of historical literature on these three canal projects.

1.3 Institutions and governance structures

The question arises: What are institutions and what are governance structures?

The two main economists of NIE, Douglass North and Oliver Williamson, have answered this question in a somewhat different way. They share the view that NIE and transaction cost

theory explain why certain institutional frameworks are better than others. The hypothesis is that these frameworks are aligned with transactions in such a way as to minimise transaction costs. It will appear that their levels of analysis are different. North's theory is mainly concerned with institutions, whereas Williamson concentrates on organisations of governance. According to North, the distinction between institutions and organisations is analogous to the distinction between the rules and players of a game. Institutions are the game's rules, or more formally, are the humanly devised constraints that shape human interaction (North 1990, p. 3). Organisations are the strategy by which the game is played, a combination of skills and coordination. Organisations are groups of individuals bound by some common purpose to achieve objectives and, like institutions, provide a structure to human interaction (North 1990, p. 5). A governance structure is a set of organisations involved in a certain kind of production. From the perspective of a study of large infrastructures, a governance structure can consist of all organisations interacting to decide on project investments, carrying out actual building of the infrastructure and subsequently the operation of the infrastructure when it is completed.

According to Williamson, NIE also operates at two levels. He refers to them as the institutional environment and the institutional arrangements: “The institutional environment is the set of fundamental, political, social and legal ground rules that establishes the basis for production, exchange and distribution. Rules governing elections, property rights, and the right of contract are examples. An institutional arrangement is an arrangement between economic units that governs the way in which these units can co-operate and/or compete.” (Williamson, 1993 p. 13) Being able to make this distinction is very useful because now it is possible to separate the changes in the institutional environment from the governance structure or institutional arrangement.

As mentioned above, in Williamson's transaction cost theory the economic rationale of organisations is assumed to be that of economising on transaction costs. Williamson (1993, p. 16) goes on to state that governance may be defined as the institutional framework which consists of markets, hybrids and hierarchies through which a transaction is channelled. Governance structures are all situated on a continuum, which has at one end the fully competitive market, and at the other end the hierarchy or the firm. Hybrids are intermediary forms of governance structures.

1.4 Large infrastructures as collective or market goods

In a study for the World Bank, Kessides investigated institutional options for the provision of infrastructures. The key concern of this study was to clarify the rationale for choosing particular institutional arrangements for the provision of infrastructure services. The aim was to promote efficiency, equity, and accountability to users and financiers. According to the study's author, these choices should be based on an understanding of the economic and technological characteristics of the infrastructure services (Kessides 1993, p. ix). Although this is a starting point that resembles transaction cost economics (TCE), NIE and TCE were certainly not used in this study. The premise of the Kessides study is that competitive private markets are the preferred mode of supply when the economic and technological characteristics of activity permit it. The analyses are based on a framework that contains the following criteria: the nature of the good or service; whether the service is a collective or a private good; conditions of production; the extent to which economies of scale create a natural monopoly; externalities and social objectives; and characteristics of user demand (Kessides 1993, p. x). In this thesis on the governance of the three canal projects, no attention will be paid to market conditions, to possible externalities and to the user demands for the provision of these infrastructures. Applying TCE and the Williamson branch of NIE leads to a much more micro-kind of perspective.

However, there is one part of the Kessides framework that is of use for this thesis, and that is the identification of the nature of goods involved. This thesis focuses on certain kinds of large infrastructures, restricting itself to those infrastructures where more or less public-private partnership arrangements are possible. This means that the infrastructures need to have the characteristic of a marketable good, infrastructures as collective goods are excluded. The collective goods theory explains those characteristics of a good or service which lead to market failure, so that public provision becomes necessary (Wolfson, 1987). The relevant characteristics in this case are excludability and rivalry or subtractability (Kessides 1993, p. 4). Excludability can be defined as the power to exclude someone from consuming a good. For instance, someone who does not pay can be excluded from using something. On the other hand, it is possible for someone to refuse the consumption of a good. Rivalry means that the consumption of a good by one person is at the expense of the consumption by another person.

A good example of this is the use of a window seat in an aeroplane: if one person uses the window seat, another person cannot.

The clearest example of market failure occurs when excludability is technically not possible or is only possible at high costs.

The question is now whether large infrastructures can be characterised as collective or market goods. The answer depends on the infrastructure itself. A dike, for instance, protects the land behind the dike against high water levels. A particular individual that lives in the area protected by the dike must necessarily consume the service of the dike, and cannot be excluded. The consumption of the dike's protection is also not rivalrous up to a certain degree of utilisation of the land. The services of transport infrastructures are theoretically excludable and they are also rivalrous, mostly above a certain use of the infrastructure. However, for road infrastructures to organise excludability is technically not very easy (Kessides 1993, p. 4-6). Relatively high cost must be incurred to exclude someone from the use of a road infrastructure. Consequently, public authorities must play a large role in supplying road infrastructures.

A canal, though, is a transport infrastructure for which excludability is relatively easy to organise. It is not difficult and not costly to gather and process information about the use of a canal. Because of the nature of a canal, its users can be controlled much easier than is the case for road infrastructures, and this is why it is in principle possible for a canal to be built by private investors. One of the most successful canals in history, the Duke of Bridgewater's 12 km canal from coal mines on his estate at Worsley to Manchester, was a completely private undertaking, and its success boosted canal building in England during the early years of the industrial revolution (Garrison 2003, p. 8).

The conclusion is thus that canals have in principle the characteristics of a market good and that therefore canals can be supplied in a more or less market kind of environment, based on contractual relations and transactions. As will be described later on, the basic unit of analysis in TCE is the transaction. Following this reasoning it can be assumed that TCE can be applied to the study of the canal projects.

1.5 Three projects

Three case studies will be undertaken in this study analysing governance of large infrastructures. The canals in question are: the canals of the Dutch King William I from the first half of the nineteenth century, particularly the Noordhollandsch Kanaal and the Zuid-Willemsvaart; the Suez Canal, built in the second half of the nineteenth century; and the Rhine Main Danube waterway, which came into existence after the Second World War. These projects have been chosen because private initiative was important for the investments in these canals. Entrepreneurs and their private enterprises played influential roles as governance structures for these canals. Additionally, except for the Noordhollandsch Kanaal, the projects all have more or less, international aspects. The Zuid-Willemsvaart crosses the Dutch-Belgian border and was built just before the turmoil of the separation of Belgium from the United Kingdom of the Netherlands. The Suez Canal was a project undertaken by a Frenchman in an Arab country, which started with an idea conceived by Napoleon, yet finally controlled by the British Empire. The decision-making process regarding the Rhine-Main-Danube waterway involved the Bavarian state (the Free state of Bavaria) and the German 'Reich' (the Federal State of Germany) in a period covering at least 50 years. Consequently, various types and levels of government were involved in the decision-making process for these three projects.

The canals of the Merchant King Willem I

William I was the first king of the Netherlands, reigning from 1813 to 1840. His nickname, "The Merchant King", refers to his economic policy as a strong promoter of trade and industry in his kingdom, which during most of his his rule included present day the Netherlands and Belgium. He realised high investments in transport infrastructures, a large proportion of which went to a number of canals. Sometimes Willem I is also referred to as the "Canal King" (Filarsky, 1995). In this study two canals that were built by Willem I will be highlighted: the Noordhollandsch Kanaal and the Zuid-Willemsvaart.

The Noordhollandsch Kanaal was one of the biggest shipping canals in the world at the time it was built (Jongenelen, 1967), and it was also very expensive. The canal was built to improve waterway access to Amsterdam, which was difficult for ships coming from the North Sea. They would first have to enter the Zuiderzee, a sometimes difficult journey, and then cross a sandbank that blocked the entrance to Amsterdam's harbour. This sandbank had always been a

problem since the late seventeenth century, but became a serious shipping obstacle during Willem I's time. The canal is situated between Amsterdam and Den Helder, north of Amsterdam. A more logical route would have been westward from Amsterdam to the sea, but this was considered too dangerous and technically unfeasible because the path would have had to cross natural dune sea defences.

The Zuid-Willemsvaart is a canal that, at the time of building, went through one of the poorest parts of the Netherlands (De Jong, 1967). The goal was to connect navigable stretches of the river Maas in the north-west to the Wallonian city of Liège at the border of the Maas, in the south-east of the country.

Shortly after his accession, King Willem I ordered an investigation into the possibility of an improved inland waterway connection between the Dutch cities of Den Bosch and Maastricht. The possibility of improving the flow of the river Maas was also investigated. However, due to unfavourable conditions - high currents and low depths - it was thought to be too costly, and in the end the improvements would not favour shipping much. Construction of the 123 km long canal started in 1822 and the first stretches were ready in 1826. The connection between Maastricht and Liège was only opened in 1850, seriously hampering the success of the canal in the first decades after opening. Also, due to hostilities between the northern and southern part of the Netherlands, the canal system was closed from 1830 to 1839.

The Suez Canal

The 3,000 year old dream of a canal across the Isthmus of Suez had existed since the Pharaohs built Egypt's first canal (Karabell, 2003). With the occupation of Egypt by Napoleon Bonaparte the idea of a canal cutting the isthmus was revived again. In 1854 and 1856 Ferdinand de Lesseps obtained concessions to develop such a project from the viceroy of Egypt, Said Pasha. As a French diplomat, Lesseps had come to know the viceroy in the 1830s, and held considerable influence in the affairs around the project. Said Pasha authorised the establishment of a company for the purpose of constructing a maritime canal open to ships of all nations. Subsequently, the Suez Canal Company (Compagnie Universelle du Canal Maritime de Suez) came into being in 1858.

Excavations of the 163 km long canal took nearly eleven years to accomplish. Numerous technical, political, and financial problems had to be overcome and the final costs of building the canal exceeded the original estimates on a scale that matches the stature of this project: some estimates indicate an overrun of 1,900% (Flyvbjerg 2003, p. 19). The canal opened to

traffic on November 17, 1869. In 1875 Britain became a minority shareholder of the Suez Company, acquiring 44% of the Suez Canal Company with French syndicates controlling the remaining shares, though in 1882 the British took control of the canal area. In 1956 the canal became the subject of the Suez Crisis: Egyptian president Nasser announced the nationalisation of the canal in response to the American, British and French refusal to provide loans for building the Aswan High Dam. The revenue from the canal, he argued, would help finance the Dam project. This announcement triggered reactions from Britain, France and Israel, who all invaded Egypt less than two months later. The international community condemned this military action, and in the end Nasser claimed victory.

The canal was closed in the wake of the Six-Day War in 1967 when Israel occupied the Sinai Peninsula. The canal acted as a buffer zone between the fighting forces, though the Egyptians reclaimed the canal zone during the 1973 Arab-Israeli War, with shipping re-opened in 1975. Since then, the canal has been constantly widened to accommodate modern shipping, and today approximately 50 to 60 ships pass through the canal daily.

The Rhine-Main-Danube canal

With the official opening of the Main-Danube Canal in September 1992, a 3,500 km inland waterway came into existence from the North Sea to the Black Sea (Bader 1982; Bräunlein 1991; Hauch 1992). For the first time Rotterdam was connected to Constansa in Romania by inland waterway. The complete waterway can be seen as divided into three stretches: the first stretch is the Rhine-Main stretch, from Rotterdam to the mouth of the river Regnitz in the Main near Bamberg, with a total length of 924 km. From this point the Main-Danube canal starts and is considered the second stretch The canal is 171 km long and flows into the Danube at the mouth of the river Altmühl, near Kelheim in Bavaria. The third stretch of the waterway is the river Danube, 2,411 km in length from Kelheim to the mouth of the Danube in the Black Sea near Sulina. The name 'Rhine-Main-Danube waterway' will be used in this thesis to indicate the stretch of the waterway beginning at the mouth of the Main in the Rhine and ending with the crossing of the German-Austrian border by the Danube. The actual canal is referred to as the Main-Danube Canal. The existence of the canal does not mean that traffic is shipped inland on a regular basis directly from Rotterdam to the Black Sea. Economically speaking, the significance of the Rhine-Main-Danube waterway does not lie in the inland connection from Rotterdam to the Black Sea, but rather in its importance for regional transportation.

The idea of linking the Rhine and Danube originates far back in history and has inspired Bavarian people to envision and attempt a competitive shipping linkage between Main and Danube. In November 1892 a society was founded in Nürnberg called the "German Rhine-Main-Danube Canal and Shipping Society" (Deutscher Kanal- und Schiffahrtsverrein Rhein-Main-Donau e.V.), which raised the idea of and stimulated discussion on a high-capacity waterway between the Main and the Danube. The actions of the society cumulated in the founding of the Main-Danube Association ("Main-Donau-Stromverbandes") in 1917, which was the direct predecessor of the Rhein-Main-Donau AG (RMD AG). The RMD AG obtained the concession to build and operate hydroelectric power stations on five rivers in southern Germany, and it was obliged to construct the Rhine-Main-Danube waterway in such a way that it was suitable for modern ships to navigate.
Until recently one-third of RMD AG belonged to the Free State of Bavaria and two-thirds to the German Federal Republic. Now RMD AG is owned by E.ON AG and other German electricity producers.

1.6 Specific research questions

In order to answer the central research question that was defined in section 1.2, six more specific questions need to be answered. These questions are:

1. What are the main characteristics of the histories of the three canal projects?

Answering this question requires highlighting specific features of the three histories in the light of this thesis' central research question. Because the subject of this thesis is the governance of large infrastructures, the historical descriptions will concentrate on governance structure. Published material will be used to study the history of the canal projects and secondary sources will be consulted. It is outside the scope of this thesis to investigate primary sources about the history of the canal projects.
The period of canal construction for all three projects is already some time passed. Thus, it is possible to describe the complete history of the projects, with the benefit of knowing how the

stories end. This makes it possible to identify relevant factors of governance structures throughout the complete history of the canal projects.

2. What are the characteristics of new institutional economics that will be applied to the study of the governance of investments in large infrastructures?

In first instance, this specific research question will be implicitly answered for all three projects together. This will result in an analytical scheme that can be used in the case studies of the projects. However, this question will also be answered for each case separately. For this question to be answered, in first instance the three main directions of NIE will be considered. These are:

- principal-agent theory,
- property-rights theory,
- transaction cost economics.

It will be investigated whether it is useful to apply all three components of NIE.

3. What are the relevant governance structures of the three canal projects in the light of NIE?

This question is more specific than the second question. To answer this question, the relevant parts of NIE identified by question two will be applied to the history of the canal projects. NIE can provide insight into the question of why some governance structures are better than others.

4. How well were the governance structures able to cope with unexpected technical, economic and political events?

A quick scan of the history of the three projects reveals that there was never a straight line from the start of the project to completion. Every undertaking had to deal with unexpected technical, organisational, financial and political problems. It will be interesting to see whether and how the governance structures were able to cope with unexpected events.

5. Can NIE help to explain the success or failure of the canal building and the subsequent operation of the canals?

In answering this question one must bear in mind the difference between supply of and demand for canal capacity. NIE deals with matters of supply, in the sense of the institutional environment and governance structures in which this supply takes place. These are not theories to explain demand-side factors. Consequently, this thesis is restricted to studying the governance of the supply of canal capacity.

The concluding sub-question in this study will be:

7. Can something be learned from the history of the three canals in light of insights from NIE?

In answering this last specific research question, the information from the five previous questions will be used to reach some form of overview on the possibilities of applying NIE to the history of the canal projects.

1.7 Limitations of the research

Cost containment, or rather the apparent impossibility of cost containment, seems to be a general characteristic of large infrastructural projects (Flyvbjerg 2002 and 2003). One can assume a relation between well-aligned governance structures and cost containment. The hypothesis in TCE is that aligned governance structures reduce transaction costs. This could imply that information flows and governance procedures are optimised, which enhance the capacity of the governance structures to contain costs. However, this relationship or the possibility of this relationship will not be studied in this thesis.

As has been described above, NIE concentrates on supply-side factors of a specific nature. Market conditions on the supply side of the market do not play a prominent role in NIE. The question of economies of scale and the consequent market conditions of, for instance, a

natural monopoly are outside the scope of this study. Also, regulation of the provision of the infrastructure on the basis of externalities will not be dealt with explicitly. It is conceivable that this would have an effect on the types of governance structures chosen for projects. Additionally, characteristics of user demand and their possible relation with the governance structures will not be studied.

NIE, restricted to consisting of TCE, property rights theory and agency theory, leads to applying what is called the 'static blueprint approach'. The question which this school of institutional economics attempts to answer is this: given the technology, given the values in the society, given the legal structure and given the preferences of economic actors, what is the most cost-efficient governance structure available? This optimal governance structure is presented as a blueprint that designs how transactions should be coordinated (Groenewegen 2005, p. 8). A dynamic learning economic perspective and for instance path dependency are not accounted for (Groenewegen 2005, p. 13-15).

This thesis will not apply a comparative institutional analysis as defined by Aoki (Groenewegen 2008), which takes a game theoretical evolutionary perspective, the analyses in this thesis are conducted from a comparatively static perspective. The observed governance structures of the three projects will be compared in the concluding chapter. The process towards these governance structures falls outside the analytical scheme constructed in chapter 4, though some notions about the evolution of governance structures will be discussed in the case studies.

Limitations of the research could also come from the nature of the applied theories. TCE and property rights theory are not so much about the behaviour of management or other actors involved with the governance structure, which is much more the subject of agency theory. In this introductory chapter no decision will be taken on which part of NIE will be used to analyse the case studies. Deciding to apply certain parts of NIE has a direct effect on the content and scope of research. The decision will be made in chapter 2.

1.8 Outline of the thesis

The thesis will consist of three parts. First, a description will be given of NIE. To deal with the theoretical issues first is a deliberate choice, because it can be expected that this will facilitate the next part of the study, which analyses the histories of the three canal projects. The study of NIE and the description of the relevant features of this theory will provide tools with which to describe the case histories in the light of the central research question of this thesis. It will turn out that the parts of NIE that will be applied in this theses are TCE and property rights theory.

In the second part of the thesis an analytical scheme will be formulated on the basis of the information and conclusions from the first part. The relevant characteristics of the theories that will be applied in the study of the canal governance structures, will be identified.

The third part of this dissertation will focus on the case studies of the three canal projects, the application of the analytical scheme to answer the research questions, and the conclusions of the study.

This leads to a division of this thesis into seven chapters. In chapter 2 a short description will be given of the development of institutional economics. This description will start with some notions about the difference between old institutional economics and NIE. Attention will then be paid to the 1937 article of Ronald Coase as a starting point of NIE. A four level model of NIE designed by Oliver Williamson will then be described as a model for social and institutional analysis. The relevance of incomplete contracting and uncertainty will be discussed, and the result will be a selection of the specific parts of NIE to be used in this thesis.

In chapter 3 TCE and property-rights theory will be dealt with. The possible application of TCE in the public sector will be investigated and special attention will be paid to a subdivision of hybrid modes of governance in compliance control and exploratory control hybrids. The characteristics and the function of property rights will be described. This function refers to the role of property rights as shift parameters for the efficiency of the governance structures.

In chapter 4 the above mentioned analytical scheme for the case studies will be derived from TCE and property-rights theory as described in chapter 3. Important here is that different stages

of a project will be discerned, to be able to apply the analytical scheme derived from TCE for each of these stages separately.

The process of writing this thesis was that property rights theory and TCE were selected ex ante. After this the case studies were carried out using the analysis schema of chapter 4. No adaptation of the analysis scheme took place after the case studies were carried out. In the process of making up the analysis scheme it was decided not to use the principal agent theory in this thesis. The main reason for this was that by using principal agent theory the analysis scheme became confusing. As described in chapter 2, Williamson regards agency theory not in accordance with TCE, because it is concerned with an ex ante alignment of contractual relations, rather than ex post governance.

Chapters 5, 6 and 7 concern the actual case studies of the three canal projects. The histories of the projects will be discussed on the basis of five different project phases. The case studies will result in a table for each project containing answers to property-rights theory questions and a table for each case study containing answers to TCE-questions. In the concluding sections of the chapters, the specific research questions defined in section 1.5 will be answered.

In the last chapter of the thesis, a summary will be given and the answers to the specific research questions of the three case studies will be compared, in order to draw overall conclusions regarding this study's ultimate central research question. This concluding chapter will end with some reflections on governance structures for large infrastructure project investments and on possibilities for future research on this topic.

2 New institutional economics

2.1 Introduction

New institutional economics (NIE) is an interdisciplinary approach combining economics, law, organisation theory, political science, sociology and anthropology to understand the institutions of social, political and commercial life. Though it borrows from various social-science disciplines, its primary language is economics. The goal of NIE is to explain what institutions are and what purposes they serve, how they arise and change and how- if at all- they should be reformed (Klein 2000, p.456).

To be short: NIE studies institutions and how institutions interact with organisational arrangements (Menard and Shirly 2005, p.1). Here, a distinction is made between institutions and organisational arrangements, a cornerstone idea of NIE that can be found in most publications on NIE. Different authors, however, use different forms and different wording. According to Menard and Shirly, institutions are the unwritten and written rules, norms and constraints that humans devise to reduce their uncertainty and control their environment. They include unwritten codes of conduct, like behavioural norms, constitutions, laws and rules that govern politics, government, finance and society more broadly. They also include written rules and agreements that govern contractual relations and corporate governance (Menard and Shirly 2005, p.1). A good definition of organisational arrangements originates from Douglass North, who made the distinction between institutions and organisations in his 1990 study. Like institutions, organisations provide a structure to human interaction. 'Indeed when we examine the costs that arise as a consequence of the institutional framework we see that they are a result not only of that framework, but also of the organisations that have developed in consequence of that framework. Conceptually, what must be clearly differentiated are the rules from the players' (North 1990, p.4-5). Rules are the institutions and organisations are the players. Institutions take any form of constraint that human beings devise to shape human interaction, including both what individuals are prohibited from doing and, sometimes, under what conditions some individuals are permitted to undertake certain activities (North 1990, p.4).

Institutions reduce uncertainty by providing a structure to everyday life. They are a guide to human interaction (North 1990, p.3). Organisations include political bodies (political parties, the Parliament, a city council, a regulatory agency), economic bodies (firms, trade unions, family farms, cooperatives), social bodies (churches, clubs, athletic associations), and educational bodies (schools, universities, vocational training centres). They are groups of individuals bound by some common purpose to achieve objectives. Modelling organisations means analysing governance structures, skills, and how learning-by-doing will determine the organisation's success over time. Both what organisations come into existence and how they evolve are fundamentally influenced by the institutional framework. In turn they influence how the institutional framework evolves (North 1990, p.5).

Institutions are not necessarily or even usually created to be efficient in a societal sense. Rather, they can be created to serve the interests of those with the bargaining power to devise new rules. One of the insights that was reached from the work of Ronald Coase is that, in a zero-transaction-cost world, bargaining strength does not have to affect the efficiency of bargaining processes' outcomes (Coase, 1960). But in a world of positive transaction costs it does, and given the lumpy indivisibilities that characterise institutions, this can shape the direction of long-run economic change (North 1990, p.16).

The concept of transaction costs is also prominent in the work of Oliver E. Williamson. According to his transaction cost theory, the governance of contractual relations by the proper organisational arrangements will minimise transaction costs. What these proper organisational arrangements are will be discussed in chapter 3.

This chapter will start with an overview on the similarities and differences between 'old institutional economics,' developed at the end of the nineteenth century and the beginning of the twentieth, and the more recent developments known as the 'new' institutional economics. This section is for a large part based on the work of Malcolm Rutherforth (2001) who described institutional economics and the developments that formed the bases of NIE. One of the starting points of NIE will be addressed in section 3 of this chapter, which originates from another famous article of Ronald Coase, that from 1937 about the nature of 'the firm'. The schemes of Williamson will be discussed where four levels of institutions and organisations are distinguished. Section 5 will then turn attention to the relevance of incomplete contracting models within NIE. It can be expected that this notion of incomplete contracting is very important for the study of large infrastructural projects, because the notion refers to the fact

that beforehand not all contingencies can be specified in a contract.. This is the bases for agency theory. However, following Williamson it will be argued why agency theory does not play a role in this thesis. Section 6 will deal with some recent literature on uncertainty and rationality within NIE. Different concepts of uncertainty lead to different notions of rationality within different strands of NIE. In section 7 by way of conclusion an overview will be given on the different levels on which NIE operates, the different concepts of rationality and the different branches. The overview will facilitate considerations of the applicability of NIE branches for the case studies on the history of three canal projects, and will make an introduction into the next chapter.

2.2 Old and new in institutional economics

Until recently, institutional economics usually referred to the writings of Clarence Ayres, John R. Commons, Wesley C. Mitchell, Thorstein Veblen and their followers. This is a diverse group, but their work reflects several common themes, mostly criticisms of orthodox economics. These writers focus on collective rather than individual action, having a preference for an evolutionary rather than mechanistic economic approach and emphasising empirical observation over deductive reasoning. Older institutionalists are little known to most contemporary economists, though (Klein 2000, p.456-457). In this respect Coase's dismissal is typical: "Without a theory old institutionalists had nothing to pass on except a mass of descriptive material waiting for a theory, or a fire" (Coase 1984, p.220. Cited in Klein 2000, p.457).

However, Coase's comment is too harsh. These old institutionalists had ideas and starting points that were fundamental to the development of the NIE (Rutherfort 2001). Even still within NIE do different strands, some of them closely, resemble ideas of the old institutionalists. Therefore a short description must be given of the ideas and starting points of the old institutionalists, to shed some light on the differences between the old and the new. Doing so, a clarification can be reached on the idiosyncratic characteristics of NIE.

Of the founders of institutionalism, John Commons and Thorstein Veblen are the most prominent, though Commons came later into the institutional picture. Veblen's overall framework was one which stressed the cumulative and path-dependent nature of institutional

change, and the role of new technology in bringing about institutional change by altering underlying habitual ways of living and thinking. He stressed the predominantly “pecuniary” character of the existing set of American institutions. That is the “business” values of pecuniary success and individual gain by money making, to the virtual exclusion of all other values. For Veblen, as for other institutionalists, institutions were more than merely constraints on individual action, but embodiments of generally accepted ways of thinking and behaving. Existing institutions, due both to the inertia in any established scheme and to the defensive activities of vested interests, tend to become out of step with new technological means and with the economic issues and social problems they generated. Thus, for Veblen the existing legal and social institutions of his America were outmoded and inadequate for the task of modern large-scale industry social control (Rutherford 2001, p.174).

Commons' classification as an institutionalist grew out of his 1924 book 'The Legal Foundations of Capitalism'. Commons' approach was built on his notion of distributional conflict pervasiveness, of legislatures and courts attempting to resolve conflicts, and of the evolution of the law as the outcome of ongoing conflict resolution processes. At the micro level, Commons developed his concept of a “transaction” as the basic unit of analysis. In turn the terms of transactions were determined by the ‘working rules' structure, including legal rights, duties, liberties, and exposures, and by economic bargaining power.

For Commons and others, market transactions were conceived of as a transfer of rights, not physical goods, taking place in a legal and economic power context, and always involving some degree of ‘coercion', in the sense of restriction of alternatives. Commons distinguished between bargaining transactions or market transactions and managerial transactions or a hierarchy, and was aware of the substitutability between the two (Rutherford 2001, p.176 and p.181-182). With his viewpoint and insights, Commons can be regarded as one of the founding fathers of transaction cost economics (TCE) (Williamson 2000, p.599). His concept of transactions as the unit of analysis was path breaking for Williamson's TCE. Commons' distinction between market transactions and managerial transactions and the possibility of substituting between the two is one of the hallmarks of TCE.

Very important for the attraction of institutionalism in the interbellum was the claim that institutionalism represented the ideal of empirical science. According to Rutherford, the major influence here was Wesley Mitchell’s combination of Veblenian ideas with quantitative and statistical approaches he had absorbed as a student in Chicago. The result was his 1913 book

'Business Cycles'. According to Rutherford, this work was regarded at the time as a paradigm for scientific economics. Mitchell thought of business cycles as a phenomenon arising out of behavioural patterns generated by the institutions of a developed money economy. Institutionalism was also held to be more "scientific" than orthodox economics because it was both more empirical and more in line with the latest research in other related disciplines (Rutherford 2001, p.177).

Institutionalists attained a significant position in American economics in the period between the twentieth century's world wars, both in academia and in government, but then declined in position and prestige (Rutherford 2001, p.182). Institutionalism clearly did not live up to its own promise, particularly in failuring to pin down exactly what foundations in "modern psychology" it was supposed to have. Moreover, institutionalist work could be attacked as ad hoc, or as lacking proper foundations in a theory of individual behaviour (Koopmans 1947. Cited in Rutherford 2001, p.183). Institutionalism failed to develop theory much beyond the stages reached by Veblen and Commons.

In addition, mainstream economics gained an empirical component with the rise of econometrics. Institutionalists could no longer claim greater "scientific" standing because of their empiricism. As mentioned earlier, they were accused by Koopmans of "measurement without theory". Furthermore, neoclassical theory underwent significant development, especially from the 1930s onward, including theories of imperfect and monopolistic competition and market failures and externalities (Rutherford 2001, p.183-184).

For a period from the late 1940s to about 1970, institutions became almost a prohibited subject within mainstream economics. Eventually, though, the lack of institutional content in the core of neoclassical theory became an issue, and a revived interest in institutions started that had a number of effects. Perhaps the most obvious outcome of this was the development of NIE, consisting in large part of property right, contract and organisation transactions cost analysis. This new institutional economics has generally identified itself as an attempt to extend the range of neoclassical theory by explaining institutional factors traditionally taken as given, such as property rights and governances structures, and, unlike the old institutionalism, not as an attempt to replace standard theory (Rutherford 2001, p.186-187).

Many developments in contemporary economics have found themselves, in one way or another, dealing with topics that had been a part of the older institutionalist tradition (Rutherford 2001, p.186). One of these connections between old institutionalism and NIE is

the concept of transaction costs. This concept was implicit in some of the older institutionalist literature. Its more recent, explicit development has generated an explosive growth of literature on organisations, contracts and the role of institutions in economic development (Rutherford 2001, p.187).

It is striking, though, that Rutherford does not mention the ground breaking 1937 article from Coase. This is prominent especially because Coase says in his Nobel prize lecture that microeconomics is largely a study of price and output determinants, often called 'price theory'. There is much theory without any empirical basis. 'What is studied is a system which lives in the minds of economists but not on earth.' The firm and the market appear by name but they lack any substance. The firm in mainstream economic theory has often been described as a 'black box' (Coase 2005, p.32-33).

Another connection between old institutionalism and NIE is to be found in the increasingly common reference to bounded rationality, even as a principle that is central to the new institutionalism. It is indeed one of the leading principles of Willamson's TCE.

Within NIE there has also been a growing appreciation of the fact that institutions capable of generating social benefits not emerging, and inefficient institutions emerging and surviving. The work of North (1990) provides a powerful example of this viewpoint (Rutherford 2001, p.187-188).

For the difference between old and new institutionalism, it can be argued that new institutionalism still uses the rational individual behaviour model and the assumptions of given individual preference functions (Rutherford 2001, p.188-189). However it will be shown in section 6 of this chapter that there can be much more said about the role of rational behaviour in NIE.

2.3 The nature of the firm: transaction costs

A starting point in the development of NIE was the famous 1937 article by Ronald Coase titled "The Nature of the Firm". In this article, Coase raises the question of why coordination through a price system can be superseded by coordination of management or the establishment of a firm. He starts his reasoning from the basic view that in an economy competition acting through the price system will provide all necessary coordination. "And yet

[there was] a factor of production, management, whose function was to coordinate. Why was it needed if the price system provided all the coordination necessary?" (Coase 2005, p.34) Coase continues by discussing the Russian Revolution, pointing out that little was known about how central planning would be conducted in a communist system. "Lenin had said that the economic system in Russia would be run as an one big factory. However, many economists in the West maintained this was impossible. And yet there were factories in the West, and some of them were extremely large. How did one reconcile the views expressed by economists on the role of the pricing system and the impossibility of successful central economic planning with the existence of management and these apparently planned societies, firms, operating within our own economy." (Coase 2005, p.34) The answer lies in the costs of using the price system. What the prices are must be discovered: there are negotiations to be undertaken, contracts to be drawn up, inspections to be made, arrangements and disputes to be settled and so on. These costs have come to be known as transaction costs. Their existence implies that methods of coordination alternative to the market, which are themselves costly and in various ways imperfect, may nonetheless be preferable to relying on the price mechanism, the only method of coordination normally analysed by economists. This implies that in a competitive system there will be an optimum of planning, since a firm, which can be seen as a small-scale society, can only exist if it performs its coordinating functions at a lower cost than would be incurred if achieved by means of market transactions, as well as at a lower cost than this function could be performed by another firm (Coase 2005, p.34).

However, according to Coase himself, the most important effect of the publication of "The Nature of the Firm" is not to direct attention to the importance of the firm in our modern economy. The opinion of Coase is that in the future it will appear that the most important contribution of his article will be that it explicitly introduces transaction costs into economic analysis. Effects of transaction costs are pervasive in the economy. They not only affect contractual arrangements but also the types of goods and services produced. To exclude transaction costs from theory leaves many aspects of the economic system unexplained, including the firm's emergence. "In fact, a large part of what we think of as economic activity is designed to accomplish what high transaction costs would otherwise prevent or to reduce transaction costs so that individuals can freely negotiate." (Coase 2005, p.35)

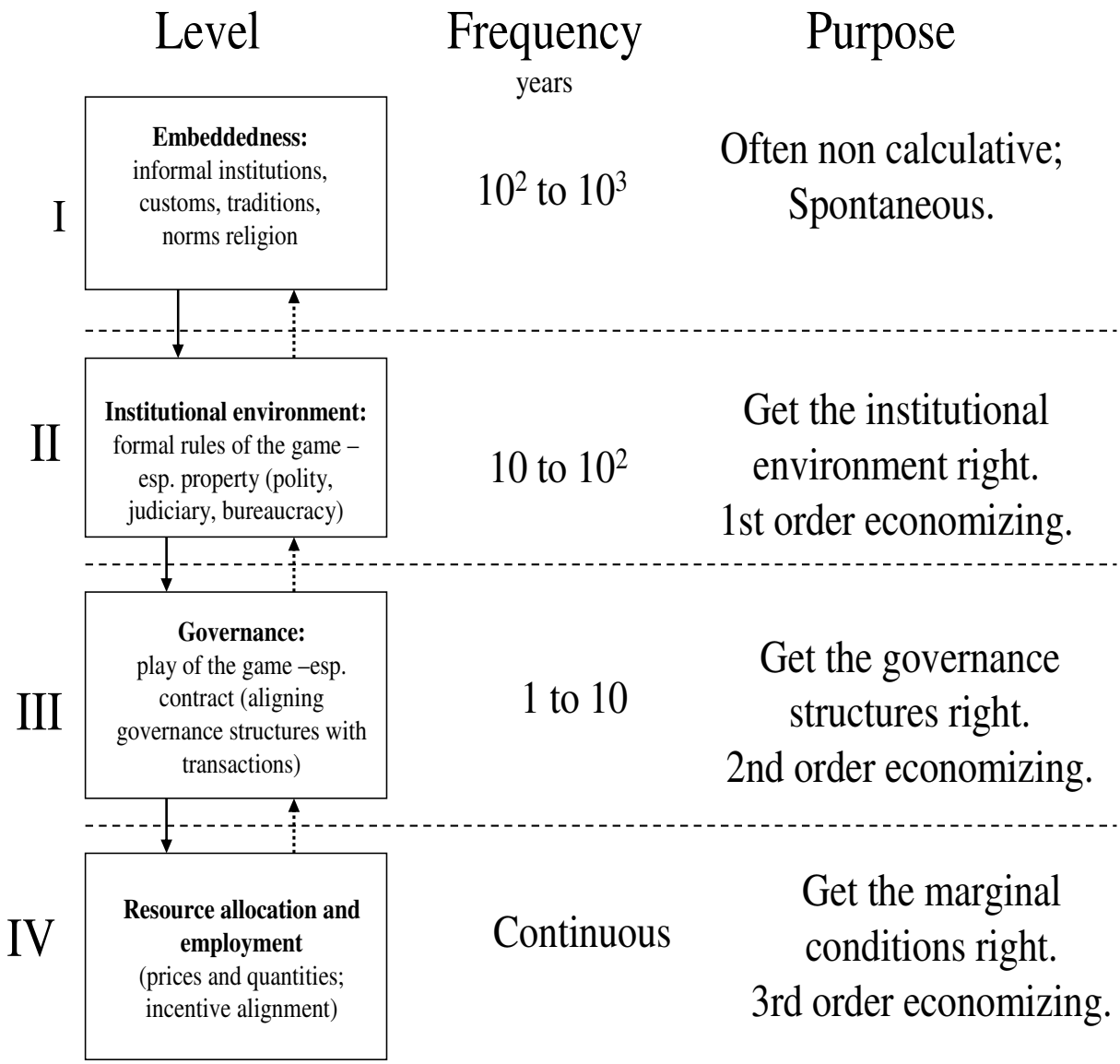
2.4 Institutions and organisations

As has been observed in previous sections different authors have distinguished between different levels of institutions. While North distinguishes between institutions and organisational arrangements. Menard and Shirley (2005b) talk about different branches in NIE. One branch of NIE focuses on the macro institutions that shape the functioning of markets, firms, and other modes of organisation, e.g., the state and the legal systems. Another branch concentrates on the micro institutions that govern firms. Williamson discerns four levels of social analysis, depicted in figure 2.1, in his 2000 article about taking stock and looking ahead. It is striking that he uses the term 'social analysis' as the overall level of analysis in a paper about NIE. The solid arrows in the figure, connecting higher levels with lower levels, signify that the higher section imposes constraints on the level immediately below. The reverse dashed arrows signal feedback. The top level is the social embeddedness level, where norms, customs, traditions, etc. are located (Williamson 2000, p.596-600). Level I is taken as given by most institutional economists. This is probably why Williamson uses the phrase ‘social analysis’: institutions at this level change very slowly – in the order of centuries or millennia – whereupon Douglass North poses the query “What is it about informal constraints that gives them such a pervasive influence upon the long-run character of economies?” (Cited in Williamson 2000, p.596). The informal institutions have mainly spontaneous and evolutionary origins, and given these beginnings they display a great deal of inertia.

The second level is the level of the institutional environment. The structures observed here are partly the products of evolutionary processes, but are also partly the product by deliberate design. The institutional environment consists of formal rules like constitutions, laws and property rights, and includes the executive, legislative, judicial, and bureaucratic functions of government as well as the distribution of powers across different governmental levels. At this level the opportunity for first order economising exists: get the formal rules of the game right. However, cumulative change of a progressive kind is very difficult to orchestrate. Different kind of shocks will occasionally produce a sharp break from established procedures, where rare windows of opportunities to effect broad reform are opened. Absent such a window, major changes in the rules of the game occur on the order of decades or centuries. “Much of the economics of property rights is of a Level II kind” (Williamson 2000, p.598). According to Williamson, the great strength of this literature is that it brings property rights to the

forefront where they belong. The weakness is that it overplayed its hand. The claim, for example, that the legal system will eliminate chaos by defining and enforcing property rights assumes that the definition and enforcement of such rights is easy and costless. Plainly, many parts of the legal system do not qualify. A need existed to go beyond the rules of the game (property) to include the play of the game (contract). "That is the opening through which the governance of contractual relations walked in during the 1970s" (Williamson 2000, p.599).

Figure 2.1 Four levels of social analysis



Source: Williamson 2000, p. 597.

This development led to the third level of Williamson's scheme, where the institutions of governance are located. Costless court ordering is a fiction. Much of contract management and dispute settlement is dealt with by private parties directly. So here the governance of contractual relations becomes the focus of analysis. The unit of analysis is a transaction, the 'old' idea from Commons as described in section 2 of this chapter. Williamson's TCE comes into play. "So conceived a governance structure obviously reshapes incentives." However: "To focus entirely on ex ante incentives alignment, is a truncated way to study organisations – especially if all complex contracts are unavoidably incomplete and if adaptation is the central problem of economic organisation. Agency theory emphasises ex ante incentive alignment and efficient risk bearing, rather than ex post governance. Moving beyond this agency theory tradition of ex ante incentive alignment, transaction cost economics turns its attention to the ex post stage of contract". (Williamson 2000, p.599)

Level III entails what Williamson calls second-order economising: get the governance structures right. The possible reorganisation of transactions among governance structures is re-examined periodically, on the order of a year to a decade.

The discrete structural analysis of the third level is to be distinguished from the fourth level, which is the level at which neoclassical analysis works. Optimality apparatus, often marginal analysis, is employed, where the firm is described as a production function. Adjustments to prices and output occur more or less continuously (Williamson 2000, p.599-600).

2.5 Incomplete contracting and transaction cost economics

This section concentrates on incomplete contracting, as a product of the real world's complexity together with bounded rationality. The concept relates to the question of whether a transaction cost approach may be useful in analysing the public sector or more or less public arrangements. Williamson uses here the rational spirit assumption. "Referring to North, who observed that high transaction cost issues 'gravitate to the polity,' Williamson makes the connection between different governance structures and the complexity of organisations or transactions where the highest complexity is reserved for the public sector." (Boorsma 1997, p.5)

According to Furubotn and Richter (2005, p.251) in the principal–agent theory and the implicit labour contract theory, it is assumed that contracts are concluded once and for all. The phase of contract execution is considered to be unproblematic, and all contingencies are known in advance. “These theories were criticised by Williamson ... and others for failing to consider relation-specific investments and the resulting incentives for opportunistic behaviour of parties. Relation-specific investments imply that once made they have a higher value inside the relationship than outside” (Furubotn and Richter 2005, p.251). Due to high transaction costs for describing all the contingencies, contracts with relation specific investments will be incomplete in important respects. This implies room for opportunistic behaviour by a contracting party with the consequence for the other party being a diminishing of the value of the contract. The party at loss will benefit by bringing safe guards into play, meaning higher ex post transaction costs. Another problem is that contingencies, even though they may be foreseeable by the contract parties, cannot be verified by outsiders such as courts. This has the consequence that such contracts are practically not enforceable. Unlike agency theory, there is no asymmetry of information between the parties, but there is between both parties and outsiders (Furubotn and Richter 2006, p.252).

Incomplete contract theory is designed to give economically rational explanations of how the relationship between two contractual parties can be organised so that uncontractable actions, such as transaction specific investments and complex production decisions, can become part of a binding bundle of agreements. The theory assumes that since parties are unable to describe completely in advance the possible improvements of the buyer’s product, they prefer to wait and see what happens and thus allow for (costless) recontracting (Furubotn and Richter 2005, p.258). These models of incomplete contracting have become known as Grossman-Hart-Moore models (GHM). Williamson criticises these models because according to him they are very different from TCE in assuming costless recontracting. According to Williamson: “The most consequential difference between the TCE and the GHM set-ups is that the former holds that maladaptations in the contract execution interval is the principal source of inefficiency, whereas GHM vaporises ex post maladaptations by their assumption of common knowledge and costless ex post bargaining.” (Williamson 2000)

2.6 Uncertainty and new institutional economics

Frank Knight [1](1885 –1972), in his 1921 book Risk, Uncertainty and Profit, invented the notion of what came to be called Knightian uncertainty, where he makes a distinction between risk and uncertainty. He argues that situations with risk are those where decision making is faced with unknown outcomes but known ex-ante probability distributions. These are situations with perfect perception. With imperfect perception a probability distribution is not known, at least not correctly, but can be known. In situations with perfect or imperfect perception, decision making rules can be applied, maximising expected utility for example. However, they differ in a deep way from those situations where the probability distribution of a random outcome cannot be known. Theorising under this condition of uncertainty was deemed not possible. "But uncertainty is not an unusual condition. It has been the underlying condition responsible for the evolving structure of human organisation throughout history and pre-history." Like Boorsma at al, authors have regarded uncertainty to be at the hart of NIE (Boorsma 1997, p.3).

Knight limited his definition to a probabilistic criterion; "a more general view is that humans have an ubiquitous drive to make their environment more predictable" (North 2005a, p.14). The human agent will construct rules to restrict the flexibility of choices in uncertain situations. Humans know these rules as institutions (North, 2005a, p.14), though the understanding of this human environment is very limited, the fundamental reason for this being the non-ergodic character of the world. Ergodic here is defined as "involving or relating to the probability that any state will recur, especially having zero probability that any state will never recur. Therefore an ergodic stochastic process simply means that averages calculated from past observations cannot be persistently different from the time average of future outcomes." (North 2005a, p.19) An ergodic economy is one in which the fundamental underlying structure of the economy is constant and therefore timeless. In a non-ergodic world states have a zero probability of recurring.

[1] Frank Knight was the dominant intellectual influence in economics at The University of Chicago during the formative years of the economic analysis that is identified with Chicago Economics. An economist by training and a philosopher/historian by inclination, Knight spent his career opposing the efforts of progressives, institutionalists, Keynesians and Christians who advocated social control in the name of science and/or morality. Liberal society, he believed, was always in danger from those who claimed to know what was best for society on either moral or scientific grounds. (http://www.msu.edu/~emmettr/fhk/)

When issues arising from perfect and imperfect perception are combined with issues arising from non-ergodicity, the following combinations can be defined (North 2005a, p.22) in which North uses the concept of uncertainty in a Knightian sense:
In situations with perfect perception there may not be any need for institutions even in the face of uncertainty. With imperfect perception two possibilities can be discerned:

1. Uncertainty in an ergodic world: If agents' perception of the environment is imperfect, then it may be possible that uncertainty persists even if the static uncertainty case is replicated over time. An agent's imperfect perception can be defined as having a wrong probability distribution of risk-states or assigning probability over uncertainty-states. Non–rational beliefs are likely to be of the latter sort; that is, they assign certain probability on states of uncertainty for which no such probability can be "reasonably" assigned. In a world of imperfect perception, uncertainty is a function of knowledge and institutions.
2. Uncertainty in a non-ergodic world: The major change here is that institutions adopted for a particular time, even if optimal (that is, of correct perception) at that time, be far from optimal as the human environment changes over time.

This last possibility connects to the efficiency definition of North, who uses the term to mean a condition in which, given the state of technology and information costs, the market has the lowest production and transaction costs attainable. The term is almost always used in relative rather than absolute terms. Moreover, while in economic markets efficiency would coincide with improved material well-being, in political markets the welfare implications are more ambiguous (North 2005a, p.15-16).

It will be clear that when Knight argues the impossibility of theorising under uncertain conditions, he restricts himself to theorising in a neoclassical sense: maximising utility or profits. North however starts with a non-neoclassical view and introduces the notion of a non-ergodic world. This distinction between North and Knight is not the complete picture, though. In his paper about NIE and the theory of behaviour under uncertainty, Dequech (2006) argues that one can define NIE in relation to neoclassical economics depending on the applied starting points of risk and uncertainty. He argues that in NIE there is on the one side a neoclassical strand and on the opposite an Austrian strand.

To the extent that there is a neoclassical strand in NIE applying the neoclassical approach to institutional issues, its implicit notion of uncertainty is that of the Knightian risk or expected utility. In contrast, implicit notions of procedural uncertainty, arising from limitations on the computational and cognitive capabilities of the agents, may be found in other segments of NIE. For instance, Williamson's TCE, with its starting point of bounded rationality. Also, North's 1990 book concerning institutionalism implicitly adopts a notion of procedural uncertainty (Dequech 2006, p.113).

Regarding the definition of Knightian uncertainty it is unclear, even when used by NIE authors, whether to include ambiguity, which is uncertainty about probability, created by missing relevant and possibly known information, or fundamental uncertainty (Dequech 2006, p.115). Unfortunately, this does not make it easier to understand whether and how NIE differs from neoclassical economics. "Some new institutionalists are in fact sufficiently clear for us to attribute to them a notion of fundamental uncertainty. In this respect it is important to consider what Rutherford (1994) calls the 'Austrian wing' of NIE" (Dequech 2006, p.115). Take for example the notion of a non-ergodic world in the recent work of North as a notion about fundamental uncertainty (Dequech 2006, p.115).

As suggested above, NIE can be seen as including a strand extending the neoclassical approach to institutional issues. This means that this strand of NIE adopts a neoclassical notion of rationality and applies this to the study of institutions. From this perspective, rationality is typically understood as corresponding to utility maximisation or, more formally, to the satisfaction of the axioms of standard expected utility theory (Dequech 2006, p.121). Not surprisingly, there is a parallel between the different approaches of rationality and the distinctions made earlier between different NIE approaches to uncertainty. Different views on uncertainty are associated with, or even lead to, different views on rationality (Dequech 2006, p.125).

The notion of rationality as utility maximisation is very clearly accepted in agency theory. The property rights literature may also be seen as part of the effort to extend the maximisation hypothesis to consider institutional constrains imposed by property rights. The property rights system itself has also been seen as the object of maximising choice (Dequech 2006, p.121). Rationality as maximisation is also present in the new institutional game theory and the Law and Economics approach of Posner (Dequech 2006, p.122).

Other strands of NIE can be characterised by applying an alternative notion of rationality to the study of institutions: bounded rationality. “Bounded rationality is the representative par excellence of what Furubotn and Richter (pp 3-4) call the assumption of imperfect individual rationality that is dominant in TCE, in the more recent work on property rights, and the new institutional approach to new economic history” (Dequech 2006, p.122). Incomplete contracting theory can be seen as a development of the earlier TCE of Williamson and others. As such it can be related to this branch of NIE. “On the other hand, there are only occasional references to bounded rationality in this type of research. Some difficulties in formalising bounded rationality seem to have played an important role in preventing it from becoming an integral part of the incomplete contracting literature so far” (Dequech 2006, p.123).

The neoclassical strand of agency and property rights theory, with the neoclassical notion of rationality and the bounded rationality strand of TCE, do not represent the only approaches to rationality within NIE. There have been a few non-neoclassical critiques of bounded rationality by new institutionalist authors belonging to the Austrian wing of NIE. Richard Langlois, for instance, criticises bounded rationality for not paying sufficient attention to the interactions among agents as part of the environment where they operate. His research programme would admit several kinds of reasonable action in certain situations, including satisfying rule-following behaviour, entrepreneurship and so on. Streit et al., criticise bounded rationality for neglecting the creativity of the human mind. “Cognition, they argue, is not only a process of running after new information about changes in the environment. It is also a process by which new opportunities of action are created.” They propose a concept of entrepreneurial-creative rationality, in which agents try to overcome existing constraints whether through resource supplies, technological limits or institutional constraints (Dequech 2006, p.112). According to Dequech (2006, p.126): “Most economists accept the usefulness of some notion of rationality to help us to deal with the existence of order in reality and, when possible, make predictions. The attempt to incorporate the additional notion of creativity is important for both theoretical and empirical research that acknowledges the widespread occurrence of innovative behaviour as creating both technological and organisational change.”

2.7 An overview

NIE works at two levels of analysis. There is a macroscopic level that has been called the institutional environment and the microscopic level or the institutional arrangements (Furubotn and Richter 2005, p.291-292). This scheme is much the same as the framework of Williamson discussed in section 4. Williamson speaks of the institutions of governance. His TCE deals with the microscopic level. Therefore, the Furubotn and Richter dichotomy has been used in the framework in table 2.1 where this dichotomy is combined with different notions of rationality that can be distinguished within NIE, as discussed in the preceding subsection. The macro level is level II of WIlliamson's four layer model, and the micro level is level III. Level I and IV do not play a role here; level I is taken as a given by most institutionalists and certainly in this thesis. Level IV is where the neoclassical marginal apparatus works in which output and prices are adjusted continuously, and is outside the scope of NIE.

The purpose here is to identify the different branches of NIE that need to be studied in more detail in this thesis. The plan is to describe in chapter 3 more detail of the NIE branches that will be applied to the histories of the three canal projects. The difficulty is now to decide which branches will be of particular interest for this thesis and which branches are not.

Table 2.1 Different strands of new institutional economics

	Rationality		
Levels	Neoclassical	Bounded	Austrian
Macro Level II of Williamson	Property rights; game theory; Law and Economics	Modern versions of property rights; TCE of North	Interactions of agents and institutions with the changing human environment
Micro Level III of Williamson	Agency theory; game theory; GHM	Modern versions of incomplete contracting; TCE, Williamson	Creativity and entrepreneurship

Based on Furubotn and Richter 2005, p. 291-292.

First it must be stressed that NIE will be applied in this study, meaning that old institutionalism will be excluded from further treatment. Given this starting point, areas of uncertainty may still be open to interpretation because the case studies have not yet been conducted. What is clear, however, is that Williamson's TCE should be used, as this study

deals for a great part with the micro-level, or to be more precise, second order economising at the third level. This also implies that other theories located on the macro level will be of limited meaning, applying as well to the TCE approach of North. This theory concentrates on economic change throughout history in a broader perspective. Most probably property rights theory will also be of interest for the canal projects' study. It is already clear from short and preliminary descriptions of the three canal projects in chapter 1 that institutional environment shocks occurred during preparation and building of the canals; perhaps these shocks influenced the property rights structure in which the governance of these project operated.

Williamson argues that agency theory is not TCE because it regards ex ante alignments of contractual relations, rather than ex post governance. In accordance with these remarks about differences between TCE and agency theory, Williamson has the opinion than the incomplete contracting theory of GHM is not TCE, because GHM assumes ex post costless bargaining. Due to the complicated nature of the projects it is to be expected that incomplete contracting is one of the decisive characteristics of the canal projects' histories, but that ex post bargaining will not be costless and that thus ex post governance is important. Consequently the applicability of models of agency theory and of incomplete contracting must be regarded to be of limited meaning for the purpose of this thesis. At least when Williamson’s critique on costless ex post bargaining as one of the assumptions in these models, holds

So the question is: what institutions can be regarded as constant in the study of the canal projects? Certainly Williamson's level I informal institutions. It is uncertain that level II institutional environments can also be assumed constant over total project histories. Furthermore, it could be that Austrian concepts of uncertainty and entrepreneurship are of great value to describing the decision-making which led to the projects' realisation and to the description of the subsequent project outcomes. The conclusion, though, is that for the study of the history of the three projects Williamson's TCE will be used in conjunction with property rights theory. Therefore, in the next chapter these two theories will be described in more detail.

3 Transaction cost economics and property rights theory

3.1 Introduction

With the conclusion of chapter 2 it was decided that institutional economics will be applied in this research, but concentrating on what has come to be known as 'new' institutional economics, or NIE. Old institutionalism will be excluded from further treatment. It was also concluded that Oliver Williamson's TCE will be used, because this study deals for a great part with the governance structures for which the problem is to get these structures to operate in a transaction cost minimizing way. It was also concluded that property rights theory will be used because property rights work at the level of the institutional environment.
Here again, as throughout this thesis, a distinction is made between institutional environments and institutional arrangements or governance structures. The institutional environment is the set of fundamental, political, social and legal ground rules that establishes the basis for production, exchange and distribution. Douglass North describes institutions as “the humanly devised constraints that structure political, economic, and social interactions. They consist of both informal and formal constraints. Informal constraints are sanctions, taboos, customs, traditions, and codes of conduct and formal rules are constitutions, laws and property rights” (North 1991. Cited in Williamson 1993, p.12). An institutional arrangement is an arrangement between economic units that governs the way in which these units cooperate and/or compete (Williamson 1993, p.13). TCE relates to this two-level approach by treating institutional environments as a set of shift parameters for the efficiency of the institutional arrangements: changes of these parameters shift the comparative costs of governance.

Being able to make the distinction between the institutional environment and the institutional arrangements is very useful because now the changes in the institutional environment can be separated from the changes in the institutional arrangements that governed the realisation and exploitation of the canal projects that are studied in this thesis: the canals of the Merchant King, Willem I of the Netherlands; the Suez Canal in Egypt; and the Rhine-Main-Danube

waterway. Institutional environments are formed by the political, social and legal ground rules of the countries in which the projects were realised. The institutional arrangements are the governance structures that carried out the realisation and exploitation of these projects.
Property rights theory will be of interest for the study of the canal projects. From the short and preliminary description of the three, it is already clear that during the projects' preparation and building, shocks in their institutional environments occurred. Perhaps these shocks influenced the property rights structure in which the governance structures of the projects operated. According to Williamson, TCE is more explicit about its behaviour assumptions compared with a property rights approach. These assumptions relate to the concepts of bounded rationality and opportunism (Williamson 1993, p.9). TCE is concerned with incentive alignment and the credible commitment properties of contracting (Williamson 1993, p.10). The basic hypothesis from which TCE operates is that governance structures are aligned with transactions in such a way as to effect a transaction cost economising result (Williamson 1993, p.17). It will appear that it is needed to go beyond a generic treatment of TCE with a more elaborate description of recent developments regarding hybrid governance structures. These structures combine characteristics of the market and the hierarchy. Literature repeatedly makes clear that hybrid governance structures frequently occur in situations that are not in accordance with the generic notions of TCE. To deal with this problem it is frequently suggested to incorporate the effects of trust in governance structures as a new variable in TCE. However there is also a possible solution to this theoretical problem in concentrating on the mechanisms of governance, rather than on the variables of transaction cost theory (Speklé, 2001).

In section 3.2 of this chapter TCE will be described. Section 3.3 will discuss the different governance structures that are distinguished within TCE. Section 3.4 will pay attention to the applicability of TCE to the public sector. Finally, section 3.5 will deal with hybrid governance in more detail and in section 3.6 the most important features of the property rights theory shall be identified. This chapter concludes with provisional guidelines that can be inferred from the two branches of NIE to be used in studying the history of the canal projects.

3.2 Transaction cost economics

The economic rationale of organisations under NIE and especially in TCE is assumed to be that of economising on transaction costs. According to this hypothesis, governance structures are aligned with transactions in such a way as to effect a transaction cost minimisation (Williamson 1993, p.9).

Transaction costs are costs of running an economic system, and can be thought of as the costs of contracting (Williamson 1996, p.5). These costs include search and information costs, bargaining costs, the cost to draw up an agreement and policing and enforcement costs. A transaction may be said to occur when a good or service is traded across a technologically separable interface. By definition, the organisation of technologically separable activities is not technologically determined but is a matter to which the comparative analysis of alternative forms of governance may usefully be brought to bear (Williamson 1993, p.16).

3.2.1 Behavioural assumptions

The starting point of TCE can be found in two behavioural assumptions: bounded rationality and opportunism. Bounded rationality means that human beings are limited in their knowledge, foresight and skill. The essence of bounded rationality is that though humans intend to behave rationally, their decisions are hardly ever optimal in a neoclassical sense, because man-kind simply lacks cognitive and computable ability to arrive at such decisions (Speklé 2001, p.11). Therefore, the starting point of perfect information, as is in neo-classical economics, can not and does not exist in TCE.

The second behavioural assumption of TCE is opportunism. This refers to the self-interest of economic agents combined with their own guile, causing people to sometimes say one thing and do another. They will not reliably tell the truth, the whole truth, and nothing but the truth if it suits their purposes to behave otherwise (Williamson 1993, p.12). 'Opportunism is a stronger form of the simple self-serving behaviour commonly attributed to homo economicus: economic man is a relatively nice chap for at least he plays by the rules, whereas such thoughtfulness cannot be expected from his opportunistic counterpart' (Speklé 2001, p.11). The main ramification of bounded rationality, for purposes of studying economic organisation, is that all complex contracts are unavoidably incomplete. TCE joins incompleteness with the presumption that parties to recurrent transactions are broadly

perceptive of the nature of the contracting relation of which they are a part. Accordingly, the study of contract is characterised as one of incomplete contracting in its entirety (Williamson 1993, p.11).

To understand better the mechanism of institutional evolution and institutional change, farsightedness has been included by some theorists as one of the behavioural assumptions. This refers to the idea that actors anticipate future possible opportunistic behaviour and create safeguards to protect themselves against this opportunistic behaviour. (Groenewegen and De Jong 2008, p. 53). But the main point here is that TCE maintains that all complex contracts are unavoidably incomplete by reason of bounded rationality. Such incompleteness does not imply myopia, because rational agents are farsighted. They will look ahead, perceive hazards and take these into account into the contractual calculus. (Williamson 1998, p. 42 and Williamson 2005a). For the static blueprint approach of TCE is seems to be sufficient to regard farsightedness as a more detailed specification of the bounded rationality specification. Consequently no further attention will be paid to possible ramifications of farsightedness.

In summary, whereas it was once customary to focus on "market failures" and to discuss these in technical terms, it becomes clear under more behavioural assumptions that such a focus is unattainable if the core source of failure is the human condition rather than technology. Once that is granted then all forms of organisations are subject to failure and the only way to proceed is comparatively (Wolf 1994, pp. 71-79 and pp.153-157; Coase 1964; Williamson 1993, p.12).

Incomplete contracts leave room for opportunistic behaviour in the stage of the contract execution. The consequence of assuming bounded rationality and opportunism is that with incomplete contracts and with opportunism, transaction costs - policing and enforcement costs in particular - will be high to counter risk. Proper governance structures in which the transactions will be fulfilled become important in minimising these transactions costs. Governance may be defined as the institutional framework that consists of markets, hybrids and hierarchies through which a transaction is channelled (Williamson 1993, p.16). In a hierarchy transactions are governed by authority (Williamson 1996, p.13). Governance structures are all situated on a continuum, which has on the one end the complete competitive market and the hierarchy on the other. Hybrids are intermediary forms of governance structures, being neither markets nor hierarchies.

3.2.2 Attributes of transactions

Given bounded rationality and opportunism, TCE associates contracting problems with the characteristics of the transactions in question. The three attributes of transactions upon which TCE concentrates attention are (1) the frequency with which transactions recur, (2) the uncertainty to which transactions are subject, and (3) the degree of asset specificity or the idiosyncrasy of the transaction. This last attribute is the most important, because an especially high degree of asset specificity makes the owner of the asset vulnerable to opportunistic behaviour by his counterpart in the transaction. Asset specificity refers to the degree with which an asset can be redeployed for alternative uses and by alternative users without sacrificing production value. Asset specificity is high when the possibility of redeployment is low. Thus asset specificity corresponds to the opportunity losses that may arise when the transaction requires specialised commitment of custom-made products, processes or knowledge. The full ramifications of asset specificity only become evident in the context of incomplete contracting, due to bounded rationality. In these instances, the vulnerability to opportunism, originating from the presence of asset specificity, will be high (Williamson 1993, p.16/17). Asset specificity refers to the size of the opportunity losses that will be incurred in case of premature termination. It must be stressed that the problems associated with asset specificity are quite pervasive, because asset specificity is not rare and it comes in many flavours (Speklé 2001, p.18). Williamson (1996, p.59/60 and 106) discerns at least six forms of asset specificity:

1. Site specificity, referring to a situation in which the production site cannot be abandoned without costs. This is, for instance, the case with shop renting (Weijnen, 1993), or in the situation of two successive production stages located close to each other to economise transportation costs.
2. Physical asset specificity. This asset specificity is present when customised components are involved.
3. Human asset specificity. This could be special training or learning-by-doing required to execute a transaction.
4. Dedicated investment. These are discrete investments made at the order of a particular customer.
5. Brand name capital. This is the future value of a brand name, which can only be realised within a certain transaction.

6. Temporal specificity. This alludes to some particular strength in timely responsiveness. Temporal specificity is 'akin to technological non-separability and can be thought of as a type of site specificity in which timely responsiveness by on-site human assets is vital...' (Williamson 1996, p.106).

Uncertainty refers to the possibility of specifying intended performance before completing a contract and predicting the environment within which the contract is to be executed. Frequency needs no special definition; it has no peculiar connotation in TCE.
The essential challenge of contracting and economic organisation is to overcome impediments to adaptation (Williamson 1996, p.101-103). Uncertainty and bounded rationality jointly determine when and why the need to adapt is likely to arise, whereas asset specificity in conjunction with opportunity explain when and why achievement of successful adaptation cannot be taken for granted. Uncertainty is relevant for it inhibits the ex ante specification of required performance in a comprehensive, state-contingent way. Bounded rationality aggravates this problem (Speklé 1993, p.12).

3.3 Governance structures

Economic actors try to cope with opportunism and bounded rationality by means of organisation, by adopting appropriate institutional arrangements to minimise costs incurred in transaction handling.
TCE defines three distinct modes of organisations: 1) market governance; 2) hybrid governance and 3) hierarchical control or internalisation. These alternative governance structures differ in the control mechanisms employed to safeguard contract execution and to achieve successful adaptation. Market governance derives control from the ‘invisible hand’ and relies on competition to bring about equitable terms of trade and disciplined contract execution. Hybrid forms of governance are typically based on fairly explicit long-term contracts in conjunction with additional safeguards to assure compliance. Hierarchical governance attains control primarily by means of authority, internal incentive structures and monitoring (Speklé 2001, p.13).

With regard to contract law regimes for the market and hybrid structures, a distinction can be made between classical and neo-classical contract law. The contract law of hierarchy is that of forbearance, which means self-control, kindness and forgiveness. Classical contract law applies to the ideal transaction in law and economics - 'sharp in by clear agreement; sharp out by clear performance' - in which the identity of the parties is irrelevant. Individual buyers and sellers bear no dependency relation to each other. Instead, each party can go its own way at negligible cost to another. If contracts are renewed period by period, that is only because current suppliers are continuously meeting bids in the spot market. Contract law is interpreted in a very legalistic way. Should disputes arise between formal and less formal terms and hard bargaining, more formal features supersede less formal. Classical contract law is congruent with and supports the autonomous market form of organisation (Macneil, 1974. Cited in Williamson 1993, p.13).

The neo-classical contract law regime proceeds very differently. It refers to the concept of a contract as a framework, in transactions where continuity is the source of added value and in which parties bear a bilateral dependency relation to each other. One of the characteristics is that if direct efforts between the parties fail to resolve disputes, these disputes are commonly presented to specialised forums, like arbitration. The purpose of this dispute settlement is to promote continuity by reaching an objective reconciliation. Neo-classical contract law relies more on the spirit of the framework, rather than on the letter or legal rules in an effort to see contracts through to completion (Williamson 1993, p.14).

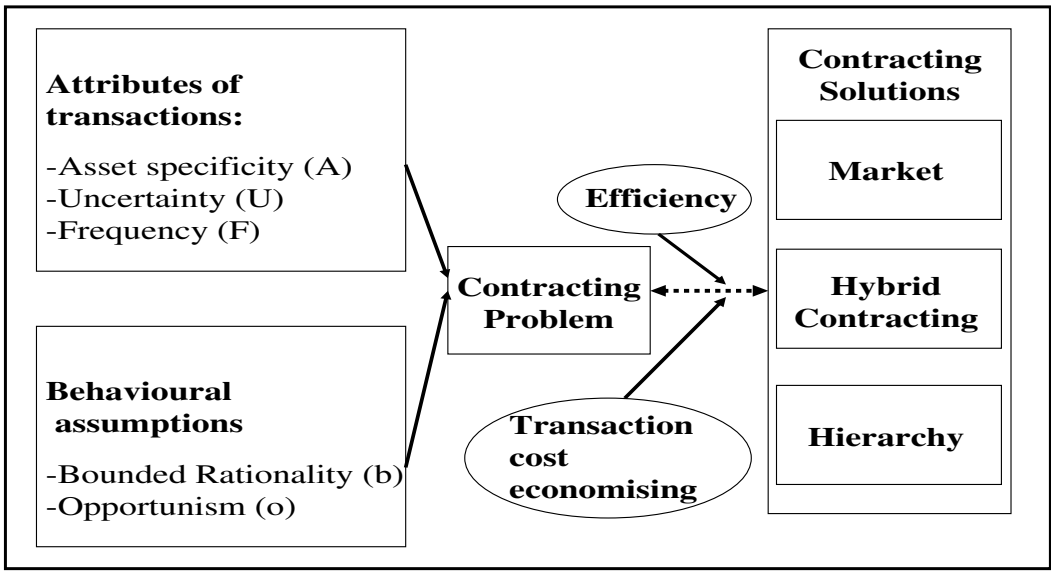
The contract law of internal organisation is more obscure. TCE maintains that the implicit contract law of internal organisation is of forbearance. Because access to courts is mostly impossible, the parties must resolve their disputes internally and hierarchically (Williamson 1993, p.14). The underlying rationale for forbearance law is twofold. First, parties to an internal dispute have deep knowledge about the circumstances surrounding a dispute and about the efficiency properties of alternative solutions, which can only be communicated to the court at great cost. Secondly, permitting internal disputes to be appealed to the court would reduce the efficacy and integrity of the hierarchy. “Since legalistic arguments fail, greater reliance on instrumental reasoning results” (Williamson 1993, p.15).

The differential access to control devices makes the structures appropriate for the governance of some transactions but not for others. Effectiveness of governance, then, depends on the match between the problem to be solved and the problem-solving ability. As a consequence,

types of governance structures also differ with respect to their transaction costs. TCE holds that ultimately efficiency, and not effectiveness, explains the match between transactions and governances structures. To put it another way, a transaction is aligned with a specific governance structure because of the different transaction cost economising properties of that alignment. This is the alignment hypothesis from which TCE works (Williamson 1997, p.309-311).

The essence of TCE can now be stated as follows: its main argument is that, given opportunism and bounded rationality, the specific nature of a transaction, as expressed in terms of asset specificity, uncertainty and frequency, gives rise to different though predictable contractual problems with which contracting parties have to cope (Speklé 2001, p. 13). Figure 3.1 presents an overview of the basic starting points of TCE. The behavioural assumptions, the attributes of transactions and the possible contractual solutions are presented. The driving force of seeking efficient solutions for the contracting problem is transaction cost economising.

Figure 3.1. The basic structure of transaction cost economics



Source: Speklé 2001, p 14

3.3.1 Scores on the dimension

The dimensions of TCE are the 3 attributes of transactions and the 2 behavioural characteristics of human nature. To analyse the partial effects of the attributes of the transactions and the behavioural assumptions these dimensions can be combined. This would

result in six possible combinations. Frequency as an attribution of transactions is here not an independent variable, because the role of frequency is basically confined to that of a problem multiplier or intensifier, and adds to the pressure to find a suitable solution to a contracting problem. It also affects the economic rationality of investing in specialised governance, because recurrent transactions provide a larger basis against which to charge the extra costs of specialised governance. On the other hand, frequency can be an important feature to evolve towards more hybrid governance structures. 'Tit for tat' (Axelrod, 1984) as a protection against opportunistic behaviour becomes only possible in recurrent transactions (Speklé 2001, p.17). Seen in this way, recurrent transactions can be seen as an autonomous safeguard against opportunism.

For the four remaining combinations, listed below, the levels of asset specificity and uncertainty are sufficiently high to be important.

1. Asset specificity and bounded rationality (A & b)
2. Asset specificity and opportunism (A & o)
3. Uncertainty and bounded rationality (U & b)
4. Uncertainty and opportunism (U & o)

The combinations 2, 3 and 4 are especially consequential (Speklé 2001, p.14-16). The combination of asset specificity and bounded rationality (A & b) in itself does not make a difference as driving force of transactions costs; also, without bounded rationality parties would be vulnerable to opportunistic behaviour in situations where asset specificity is high. Only now parties can organise a sufficient contractual solution, because it would be possible to specify the consequences of every contingency beforehand. This would constitute an efficient governance structure. The combined effects in the three consequential combinations are described below:

Asset specificity and opportunism

The implications of opportunism are strongly associated with asset specificity. If asset specificity would not exist, opportunistic behaviour would not have harmful effects. As soon as asset specificity comes in, however, contracting parties experience certain lock-in effects.

Once transaction-specific investments are made, continuity of the relation becomes of value, because in that case the full proceeds of the investment can only be realised if the transaction is to be completed. Asset specificity tends to involve mutual dependency, because both parties become strategically tied-in to bargain whenever a proposal to adapt is made by the other party.

Uncertainty and bounded rationality

For cases of transaction that are carried out under uncertainty, bounded rationality is important to the extent that the limits of man's cognitive ability are actually reached. Given substantial uncertainty, bounded rationality does not allow for a full specification of the required performance. Therefore contracts will necessary be incomplete and can even be ill constructed.

Uncertainty and opportunism

In situations in which opportunistic behaviour might occur, one may expect contracts to contain explicit provisions to protect the parties from opportunistic hazards. Such clauses are, however, difficult to design for reasons of uncertainty and bounded rationality. Integral contractual protections require the contracting parties to foresee the full set of contingencies and hazards that may possibly arise in the course of the contract execution, and further requires the parties to be able to devise appropriate and enforceable safeguards against such hazards. Therefore, full protection through contract specifications soon becomes impossible.

TCE then predicts that if asset specificity is high and uncertainty is high, which is generally the case with long-term contracting, the governance structures will move from more market and hybrid forms to more hierarchical forms of governance. In cases of a high frequency of transactions, parties will be inclined to rely more on market or hybrid forms of governance. This is even more obvious if the degree of asset specificity is not so high. Parties are then more mutually dependent and this dependency will protect them against opportunistic behaviour.

3.3.2 Mechanisms of adaptation

Governance may be defined as the institutional framework broadly consisting of markets, hierarchies and hybrids through which a transaction is channelled (Williamson 1993, p.16).

The most important difference between these governance structures lies in their nature and ability in adapting to opportunistic behaviour or changing circumstances, and in their distinctive access to control devices. Williamson distinguishes between autonomous adaptations (A-adaptations) and coordinated adaptations (C-adaptations). A-adaptations follow the neoclassical price theory where producers and consumers respond independently to parametric price changes to maximise their utility and profits respectively. Parties that are in a long-term bilateral dependency relation must recognise that incomplete contracts require gap filling, but the distribution of the resulting gains is undetermined. To overcome maladaptations in the process of bargaining, recourse to different coordinating mechanisms is needed. The adaptations by these coordinating mechanisms are called C-adaptations (Williamson, 1996, p.102 -103).

Market governance is based on free competition and A-adaptations. Governance operates through classical contracting. In an extreme form, market governance features standardise, even non-explicated contracts and instantaneous settlements. Longer-term relations between parties are governed by a series of successive short-term contracts, each subject to competitive forces. Individual contracts are written again, and each party is free to adjust to changing circumstances without prior consultation. This freedom is only restricted by the market's opinion of what constitutes an appropriate adjustment (Speklé 2001, p.20).

Hybrids consist of various forms of long term contracting, reciprocal trading, regulation, and franchising. Here, neoclassical contract law operates which differs from the classical contract law of markets and the forbearance contract law of hierarchies. Hybrids display intermediate values of A- and C- type adaptabilities. It preserves ownership autonomy which elicits strong incentives and encourages A-adaptability. But in a long-term relation, successful adjustment requires some form of mutual consent and the contract itself provides no direct guarantees that such an agreement will be reached. That is why parties demand additional, transaction-specific safeguards, which are forms of C-adaptability (Williamson 1996, p.103-104). These safeguards often take the form of some kind of hostage, the exchange of which serves to infuse a self-enforcing quality into the transaction. Room for dispute, however, inevitably remains and when parties fail to agree their conflict will ultimately be referred to arbitration or to a court for settlement. Court referral is only appropriate in conditions where easily accessible information suffices for fair conflict settlement (Speklé 2001, p.20).

The hierarchy plays by altogether different forbearance contract law rules, complemented by reliance on strong administrative control while buttressing incentive intensity (Williamson

1996, p.105). Inside the firm, most contracts contain hardly any explicit clauses as to the desired outcomes. Rather, contracts are designed to secure command over factors of production. Such contracts grant considerable flexibility in decision–making, as well in timing as in scope, thus permitting sequential, adaptive responses to disturbances and unforeseen events.

The incentive structure is usually left implicit and performance standards are communicated in somewhat vague and informal ways (Speklé 2001, p.21). Thus, internal organisation works from an entirely different doctrine than that which governs relations between independent parties.

Whereas autonomous party contracting is in last resort regulated by a vast body of rather rigid legal rules and procedures with little talent for tailor-made solutions, the hierarchy applies an adaptive doctrine of forbearance (Williamsom 1996, p.22). Table 3.1 gives an overview of the possibilities and mechanisms of adaptations for each of the governance structures defined in TCE.

Table 3.1 Governance structures and their mechanisms of adaptation*)

Governance structure	**Mechanisms of adaptation**
Market	- A-adaptations - No prior agreement on the framework for adjustments - Adjustment via market-driven modification of next contract - Court ordering in case of unresolved conflict
Hybrid	- A- and C-adaptations - Contract-governed adaptation, usually incompletely specified - Contractual gaps filled in by negotiation - Hostages to balance stakes in successful contract execution - Unresolved conflicts referred to arbitration or court
Hierarchy	- C-adaptations - No ex ante specification of when and how to adapt - Sequential adjustment: postpone decisions until need to adapt arises - Conflict settlement by hierarchical fiat

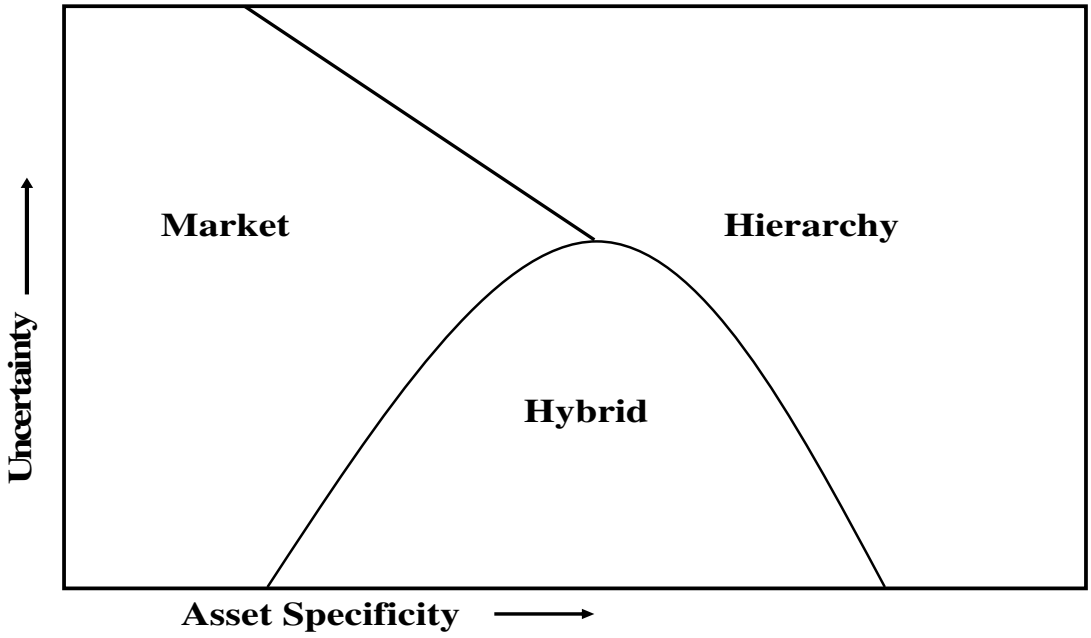
* Based on Speklé 2001, p.22

3.3.3 Transaction cost economising

TCE maintains that the discriminating alignment of transactions, which differ in their attributes, with governance structures, which differ in their costs and competencies, can be understood by referring to the alignment's transaction cost economising properties (Williamson 1996, p.46-47). Consider market governance: the market provides little ex-ante safeguards when it comes to adjustments, but many transactions do not need such prior protection. Contractual hazards are low with transactions that score low on asset specificity and uncertainty. These transactions can do perfectly without all kinds of safeguards against opportunism. Things change only gradually with increasing uncertainty, provided that asset specificity is low. The market mechanism often remains unsurpassable in cost-effectiveness respects. Given low asset specificity, high uncertainty can ordinarily be understood to mean incertitude or ignorance regarding future price movements, though this can be coped with in the many ways incorporated in the market process. For instance, one could build up stocks, or write long-term fixed price contracts. Furthermore the effects of uncertainty can be redistributed by well-developed secondary markets on which one can obtain the desired hedges at relatively low costs. But when asset specificity rises above moderate levels, the market loses much of its power and practically becomes an obstacle to redress opportunism (Speklé 2001, p.24-25). Assigning market governance to relations characterised by moderate levels of asset specificity will probably result in endless bargaining over appropriation issues, leading to opportunity losses. TCE explicitly predicts the prevalence of hybrid and hierarchical governances in circumstances of more-than-low to moderate levels of specificity. With low uncertainty and a moderate degree of asset specificity a hybrid type of governance will prevail. With rising levels of uncertainty the efficacy of all modes of governance may deteriorate but the hybrid mode is arguably the most susceptible. This is because hybrid adaptations cannot be made unilaterally as in the market mode, or by fiat as in the hierarchical mode. Adaptations will require mutual consent, but this takes time and comes with an extra cost (Williamson 1996, p.116). Thus, the hybrid mode soon becomes non-viable when uncertainty reaches high levels and will usually be substituted by the market or the hierarchy, depending on the degree of asset specificity. High asset specificity requests hierarchical governance, even when uncertainty is low. Unanticipated disturbances may still occur, but the market and the hybrid governance cannot assure accurate reaction due to opportunism.

Figure 3.2 presents in an indicative manner the economical viability of the three generic governance forms in relation to asset specificity and uncertainty, as presented by Williamson (1996). The exact scaling is unclear, as is the precise location of the dividing lines, making the figure only indicative.

Figure 3.2. The viability of governance structures



Taken from Williamson 1996, p.117.

3.4 Transaction cost economics and the public sector

3.4.1 Economising on transaction costs

The basic assumption of TCE is that organisations economise on transaction costs. However, in empirical studies there is no need to measure transaction costs directly, something that would have formed a critical obstacle in testing transaction cost theory. Theoretically the concept of transaction costs is clear but empirically transaction costs are very difficult to measure because these costs are enclosed in all kind of other costs normally measured in management information systems (Bokkes 1989, pp. 191-194). Fortunately, the need to directly measure transaction costs was removed by Williamson's reformulation of the transaction cost argument in terms of the effects of transactions' observable attributes on the

differential organising costs. According to Scott E. Masten, the ensuing empirical research has provided a broad and sophisticated base of support for the claim that transaction cost considerations influence organisational choice and design. These decisions are particularly sensitive for the role of asset specificity and uncertainty (Masten 1996, p.51). It is recognised that asset specificity and uncertainty are the two most important and decisive characteristics of transactions.

With this reformulation of the transaction cost argument, transactions become the basic unit of analysis in TCE. The secondary unit of analysis is the governance structure. TCE is concerned with the trade-off between the benefits and costs of autonomy and cooperation within different governance structures. Market oriented governance structures feature A-adaptations and encourage independence and enterprise. Hierarchical governance structures feature C-adaptation that encourage greater compliance and is based on what Williamson calls forbearance.

The question now is whether this schema can be applied to the public sector. Williamson, in his 1999 paper, expands the key attributes of transactions with a attribute named 'probity'. It refers to the loyalty and rectitude with which certain public transactions are to be discharged (Ruiter 2005, p.292)[2].

3.4.2 Probity and the alignment hypothesis

Based on the original twofold differentiation between transactions and governance structures, the proper method for applying the alignment hypothesis to real-world transactions appear to be as follows:

1. Identify a certain category of transfers of goods or services between parties across some technologically separable interface.
2. Determine how they score on the key attributes: asset specificity, uncertainty and frequency.
3. Find the matching governance structure in terms of the key attributes.

[2] According to the 'Collins Cobuild English Language Dictionary', probity can be defined as a high standard of correct moral behaviour.

According to Ruiter (2005) this method becomes problematic when the original set of three key attributes is extended with the attribute 'probity' with respect to transactions in the public sphere. The problem is that the method runs out when used to determine how public transactions score on probity when finding the matching governance structure by these criterion. When the steps are followed as described by the general method, a certain category of goods' transfer or services across some technologically separable interface must be identified. Then their score on probity, that is, on their need for loyalty to political leadership and public mission, and for process integrity must be discovered. And lastly the governance structure that offers the best safeguards for fulfilling this need must be found.

However, how can the need for loyalty to political leadership and public mission of a transaction be determined without reference to some specific governance structure equipped with such a leadership and mission (Ruiter 2005, p.299)?

Williamson sees himself time and again pushed to the conclusion that the 'hazards of probity' apparently stand in the way of other, more market oriented, forms of organising sovereign transactions than through the public agency. Ruiter takes the viewpoint that it actually is not the hazard of probity that stands in the way of market oriented governance structures but the simple fact that the administration of collective goods is inconceivable as being conducted on markets (Ruiter 2005, p.296-297). The conclusion must be, according to Ruiter, that 'probity' as specified by Williamson is not a primary attribute for choosing between modes of public governance. This conclusion offers at the same time the perspective that a more general primary attribute probably exist which determines whether transactions should preferably be conducted in governance structures securing good faith, corporate loyalty, or public probity (Ruiter 2005, p.300).

3.4.3 Theory of collective goods

The question to answer now is: What does it mean for transactions to be inconceivably conducted on markets? This can be regarded as the key question that is answered by Ruiter (2005). The starting point for the answer is that if something is inconceivable as being conducted on markets, TCE is not applicable. From an economics perspective it is possible to specify more precisely the inconceivability condition by applying the theory of collective goods. When a good is excludable and non-rival then it is conceivable of being conducted on markets, and consequently TCE is applicable. Again here, as are the main elements in TCE,

the characteristics of a good or transaction, excludability and rivalry, are decisive for the possibility to apply TCE.

The conclusion is that in order to determine whether a governance structure secures an optimal combination of autonomous and coordinative adaptability, one need not apply the probity characteristic any longer; one can rely on the TCE methodology that is applicable in the private sector with one step extra. In this step it is decided whether or not public interactions of the category under scrutiny are conceivable as basically taking place within a market oriented governance structure. If no, then the analysis ends. If yes then the next step can be taken The transaction in question is subjected to a comparative efficiency analysis with the use of criteria deriving from the three notions of asset specificity, uncertainty and frequency.

When the conclusion is reached that the transactions are to be regulated by an authority regime between the state and a public agency, it follows that the parties must answer to the requirements of probity. When the conclusion is that the interactions are to be regulated by a contractual regime between the state and a private bureau, it follows that they must answer the requirements of contractual relations.

When the conclusion is that the interactions are to be regulated by a contractual regime between the state, a regulatory agency and a private bureau, it follows that they must answer to a balanced combination of requirements of probity and contractual relations (Ruiter 2005, p.301).

3.5 Hybrids

One part of TCE theory as described in section 3.3 must now be elaborated more. The assumption in TCE that hybrid forms of governance are particularly susceptible to rising levels of uncertainty brings up this need. According to Williamson, an increasing level of uncertainty with a constant level of asset specificity could lead to a move from a hybrid to a market type of governance or to a hierarchy when asset specificity is sufficiently high.. Figure 3.2 presented an illustration of this phenomenon. In his 2001 study, Speklé argues that although hybrid forms of organisations are not attractive on a theoretical basis when uncertainty becomes relevant, in practice hybrids can be observed in many situations where it can be assumed that uncertainty is relevant. Speklé developed an explanation for this

phenomenon. Hybrid forms of governance, with high levels of uncertainty, can probably also be observed in the canal project cases in this thesis. Therefore, it seems to be useful to pay more attention to the theoretical notions of Speklé.

Hybrid forms of governance are characterised by a great diversity of agreements among legally autonomous entities doing business together, mutually adjusting with little help from the price system, and sharing or exchanging technologies, capital, products and services, and without a unified ownership. Numerous studies on hybrids substantiate the idea that subcontracting strategies based on durable relationships often coordinate more efficiently than markets while avoiding integration and bureaucratic burden.

3.5.1 The problem

Adaptations to contingencies not foreseen at the time of contract specification require renegotiations and mutual consent. That, of course takes time, and if parties to a hybrid agreements are negotiating a response to one disturbance only to be hit by another, failures to adapt predictably arise (Williamson 1996, p.116). For these reasons, hybrid governance is generally held to be vulnarable in conditions of substantial uncertainty. The notion, however, meets uneasily with a growing body of empirical evidence that shows hybrids existing in spite of significant levels of uncertainty (Speklé 2001, p.39).

These observations can lead to several different responses. One may be to conclude that TCE puts too much emphasis on opportunism and the associated problems of adaptation as driving the choice of governance structure. Therefore, there is growing literature suggesting that an introduction of trust into TCE's explanatory framework would increase its quality. By emphasising the role of trust in enabling stable, long-lasting relations between contracting parties, these studies tone down the need for enforceable safeguards against opportunism. See for instance the work of Nooteboom (Nooteboom 1997 and 2002). This can then explain the rise of hybrid governance despite uncertainty: although the hybrid mode cannot offer full protection, it is chosen nonetheless because full protection is redundant.

There is, however, another strategy to bring the inconsistency between theory and empirical observations into accordance with the theory. This strategy focuses on altering the mechanisms of governance rather than introducing new key variables into transaction cost theory. The modification is based on two case studies of hybrid forms in different situations. The first is the case of Japanese automotive industry subcontracting, and the second is a study

on venture capital investing (Speklé 2001, p.40-41). For the purpose of the present study on canal building, the second case will especially be given more attention, as it resembles situations that can also be observed in the canal project histories.

3.5.2 Two case studies

In the hybrid governance structure, additional safeguards normally take one or more of three forms: (1) specialised, private dispute resolution; (2) embedding the transaction in an extended set of transactions; and (3) realignment of incentives. These safeguards, however, are imperfect and incomplete, and above some level of asset specificity or uncertainty the hierarchy is expected to supplant the hybrid mode. In conditions of substantial uncertainty or complexity, a minimum level of contractual robustness cannot always be provided. Governance structures are then needed to encourage adaptive, cooperative attitudes and actions when it comes to filling contractual gaps. This implies more hierarchical structuring, but a growing body of empirical evidence suggests that hybrids do sometimes supplant hierarchies even in conditions of both high idiosyncrasy and uncertainty. So, how do they do that, and why (Speklé 2001, p.42-46)?

The Japanese automotive industry

Basically, the answer from the Japanese automotive industry is the establishment of a conditional long-term relationship between buyer and supplier. Instead of relying on long term contracts, parties enter into a series of contracts where each individual contract has a relatively short duration. Each contract features an implicit renewal option, the exercise of which depends upon performance within the present and previous contracts. The buying firm makes a commitment to favour its current set of suppliers when new bids are invited, under the condition that supplier performance is satisfactory. Hence, buyers must rely on internally generated track records, and business is awarded on the basis of demonstrated ability to generate solutions to the specific problems of the individual buyer.

Consequently, inside suppliers tend to increase their customer-specific competence, giving them a sustainable competitive edge and relieving future competitive strain. Insiders can expect to win subsequent bids also, and a justified expectation of a long-term relation arises.

The problem here is that the inclination of the buyer to rely on inside suppliers could eventually lead to a monopolistic situation in which the threat of the buyer to take its business

elsewhere is no longer credible. To prevent this situation the buying firm will usually not consider single sourcing. This policy of multi-sourcing might decrease the degree of specialisation, but it keeps the acces of the firm open to alternative sources of supply, avoiding excessive dependency on one supplier.

Venture capital financing

The other case study to consider is venture capital financing. Venture capital financing can be described as the temporary provision of risk bearing capital for immature companies to fund intended growth. The essence of the venture capital challenge is to ultimately pick successful companies at a point in time when they have hardly proven their rationale. Informative financial track records do not yet exist, and the value of a venture capital investment can only be inferred from a direct assessment of technological feasibility, market potential, management skills and the like. The implication is that venture capital can be qualified as "relational finance," in which the financier agrees in advance to provide additional financing for not specifiable -and therefore not contractible- future contingencies. Complete contracting is not feasible, and the typical venture capital contract therefore contains no details on required performance or state-contingent actions. It instead centres on the general division of information rights, influence and control, and it does so in a particularly global way with few qualifications as to the way in which these rights are to be satisfied and the conditions under which they can be exercised. Venture capital firms rely on a mixture of mechanisms that combine market type incentives with hierarchy types of influence on actions and entrepreneurial team decisions. This influence concerns a demanded extensive transparency to enable timely detection of impending problems. Additionally, venture capitalists mostly claim the power to instigate appropriate action when managerial response is believed to be inadequate. For instance, investors may have the right to fire and replace management, and despite the costs the replacement right remains a credible threat to discipline 'unreasonably stubborn entrepreneurs'.

The venture capital agreement usually requires the provision of detailed accounting and operating statements on a frequent basis. The frequent interaction between venture capitalist and management team, their common destiny, and the strongly reduced information asymmetry allow parties to give up ex ante contractual specification of the constituents of performance and their contingent adequacy (Speklé 2001, p.53-58).

3.5.3 Exploratory control

The foregoing case studies revealed some substantial similarities. On the basis of these similarities, a new subcategory of hybrid governance can be discerned, different from the more compliance-focused type of governance. This compliance is mostly enforced by forms of specialised private dispute resolution, embedding the transaction in an extended set of transactions, and most importantly realignment of incentives by hostage type provisions. When uncertainty is present but in moderate levels, it is often possible to define the required performance in advance with sufficient clarity. Then the major governance issue is to assure compliance, and hostage arrangements can be applied. These arrangements involve investments or transfers of wealth, the full value of which can only be recovered in case of successful contract execution. However, rising uncertainty drives attention away from compliance control towards exploratory control. Due to the inherent ex ante indeterminacy of desired results, predefined performance standards become increasingly impracticable and even irrelevant. Consequently, contracts need to become general trust agreements requiring mechanisms that elicit adaptive, cooperative and coordinated behaviour from the parties in the contract execution's exploratory process.

In order to achieve the cooperative solution, there must be a justified expectation that the relationship has a long term nature. Explicitly long-term contracts are not needed, though. A self-enforcing mutual interest in continuance due to switching costs and lock-in effects suffices in situations where the governance structure offers the means to preserve a balance between the interests of the parties in the relationship's successive evolution.

A partial solution is found by importing disciplinary elements of market-based control into the compensation structure. This can be done either directly by tying ultimate recompense to the market’s appraisal of created value, as in the case of venture capital financing, or it can indirectly by linking subsequent business to the quality of current performance relative to competition standards, as in the case of Japanese subcontracting. These direct or indirect incentive structures serve to enhance goal congruence without requiring the goals to be specified in advance. Furthermore, they stimulate responsiveness to technological and market conditions, and help to ensure a reasonably objective and verifiable assessment of performance together with associated rewards. The conclusion of this elaborated hybrid specification of transaction cost theory is that it is well possible for hybrids to be an efficient governance structure in situations of high uncertainty. According to standard theory, a hybrid is susceptible to higher levels of uncertainty, which may lead to a move from hybrid

governance to hierarchical and even to market governance. This generic cluster of hybrids, though, can be divided into two subcategories: the hostage-taking compliance control hybrid, and the class of hybrids based on exploratory control. In theory this latter class of hybrids is much more able to incorporate higher levels of uncertainty. If the distinction between compliance control and exploratory control is workable in the sense that it can be applied in case studies, there will be no need to introduce new variables, e.g. trust, into the theory to explain the existence of hybrid governances in the presence of high levels of uncertainty. This is an advantage, as well, especially in the case studies on canal building. It can be expected that canal building is surrounded by higher levels of uncertainty, yet hybrid forms of governance could play an important role in canal building. Table 3.2 summarises the features of an exploratory control hybrid in contrast with the compliance control hybrid (Speklé 2001, p.59-62).

Table 3.2: Features of compliance-focused versus exploratory control hybrids

Uncertainty	
Low to moderate	**High**
Compliance Control Hybrid:	**Exploratory Control Hybrid:**
Contract: reasonably full specification of results or actions.	Contract: general thrust agreement.
Long-term contracts to induce relation specific investments.	Expectation of long-term relation to induce relation-specific investments.
Focused monitoring: compliance control based on predefined, contractually anchored standards.	Emergent standards against which to assess performance. Broad monitoring of processes and actions. Preventive intervention.
Hostage exchange as safeguard against opportunism.	Information and market-based incentives as protection against opportunism.

Taken from Speklé 2001, p.62

3.6 Some notions on property rights

Now there is another part of NIE that needs to be given attention, as it plays a role in the Williamson's scheme of levels of social analysis described in chapter two: property rights theory. Property rights regard first order economising, where the task is to get the right

institutional environment. In the scheme of Williamson, first order economising is the bases for the level of economising to get the right governance structures. Here Williamson's TCE is applied.

Property rights are broadly defined as the set of laws and customs, or formal and informal rules, that determine how individuals may gain access to resources and the range of possible uses they may make of them. This include rights and obligations with respect to the use, maintenance and improvement of resources, the rules of exchange or contract, and rules of liability when a particular use of a resource by one individual comes into conflict with the rights of other individuals (Künneke 1991, pp. 49-50; Tijdink 1998, pp 41-42; Salem 2004, p.5). Property rights that emerge in a society need not be and most often are not wealth maximising. The structure of incentives will be determined by how rights are defined with respect to the resources in an economy, who controls the resources, and how the use of the resources and the rewards of this use can be transferred to others. This will be decisive for the efficiency of the property right (Salem 2004, p.7).

3.6.1 Characteristics of property rights

The theory of property rights has three parts. First, the concept of a property right is defined. Second, alternative systems of property rights are delineated. Third, the assignment of rights under different property right systems is examined for the implication of efficient resource use.

The concept of a property right incorporates more than the ability to obtain the potential reward or return from a resource, but also includes the right to use a resource and the right to alter or modify that resource. The characteristics of use and transformation specify the control rights. The rights to the return are derived from the leasing or selling of the resource and are the residual rights. Full ownership includes both control rights and residual rights. The distinction between control rights and residual rights is important in the analysis of decision-making (Tijdink 1998, p.59). In complex organisations, the individuals who control the resources and the individuals who obtain the returns from resource use are not always the same (Carroll 2004, p.45-46). Three essential characteristics of a property right can be distinguished. These are:

1. How clearly the right is defined.
2. The exclusivity of the right.
3. The transferability of the right.

Property rights are usually defined through laws and regulations of society, but sometimes they are also derived from customs or social traditions. The value of the property right is affected by how clearly defined the right is, though whether clarity increases or decreases the value depends on the property right in question and the form of clarification. In general, more clarification means a higher value; sometimes however, more clarification implies a lower value, which is the case in a situation when a court ordering limits the right.

The second characteristic of exclusivity implies that the holder of an exclusive property right is legally permitted to withhold use of the resource to other individuals. Exclusivity affects the potential value of the resources to the holder of the rights. The holder is protected from any attempt to usurp his rights by unlawful accessing of the recourse (Carroll 2004, p.46).

The third characteristic that defines a property right is the transferability of the right. This characteristic allows the holder of the right to obtain returns from the resource. Transferability of a resource right may be in full, such as in a sale, or in part, such as through a lease. Restrictions may be placed on the transfer of a right, which implies limiting control and residual rights.

Different property right can be discerned as well, from open access communal resources to private property. Open access communal resources may be used by members of a community in an unrestricted way. Such property rights are appropriate when the resource is non-scarce in an economic sense or when the resource is scarce but the societal costs of defining boundaries or other limits to common access are higher than the benefits of exclusion (Salem 2004, pp.9-10). The use of an open access communal resource is not defined; it is not exclusive and it is not transferable.

When avoiding the 'tragedy of the commons' becomes desirable from a societal viewpoint, restricted access to the common resource can then be defined. At this point the rights to use the resource will be defined, possibly including exclusivity and also possibly transferability. When the costs of communal governance rise sufficiently it may be efficient to divide up a resource into different segments under individual control. Such rights to use but not to transfer the resource, are called usufruct rights. However usufructs may still result in under-investments and overexploitation, since the benefits of investments are not transferable to

potential buyers while the costs of overexploitation can be passed to future users. When the costs of having usufructs and prohibiting sale may become too great, alienability of the resource may be allowed, and private property rights emerge. With full private property rights, greater opportunities are opened up for more complex contractual exchange and greater specialisation (Salem 2004, p.11-12). Private property rights are clearly defined, are highly exclusive and are unrestrictedly transferable.

3.6.2 Alternative property rights systems and their implications

The second part of the property rights theory distinguishes alternative property rights systems. Such a system can be thought of as a configuration of control and residual rights. There are three general configurations of systems of rights: communal property rights, state property rights and private property rights. Communal property right systems consist of open access or restricted access communal resources. Public roads, waterways and ocean fisheries beyond the internationally agreed upon limits are examples of common property resources under a communal system. In a state property rights system, rights are assigned to the government or to the state. State ownership is not the same thing as public ownership in a communal system. In a state property rights system the government is granted exclusive right to the resource, thereby being in the position to limit public access to the resource. In a private property rights system the rights to the resource are assigned to individuals or to organisations. However, these rights may be mitigated by certain regulations and laws (Carroll 2004, pp.47-48). Mostly restrictions are placed on the property right due to the potential harm that particular uses may inflict on others.

The third part of the theory of property rights is determining the implications of rights assignment for effects on behaviour and resource allocation. This analysis is accomplished firstly within the context of neoclassical economic modelling. Private property rights are executed with the effect that the total societal value of the resources is maximised. Together with individual wealth maximisation in a competitive market system, private property rights promote an efficient allocation of resources (Caroll 2004, pp.48-49). Important here is that transaction costs are assumed to be zero in the neoclassical model. As a consequence of this lack of transaction cost, the Coase theorem states that an efficient allocation of resources is achieved regardless of how rights are initially assigned. The assumption though of zero transaction costs does not hold for corporations and public bureaus. Positive transaction costs

are predicted to be low for those shareholders who own tradable shares transacting in the private sector. But transaction costs for citizens in the public sector are significant: they must move to a different political jurisdiction to 'trade' their public ownership rights (Carroll 2004, p.55).

When transaction costs are positive, the distinction between economic property rights and legal property rights becomes important. Economic property rights are the individual's ability, in expected terms, to consume the good directly or indirectly through exchange (Demsetz 1967; Barzel 1997, pp.4-5). Legal property rights are the rights recognised and enforced, in part, by the government. Under conditions of bounded rationality, and thus positive transaction costs, legal and economic property rights cannot coincide any longer. Legal property rights exist, though more difficult and costly to understand and enforce. Therefore, economic property rights become more effective relative to the legal property rights. The economic property rights guide the decision process, and the result is that a decision maker who does not have legal residual rights may expropriate the right of residual return. The context in which this may occur, and the ways in which economic property rights may be exercised vary by organisational form (Tijdink 1998, p.58). It shows that as a consequence of positive transaction cost, the assignment of property rights becomes important for efficient governance structures.

3.6.3 Property rights as shift parameters in transaction costs economics

As referred to before, Williamson's four levels of institutions distinguish specific kinds of institutions. Level I contains informal institutions and level II marks the institutional environment. At level III of Williamson's nomenclature, the institutions of governance are located, and at level IV resource allocation takes place and prices are adapted to quantities and vice versa. First order economising refers to the question of getting the institutional environment right, or how to properly define the formal rules of the game. Second order economising, which takes place at the third level, refers to the question of getting the governance structure right.

Here again, as throughout this thesis, the distinction is made between institutional environments and institutional arrangements. The institutional environment is the set of fundamental, political, social and legal ground rules that establishes the basis for production, exchange and distribution: the rules of the game. An institutional arrangement is an

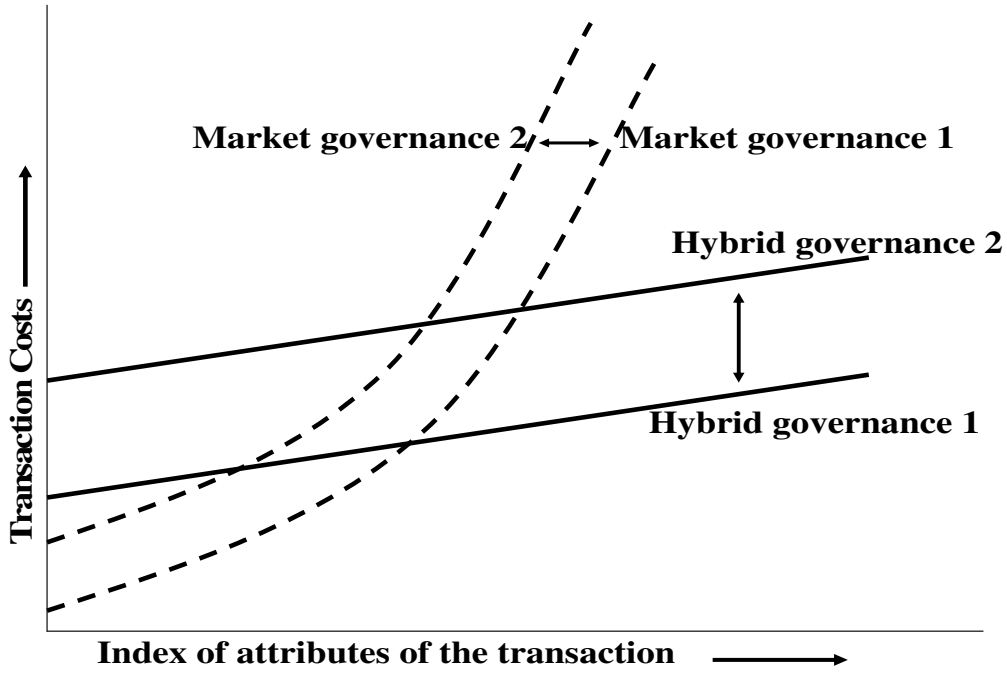
arrangement between economic units that governs the way in which these units can cooperate and/or compete (Williamson 1993, p.13).

TCE relates to this two-level approach by treating the institutional environment as a set of shift parameters. Changes of these parameters shift the comparative costs of governance.

The relationship between the institutional environment and the institutional arrangements is presented in figure 3.3, adapted from Buvik (2002).

For ease of simplicity, only the transactions costs of two institutional arrangements, market and hybrid governances, are presented. These transactions depend on the level of the attributes of the transaction, the level of which is here represented by an index. It is assumed that this index can be constructed from the following observed attributes: uncertainty which includes frequency and asset specificity. Uncertainty is negatively related with frequency. The value of the index is positively related to uncertainty and asset specificity.

Figure 3.3. Institutional environment as shift parameter. Transaction costs of market and hybrid governance in two different institutional environments.



Source: Buvik, 2002.

The level of transaction costs is not only dependent on the attribute index but also on the existing institutional environment. However, the attribute index does not influence the institutional environment, and consequently the institutional environment is a shift parameter.

In figure 3.3 a change in institutional environment from 1 to 2 increases transaction costs in every situation. This is presented by the shift of the curves hybrid governance 1 and market governance 1 to hybrid governance 2 and market governance 2.
It is assumed here that in the situation of market governance the level of the attribute index causes the transaction costs to rise in an exponential way. It is also assumed that with the lower levels of the index transaction costs of market governance are lower than transaction costs of hybrid governance. Thirdly, it is assumed in figure 3.3 that hybrid governance is affected by the change in the institutional environment more than market governance is. This implies that the comparative costs of governance are changed and that it is a welfare decreasing change.

3.7 Summary and conclusion

This chapter concentrated on transaction cost economics (TCE), which concerns itself with incentive alignment and the credible commitment properties of contracting. The central hypothesis of TCE is that governance structures are aligned with transactions in such a way as to bring about a transaction cost economising result. This hypothesis implies that the basic unit of analysis is the transaction and the second level unit is the governance structure.
TCE is characterised by two behavioural assumptions and three attributes of the transaction. The behavioural assumptions are bounded rationality and opportunism. Bounded rationality means that individual human beings are limited in their knowledge, foresight and skill. The consequence is that decisions are hardly ever optimal because mankind simply lacks cognitive and computable abilities. Opportunism refers to self interest with guile, whereupon economic agents will sometimes say one thing and do the other.
The three attributes of transactions are (1) the frequency with which transactions recur, (2) the uncertainty to which transactions are subject, and (3) the degree of asset specificity or idiosyncrasy of the transaction. Asset specificity refers to the degree with which an asset can be redeployed for alternative uses and by alternative users without sacrifice of production value. Thus asset specificity corresponds to the opportunity losses that may arise when the transaction requires commitment of specialised, custom-made products, processes or knowledge. This attribute of a transaction is the most important one, because an especially

high degree of asset specificity makes the owner of the asset vulnerable to opportunistic behaviour from the transaction counterpart.

The realignment hypothesis of TCE states that, given bounded rationality and opportunism, the efficiency of a governance structure in the sense of minimising transaction costs will depend on the levels of uncertainty and asset specificity connected with the transaction. In transactions with low uncertainty and low asset specificity, market governance will prevail. In situations with high uncertainty and high asset specificity, the hierarchy is the most efficient governance structure, where transactions can be governed by authority. With more or less moderate levels of uncertainty and asset specificity, hybrid modes of governance can be more efficient than market or hierarchy structures. Hybrid modes of governance seem to be relevant for this study on canal building. This is certainly the case when one considers forms of governance that exist as cooperation between different levels of government and between private parties. The problem here is whether TCE is applicable in the public sector and public-private partnerships. According to Ruiter (2005) this is indeed the case when one does not use the approach of Williamson that includes probity as an attribute of a transaction. Instead, one needs to apply the theory of collective goods. When a transaction refers to a collective good, as defined by this theory, then TCE is not applicable. In all other cases TCE is applicable whether or not public bodies are involved in the transaction.

It appears that it is needed to go beyond a generic treatment of TCE, towards a more elaborate description of recent developments regarding the hybrid governance structure. Hybrid forms of governance are characterised by a great diversity of agreements among legally autonomous entities doing business together, mutually adjusting with little help from the price system, and sharing or exchanging technologies, capital, products, and services, but without a unified ownership. Based on durable relationships, hybrids often coordinate more efficiently than markets while avoiding integration and bureaucratic burden of the hierarchy. According to standard theory, hybrids are vulnerable to uncertainty, though it has become clear in the literature that hybrid governance structures frequently occur in situations that are not in accordance with this generic notion in TCE. To deal with this problem it has been suggested to incorporate effects of trust in governance structures as a new TCE variable. However, there is another possible solution to this problem that concentrates on the mechanisms of governance rather than on the variables of transaction cost theory. Speklé (2001) states that there are two ways in which these mechanisms in hybrid organisations work. The first is the more standard-class of hybrids that utilise compliance control. Here, contracts have specified

the results or actions with a reasonable level of detail. They are mostly long-term contracts to induce relation specific investments. The control mechanism concentrates on monitoring based on predefined and contractually anchored standards. Hostage exchange serves as a safeguard against opportunism.

On the other hand there are hybrids characterised by exploratory control. Here, contracts are general trust contracts, mostly where an expectation of long-term relations is specified to induce relation-specific investments. Standards against which to assess performance emerge during contract execution, accompanied by broad monitoring of actions and performance. Usually one of the parties has the right of preventive interventions, and information and market based incentives are used as protection against opportunism.

The conclusion of this elaborated transaction cost theory specification on hybrids is that it is well possible for exploratory control hybrids to be an efficient governance structure in situations of high uncertainty. They are less susceptible to uncertainty than previously assumed. To study the phenomenon of hybrid resistance against higher levels of uncertainty, the generic cluster of hybrids can be divided into two subcategories: the compliance control type and the class of hybrids based on exploratory control. This provides a workable distinction in the sense that it can be applied in case studies, and there is no need to introduce new variables into the theory, such as trust. In the case studies on canal building this is an advantage, as it is expected that hybrid forms of governance will play an important role in canal building, the studies of which will be presented in chapters 5 through 7. This will be even moreso when hybrid forms of governance are also possible in situations where public governance in involved. In the chapters of this thesis focusing on the canal building projects, it will be investigated whether the hybrid forms of governance utilised were compliance control or exploratory control hybrids.

As was indicated in chapter 1, one of the characteristics of the projects' histories is that all three canals underwent serious shocks to their political or economic environments during realisation. It seems reasonable to expect that, together with TCE, basic notions of property rights theory can be meaningfully applied on the level of institutional environments. Based on Williamson, property rights can be regarded as shift parameters for the alignment of governance structures with transactions. This is the approach that will be chosen in this thesis. A description of the property rights system for the canal building projects will precede the application of TCE.

The application of TCE in the following of this study then appears to be as follows: First, identification of a certain category of transfers of goods or services between parties across some technologically separable interface. Then, determination of key attributes, and finally finding matching governance structures in terms of the key attributes. Although this scheme is normative in determining the matching governance structure, it can also be used to study the history of the canal projects more positively. There is therefore a need to elaborate this scheme more and to include descriptions of observed transactions, the parties transacting and the scoring of key TCE attributes. The scheme to be defined will also pay attention the modes of control observable in the case studies, with the starting point that probably parts of the governance structures in the canal projects can be characterised as more or less compliance control or more or less exploratory control hybrids. This scheme will be constructed in the next chapter.

4 Analytical scheme derived from new institutional economics

4.1 Introduction

This chapter will seek to summarise the property rights theory and TCE as described in chapter 3 of this thesis. The purpose of this summary is to identify the relevant characteristics of property rights theory and TCE and the formulation of an analytical scheme and a check-list to be applied in the empirical part of the research in which the case studies of the three canal project will be carried out.

First, in section 2 of this chapter, some considerations will be given about the methodological approach of this thesis. A comparative case study is regarded as a necessary first step in the development of hypotheses that can be tested, and the plausibility of such comparisons will be set forth. The aforementioned check-list is a kind of framework to try to describe the three cases of canal building in terms of NIE.

The starting point for the case studies will be described in section three on the basis of Williamson's four layer model. In sections 4 and 5 the check-lists for the application of property rights theory and TCE will be devised. Section 6 stages will describe different stages in the total life time of a project. This division of stages is frequently used in considerations about public-private partnerships. Application of these stages in the case studies will shed light on the difference in transactions that occurred in the different stages. This will facilitate the use of the check-list with the characteristics of property rights theory and TCE.

4.2 Methodological considerations

Transactions are the core of NIE. The relevance of transactions for economic development is that it would be impossible to take advantage of divisions of labour without transactions and their relevant organisations. TCE is built on the starting point that organising transactions involves costs (Ménard 2001, p.86). In a world of positive transaction costs, the allocation of

resources and the development of new technologies depend on the prevailing governance structure. This structure is formed by the modes of governance to organise transactions and characteristics of the property rights (Ménard 2001, p.86). For the empirical study of transaction and governance structures three modes of testing can be distinguished; each raises specific problems with respect to the data collection within the framework of NIE (Ménard 2001, p.89). In economics the dominant form of testing hypotheses is along the line of econometric methods. According to Ménard, major problems may emerge here, referring to the collection of complex data and to the requirement of more refined concepts to be applied in the data collection. Examples of these problems are the definitions of contractual forms, the degree of asset specificity in a transaction and the degree of uncertainty surrounding a contract. 'We need to define better proxies, which supposes more detailed and better defined concepts' (Ménard 2001, p.89). Case studies and the related building of stylised facts can be of great help in the process of defining these concepts. 'Economists do not like case studies. The reasons for that spontaneous rejection are obscure, and seem to be rooted in the dead ends of empiricist movements such as the historical school in Germany or the old institutionalists in the USA' (Ménard 2001, p.89). But what matters is that the case is relevant to the exploration of a theoretical question. 'Two types of case studies can be distinguished. One has to do with the construction of a stylised fact and is intended to provide an in-depth analysis of a specific question and of related explanatory concepts' (Ménard 2001, p.89). The other type of case studies is formed by comparative case studies, particularly relevant in NIE because of the need to deal with a limited number of discrete organising transaction modes that characterise society, both at the microlevel and at the institutional level. Essential to the success of this approach is that a limited number of variables be isolated and kept under strict control by the researcher as the analysis proceeds (Ménard, 2001 p.98-90).

Also, Alston (1996) refers to the benefits case studies can contribute to the development of more formal hypotheses testing derived from new institutional theory. According to Alston we are not abandoning science in arguing for the case study approach. 'We still maintain that the use of theory in developing hypotheses is important. Indeed, the intuitiveness of a hypothesis influences the standards of evidence that we must have before we “accept” the hypothesis.' The more compelling the hypothesis is, the lower our standards of evidence are before we become convinced. Furthermore, the case study approach to institutions is attractive because it may yield the building blocks for more general theories of institutional change. With the present state of theoretical institutional knowledge, the case study approach

is often the only way to further knowledge about institutional changes, given that an understanding of institutions and their change is central to understanding economic performance. The issues at stake are too important to not use whatever analytical tools provide insights into the complex institutional relationships, institutional change, and economic performance (Alston 1996, p.30).

Aoki (2001) uses a game theory approach to investigate the sources and implications of institutional diversity and the nature of the institutional interdependencies across economic, political, organisational and social domains. However, according to Aoki, the game-theoretical analysis cannot be complete by itself as a systematic study of institutions. "The analysis of the interdependencies of institutions within a game-theoretic framework would indicate the possibility of multiple, suboptimal Pareto-unrankable institutional arrangements. That is, institutional arrangements can be diverse across economies even if they are exposed to the same technological knowledge and are linked through the same markets. Thus we need to rely on comparative and historical information to understand why particular institutional arrangements have evolved in one economy but not in others." (Aoki 2001, p.3) History matters according to Aoki. Once an institutional bifurcation occurs, even if two economies are exposed to the same technological and market environments afterwards, the subsequent overall institutional arrangements of the two economies may well differ depending on their respective interim institutional trajectories. This phenomenon is known as path dependency. Thus, equilibrium, that is game theoretical, and historical analyses are mutually complementary and are both indispensable to comparative institutional analysis (Aoki 2001, p.16).

These three authors all stress the importance of case studies for the development of hypotheses that can be tested in a more formal econometric way. Case studies can also be particularly relevant for the building of more general formal models, as in game theory. The purpose of this thesis is a comparative analysis of the three canal projects by a case study approach.

4.3 A starting point for studying the canal projects

The starting point for the case studies of the three canal projects is Williamson (2000)'s model as it is described in chapter 2, concerned with four levels of analysis. Level I of this model is the level of informal institutions and is taken as a given by most institutional economists. They can be regarded as constant during the history of the canal projects and this level will not be involved in the present study. The level II of Williamson's model is the institutional environment. The institutional environment consists of formal rules like constitutions, laws and property rights. Level III is where the institutions of governance are located. Here the governance of contractual relations becomes the focus of analysis. The unit of analysis is the transaction and TCE comes into play. The discrete structural analysis of the third level is to be distinguished from level IV, the level at which neoclassical analysis works. Here an optimality apparatus is employed (Williamson 2000, p.598). Along with level I, the analysis from the fourth level will not be applied in this thesis, thus leaving open analyses from levels II and III.

One can concentrate on the application of TCE as a stand-alone analysis tool only when the comparative analysis is concerned with the alignment of governance in a relative short time period or more or less the same jurisdiction. Then one can assume that the institutional environment - and certainly the embedding in the informal institutions - will not change. These factors would cancel out in the comparison. However, the study of the three canal projects needs to pay attention to level II economising in the sense of property rights adaptations. This is because, first, the jurisdictions of the canal projects differ due to the geographical spread, and second, the three projects are realised in different periods of time and in different stadiums of economic development. As will be shown, all three projects show instances of changing property rights having an effect on the governance structures of the projects. Therefore the study of the history of the canal projects will start with a more or less provisional application of property rights theory.

4.4 Property rights

As was indicated in chapter 1, one of the characteristics of the canals' histories is that all of the projects underwent serious shocks in their political or economic environments. Therefore it seems reasonable to expect that adding property rights theory to the analytical scheme will

give the possibility to study the influence of these chocks on the governance structures. According to Carrol (2004) as described in chapter 3, the property right analysis can consist of three parts: first, the concept of a property right is defined; Second, alternative systems of property rights are delineated; and third, the assignment of rights under different property rights systems is examined for the implication for resource use efficiency (Carroll 2004, p.45).

4.4.1 The concept of property rights

It is suggested that many categories of property rights exist, but most authors confine their attention to the specific property rights of ownership. Usually this right is subdivided into three elements (Tijdink 1998, p.59):

1. Usus rights: this is the right to use an asset.
2. Usus fructus: the right to appropriate returns from the asset.
3. Abusus: the right to change the form and substance of the asset as well as the right to bear the consequences from changes in the value of the asset.

Characteristics of the property rights will also be identified and assessed by this study. These characteristics are represented by the following three questions: 1) How clearly is the right defined? 2) What is the exclusivity of the right? 3) Is the right transferable?

4.4.2 Alternative systems of property rights

A system of property rights can be thought of as a configuration of control and residual rights. There are three general configurations of rights systems: private property rights, state property rights and communal property rights. These systems are described in chapter 3. In the analytical scheme for the canal case studies it is assumed that the dominant system is a system of private property rights. When this is not the case for one of the projects, it will be mentioned in the analysis and the relevance for the efficiency of the property right will be indicated.

As is also described in chapter 3 the distinction between economic property rights and legal property rights becomes important when transaction costs are positive. Economic property rights are the individual's ability, in expected terms, to consume the good directly or

indirectly through exchange (Carroll 2004, p.54). Legal property rights are the rights recognised and enforced, in part, by the government. Under conditions of bounded rationality and thus positive transaction costs, legal and economic property rights cannot coincide any longer. The result is that the actor, who does not have the legal residual right, may yet be able to expropriate the right of residual return. The context in which this may occur and the ways in which an economic property right may be exercised vary by organisational form. Thus, as a consequence of positive transaction costs, the assignment of property rights becomes important to avoid the possibility of expropriating the residual return. The opportunity to expropriate the return is in this situation based on the possible difference between economic and legal property rights.

4.4.3 Analytical scheme for applying property rights theory

In table 4.1 a summary is given of the main questions that can be asked regarding property rights theory in undertaking the case studies. This summary will serve as the analytical scheme for the institutional environment of the canal building projects.

Two answers will be given on the first question about the kind of property rights, the first answers indicating whether the property right is a state, communal or private property right, and the second answer indicating what the relevant element is of the property rights.

Table 4.1 Basic questions from the property rights theory

What property Right (PR)?	- state PR or - private PR or - communal PR
What elements of property rights?	- usus - usus fructus - abusus
Three characteristics of a property right:	
1. How clearly is the right defined?	Scored according to the rating system. (Explained below)
2. Is the right transferable?	Scored according to the rating system.
3. Exclusivity of the right?	Scored according to the rating system.
Based on the possible difference between economic and legal PR:	
Opportunity of expropriation of the residual return?	Scored according to the rating system.

Regarding the characteristics of the property rights, a rating system will be applied that indicates the quality or value of the property right. The relevance of these characteristics is that they influence the quality of the property rights as an institutional environment. In theory a property right has a high quality when it is clearly defined and when the right is transferable, when it offers exclusivity against third parties and when the possibility of expropriation of the residual revenue is low. Quality will be indicated by the following rating system:

+	positive
+/-	neutral
-	low.

The score of a '+' implies that this characteristic is regarded to be well developed in the concerned property right. The symbol '+/-' means that the characteristic is developed on a medium level, and the symbol '-' expresses that the characteristic is badly or not at all represented in the property right and that therefore the property right has a low quality.

4.5 Transaction cost economics

The key conceptual aspect of TCE is to describe firms not as as production functions in neoclassical terms, but in organisational terms as governance structures. The basic insight of TCE is to recognise that in a world of positive transaction costs, exchange agreements must be governed, and that, contingent on the transactions to be organised, some forms of governance are better than others (Macher and Richman 2006, p.3). It is said before that in TCE the transaction is the basic unit of analysis. The critical dimensions to which transactions differ are identified and the ramifications are worked out. These ramifications are refutable implications from the discrimination alignment hypothesis that was formulated by Williamson (1991, p.79). This hypothesis states that transactions, which differ in their attributes, are aligned with governance structures, which differ in their costs and competences, as to effect a transaction cost economising result (Macher and Richman 2006, p.4).

The majority of empirical research in TCE is a variation of the discriminating alignment hypothesis. Organisational mode is the dependent variable, while transactional properties and

other control variables serve as independent variables. Organisational modes are most frequently conceptualised by a distinction between market, hierarchy and various hybrid forms of organisations. Hybrids include joint ventures, relational contracting and bilateral governance (Macher and Richman 2006, p.5). For this thesis, two subcategories of hybrid organisations will also be discerned: compliance control hybrids and exploratory control hybrids.

The probability of observing more or less integrated forms of organisation depends upon the properties of the transactions. These properties are: asset specificity, uncertainty and the frequency of the transaction. Transaction frequency has received far less treatment in the empirical literature in comparison with asset specificity and uncertainty (Macher and Richman 2006, p.7). It can be assumed that for the empirical study of the canal projects frequency of transaction will be a factor that is negatively correlated with uncertainty, thus leaving asset specificity and uncertainty as usable properties.

More integrated modes of governance are associated with a higher degree of asset specificity and greater uncertainty. Of these properties asset specificity, or the transferability of assets that support a given transaction to a different user, is argued to be the most important (Macher and Richman 2006, p.5). As has been described in chapter 3, there are different forms of asset specificity to be distinguished.

The treatment of uncertainty in empirical TCE literature is similarly broad. Different types of uncertainty can be distinguished. First: transactional uncertainty, which refers to unanticipated changes in circumstances surrounding an exchange and is typical in reference to environmental changes of future events. Transactional uncertainty includes demand uncertainty, technological uncertainty and supplier uncertainty. Uncertainty with a behavioural foundation is another type of uncertainty. This type, however has received far less attention in empirical literature.

Although each type of uncertainty is concerned with the hazards of maladaptation, empirical findings that relate uncertainty to modes of organisation are mixed. One potential explanation for the diverse empirical findings around uncertainty is that it needs to be examined in conjunction with asset specificity. According to predictions from TCE, in the case of no asset specificity uncertainty will not lead to more hierarchical forms of governance. It is only when there is a risk of contractual hazards brought on by relationship-specific investments that expropriation is a concern (Macher and Richman 2006, p.7). Opportunistic behaviour will not be effective or will be less effective when there is no asset specificity.

It goes without saying that there will be a certain level of uncertainty and asset specificity involved in the transactions that formed the canal projects. Thus, the hypotheses of TCE can shed light on the level of the particular governance structure's efficiency. It will therefore be very worthwhile to define questions derived from the theoretical notions in this chapter and in chapter 3, which can be used as guideline, compass, gauge and yardstick for the study of the canal projects. These questions are formulated in the form of a check-list in table 4.2.

Table 4.2 Summary of the features of transaction cost economics

Starting points	
Transaction cost economics (TCE)	The hypothesis in TCE is that, given opportunism and bounded rationality, transactions, which differ in their attributes are aligned with governance structures, which differ in their costs and competences, as to effect a transaction cost economising result.
Transaction cost	Costs incurred in making an economic exchange, like planning, adapting and monitoring task completion. TCE is not concerned with the measurement of the transaction costs. It is a highly intangible concept like utility in consumer theory.
The transaction	The basic unit of analysis. A transaction is said to occur when a good or service is traded across a technologically separable interface.
Attributes of the transaction	
1: Uncertainty	1) Uncertainty to which transactions are subject: transactional uncertainty which includes demand uncertainty, technological uncertainty and supplier uncertainty. 2) Uncertainty with a behavioural foundation.
2: Recurrence	More frequent to less frequent.
3: Asset specificity	Refers to the degree to which an asset can be redeployed for alternative uses and by alternative users without sacrifice of production value.
Kind of asset specificity	Site specificity. Physical asset specificity. Human asset specificity. Dedicated investment. Brand name capital. Temporal specificity.
Level of asset specificity	From low to high.
Relevance of the attributes of transactions	Asset specificity is the most important discriminating factor in the choice between modes of governance. In the presence of a sufficient level of asset specificity, uncertainty plays a role in the choice between hybrid and hierarchical modes of governance.

Table 4.2 Summary of the features of transaction cost economics. Continuation

Governance structures. The secondary unit of analysis in TCE. The institutional framework through which a transaction is channelled, consisting of markets hierarchies and hybrids..	
Market governance	On the basis of classical contracting, short term contracts. **Incentive intensity:** High powered efficiency incentives. **Administrative controls:** Weak. **Adaptation:** No prior agreement on framework within which adjustments ought to fit. Adjustment via market-driven modification of next contract. **Dispute settling:** Court ordering.
Hybrid governance General	Neo-classical contract law, spirit of the framework is defined. **Incentive intensity:** Semi-strong efficiency incentives. **Administrative controls:** Restrictive. **Adaptation:** Is contract governed, but usually incompletely specified. Contractual gaps filled in by negotiation. Hostages to balance stakes in successful contract execution. **Dispute settling:** Conflicts referred to arbitration or court.
Compliance control hybrid	In cases of low moderate uncertainty. Long-term contracts to induce relation specific investments. Results and actions are reasonably specified in the contract. **Incentive intensity:** As in the general form. **Administrative controls:** Compliance control based on predefined, contractually anchored standards. **Adaptation:** Hostage exchange as safeguards**.** **Dispute settling:** As in the general form.
Exploratory control hybrid	General trust agreements. Expectation of a long-term relation to induce relation-specific investments. **Incentive intensity:** More market- based incentives as compared to the general form. **Administrative controls:** Emergent standards against which to assess performance. Broad monitoring of processes and actions. Preventive interventions. **Adaptation:** Information and close repetitive interaction between parties to the contract. **Dispute settling:** As in the general form.
Hierarchical governance	Contracts that secure command over factors of production, forbearance with instrumental reasoning. **Incentive intensity:** Goal congruence through internal incentive system and monitoring. **Administrative controls:** Strong. **Adaptation:** No ex ante specification of when and how to adapt. Sequential adjustment. **Dispute settling:** By hierarchical fiat.

The question is now how to apply the above table to the study of the three canal projects. The starting point will be the alignment hypothesis, but this hypothesis will not be tested. Instead

it will be used as a yardstick against which to measure the development of the canal projects' governance structures. In the process of using the alignment hypothesis, three steps can normally be discerned:

1. Identify a certain category of transfers of goods or services.
2. Determine how the transaction scores on the key attributes.
3. Find the matching governance structure.

In step 3 a normative approach is chosen, while this study applies a descriptive approach. The main purpose is to investigate whether and how TCE can be applied to the history of the three projects; consequently the third step will be different in this study, in the sense that the theoretical alignment of governance structures with transactions in TCE will be used to describe the governance structures with which the canal projects are realised. In the first two steps the transactions in the canal projects are identified and scored on the key attributes. Confrontation with the results of step 1 and step 2 with the results of step 3 will provide insights into the comparative efficiency of the governance structures of the canal projects.

4.6 Phases of a project

To describe the different functions that need to be carried out to complete a project, from the first beginning to the end of its economic and perhaps even physical lifetime, it is efficient to use a more theoretical description of project stages. These stages concentrate on the work that needs to be done, they are placed in a theoretical logical order, indicating that in practice the work will show a much more complicated pattern. These stages are:

1. Planning
2. Designing and financing
3. Building
4. Own, operate and maintain
5. Transfer

Planning refers to the stage in which the idea of the project is developed. In this stage the feasibility of the project is under scrutiny as basically a practicability study. The questions to be answered in this stage are: Is there a need for this canal, and what is the purpose of it? The route of the canal is also investigated, and the different parties are identified that will be involved in the project's realisation. The different possibilities of financing the canal will be investigated as part of the feasibility study, and the stage ends with the decision to start realising the project.

The second stage is the stage in which the actual canal will be designed on the drawing boards. This is the stage of blue prints. In connection with the technical design, the modes of financing of the canal will be decided and actual financing arrangements will be realised.
On the bases of the first blue prints, the actual stretches of the canal will be specified and preparations will start by involving contractors in the project. Possibly the work will be put out to tender. Here a distinction must be made between matters of financing and cost a project. Financing refers to the supply of funds to realise the project. Costing is the debt service payment together with other cost of maintenance and exploitation. Costing is part of the activities in stage 4. Different parties with different transactions can be involved in financing and costing. For instance: the state can finance a project and costing will be conducted by levying toll by a private party who owns a concession to operate the infrastructure.

In the building stage the canal is actually built. Here contractors and subcontractors are involved in carrying out the work.

The next stage is when the canal is finished and taken into operation. It is thinkable that in this stage the matter of canal ownership will be established, because this question will be the basis for who operates and maintains the canal. This does not mean that ownership, operation and maintenance have to be in one hand. One can say that in fact most of the time this is not the case. For instance a canal could be owned by the state but operated and maintained by a special body.

The transfer is the stage in which a possible concession to operate the canal will end and at least some property rights to the canal will be transferred to another party. This stage can also

be regarded as the stage in which the economic lifetime of the canal ends, although the physical lifetime has not yet ended. For instance, the canals built in southern Belgium at the beginning of the nineteenth century were devised for transporting coal from the mines to the population and industrial centres. Over time they lost their original meaning, and now these canals are used mainly for recreational shipping.

In the light of the analysis to be carried out in the next chapter, the stages will be used to identify different transactions that are typical for a certain stage. It is assumed that these transactions differ in their main TCE-attributes: uncertainty and asset specificity.

4.7 Analytical scheme for applying transaction cost economics

This structure of activity stages in realising and operation an infrastructure can now be used to identify the parties and the transactions involved. Planning a canal is quite a different activity compared to operating a canal. Consequently, different parties could be involved. In this thesis, the above classification of stages will be used to describe the parties involved and to identify the main transactions in a certain stage. This is the beginning of applying TCE to the history of the three canal projects. In fact, with the use of the project stages the first step of TCE application is taken, which is concerning the question of identifying certain transfer of goods or services as described in section 5 of this chapter.

Now a table can be designed which will serve as the analytical scheme for applying TCE. In this table the relevant features from TCE are the columns, and the stages of the project are the rows. Table 4.3 presents this analytical scheme. In column A the parties are described who are involved in the specific stage of the project. In the second column B, the transactions and the relevant attributes of the transactions are specified. In this column the question is answered what levels of uncertainty and asset specificity are involved in the transaction. The governance structure that prevailed in the particular project stage will be identified in column C. In the last column a rating is presented of the match between the transaction attributes and the governance structure. Here the hypothesis from TCE will be used of aligning governance structures with transactions, with the rating presenting the expected TCE outcome of this alignment. The ratings are indicated by the following system:

+ positive effect: transaction cost minimising

+/- neutral effect: no effect on transaction costs

- negative effect: transaction costs will be enhanced.

Table 4.3 The analytical scheme for applying TCE

	Parties involved (A)	Transactions and attributes (B)	Governance structure (C)	Rating (D)
Planning				
Designing				
Financing				
Building				
Own, operate and maintain				
Transfer				

The attributes of the transactions and the governance structures will be identified and described using the summary of TCE features presented in table 4.2. The ratings relate to the adaptation of the governance structures to the kind of transactions, defined by the attributes of these transactions. The column in which the parties involved are described, mainly serves to identify the relevant transactions.

4.8 Summary

Comparative case studies are particularly relevant in NIE because of the need to deal with a limited number of discrete organising transaction modes both at the microlevel and at the institutional levels that characterise society. Path dependency in the development of governance structures has been observed, meaning that institutional arrangements can be diverse across economies even if they are exposed to the same technological knowledge and are linked through the same markets. Thus NIE needs to rely on comparative and historical information to understand why particular institutional arrangements have evolved in one economy but not in others. History matters.

The purpose of this thesis is also a comparative analysis of the three canal projects by a case study approach, an approach that may yield relevant insight in the decisive characteristics of an efficient governance structure for large infrastructures. The thesis may also yield the first building blocks for the development of testable hypotheses and model building.

Essential to the success of a comparative case study approach is for the researcher to keep strict control of the analysis by limiting and isolating the number of variables. Therefore, in the preceding sections a summary was given of the relevant characteristics of the two parts of NIE: property rights theory and TCE. This summary was made with respect to the applicability of the relevant theory characteristics for the study of the three canal projects. The summary was shaped in the form of tables depicting the relevant characteristics of property rights theory and TCE.

The table on the property rights theory presents a number of questions that were elicited from property rights theory and that will serve as the analytical scheme for the institutional environment for the three canal projects.
Using a subdivision of a project's total lifetime in stages, the case studies for the three projects will proceed by applying an analytical scheme with the relevant features of TCE. A table was designed in which these features are the columns and the project stages are the rows. In each row of this table the parties, the transactions, the attributes of the transactions and the governance structures of the stage will be identified and described using a summary of the features of TCE as was given in this chapter.
The alignment hypothesis from TCE will be used to rate the governance structures of a stage according to their expected transaction cost minimising capabilities.

5. The canals of King Willem I

5.1 The Netherlands in the early 19th century

After a period of remarkable growth in the seventeenth century the Dutch economy was caught in a stationary state for a period of 150 years, starting in the last quarter of the seventeenth century and only ending in the 1820s. During this period the relatively modern market economy was characterised by a virtually constant level of production and income (Van Zanden and Van Riel 2004, p.8.).

In many ways the development of the economy in the years after 1780 reflected political and military turbulence of that time. In the early years of the nineteenth century the economic and social situation in the Netherlands had deteriorated in absolute terms, certainly after 1806, partly due to the Napoleonic wars and the closure of all trade through the North Sea by the English (Van Zanden and Van Riel 2004, p.84). The Northern part of the country especially suffered under the pressures of the Continental System imposed by Napoleon, because in the regions of the North Sea coast international trade had been the predominant economic sector, in the sense that this trade influenced developments in other sectors like agriculture. The consequence of the Napoleonic ban on trade with England was that the trade infrastructure was severely damaged by the end of the Napoleonic wars. There was also the heritage of the break down of the once very successful and powerful Verenigde Oostindische Companie (VOC), which ruined the state finances of the province of Holland for years and continued to have negative effects on the finances of the Netherlands through the Napoleonic era and even through the subsequent kingdom of the United Netherlands. It was only in the 1850s that the financial situation of the Netherlands improved substantially.

However, to a certain extent the stationary state of the eighteenth century was a story of success. The republic maintained its position as one of the wealthiest regions in Europe, and the most recent estimates suggest that it was only sometime between 1780 and 1800 that the United Kingdom caught up with the Netherlands in per capita income (Van Zanden en Van Riel p.24).

The Dutch have clearly been the victims of their own success in the seventeenth century, and while other countries 'coming from behind' may have undergone more dramatic economic progress, the Dutch have remained amongst the leading economic nations of the world (Wintle 2000, p.71).

The global differences in GNP per capita have been substantial and increasing since 1815, but the Netherlands has clearly been amongst the world leaders (Wintle 2000, p.72). The Dutch have been a leading class economy since the middle of the seventeenth century. By 1700 the economy was already a capitalised, agricultural processing economy, importing staple foods from elsewhere, like from the Baltic states, and using land to produce labour- and capital-intensive cash crops for national and international markets. It is a fact that the trading and shipping sector was legendarily decimated by the French occupation, the blockade on trade with England, and the Continental System, but after the Napoleonic wars there still was a tradition and basis on which to build, together with the possession of a vast colonial empire in the East and the West Indies. 'And linked to that trade there was an industry sector, importing raw materials, performing skilled processes on them of high added value, and re-exporting them in finished or more finished form. The Dutch economy, it seemed, had it all.' (Wintle 2000, p.75). However on the journey between prosperity peaks of the seventeenth and twentieth century, evidence from research on the national accounts suggest that the turning point came only around 1850. During the reign of the "merchant King" Willem I there even was a structural depression in the 1830s and the King himself never experienced the fruits of the boom in the 1860s (Wintle 2000, p.83).

5.2 King Willem I

Willem Frederik, the later King Willem I, was born in 1772 from the House of Orange, growing up as a solitary boy who was uncommunicative (Romein and Romein 1977, p.628). In 1789 and 1790 he followed lectures of Christiaan Hendrik Damen at the famous University of Leiden in the Netherlands. Damen was specialised in military and civilian building with an emphasis on waterway building, and according to one of Willem Frederik's biographers this could possibly explain the interest he took later in his life for canal building

Willem Frederik was not a soldier. His endowments were in the field of management and diplomacy. A late nineteenth century historian, Colenbrander, called him a diligent civil servant with a passion for work (Kikkert 1995, p.21-25).

In the period of the French hegemony over continental Europe, he governed the German Princedom of Fulda for a couple of years, where he employed all his administrative skills and learned to use them as he did during his later reign as king of the United Netherlands (Romein and Romein, p.633).

After the defeat of Napoleon Bonaparte, Willem Frederik returned back to the Netherlands on 30 November 1813 to be the lawful pretender to the throne. Already in 1805 the allied forces of England and Russia decided that the low countries at the North Sea should be united to form a stable countervailing power at the northern border of France (Kikkert 1995, p.60). So, under the influence of foreign powers, this sovereign principal was declared with the acceptance of a new constitution on 29 March 1814 as King of the United Netherlands, consisting of present-day Belgium and the Netherlands. Willem Frederik became the first King of the House of Orange and was named Willem I. The constitution gave him great power, especially in financial matters, with a limited role for Parliament. The constitution allowed him to be a manager like he had been in Fulda, instead of being a ruler in the sense of the later parliamentary monarchy. For him, the constitution was always much more a description of his rights and the duties of his subjects than the other way around (Romein and Romein 1977, p.636-637).

Without a doubt, Willem I was the most forceful and powerful sovereign the Netherlands had ever known. Certainly in the first half of the nineteenth century he must be qualified as reaching head and shoulders above his contemporaries. He dominated not so much in cultural or political matters but certainly in economics and finance (Romein and Romein 1977, p.622-623). His reign was characterised by an unprecedented highly centralised political decision-making process. Some historians judge him as an extremely competent ruler with an impressive working capacity, a huge knowledge of his kingdom and an eye for detail on the basis of which he involved himself in all sorts of decisions (Van Zanden and Van Riel, p.166). Other historians, though, are much more critical about his style of management: intelligent but hesitant, curt and headstrong. He was in fact an autocrat and did not trust his advisers. This difficult man was neither able to delegate nor cooperate with others. In his eyes ministers, were not more than his personal servants (Kosmann, 1976, p.74-75). But in the end,

these historians all value his extraordinary working power and his extensive expertise in financial and economic matters.

At first sight he was able to combine his rare collection of qualities with a very strong power base provided by the constitution of 1815. Nevertheless, his reign came to a dramatic end, and many contemporaries- in particular the liberals, who held political control in subsequent decades - also judged him and his great experiment in an extremely negative fashion. To understand this paradox, one first must realise that his power base was not so strong after all: from 1815 onward he was forced to expend much effort legitimising his regime, particularly in the southern provinces, so that in fact for him the threshold of his power was not that large. Secondly, due to a failing tax system, he became vulnerable to pressure groups of the elite from the Northern Netherlands and especially from the province of Holland. Willem I felt responsible for all social groups in his kingdom and because of his unbridled activism there was an almost continual shortage of means for financing all his plans. He therefore used his own private means to initiate nearly all his large plans or strengthened their guarantees on the basis of his own capital (Van Zanden and Van Riel, 2004, p.167).

Under the influence of his public works, canal building and the war with Belgium, the financial situation only deteriorated. In reaction a parliamentary movement called for greater influence in budgetary matters, which led to an adaptation of the constitution that came into effect in 1840. This was too much for Willem I. He abdicated the throne in 1840 to his son Willem II, and moved to Berlin as a disappointed man.

Following the death of his wife in 1837, Willem Frederik married again in February 1841 with Henriëtte d'Oultremont de Wégimont, a Roman Catholic countess from the south of the Netherlands. This marriage was highly contentious, not only for religious reasons, but was also regarded to be more or less morganatic.

Willem Frederik died suddenly from a stroke on 12 December 1842, after his physician declared him recovered from a severe illness. At the fatal moment he was alone in his house in Berlin, and a servant found him dead with a French translation of the 'Imitatio Christi' from fifteenth century monk and mystic Thomas à Kempis in his hands (Kikkert 1995, p.225). After the death of Willem Frederik, Henriëtte d'Oultremont withdrew from public life to a castle near Aachen. She was even not present at his funeral ceremony in the Netherlands.

5.3 The Constitution

In the pre-Napoleonic times the Netherlands were a republic of city-states organised into seven provinces. The head of the republic was formed by the 'Staten-Generaal,' a body with representatives of the city-states and the provinces. The executive power, for some functions, was laid in the hands of a 'Stadhouder', originally more or less a civil servant that was held accountable by the 'Staten-Generaal'. The title of Stadhouder evolved to a hereditary position in the hands of members of the House of Orange. After the Napoleonic occupation of the Low Countries, Willem Frederik became King Willem I, and the father of Willem Frederik was the last Stadhouder.

When Willem Frederik arrived in the Netherlands in November 1813 there was already a draft constitution that would make him King. The definite constitution was confirmed when Willem Frederik accepted the crown of the kingdom on 29 March 1814. The constitution of 1814-1815 became the legitimisation of the personal power of Willem I, making him a sovereign principal. He supervised the administration of the colonies without interference of Parliament, had the right to declare war by himself, was in charge of foreign policy and had the right to conclude treaties. He was the supreme commander of the armed forces and wielded high command over the State finances. He could neglect decisions by Parliament and he appointed the ministers who were held accountable only to him, not to Parliament. The constitution was much more a continuation of the preceding Napoleonic times than the start of a new era. Parliament would only gain more power in 1848 with constitutional reforms under King Willem II, the son and successor of Willem I.

Most important for this study is the fact that Willem I was also given nearly absolute power with respect to water management in his kingdom, with a separate section of the constitution of 1815 devoted to this issue. The section described the positions of the local and provincial governments. Traditionally in the Netherlands water management had been a local affair, but this turned out to be impractical, especially concerning river management. Ineffective attempts were made to centralise water management systems in the early years of the nineteenth century. So in the 1814 constitution provincial administrations were again given more daily water management affair responsibilities, but these administrators needed approval from the King for their actions and policies (Van der Woud 1987, p.52-54). Articles 215 and

216 of the constitution defined the supreme supervision by the King[3]. Article 215 stated that the King had the supreme supervision over all that concerns water affairs in the kingdom, including roads and bridges, without discrimination whether costs were to be paid from the state treasury or from another source. Article 216 determined that the King had the right to practise the management of the water affairs in such a way as he finds most suitable.

Shortly after 1815 it appeared that the King did not choose equal distribution of power between national, regional and local levels. He acted against the spirit of the water management arrangements in the constitution and used his supreme supervision to form an executive organisation that transferred power to him personally (Van der Woud 1987, p.55).

Water management had been a separate ministry in the period 1815 to 1820, but due to high costs reorganisation was needed. The department of water management moved to the ministry of the Interior, and at the same time the King ordered the organisation to be more horizontal. Management of a number of tasks concerning specific small rivers, canals, harbours and locks were transferred to the provinces in line with articles in the constitution. This organisation came at the expense of provincial budgets, with the exception of the principal engineer who was paid by the state. This engineer was appointed by the King, and was only accountable to the minister of the Interior and thus the King. Furthermore, the provincial bureaus of this decentralised organisation could also be used by the central government. The bureaus were placed under the command of the provincial Governor, the acting representative of the King in the provincial governments. Consequently, provincial water management bureaus came under the command of the King. There was a direct line from the Cabinet of the King, through the provincial Governor, and ending with the principal engineer of the province (Van der Woud 1987, p.56). Important here is also that the horizontal organisation of the water management bureaus was implemented by a reorganisation of the corps of engineers. This national corps was transformed into a provincial organisation of inspectors supervising regional and local activities. With the help of these inspectors, the central government slowly took possession of the management of the complicated and subtle world of water management in the Netherlands. This was not only a matter of inspections and supervisions carried out, but this centralisation was also based on the body of knowledge built by the inspectors. They

[3] The two articles in Dutch: Artikel 215. De Koning heeft het oppertoezigt over alles wat betreft den waterstaat van het Koningrijk, de wegen en bruggen daaronder begrepen, zonder onderscheid of de kosten daarvan worden betaald uit 's Lands kas, of op eene andere wijze gevonden.
Artikel 216. De Koning doet het algemeene bestuur van den waterstaat, wegen en bruggen, uitoefenen op zoodanige wijze als Hij meest geschikt zal oordeelen.

collected information about all relevant factors concerning water management and processed this information to a central level (Van der Woud 1987, p.57).

From the beginning of 1820, article 215 was not just a phrase but had become a reality. This reality, though, existed only in a purely organisational form (Van der Woud 1987, p.58-59). According to Van der Woud, it can be questioned whether this organisation structure has ever been effective in practice. This is not only a matter of a proper bureaucratic organisational structure, but also of external factors. It can be claimed that the effectiveness of this organisational structure was hampered severely by two factors until the middle of the nineteenth century. The first was the constant lack of sufficient budget within all levels of government. More importantly, however, was the insufficient juridical apparatus of the constitutional and public law. The power of the central government in relation to the other levels of government was clearly specified in the constitution of 1815, but the main questions were how to execute this power and what was allowed according to this constitutional structure. "It is an enormous paradox within the reign of Willem I that his monocratic authority was driven by his intense concentration on fast and structural results, but that his autocratic operations stood in the way of the speedy development of a adequate legal structure, and consequently severely hampered the developments that he wished so much" (Van der Woud 1987, p.59).

5.4 Canal building by the King

During the first half of the nineteenth century there were two peaks in infrastructural investments, in the twenties and again in the forties (Horlings 1995, p.255). These peaks were formed by three key events: the boom in canal construction and the rise of road construction in the eighteen twenties, and the emergence of railroads after 1839 (Horlings 1995, p.257). In this thesis concentration will be on the investments in canal construction during the reign of Willem I in the twenties. The boom in the construction of the canals was certainly the principal infrastructural event of the first half of the nineteenth century. It is estimated that the canals concerned a total investment of between 50 and 55 million guilders (Horlings 1995, p.257; Filarsky 1995, p.15). This can be compared with estimates of Dutch GDP in the early

nineteenth century: in 1820 Dutch GDP in current prices was 445.7 million guilders[4]. The boom concerned 13 new inland waterways with a total length of 481 km, of which 290 km are in present day the Netherlands and 190 km in Belgium and Luxembourg. The investments for these new canals were estimated to be 36 million guilders. Figure 5.1 shows a map of the canal projects of Willem I for the northern part of his Kingdom, with the green stretches representing the new or improved canals.

Figure 5.1 The canals of King Willem I in the northern Netherlands. The green stretches are the new or improved canals. The blue stretches are the existing waterways.

Source: Filarsky 1995, p. 17.

The Noordhollandsch Kanaal, from Amsterdam to Den Helder, north of Amsterdam, with a length of 80 km and a total investment of 11 million guilders, was with no doubt the biggest project. Improvement of waterways concerned investments of approximately 16 million

[4] See the website of the Groningen Growth and Development Centre for data on the Dutch historical National Accounts: http://www.eco.rug.nl/GGDC/index.html

guilders, with the most important project here being the canalisation of the river Sambre in the south of the kingdom at a length of 94 km and an investment of 4.7 million guilders (Filarsky 1995, p.15). Most of the investments in new canals were related to the international services sector in the economy: the Noordhollandsch Kanaal and the Keulse Vaart were aimed at improving connections of Amsterdam with the North Sea and the river Rhine, while the Kanaal van Voorne was built to provide Rotterdam with a better sea link. Other projects concerned the accessibility of the ports of Middelburg, Brugge, Gent, and Zwolle. According to Horlings (1995, p.259) there is no agreement on the general aim of these new canals, but in the opinion of Van der Woud (1995, p.133-134) the aim was to repair the traditional trade routes that had become unnavigable during the eighteenth century. Others described it as an attempt to create the missing links in the network of waterways (Horlings 1995, p.259). This may appear as an overstatement, but it has been noticed that some of these canals were the first to establish contact between different regional systems of waterways. However, despite the sheer size of the investments there was no consistent plan. The only clear motivation was to provide Dutch international trade and transport with better infrastructure. Only two large canals were dug solely for the purpose of domestic distribution, the Zuid Willemsvaart and the Griftkanaal. For the Noordhollandsch Kanaal, it turned out in the end to be mainly an integrating force for the region north of Amsterdam (Horlings 1995, p.259). Potential benefits from all these canals were counteracted by the need to cover costs of the construction by returns from the canals. The Zuid-Willemsvaart, the Noordhollandsch Kanaal, and other canals were littered with tolls (Van der Woud 1992, p.240).

The two canals of Willem I that will be the focus of this study are the Noordhollandsch Kanaal and the Zuid-Willemsvaart. In table 1 the main characteristics of these canals are shown, though to compare their characteristics, data from two other canals: the Kanaal Pommereoul-Antoing and Kanaal Brussel-Charleroi are also shown as references. Situated in the southern, Belgian, part of the kingdom, these reference canals were highly specialised canals, as can be seen from the motives for the canal building, shown in table 5.1. The two canals were built to serve one purpose: lowering the prices of coal. The Kanaal Pommereoul-Antoing and the Kanaal Brussel-Charleroi both connected industrial and population centres with coal mines in the south of the United Netherlands.

Table 5.1 Characteristics of four canals built under the supervision of Willem I

	Noord-hollandsch Kanaal	Zuid-Willems-vaart	Kanaal Pommereoul-Antoing	Kanaal Brussel-Charleroi
Motives for the canal building				
Development of the sea port	XX			
Lowering costs energy transport		X	XX	XX
Opening up of waste lands		XX		
Lowering transport costs		XX		
Military interests	X	X		
Connection of northern and southern parts of the kingdom		XX		
Initiative for the building	State civil servants	King	Private	Private
Canal measures				
Length (km)	80	123	25	75
Width at the bottom (m)	9.4	-	10.0	-
Depth (m)	5.7	-	2.2	2.0
Bottleneck locks				
Length (m)	53.3	62.0	41.6	21.4
Width (m)	14.1	7.0	5.2	2.7
Depth (m)	5.4	2.1	-	-
Maximum ship measure (tonnes)	1000	250	224	70
Building				
Building period	1819-1824	1822-1826	1823-1826	1827-1832
Estimated budget (millions of guilders)	7.4	3.7	2.3	4.4
Realised costs (millions of guilders)	11.0	4.5	2.8	4.9
Costs per km (guilders)	137,500	36,585	112,000	65,333
Costs per tonne-km (guilders)	138	146	500	933
Gross returns[*)]				
Year; returns in 1000 guilders	1827; 53	1827; 54	1830; 400	1841; 620
Yearly returns on investment in %	0.5%	1.2%	15.2%	12.5%
Ship movements				
Place; year: number of ships. (The ships counted in Den Helder are sea going vessels)	Den Helder; 1828: 692; 1874: 2,782	Den Bosch; 1827: 2,786; 1874: 7,758		

Source: tables 8.1 through 8.7 from Filarsky, 1995
XX : main motive
X : side motive
[*)] Probably these figures refer to gross returns from the collection of toll. It can be deducted from Filarsky (1995, p.349) that from this gross returns interest, redemption and maintenance needed to be paid.

It is very interesting to see that these two southern canals were privately built, or at least the initiative to build the canals was undertaken by private organisations. The plan was to build these canals with private capital on the basis of granted concessions; however, as will be shown, this privatisation did no succeed. It is also interesting to see that these two canals were

very expensive. Measured in costs per tonne-km, they were four to seven times as expensive as the Noordhollandsch Kanaal.[5] Still, they were profitable with a pay back period of approximately seven to ten years, based on reported annual returns in 1830 and 1841.

Forced by growing resistance from Parliament, Willem I sought for ways of financing the canal projects outside the state budget. The Kanaal of Pommeroeul-Antoing was the first canal that would be financed by private capital. Although the King and his advisers did not have experience in this field, they managed to come up with conditions for a concession in a relatively short period of time. Their main goal was to provide industry with low transportation costs. To achieve this goal the King decided to a public call for tender. The toll prices that could be collected by the contractor were fixed by the King and the concession would be granted to the tenderer that offered the shortest duration for the concession to collect the tolls from the canal. The contractor would be obliged to build and maintain the canal at his own risk. The construction and maintenance would be supervised by 'Waterstaat,' the bureau of the Ministry of the Interior that governed the inland waterways (Filarsky 1995, p.332/333). The concession was granted to P.J. Nicaise from Mons. From the beginning there were doubts at the capability of Nicaise to fulfil the work, and soon it became clear that his financial capability was not sufficient. Willem I was advised to reject the offer of Nicaise, but Willem I did not want this first tender to become a failure, so he went ahead with Nicaise. The term of the concession was extended to 22 years, although Nicaise had offered 19 years, and Willem I helped financially to start the construction of the canal by arranging a loan of 1.9 million guilders from the 'Algemene Nederlandsche Maatschappij ter Begunstiging van de Volksvlijt' in Brussels (Filarsky 1995, p.333). In 1826, at the end of the construction, it appeared that Nicaise was at the edge of bankruptcy. The 'Algemene Maatschappij' did not want to give Nicaise any more credit, so to ensure the opening of the canal it was decided that the State would buy back the concession from Nicaise. This was financed by a loan to the State by the 'Algemene Maatschappij', and in the end the result was that the national debt was increased by 3.5 million guilders (Filarsky 1995, p.335). According to Filasky this was probably a good outcome for Nicaise, but was probably also a profitable undertaking for the State according to the returns from the toll on the canal.

[5] The measure cost per tonne-km is calculated by dividing realised costs by length multiplied with maximum ship measure. (total costs/(length x tonne).

In 1826 the concession of the Kanaal Brussel-Charleroi was granted to a merchant from Amsterdam, J.A. Classen, and a civil engineer from Mons, J.B. Castinel. The conditions were that the contractor should pay from his own accounts three hundred thousand guilders and that he would receive a loan of 4 million guilders at 4.5% interest. Willem I first tried to accommodate the loan with the 'Amortisatiesyndicaat,' a fund under the control of Willem I, but they could not help because they were short on liquidity. In the end it was decided that the Amortisatiesyndicaat would be the lender for the contractor but that Willem I would finance half of the loan secretly from his personal finances (Filarsky 1995, p.336). The project budget was exceeded and the contractor blamed the State for shortcomings in the technical specifications and the technical drawings. In the end, after the Belgian separation, the contractor was granted a compensation of half a million guilders (Filarsky 1995, p.336).

According to Filarsky the main problem was that prospects of return were uncertain. Large enterprises that could have built the canals by themselves and taken the financial risks involved did not exist. He concluded that the privatisation of the canal projects failed due to the contractors' high risks of building and financing the canals. This had the consequence that concessions could only be successful when the King financially supported risky undertakings. In first instance, the concessions were financed by loans from the Algemene Maatschappy with a guarantee of the King regarding the payment of interest and redemptions. Later, the King used unlawful methods of financing the canals by involving the Amortisatiesyndicaat and temporarily advanced treasury credits (Filarsky 1995, p.337). In the end, from the five canal concessions granted by Willem I, three had to be bought back by the State, one concession failed completely, and in one a substantial compensation had to be paid (Filarsky 1995, p.338).

It is claimed that the significance of Willem I's canals was only temporary. While the canals in the south had more success, in the north the economic results of the canals were very limited (Kikkert 1995, p.120). The Noordhollandsch Kanaal has been regarded as a failure, and in the first years of its existence the Zuid-Willemsvaart did not generate enough income to pay the maintenance. This changed in the 1840s when the political relations between Belgium and the Netherlands normalised more and more. The growing importance of the Zuid-Willemsvaart can be concluded from the fact that the city of Eindhoven, at own expense, constructed a side canal in 1846 that connected Eindhoven and the Zuid-Willemsvaart (Wiskerke 1944, p.13).

But it was the IJ-project, another of Willem's canal projects, that was the direct cause for a conflict in 1828 between the King and Parliament. This project was a second attempt to improve the accessibility of the harbour of Amsterdam for seagoing vessels. The controversial project was never realised, though here part of the work was also started before Parliamentary approval (Van der Woud 1992, p.258). Willem I's reputation was severely damaged by this conflict. In 1829, Parliament rejected the ten year State budget for the first time.

5.5 Fiscal policy and the Amortisatiesyndicaat

One of the most striking aspects of Willem's financial policy consisted of his attempts to reduce the influence of Parliament on fiscal matters and to suppress public debate in general on issues of government finance. Important here is that as a result of the need to harmonise southern and northern tax levying interests, substantial defence spending, and his own activist ambitions, Willem I found himself unchangingly in the situation where one financial hole's creation was used to fill the next, leading to a situation that became more and more difficult to control. However, he started his reign with generally positive attitudes towards his fiscal policy, both from the citizens and from the financial markets. The reorganisation of the national debt in 1814 fixed one important item of expenditure: the burden of interest was decreased spectacularly in comparison with the French-Batavian period that preceded his reign - from fl 35 to 40 million between 1806 and 1810 to some fl 20 million in 1814-1815 - only to rise swiftly again shortly after the creation of the new kingdom. Despite the relatively favourable conditions at the start, i.e., a tax base almost doubled in size, a sharp decrease in interest payments, and a politically stable Europe, Willem I had great difficulty in balancing his budget (Van Zanden and Van Riel 2000, p.97-100).

Two developments provided Willem I with the opportunity to gain control of the treasury. The first was the constitution of 1815 and the second was the foundation of the Amortisatiesyndicaat in 1822. The constitution of 1815 distinguished between two different budgets: a ten-year budget for "constant" items of expenditure, and an annual budget for varying budgetary items. In his first ten-year budget of 1819, covering 1820-1829, Willem I included virtually all controversial items, so that acceptance of the budget allowed him a free

hand in the subsequent decade. This budget was in the first instance rejected by a parliament in which representatives from the north and south were united in opposition. Following resubmission, however, the ten-year budget was approved with only a few minor alterations. It was still too large of a political risk for Parliament to persist in rejecting the budget; this would have resulted in a constitutional crisis (Riemers 1935, p.44; Van Zanden and Van Riel 2000, p.101).

Even more drastic than the parliamentary bypass was Willem I's plan for the foundation of the Amortisatiesyndicaat in 1822. The Amortisatiesyndicaat was a fund under the control of Willem I and was separated from the treasury. The primary purpose was to purchase 'deferred' debt from the 1814 debt reform against low market prices, so that government finance could gradually be freed from the millstone around its neck (Van Zanden and Van Riel 2000, p.101).

The Amortisatiesyndicaat was also given responsibility for funding the reorganisation of the monetary system, the payment of pensions and other executive tasks, so that at least cosmetically these could no longer burden the treasury budget. To fulfil these responsibilities, the Syndicate was allowed to borrow as much as fl 68 million (later even fl 80 million), and was placed under the minister of Finance, who was obliged to seek parliamentary approval for the Syndicate's operations only every ten years, similar to the overall budget (Riemers 1935, p.72ff).

In the beginning the capital market was positive about the Amortisatiesyndicaat. National debt (NWS) prices shot upwards at the end of 1823 once it became clear that the Syndicate's borrowing was a success. In practice, the Syndicate quickly abandoned its efforts to buy all the 'deferred debts', partly because of these increased prices, so that it became impossible to achieve its original goal. The capital it had amassed instead was used for activities for which the King could find no other funds, such as the construction of canals and projects undertaken by the Fund for Industry (Riemers 1935, p.110-113 and 142).

But there was no legal foundation to use the means of the Amortisatiesyndicaat for purposes of investing in canals and industrial development, there was only the notion that government finance was the privileged domain of the monarch.

The fact that even during a period of political stability and relatively rapid economic growth, Willem I and his government were unable to control the deficit's expansion, exposed the administration to criticism. The activities of the Amortisatisyndicaat in the 1820s especially

led to a considerable increase in public debt, which, contrary to its original purpose, the Syndicate itself was responsible for (Van Zanden and Van Riel 2000, p.102).

The law with which the Amortisatiesyndicaat was established was approved by Parliament on 20 December 1822 with 66 votes in favour and 36 votes against. The law allowed the government to hand over the administration of State domains to the Syndicate with an estimated value of 82.5 million guilders. The Syndicate was allowed to sell these domains, but was also allowed to issue loans. On the other hand, they had the obligation to pay 30 million to the treasury to relieve the national debt, money that would partly be used to pay the canal projects' investments. It was clearly the intention of Willem I to remove the finances of this syndicate and himself from parliamentary control. According to Kikkert (1995, p.114), Willem regarded himself as a principal with absolute powers, except in these cases where the constitution specified otherwise.

According to Riemens (1935, p.237) as well, the Amortisatiesyndicaat had a pernicious influence on the Dutch State finances. The total sum of revenues of the Syndicate was never bigger than the total sum of the expenditures. The amortisation of the domains was not enough to cover the expenditures, and consequently deficiencies in State finances were hidden by the policy to bring parts of the government spending for the account of the syndicate. The contributions of the syndicate to the treasury were covered by even greater debts issued by the syndicate. The Government concealed the consequences of this policy from public control as long as possible, but in the end it had to come out, which caused very negative attitudes towards the syndicate. The question is whether this negative judgement has to count for the complete lifetime of the syndicate. Two periods can be distinguished: before and after 1830. Before 1830 the debts of the treasury could be covered by revenues of the syndicate, that is, by selling the State domains that were handed over to the syndicate and especially by issuing loans. After 1830, however, deficits of the treasury were increasing fast and the Amortisatiesyndicaat was not able to cover these deficits from the ‘normal’ revenues of the Syndicate any more. The payment of interests on the debts issued by the Syndicate caused an increasing burden, which in the end could not be taken care of by the Syndicate itself. This led to the execution of the Syndicate in 1840 (Riemens 1935, p.237-238).

The deterioration of the State finances in the period of 1822-1830 can be explained by the operations of the syndicate that took place under the control of Willem I, but in the decade of 1830-1840 it was not the syndicate alone anymore: the treasury itself also started issuing

loans to cover for the deficits that were due to the military expenditures with regard to the Belgian upheaval. In this period the national debt increased with a feverish speed (Riemens 1935, p.236).

Public debt had increased from 575 million guilders in 1814 to around 900 million guilders in 1830 and 1.2 billion a decade later. In 1840 this debt amounted to more than 200% of GDP. This is comparable to the level of 1807, when the ratio stood at some 225%. As a consequence of the increasing debt the burden of interest, some 6.9% of GDP in 1807, had again grown from 3.7% in 1814 to 6.5% in 1839 and would go on to reach a 7.9% of GDP in 1844. Because of the unchanging deficit and the capital market's lack of confidence in fiscal policy, interest rates on the public debts were higher than those in surrounding countries.

The ultimate cause of the failure of Willem I's fiscal policy must be sought in the institutional infrastructure, particularly so in the constitution of 1815. The systems it introduced of governance finance and the distribution of executive and legislative powers were highly ambivalent. Parliament's influence was limited, whereas that of the King was unrestricted up to the point of turning a financial conflict into a constitutional one. An equal balance of power between the monarch and Parliament was absent, allowing Willem I ample opportunity to develop the tangled financial policies. The weakness of the opposition, in combination with Willem I's ambitions and personality, completed the explanation of events.

In the 1830s he became entangled in the contradictions created by his own policies. He found it increasingly necessary to hold back information on the true extent of his problems, so that when it finally became clear how he had handled to maintain his policies he lost almost all authority (Van Zanden and Van Riel 2000, p.105/106).

5.6 The Noordhollandsch Kanaal

The description of the building of the Noordhollandsch Kanaal and the Zuid-Willemsvaart will follow a pattern of stages in building infrastructures that is described in chapter 4. These stages are planning, designing and financing, building, owning, operation and maintenance, and the last stage, if applicable, transference of property rights concerning the canal. This latter refers, for instance, to the end of a concession for the revenues of the canal.

5.6.1 Planning the Noordhollandsch Kanaal

The first plans for the Noordhollandsch Kanaal had a military origin. During the English invasion of the northern part of Holland in 1799 it appeared that the new navy harbour in Den Helder was vulnerable. It was easy to isolate this harbour from the sea side due to difficult transport facilities from the land side south of the harbour. During the planning of the improvement of the supply routes for the harbour the idea was born that a canal could not only serve military purposes but could also be used by shipping to and from Amsterdam (Filarsky 1995, p.289). This could be of great advantage for Amsterdam because the harbour there was difficult to reach by seagoing vessels. These vessels had to use the route through the Zuiderzee[6], but the entrance and exit of this sea near Texel island was always difficult to sail. Sometimes ships had to wait for weeks at the coast of Den Helder. Additionally, at the end of the 18th century the situation deteriorated near Amsterdam - a sand bank developed in front of the entrance of the Amsterdam harbour causing a lot of trouble, and special docks were built to lift the seagoing ships over the sand. A solution for the problem of the difficult entrance to the harbour was of utmost importance for the development and trade of Amsterdam. The plan to construct a canal through the 'head' of Northern Holland was one of the solutions. The principal engineer of the King, Jan Blanken, drew up a plan for a canal stretch near Den Helder that would form a connection from the harbour of Den Helder to the tow barge routes of North Holland. This canal stretch was realised in 1818, so that seagoing vessels now had the possibility to sail half a kilometre in the direction of Amsterdam using the new canal, but then would be stopped by a lock that was only suitable for tow barges. Consultations with Amsterdam about possible methods to improve the entrance to the harbour had yet to be started (Filarsky 1995, p.290).

One can wonder whether it would not have been more logical from the viewpoint of the interests of Amsterdam to try to build a canal in the western direction from Amsterdam to the North Sea. This would have been a much shorter route. However, a problem here was that such a canal would need to cut the sea defences. According to Filarsky (1995, p.305), theoretically this would have been a technically possible yet costly solution.

But a new problem presented itself, namely that the construction of a deep harbour entrance in the sandy North Sea coast was technically too complicated.

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[6] An inland sea northeast of Amsterdam.

Experiences with the harbour entrance of Oostende, in Belgium, had proved that keeping the depth in the entrance was very problematic.

This was due to the heavy tide currents in front of this particular stretch of the coast. Difficulties with the construction of the later Noordzeekanaal in the 1860s proved that indeed this problem would have been too much for the technical capacity in the early nineteenth century (Filarsky 1995, p.305).

So, the choice was to go in northern direction with the possibility of using existing belt canals for the route of the Noordhollandsch Kanaal. From an economic point of view the small river Zaan could also have been a good alternative, but probably the construction of tow pads along the Zaan would have been too costly (Filarsky 1995, p.307).

As a consequence, Blanken ultimately drew up a plan for a canal with a somewhat whimsical route. As has been shown in table 5.1 the costs were estimated to be 7.4 million guilders, which made it the most costly canal plan in that time. Blanken underestimated the costs, because the ultimate construction would appear to be nearly 50% more costly than was estimated (Filarsky 1995, p.310). Also the estimates of the returns were very speculative. Filarsky is critical about the estimates of Blanken on the number of seagoing vessels that would use the canal. Blanken knew the number of seagoing vessels that crossed the Zuiderzee to reach or to leave Amsterdam, estimating that 1,400, or one third, of these seagoing vessels would use the canal. But these estimates were not built on any analyses. Later it turned out that not even half of the estimates were realised.

Furthermore, the estimates of cost advantages per ship were not backed by analysis. In connection with the over optimistic estimates of the number of ships, this led to the situation that, according to Filarsky (1995, p.314), 80% of the estimated economic advantages of the canal were doubtful.

5.6.2 Designing and Financing

Why then decided Willem I that the canal had to be built? The main reason was that Willem I was not so interested in economic analyses. Although he asked his advisers many times for economic foundations for his projects, once the financing of a project was arranged his interest in the economic reasoning disappeared.

Also important was that the King contented himself with the bad quality of the economic analyses. Apparently, neither he nor his advisers had the vision, the knowledge, the will

power or the organisational power to improve these analyses. According to Filarsky, it is remarkable in this respect that after 1830 the Belgian government had good quality analyses at her disposal (Filarsky 1995, p.315).

A third factor was that Willem I must have known that the yearly gross returns of a canal should be 8 to 10 % of invested capital. But with most of his projects he neglected this rule of thumb, continuing when he was personally convinced that such endeavors would be important. Obviously other national interests were decisive for him (Filarsky 1995, p.315). But these low estimated returns were not the main problem with the Noordhollandsch Kanaal. For this canal the estimated investments were 6.09 million guilders and the estimated yearly returns were 630 thousand guilders. (Filarsky 1995, p.312) The problem here was the low quality of the estimates.

At the same time and in relation to the planning of the Noordhollandsch Kanaal another plan was born. This was the idea to block off the entrance of the IJ from the Zuiderzee side with a dam and locks for smaller inland ships. This would have two main advantages: first it would make that every seagoing vessel would need to use the Noordhollandsch Kanaal; second it would prevent the IJ from silting further (Filarsky 1995, p.316). This plan was highly contentious, and an advisory commission from Amsterdam was of the opinion that blocking the IJ would only move trade from Amsterdam to the smaller harbours at the Zuiderzee. They did not see the advantages of the Noordhollandsch Kanaal, and predicted that after the realisation of the Noordhollandsch Kanaal many seagoing ships would take the Zuiderzee route because it was regarded to be difficult passing some stretches and locks of the canal. One of the members of this committee even accused the government of only trying to improve the canal's returns by blocking the IJ. Thanks to strong opposition from Amsterdam and also from Parliament the new plan was never realised (Filarsky 1995, p.320).

In 1818 correspondence between the King and the city of Amsterdam started concerning the financing of the canal. Amsterdam was not in favour of the canal plan, afraid that trade would move to Den Helder due to the canal being regarded as too narrow. The opinion of Amsterdam was that if the King wanted to improve the nautical situation of the city, there should be a bigger canal that would allow loaded seagoing ships to sail directly to and from Amsterdam. Besides this, the city was not able to pay the investments that were estimated to be 4 million guilders for the smaller version of the canal. Instead the city offered to pay 1 million guilders, with the condition that the state would guarantee the payment of the interest

and redemption. The city of Alkmaar was also willing to contribute 200 thousand guilders. The King and his advisor were convinced, however, that Amsterdam needed a quick solution for the problem of the IJ's entrance silting-up. The risks for the King were substantial, though, technically and financially. Nowhere in the world was a canal built with the measures of the Noordhollandsch Kanaal. Together with this, the financing was not in the least secure, and the most important stakeholders were not really in favour of the project. The King had the power to take the decisive decision and financing, thought, so without even waiting for more detailed cost estimates he decided in April 1819 that the canal had to be built with the measures that Amsterdam wanted. The first tender took place in July 1819, but the most important problem was still financing of the project. At the end of 1819 the King came into conflict with Parliament about the ten year budget for the 'normal' expenses of the State, making it impossible for him to ask Parliament for an extraordinary canal project budget. He decided to pay an advance from his own accounts of 2.7 million guilders to make it possible to go on with construction. In 1822 the situation with Parliament had improved, so it was now possible for the Government to submit a bill for a State loan of 57.5 million guilders. From this loan 5.3 million was destined for the Noordhollandsch Kanaal, including the pay back of the advance from the King (Filarsky 1995, p.327). Although the bill received a lot of criticism, Parliament did not dare to reject the bill. It was accepted with 80 votes in favour and 25 votes against. Now that Parliament actually had accepted the canal project, there were no longer problems with the financing. The remaining financing from the State for construction costs of 3.5 million guilders was approved in the extraordinary budgets of 1823 and 1826. Perhaps Parliament agreed with these budgets, because in that period the State finances were relieved by a donation of 30 million by the Amortisatiesyndicaat (Filarsky 1995, p.328).

5.6.3 Building

For the construction of the total canal tenders were issued. The budgets for these tenders, however, were too low for the contractors. They refused to bid or asked prices that were much too high for Willem I. The principal engineer of the King was obliged to follow a different strategy, now dividing the total work for the Noordhollandsch Kanaal into little stretches so that small contractors could also participate in the tenders. This strategy in the end had some success, but prices were still too high and Willem I personally continued to seek budget cuts. He interfered with all the technical details in his search for cut backs, having the consequence

that agreed prices for the contracts became too low, even for the small contractors. The contractors reacted by putting pressure on the labourers, leading to a series of upheavals and the murder of one of the contractors. In the end armed forces were called in to restore public order.

The contractors were the highest in rank of the private parties involved in the building of the canal. The contractor hired labourers, the men that did the actual digging, who were headed by a so called 'pit boss' (in Dutch: putbaas). The management and control of the work was in the hands of the engineers of the central government agency for water management. The engineers had to deal with the contractors, deciding when work had progressed enough to pay the contractor (Sprengers and Vrooland, 1976). This brief organisational description of the construction indicates a hybrid organisation. In chapter 3 two kinds of hybrid organisations are discerned: compliance control hybrids and exploratory control hybrids. This last form of hybrid organisation is able to replace a hierarchy in case of high uncertainty or highly idiosyncratic investments. Its base is in general trust agreements, yet here there were no general trust agreements. Contracts were reasonably fully specified; there was a focused monitoring and compliance control based on the predefined arrangement that the engineers of the state water management would define when work had progressed enough to give pay. This is also a form of hostage taking, as a safe guard against opportunistic behaviour from the contractors. The conclusion can be that the governance structure of building the Noordhollandsch Kanaal was a form of compliance control hybrid.

5.6.4 Own operate maintain

The canal had always been state owned, but this did not mean that financial problems were over yet. Soon after the realisation of the canal it turned out that the returns from the canal were not enough to pay maintenance, interest and redemptions (Filarsky 1995, p.348-349). At least in the first 20 years after its completion the canal was a failure. The tolls and tow costs were so high that most ships preferred the old route through the Zuiderzee. A desperate attempt by the King to lower the tolls did not have an effect. The canal remained a bad investment, also from a societal perspective. The existence of the canal hardly had any effect on the development of trade in Amsterdam. In 1828, 692 seagoing vessels made use of the canal. From the collection of tolls it can be estimated that an average ship transported approximately 200 tonnes. Thus, total transportation through the canal in 1828 was about

140,000 tonnes. Total investments for the canal were 11 million guilders; consequently, approximately 1 million guilders of gross return was needed for maintenance, interest and redemption. This implies that societal costs, exclusive of tow costs amounted to seven guilders per tonne. The tariff of a normal inland ship suitable to navigate the Zuiderzee was one to two guilder per tonne from Amsterdam to Den Helder (Filarsky 1995, p.441). After 1840 the situation improved because the canal had more and more of a function in the regional transportation due to the enlargement of inland sailing vessels and the introduction of the steam engine. In 1841 1,700 seagoing vessels made use of the canal, but it never was the direct connection for seagoing vessels between Den Helder and Amsterdam. Filarsky (1995, p.350-351) concludes that the canal was built 20 years too early, though then the canal would probably have not been built at all, since by that time the western route from Amsterdam directly to the North Sea would have been technically possible to build.

After 1850 the development of the harbour of Amsterdam was threatened severely by the difficult connection with the North Sea. The locks of the Noordhollandsch Kanaal became too small, having the consequence that Den Helder became much more important as a transshipment port and freights were no longer transported directly to Amsterdam. This threatened the position of Amsterdam since it became advantageous to move all trading services to Den Helder. To counter this development, the Noordhollandsch Kanaal was widened at the expense of the state budget, though without bringing substantial effects. The number of total tonnage arriving in Amsterdam by seagoing vessels did not increase any more after 1855, while the number of ships arriving in Amsterdam decreased. In 1860 Den Helder was a bigger sea port than Amsterdam, though most of the goods were still transported to Amsterdam by inland ships. Only in 1876 with the opening of the Noordzeekanaal this situation changed drastically in favour of Amsterdam. One can wonder whether the harbour of Amsterdam would have survived this critical period without the Noordhollandsch kanaal. Also was the canal important for the development of the industrial area around Zaandam, some 15 km north of Amsterdam. This region had been an important industrial area since the seventeenth century, but in the first years of the nineteenth century seagoing ships could not reach this region anymore through the IJ. The region was given a direct connection with the Noordhollandsch Kanaal in 1849, with booming activities as a consequence.

The overall conclusion is that the Noordhollandsch Kanaal was a costly failure in the first twenty years of her existence, though after 1840 the situation improved and ten years later the canal was a route to the Amsterdam harbour with regional importance (Filarsky 1995, p.359).

5.7 The Zuid-Willemsvaart

The Zuid-Willemsvaart unlocked the south-eastern part of the present day Netherlands, one of the least advanced regions of the United Netherlands. The canal was designed to connect the industrial region around Liege and Maastricht with merchant cities in the northwest of the kingdom through Den Bosch ('s-Hertogenbosch in figure 5.2). However the canal did not reach Liege because the last 30 km were considered far too expensive (Van der Woud 1987, p.129).

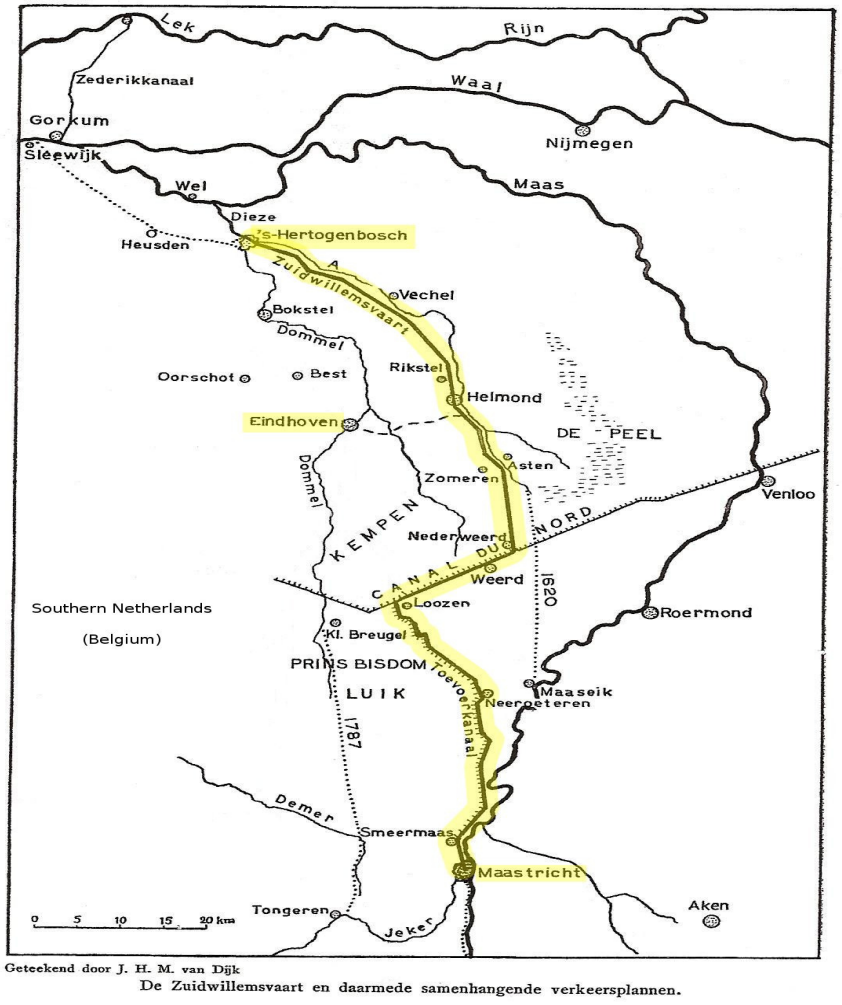
Furthermore, part of the canal is situated in Belgium territory, hindering exploitation of the canal in the first years of its existence due to little canal traffic during the years of the Belgian secession between 1830 and 1839. The Zuid-Willemsvaart was unique in at least one respect: it was designed to suit more than one particular type of ship. It was sufficiently large to allow every inland navigation vessel to use it. Unfortunately, shipping was difficult with 19 of the locks and 24 bridges each charging a separate toll (Van der Woud 1987, p.128-129, 131).

5.7.1 Planning

Already in the 17th century a plan was devised to connect the city of Den Bosch in the middle of the present Netherlands at the border of the river Maas with southern cities like Maastricht, Hasselt and Liege. Den Bosch was situated at a crossroad of important trading routes, connecting the staple markets of Holland, and especially of Amsterdam, with the hinterlands. The river Maas was one of these trading routes, but this river was very difficult to navigate upstream from Den Bosch. Half of the year the water levels were too low and the other half the currents were too strong. Therefore, important land roads had been created heading south and east starting from Den Bosch, making the city an important transshipment harbour and trading centre. It was the third ranking trading city of the Netherlands in the nineteenth century (Wiskerke, 1944), so connections with Den Bosch were important. In this situation, with difficult land routes and waterways, even a small river called the ‘A’, coming from the southeast and ending in the Maas in Den Bosch, was made navigable in the seventeenth century.

In the eighteenth century plans were made to connect Den Bosch with Maastricht and Liege by inland waterways that substituted the Maas. This plan was built on canalisation of small rivers like the Dommel and Jeker, combined with digging a canal to the Belgian city Tongeren in the direction of Maastricht and Liege. It is not known whether authorities had seriously considered the implementation of this plan, as the costs were high at an estimated 2.4 million guilders; international cooperation would have been necessary as well.

Figure 5.2 The Zuid-Willemsvaart (In yellow)



Source: Wissekerke 1944, p.6.

In this age the only improvement to facilitate traffic from Den Bosch was the pavement of a land road leading to the south to Hasselt and Liege by way of Eindhoven. In 1741 this work

started, but costs appeared to be too high for the city of Den Bosch and income from tolls were too low.

The pavement stopped some 25 km south of Den Bosch, and only in the last years of the eighteenth century was work started again at the expense of the government of Holland (Staten van Holland). The definite completion of the work was realised in 1818, connecting this paved road with the road system to the city of Liege. (Wissekerke 1944, p.9).

5.7.2 Designing

After all these plans and attempts to improve traffic conditions for Den Bosch and the staple markets in Holland, it is an irony that the first canal project that came to execution in this part of the Netherlands was aimed at harming the interests of Holland and the city of Den Bosch. This canal project was an attempt to connect the harbour of Antwerp with the river Rhine. The plan was to connect the Maas with the Rhine from Venlo to Grimlinghausen, near Neuss. From Venlo it would lead westward in the direction of Weerd and Lier with Antwerp as the end point. The highest stretch in this 'Canal du Nord' would be reached near the village of Loozen in the northeast part of the present Belgian province of Limburg. Here the canal would exist as a basin to store water to supply the canal with sufficient water levels, the so called 'Bassin Napoleon'. The water for this basin would be taken from the Maas by a feeding canal from Maastricht to Loozen (Wiskerke 1994, p.10). In the first years of the nineteenth century construction started, and the work made important progress with the deployment of several thousands of workers. But then construction activities stopped suddenly. The reason for this was that after the annexation of Holland by France there was no reason to favour the harbour of Antwerp over the harbours of Holland any longer. The situation even became more positive for Holland when in 1811 an imperial decree was issued ordering the investigation of the parties profiting from the Canal du Nord, and also to investigate the possibility of extending the feeding canal for the Canal du Nord into the direction of Den Bosch. A commission that executed the decree answered positively to this last question, but the military and political situation at the end of the Napoleonic era prevented further developments (Wiskerke 1944, p.10).

The extention of the feeding canal towards Den Bosch had to wait until Willem I came into power, as the organisation of his ministry of Water management (Waterstaat) was not yet ready in 1815. In December of this year the new King commissioned a colonel of his general

staff to investigate the feeding canal's state and to investigate whether it could be used for a project connecting Maastricht to Den Bosch. The costs were estimated to be 2 million guilders and could be paid by selling concessions for peat production in the 'Peel', a peat swamp adjoining the more northern part of the proposed canal stretch. Interest could be paid by relatively limited levels of tolls, compared to levying of tolls on the Maas (Wiskerke 1944, p.11).

This investigation had the consequence that the starting points of building the canal were clear for the State from the beginning. It needed to be an inland waterway between the cities of Den Bosch and Maastricht, and for a part of route the feeding canal for the Canal du Nord would be used. North of Loozen two stretches were possible: one following the small river Dommel to Eindhoven and then following the valley of the Dommel north to Den Bosch, and the other following first the already-existing Canal du Nord from Loozen to Nederweert and after there following the river A in the direction of Helmond, Veghel and Den Bosch. This A-route was longer than the Dommel-route, but it had a number of advantages correlated with the fact that this stretch was situated by and large in scarely populated wastelands. These lands alongside the A-route could be better cultivated with the canal, and transport costs of agricultural and forestry products would decrease substantially along with the vast peat swamp (see figure 5.2) opened for peat production. A second advantage was that this land was situated at a lower level, thus preventing the canal from drying. Also the A-stretch was less expensive because a part of the route was already realised and the stretch was more flat and less winding. Alongside the Dommel there were many watermills that would have to be compensated for damages from building the canal and the Dommel's northern stretch was also more crowded (Filarsky 1995, p.307-308).

5.7.3 Financing

On the basis of these considerations Willem I ordered to draft a plan for the building of a canal following the A-route. In 1819 the principal engineer of the King, Goudriaan, drew up the plan, estimating costs at 3.7 million guilders (Filarsky 1995, p.308). Willem I asked for advice from his minister of Finance, who answered pessimistically. He thought that the provinces in which the canal was situated were not able to contribute substantially to the financing of the canal, with the only possibility being the finances for the construction coming at the expense of the extraordinary State budget, needing approval by the Parliament. Willem

I did not dare to take this risk because he thought that Parliament would not appreciate the importance of the canal. Also, experiences had learned that issuing a public bond loan would not solve the problem. So the King needed a different approach to financing the canal. Instead he appointed a commission existing of members of the governments of the provinces that had a direct or indirect interest in the canal building with the plan that part of the investments would be financed by the State, part by the provinces and part by issuing a bond loan. It took two years of negotiations between the State and the provinces to reach an agreement. During these negotiations the King had to act strategically, ordering the drafting of a cheaper plan that would substantially lower the contributions by the provinces. At the same time he ordered a plan made for the completion of the Canal du Nord. One cannot escape the impression that this last move of the King was effective. Suddenly Holland was also prepared to contribute to the financing of the canal and also Brabant decided to contribute for an important part (Wiskerke, 1944, p.20-21). Now that the contribution of the provinces was sufficient, Willem I ordered his minister of Water Management to lay down a draft royal decision (in Dutch: Koninklijk Besluit) for him. In this draft it was described that the State would contribute 1.2 million guilders and the provinces would contribute 1.7 million over a period of twenty years. Probably part of these contributions would not be spent on the construction of the canal, but on paying redemptions and interest on a loan of 1.77 million guilders. The concept royal decision was sent to the minister of Finances. At the same time the King ordered the start of the construction by royal decision. It took the minister of Finances some time to react, but then again he was pessimistic. He thought total costs were estimated too low and he regarded the issuing of a loan very risky. This was because provincial contributions and income from tolls were not sufficient to pay redemption and interests on this loan. A state guarantee would be needed, but this demanded a special law. The minister of Finances felt not to be able to support this law, because he thought that Parliament would reject it. Half a year later the King asked his ministers of Finances and of Water Management again for advice. They suggested prudently that it was perhaps a possibility to enhance the contribution of the State by mediation of the Armortisatie-Syndicaat. Now the King took a decision and he answered that he did not agree with this advice. He did not see reasons to enlarge the state contribution and he expected Parliament to agree with the law to guarantee redemption and interest on bond loans, even in the situation where construction of the canal already had started. That the King now was prepared to submit the law was perhaps because Parliament had already agreed on the state contribution of 1.2 million guilders, partly when deciding on the extraordinary

budget for the year 1823 (Wiskerke 1944, p.22-23). The ministers of Finance and Water Management submitted the draft law to Parliament for a loan of 2.2 million guilders with state guarantee. When discussing the draft law, one of the most important members of Parliament, Van Hogendorp, said that he was aware that a substantial amount for the canal was already approved by the Parliament, but that if this had not been the case he would have been still in favour for the law, regarding the canal to be of great societal use (Wiskerke 1944, p.23). The law was approved with 77 votes in favour and 19 votes against, and the pessimistic expectations of the ministers did not come true. However, the success of the King was not complete. It appeared not possible to raise the loan publicly, and in the end the Amortisatiesyndicaat had to secretly take over this part of financing the canal.

5.7.4 Building

The canal was built under close supervision of a son of the designer of the canal, the chief engineer B.H. Goudriaan. He was a civil servant of the provincial agency of Water Management. Construction started in 1822 and was carried out according to the original design of Goudriaan, the father, in four years time (Wiskerke 1944, p.15).

There is hardly any information on the actual building process, but it is conceivable that the organisation of the work resembled the organisation of the Noordhollandsch Kanaal's construction. The Water Management agency's engineers issued tenders on which different contractors were asked to bid. These contractors hired bands of labourers to carry out the work, implying that also for the Zuid-Willemsvaart one can say the governance structure was probably a compliance control hybrid.

5.7.5 Own operate maintain and transfer

In 1828, two years after the completion of the canal, a new attempt by the King to issue a public loan failed again. In the same year, to solve the financial problems of the King, the exploitation rights of the Zuid-Willemsvaart, together with exploitation of a number of other public works, were handed over to the Amortisatiesyndicaat (Wissekerke 1944, p.23).

Since the end of the Amortisatiesyndicaat the canal has been state property, operated and maintained by the state agency of water management.

5.8 Application of the analytical scheme

5.8.1 Property rights and the canal building by Willem I

Throughout this study Oliver Williamson's nomenclature is used about the different levels and different sorts of institutions. Here again, as throughout this thesis, the distinction is made between institutional environments and institutional arrangements. The relationship between the institutional environment and the institutional arrangements is presented in figure 3.2 in chapter 3. Given the governance structure, the level of the transaction costs is not only depended on the attributes of the transaction, but also on the existing institutional environment. However the attributes do not influence the institutional environment, consequently the institutional environment is a shift parameter. Changes of these parameters shift the comparative costs of governance.

As also mentioned in chapter 3, property rights are broadly defined as the set of laws and customs, or formal and informal rules, that determine how individuals may gain access to resources and the range of possible uses they may make of them. They include rights and obligations with respect to the use, maintenance and improvement of resources, the rules of exchange or contract, and rules of liability when a particular use of a resource by one individual comes into conflict with the rights of other individuals (Salem 2004, p.5).
Property rights belong to the institutional environment, so consequently property rights are distinguished from the institutional arrangements or governance structures. In chapter 3 it was concluded that being able to make this distinction is very useful because now we can separate the changes in the institutional environment from changes in the institutional arrangement that govern the realisation and exploitation of the canal projects. It is clear from the history of the two canal projects that these institutional changes occurred and those were mainly located at the level of the institutional environment. This refers to the constitutional position Willem I had received with the constitution of 1814-1815. The constitutional rights of the King are seen as the definition of property rights regarding the canal building. The relevant constitutional rights concern the rights of Willem I regarding the state finances and regarding the water management. Willem I had the high command over the state finances and water management. The rights concerning water management were based on the articles 215 and 216 of the constitution. Article 215 states that the King has the supreme supervision over all

that concerns the water affairs in the United Kingdom, including roads and bridges, without discrimination of whether costs will be paid from the state treasury or from another source. Article 216 determines that the King practices the water management as he finds most suitable. Table 5.2 presents an overview of the property rights that were relevant for the construction of the Noordhollandsch Kanaal and the Zuid-Willemsvaart. These rights were constitutional which includes that they were nearly absolute rights against third parties and non-transferable. Although Parliament tried to gain more and more control over the state finances, the King used the Amortisatiesyndicaat more and more to safeguard his financial operations against parliamentary influences. He used this tool frequently in the financing of his canal building.

Table 5.2 Property rights for the Noordhollandsch Kanaal and the Zuid-Willemsvaart

What property Right (PR)	Elements of property rights: usus, usus fructus, abusus	How clearly is the right defined	Is the right transferable	Exclusivity against third parties	Possibility expropria-tion of the residual return
1. The King (Willem I) has the constitutional right of the high command over the state finances.	Abusus	Clear, although Parliament tried to gain control. (-+)	No (-)	Strong in the beginning. (-+)	NA
2. Art. 215 of the constitution of 1814-1815. The King has the supreme supervision over all that concerns the water management.	Abusus	In principle clear. In practice the question was how to execute this supervision (-+)	No (-)	Absolute (+)	NA
3. Art. 216 of the constitution of 1814-1815. The King practices the water management in such a way has He finds most suitable.	Abusus	In principle clear. In practice the question was how to execute this supervision (-+)	No (-)	Absolute (+)	NA

In table 5.2 a rating system is applied that indicates the quality and the value of the property right. In theory a property right has a high quality when it is clearly defined and when the right is transferable, when it offers exclusivity against third parties and when the possibility of expropriation of the residual residue is low. So, at first sight the quality of the property rights

for the building of the Noordhollandsch Kanaal and the Zuid-Willemsvaart can be regarded as sufficient. Only for the transferability of the property rights the scores are negative. With regard to the definition of the property rights the scores are neutral. These scores reflect the observation of Van der Woud, that the juridical apparatus of the constitutional and public law was insufficient. The power of the central government in relation to the other levels of government was clearly specified in the constitution of 1815. But the main questions were how to execute this power and what was allowed according to this constitutional structure (Van der Woud 1987, p.59). Therefore the seemingly autocratic power of Willem I was constrained in practice.

The question now is whether these rights were also transaction cost minimising rights. To seek an answer to this question, we need to apply insights from another branch of TCE, because Williamson's branch mainly refers to what he calls second order economising: that is get the governance structures right. But here we have a case of first order economising: get the institutional environment right.

North (1990) answers the question what the informational and institutional conditions are that would make the political market approximate the zero transaction cost model for efficient economic exchange. According to him necessary to realise such exchange are:

- The affected parties must have the information and correct model to know that the bill affects them and to know the amount of gains or losses that would incur.
- The results can be communicated to their agent (the legislator) who will faithfully vote accordingly.
- Votes will be weighted by the aggregate net gains or losses so that the net results can be ascertained and the losers appropriately compensated.
- This exchange can be accomplished at a low enough cost of transacting to make it worthwhile (North 1990, p.109).

The essential conditions in this schema are that the affected parties have both the information and the correct model to accurately appraise the consequences and that all the affected parties have equal access to the decision making process (North, 1990, p.110).

North acknowledges that in all of history these conditions are not even approximately met in the most favourable institutional framework for efficient political decision making. "Because polities make and enforce economic rules, it is not surprising that property rights are seldom

efficient." But a key consequence of formal institutions, like voting systems in democracies or organisational structures in hierarchies, is that they enable individuals who are agents to express their own views and to have a very different impact upon outcomes than those implied by the simple interest-group modeling that has characterised so much of economic and public choice theory (North 1990, p.110). Willem I did just the opposite. He did not take into account the views of affected agents, but decided by himself what was good for these agents.

Van Zanden and Van Riel (2004, p.333) follow more or less the same kind of reasoning in assessing the importance of property rights structure during the reign of Willem I, in which they define a difference between political rights and property rights. Property rights must ultimately be guaranteed by the constitution, because this defines the meta-rules of the political game, and these rules in turn determine how property rights, and changes in these rights, are established. Political rights and property rights are therefore closely related, and a constitution that fails to guarantee these essential political rights is also incapable of guaranteeing property rights. According to Van Zanden and Van Riel, the autocratic regime of Willem I shows the limits of this kind of polity. This experiment failed for three fundamental reasons: first the information flows about the conditions of the governmental finances were suppressed for a long period; second, it was impossible to replace failing decision makers like Willem I or his ministers; and, third, there was an increasing lack of control over those decision makers as a result. The changes in the Dutch constitution that began in 1840 - which not only restarted information flows but also made it possible for the Parliament to exert effective control and replace incompetent ministers - were not only an important improvement of political rights but certainly also had a positive effect on the effectiveness of property rights based on the constitution (Van Zanden and Van Riel 2004, p.333).

Going back to the analytical scheme of Williamson applied in this thesis, the conclusion is that one can regard the Willem I's constitutional rights as an institutional environment that acted as an upward shift parameter for the transaction cost minimising capacity of canal building governance structures. These governances structures could have been much more efficient in a transaction cost minimising sense if the property rights structure would have been built on more efficient political rights.

5.8.2 Governance structures.

In chapter four an analytical scheme was developed making use of TCE insights. Here, this scheme will be applied to the history of the Noordhollandsch Kanaal and the Zuid-Willemsvaart. This scheme distinguished between the different stages in a project: planning, designing, financing, building, own, operate and maintain and the possible transfer of the infrastructure. It will be clear that it is hardly possible to speak of private sector involvement in the realisation of these two canals. Only in the building stage of the projects the private sector had a certain role, in this case the contractors that did the actual digging of the canals.
The first step of the analytical scheme is to describe the parties that were involved in the different stages of the canal construction. In these projects the parties were governmental agencies represented by certain persons, the ministries of interior and water management, the State, some local governments and last but not least the King himself. He represented much of the state power, so it is difficult to distinguish between the King and central government agencies. The broad picture is that the realisation of the canals was carried out by the central government and the lower levels of government only played a minor role in the Noordhollandsch Kanaal and perhaps a somewhat bigger, but even then a modest role in the Zuid-Willemsvaart. The Amortisatiesyndicaat was also a government agency because its existence was based on a parliamentary approved law and on the personal power of the King.
As was described in chapter 4 this does not imply that TCE is not applicable, because the unit of analysis is the transaction and not the governance structure. These transactions cannot be characterised as collective goods and consequently TCE is applicable.

The next step in the analytical scheme is to describe the transaction in each stage of the project and to describe the levels of the transaction characteristics that TCE finds decisive to economise on transaction costs. These characteristics are: recurrence, uncertainty and asset specificity. When recurrence is low and uncertainty and asset specificity are low, the market is the transaction cost minimising governance structure. When recurrence and uncertainty and asset specificity are high, then hierarchy is the proper governance structure.
The recurrence is low except in the owning, operating and maintaining stage. In this stage the levels of uncertainty are not that high compared to the other stages. Uncertainty is high in the planning, designing and financing stage. In the planning and designing stage this concerns technical uncertainty and uncertainty about the planning of the use of the canal, which in turn determines the physical dimensions of the canal. In the financing stage the history of the canal

projects shows uncertainty as well. Asset specificity is high in the planning and designing stages, having to do with the body of knowledge developed by the organisations that carry out the planning and the design. This gives room for opportunistic behaviour from the side of these organisations. Asset specificity is low in the building stage. The level of technical development was such that there were no specific investments needed from the site of the constructors.

The last step in the analytical scheme is to describe the observed governance structures. Here they are mainly hierarchical. The structures are not characterised as subject to certain agreements or to private contract law, otherwise the structures could have been more hybrid. In situations where consultations with lower level governments were needed the governance structures could have been more hybrid, but in the end it was the special position of the King that was decisive. The governance structure in the Zuid-Willemsvaart's financing stage resembles a hybrid form the most, because provincial governments had some influence and there were agreements between the provinces, some cities and the King about their participation in the financing of the canal. The structures in the building stages can be characterised as more hybrid as well, because private contractors were involved who worked under close supervision the Water Management agency's engineers. Because the contracts were very specific in deciding when a contractor got paid, it can be assumed that the kind of hybrid here was a compliance control hybrid.

A problem here is that the devil is in the details, but the details were not laid down in agreements between more or less equal parties. Much of the work in the different stages was carried out solely on the basis of the specific water management powers of the King, as laid down in the constitution.

In table 5.3 and 5.4 the rating system is applied that has been described in section 4.7. It points towards the quality of the governance structure as a transaction cost minimising structure. As indicated by this rating system it can be assumed that in the financing stage the governance structures were not transaction cost minimising. The other governance structures were much more in line with TCE. However, as was argued before, the problem was the inefficient institutional environment. This was especially important in the planning and designing stage, because in these stages the fact that affected parties did not have equal access to the decision making process was important. Therefore, the hierarchical governance structures in these stages can be regarded as sub optimal.

Table 5.3 Noordhollandsch Kanaal: Parties involved, transactions and their characteristics and observed governance structures by stages of the project.

	Parties involved	Transactions and characteristics	Governance structure	rating
Planning	Military and state civil servants. The King's principal engineer Jan Blanken. Then Amsterdam started to defend her interests and plans were adapted.	Delivery of the plan. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Hierarchy. Military and state civil servants controlled by the King.	-+
Designing	The principal engineer of the King Jan Blanken.	Technical design of the canal: the specifications and drawings. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Hierarchy; state civil servant, controlled by the King.	-+
Financing	The State budget, directly and by the Armortisatiesyndicaat. The King personally. The cities of Amsterdam and Alkmaar.	Delivery of the financial means. Recurrence: low Uncertainty: high Asset specificity: low.	Hierarchy, mainly. Financing by a law approved by parliament and by the Armortisatie-syndicaat which is based on a specific law.	-
Building	1819-1824: The Ministry of Interior and water management. By government agency of water management and its principle engineer Jan Blanken. Private contractors.	Construction of the canal. Recurrence: middle Uncertainty: high Asset specificity: low.	Compliance control hybrid. Contractors controlled by the state agency for water management.	+
Own, operate and maintain	Ownership by the State, operation and maintenance by the state agency of Water management.	Operational activities, toll collection and maintenance. Recurrence: high Uncertainty: low to middle (toll collection) Asset specificity: middle.	Hierarchy. The state agency of water management.	+
Transfer	Not Applicable	N.A.	N.A.	

Table 5.4 Zuid-Willemsvaart. Parties involved, transactions and their characteristics and observed governance structures by stages of the project.

	Parties involved	Transactions and characteristics	Governance structure	Rating
Planning	1911: Napoleonic imperial degree to study the canal connection of parts of the Canal du Nord with Den Bosch. 1915: King Willem I.	Delivery of the plan. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Hierarchy. Military and state civil servants controlled by the King.	-+
Designing	The principal engineer of the King: Goudriaan.	Technical design of the canal: the specifications and drawings. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Hierarchy: state civil servant, controlled by the King.	-+
Financing	Initially the financing of the canal was based on financing by the State budget, contributions of the Provinces of Brabant and Holland and a public loan. The public loan failed and the Amortisatiesyndicaat had to step in. In 1828 the King again tried to raise money by issuing a public loan. This again failed.	Delivery of the financial means. Recurrence: low Uncertainty: high Asset specificity: low.	Hybrid, mainly. Because of the involvement of the provinces.	+
Building	1822-1826: The state agency of water management by the engineer B.H. Goudriaan. Private contractors.	Construction of the canal. Recurrence: middle Uncertainty: high Asset specificity: low.	Compliance control hybrid. Contractors controlled by the state agency for water management.	+

Table 5.4 Zuid-Willemsvaart. Parties involved, transactions and their characteristics and observed governance structures by stages of the project. Continuation from previous page.

	Parties involved	Transactions and characteristics	Governance structure	Rating
Own, operate and maintain	Ownership by the State, operation and maintenance by the state agency of Water management. With respect to ownership the state was partly represented by the Amortisatiesyndicaat.	Operational activities, toll collection and maintenance. Recurrence: high Uncertainty: low to middle (toll collection) Asset specificity: middle.	Hierarchy. The state agency of water management.	+
Transfer	After the failure of the public loan of 1828 the financial exploitation of the canal was handed over to the Amortisatiesyndicaat.	Recurrence: low Uncertainty: middle Asset specificity: middle.	Hierarchy. The Amortisatiesyndicaat can be regarded as a bureaucratic state agency.	-

5.9 Conclusions: answering the research questions

The central research question of this thesis is: Is it possible to determine from NIE the characteristics of an efficient governance structure for investments in large infrastructures and for the exploitation of these large infrastructures? NIE is here mainly limited to property rights theory and the TCE branch of Oliver Williamson. In addition to these two parts of NIE, some notion of Douglas North are also used concerning the connection between the political system and the efficiency of property rights.
In the opening chapter of this thesis more specific research questions were defined. These research questions will be answered in this concluding section with regard to the two canals of Willem I: the Noordhollandsch Kanaal and the Zuid-Willemsvaart.

The first research question is: What are the main characteristics of the history of the two canals?
As has been said, decisive for the history of the canal building during the reign of Willem I was the power the King had both concerning water management and state finances. This made it possible for him to act as a benevolent absolute ruler, based on his constitutional rights, at least in theory; in practice, matters are more complicated. In theory he did not have to work together with other interest groups, and in theory he was not dependent in financing his projects. He could do without a priori agreement with Parliament, certainly in the beginning of his reign. In practice the power of the King was limited due to the insufficient juridical apparatus of the constitutional and public law. According to Van der Woud the power of the central government in relation to the other levels of government was clearly specified in the constitution of 1815, but the main questions were how to execute this power. Van Zanden and Van Riel notice that the autocratic regime of Willem I failed for three fundamental reasons: first, the information flows about the conditions of the governmental finances were suppressed for a long period; second, it was impossible to replace failing decision makers like Willem I or his ministers; and, third, there was an increasing lack of control over those decision makers as a result.
When financial matters became more difficult Willem I used the vehicle of the Amortisatiesyndicaat, through which he had a substantial financial power at his disposal. Private parties did not seem to have this power, as Filarsky noticed. With the privately

constructed canals, public organisations had to play an important role, especially financially. This leads into an interesting area, which is however outside the scope of this thesis, and that is the question of whether there were no private parties or the capital market did not function sufficiently to make profitable private enterprises possible. Even more important, perhaps, is that the King commanded information flows through his organisation of the water management. As we saw both with the Noordhollandsch Kanaal and also with the Zuid-Willemsvaart, his water management organisation and his direct links with the principal engineers were very important for the realisation of the projects. The question is now what the quality of this information was. Technically there was no problem, or the problems could be managed by the State and regional bureaus of the water management. The construction periods of the canals, including of the technically difficult Noordhollandsch Kanaal, were surprisingly short. This points into the direction of a more-than-sufficient technical capacity. As Filarsky has described, though, there were mostly no sound economic appraisals of the projects, or uncertainties were very high around the estimates in these appraisals. Characteristic is that the King did not need to possess high quality information on the feasibility of his canal projects. He had the power to decide alone and to realise the financing of the projects, so he did not need to convince other parties about the necessity of the projects.

The second research question is to determine what features of NIE can be applied to the study of the governance of the investments in the Noordhollandsch Kanaal and the Zuid-Willemsvaart. From section 8 it is clear that property rights theory and especially some theoretical notions from Douglass North about the interplay between property rights and the polity are important to interpret the history of the two canal projects in the light of NIE. Especially important here is his notion that the essential conditions in this interplay are that affected parties have both the information and the correct model to accurately appraise the consequences, and that all the affected parties therefore need equal access to the decision making process.

The next question is: What are the governance structures that were relevant to the investment for and to the operation of the canals?
The most important governance structures were based on the constitutional rights of Willem I. Consequently, in most stages these governance structures were hierarchical and based on

the power of the King with respect to state finances and water management. Exceptions were the governance structures for building the Noordhollandsch Kanaal and the Zuid-Willemsvaart, which were compliance control hybrids, and the hybrid form of financing the Zuid-Willemsvaart.

Now the question is: How well were the governance structures able to cope with unexpected technical, economic and political events? And, can NIE help to explain the success or failure of the construction and subsequent exploitation of the canals?

Here again the difference between the institutional environment and the governance structures is important. One can say that the mainly hierarchical structure, especially for the actual building of the canals, worked well. According to TCE, high uncertainty is a reason for a more hierarchical organisation. In the stages of planning and financing the canals there were hierarchical organisations that expressed mainly the absolute power of the King. However, according to North, an efficient polity needs to make sure that all affected parties have the information and the correct model to know that the bill affects them and to know the amount of gains and losses that will be incurred, so that these parties or their agents can vote accordingly. The hierarchical organisation that planned and designed the canals, based on the constitutional rights of the King, did not involve the affected parties on an sufficient level. In the case of the Noordhollandsch Kanaal this organisation should have incorporate representatives of the harbour of Amsterdam more directly. This could have been the city council, but certainly also private entrepreneurs who had businesses connected with the harbour should have been involved in the actual decision making. This does not necessarily regard the financing of the canal, because it could have been that an inadequate capital market made it more effective to finance the project by public bodies. But within such an organisation information and project appraisal built on this information could have been more adequate. Perhaps then the canal was not built 20 years too early; perhaps it would not have been built at all, as Filarsky notes.

For the Zuid-Willemsvaart the governance structures were not much different. Only for the financing of the canal were the provinces of Holland and Brabant involved, making the governance structure more hybrid. The Zuid-Willemsvaart was from the beginning a multi-purpose canal, preventing it from being a failure. Although the first 20 years of the canal's existence did not bring substantial revenues, the fact that the city of Eindhoven constructed a

connecting canal with the Zuid-Willemsvaart on its own account indicates that the Zuid-Willemsvaart was highly valued in the 1840s.

The last question is: Can we learn from the history of the Noordhollandsch Kanaal and the Zuid-Willemsvaart in the light of insights from NIE?

The most prominent aspect here is the importance of the institutional environment and thus the property rights for the effectiveness of the governance structures.

One can say that the inadequate legal structure is a matter of first order economising in the scheme of Williamson: get the institutional environment right. But cumulative change of a progressive kind is very difficult to orchestrate, according to Williamson. Different kind of shocks will occasionally produce a sharp break from established procedures. Rare windows of opportunities are thereby opened. Absent such a window, major changes in the rules of the game occur on the order of decades or centuries. This stresses the importance of property rights and the definition of property rights. However, the claim, for example, that the legal system will eliminate chaos upon defining and enforcing property rights assumes that the definition and enforcement of such rights is easy and costless. Williamson remarks that rare windows of opportunities are right with respect to the history of the canal building. The nearly absolute power of Willem I, laid down in the constitution, was only changed after financial and political crises in the 1830s.

The inadequate institutional environment can be regarded as a shift parameter in Williamson's second order economising which is: get the governance structures right. This shift parameter had a negative effect on the outcome of the second order economising process. In the light of TCE the governance structures on their own were fairly efficient, but they operated in an inefficient environment that had especially negative effects in the planning, designing and financing stage of the Noordhollandsch Kanaal and the Zuid-Willemsvaart.

6 The Suez Canal

6.1 Introduction

6.1.1 Basic facts

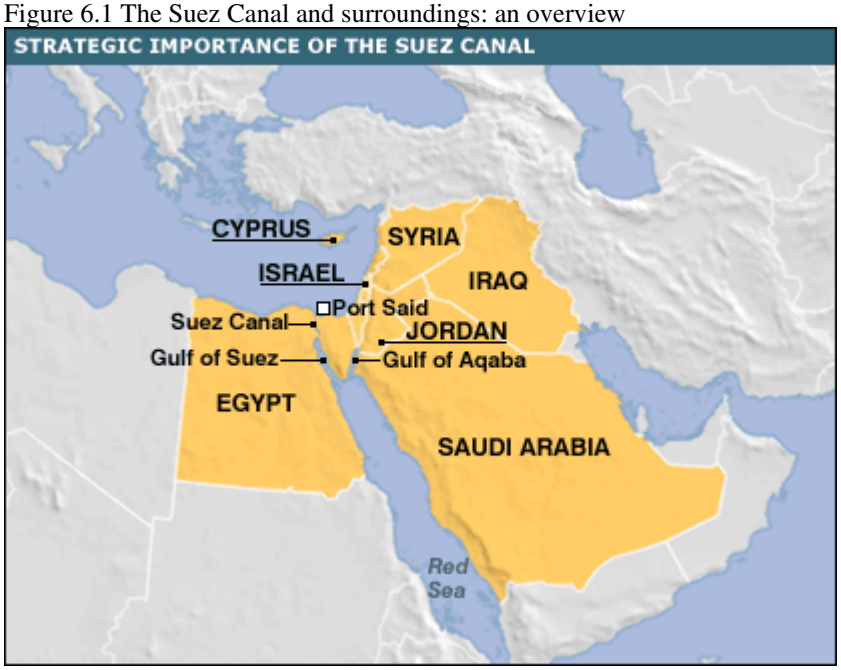
The Suez Canal (Arabic: Qanā al-Suways), is a large canal in Egypt west of the Sinai Peninsula. It runs 190 km between Port Said (*Būr Sa'īd*) on the Mediterranean Sea and Gulf of Suez (*al-Suways*) with an average width of 200 m. The canal is comprised of two parts, north and south of the Great Bitter Lake, and it links the Mediterranean and the Red Sea. This canal is one of the most important shipping links in the world, especially so for Europe and Asia, making the circumnavigation of Africa unnecessary. The canal has no locks because the sea level at both ends is about the same and the original low lying plain in which the canal is dug did not need deep excavations.

The canal currently has an average depth of 20 m. and accommodates the passage of ships with 220,000 DWT (metric tonnes of dead-weight) of cargo and up to 18.9 m of draft to pass. Improvements are under way to increase the canal's depth to 22 m. by 2010, which will allow loaded super tankers to pass; presently super tankers can offload part of their cargo onto a canal-owned boat and reload at the other end of the canal. There is one shipping lane with several passing areas, and on a typical day three convoys will transit the canal, two south-bound and one north-bound. Travel time takes between 11 and 16 hours at a top speed of around 9 knots, so low to help prevent erosion of the canal banks by ship waves (www.suezcanal.gov.eg).

Traffic on the canal headed northward are often calling north and west Europe as a final destination and are about 37.7% of total north bound ships, the north Mediterranean areas represent 16.2% of this traffic. The most important destinations for south-bound boats are South East Asia with 28% and the Far East with just over 20%.

Egypt's Suez Canal Authority reported that 21,415 ships passed through the canal in 2008. About 7.5% of all world sea trade is carried via the canal today, with yearly receipts from canal tolls approximate $5.4 billion. These figures suggest an average toll of $252,000 for each vessel passing through the canal (Suez Canal Authority n.d.).

Figure 6.1 The Suez Canal and surroundings: an overview



Source: www.bbc.co.uk.

6.1.2 Early history

Before the opening of the Suez Canal in 1869, goods were offloaded from ships and carried overland between the Mediterranean and the Red Sea. Perhaps as early as 1800 BC the Pharaoh Senusret III (1878-1839 BC) may have had a west-east canal dug through the Wadi Tumilat, joining the Nile with the Red Sea, thus allowing trade indirectly between the Red Sea and the Mediterranean. Evidence indicates the existence of a canal in the area by the 13th century BC, during the time of Ramesses II. This canal later fell into disrepair, and according to the Histories of the Greek historian Herodotus around 600 BC, Pharaoh Necho II undertook re-excavations which were not completed until the reign of Darius I of Persia, who conquered Egypt. According to Herodotus, the completed canal was wide enough for two triremes to pass each other with oars extended and it required four days to travel the complete canal. The canal of King Darius was again restored by Ptolemy II about 250 BC, and in the following 1,000 years it was successively modified, destroyed and rebuilt (Kinross 1968, p.5/6).

Amr Ibn el-As rebuilt the canal after the Islamic takeover of Egypt creating a new supply line for Cairo, but in 761 AD, the Abbasid caliph Al-Mansur closed the canal to cut off supplies to insurgents located in the Nile delta. It was never reopened (King 1984, p.593).

6.2 Planning: the idea of the modern canal

6.2.1 Napoleon Bonaparte

The story of the creation of the present canal begins in 1798, with a general looking for a mission. Young Napoleon Bonaparte was sitting in Paris with an army and more than enough ambition, but without a battlefield. The Directorate of revolutionary France did not like him staying in Paris, and wanted to send Napoleon far away. That far-away place ended up as Egypt, and preparations for an expedition to Egypt there started in 1798. It would be a blow to England's maritime supremacy, and Egypt was also at the time suffering under the tyranny of the Mamelukes. It was a good opportunity for the French revolution to show that it was bringing freedom to the oppressed.

Napoleon had had an order from the Directorate that read: "The general in chief of the Army of the Orient will seize Egypt; he will chase the English from all their possessions in the Orient; and he will destroy all of their settlements on the Red Sea. He will then cut the Isthmus of Suez and take all the necessary measurements in order to assure the free and exclusive possession of the Red Sea for the French Republic" (Karabell 2003, p.20/21).

To honour the letter of these instructions, Napoleon turned to Jacques Marie Le Père to lead a group of engineers and surveyors that would accompanying the troops. As Le Père knew, various canals had existed in antiquity, clearly described by ancient geographers and even leaving traces remaining in the desert. But most of these canals were indirect routes and at Napoleon's urging Le Père was to begin with a blank slate. Rather than trying to copy the ancient routes, he was to assess every possible permutation in constructing a usable canal in the area.

However, Le Père made a critical mistake and calculated that the waters of the Red Sea at high tide were more than ten metres higher than the waters of the Mediterranean, concluding that a direct canal was impossible. His findings were accepted, not without some question, but in the end his survey would become official outcome (Kinross 1968, p.14-18).

6.2.2 The Saint-Simonians and Enfantin

Then in 1833 a group of French intellectuals known as the Saint-Simonians arrived in Cairo and they became very interested in a Suez project despite the problem of the difference in sea levels. This group of men were followers of the Comte de Saint Simon, the philosophy of

whom stressed that there could be progress, and progress was man's destiny. These beliefs were radical in the early nineteenth century, challenging the doctrines of the church and the old regime. Traditional church theology had not been based on the notion of progress, and by the nineteenth century the French ecclesiastical establishment had fallen behind secular thinkers. Saint-Simon built on several strains of Enlightenment and crafted them into a doctrine saying that the future will always be better than the present.

After Saint Simon died in 1825, his leading students quarrelled over his inheritance, and several factions emerged. The most dynamic and most peculiar of these factions was led by Barthélemy-Prosper Enfantin. Enfantin initiated a chain of events that led directly to the creation of the Suez Canal (Karabell 2003, p.26-28).

Unfortunately, at that time the viceroy of Egypt, Mohammed Ali had little interest in the project, and in 1835 the Saint-Simonians were afflicted by a plague epidemic. Most of the twenty or so engineers returned to France, but they did leave behind several enthusiasts for the canal, including Ferdinand de Lesseps who was then the French vice-consul in Alexandria.

In 1846 the Saint-Simonians created an association in Paris to study the possibility of the Suez Canal once again. In 1847, one of the members of this association, Bourdaloue, confirmed that there was no real difference in the levels between the Mediterranean and Red Seas, and Linant de Bellefonds drew up the technical report.

A political obstacle at the time would be the considerable British opposition to the project, and following this opposition Mohammed Ali became even more dismissive. Muhammed Ali was from Albanian descent and had been a mercenary in the army of the Ottoman Sultan. In 1811 the remaining members of the Mamaluke rulers of Egypt were killed during a banquet Muhammed Ali had invited them to. With the removal of the remnants of the old ruling class, Muhammed Ali appropriated their land and founded his dynasty (Karabell 2003, p.33).

6.2.3 Ferdinand Marie Vicomte de Lesseps and Said Pasha

Ferdinand de Lesseps was born in 1805 from Mathieu de Lesseps and Catherine Grivégnée y Gallegos. Mathieu was in 1804 the French consul in Cairo, where he befriended Muhammad Ali and helped him gain control over the warring factions within Egypt. A successful diplomat, he was later posted in Philadelphia in the new United States.

Young Ferdinand became a childhood acquaintance with royalty. He was a member of the so-called “establishment,” and from the time he could walk and speak he had access to wealth and power. But his family was never in the upper tier, so he knew he had to make his own way. His early career followed the same course as those of his father and uncle, as a diplomat. While France was experiencing rapid changes and occasional turmoil, Lesseps lived thousands of miles away, identifying with France yet spending a remarkable small portion of his life there. For most of the 1830s Lesseps lived in Egypt, dividing his time between Alexandria and Cairo and making regular trips back to Paris. As consul of Alexandria, Lesseps pursued the same policies his father had, especially nurturing the relationship with Muhammed Ali who became even more crucial to French goals in international politics.

Muhammed Ali as a martial man had a problem in the upbringing of his son, the young Prince Said, who was enormously fat. Somewhat desperate at his inability to control Said’s weight, Muhammed Ali turned to an unlikely ally, the French consul Lesseps. Lesseps chose the path of least resistance: collaboration. He and Said shared a passion for horseback riding, so he began to take the teenager riding almost daily, and rather than monitor Said’s food intake Lesseps broke every rule and gave him food. This gave rise to a life long friendship between these two men (Karabell 2003, p.40-45).

Lesseps eventually changed career positions and he was transferred to Madrid as ambassador, though rather quickly Louis-Napoleon made his own brother ambassador of Madrid, and Lesseps was directed to Rome. Though in Madrid Lesseps had been happy, in Rome he would fall (Karabell 2003, p.48/49). In 1849 he was fired from the diplomatic service in a scapegoat game in French politics. Responding to his need, his mother-in-law Madame Delamalle appointed Lesseps as her agent for a large estate in central France, near Berry. But a ruined career was not all: in the summer of 1853 Lesseps' son Charles became very sick, probably with scarlet fever. Lessep’s wife cared for him and brought him back to health, but caught his fever and died within days. Not long after, another son died. One of these crisis would be enough to hurt any man, but having lost a career, a wife and a child within the space of a few years, Lesseps was left with two sons and a set of in-laws on a farm in central France.

According to Karabell (2003) Lesseps himself would never have devoted himself so single-mindedly to implementing the Suez Canal project had he not suffered loss. Disgrace and the death of his wife propelled him towards what would become his future.

This man in search of a destiny now received a gift from fate. In July 1854 a postman appeared in the courtyard of the old French manor house. Abbas, the successor of Muhammed

Ali, had been assassinated. He was oldest male descendent of Muhammed Ali and under the somewhat peculiar succession laws of Egypt had become the viceroy. Lesseps knew instantly what that meant: power now passed to the eldest male of the house of Muhammad Ali, his son, a thirty-two-year-old man with a fondness for all things French and large plates of pasta. So Lesseps again went to Egypt to visit his old friend Said Pasha (Karabell 2003, p.63-64).

6.3 Designing and financing: concessions and the Suez Canal Company

6.3.1 First concession

Lesseps went to Egypt in 1854 to renew his relationship with Said Pasha and upon disembarkment in Alexandria he was treated as a royalty. Said invited him to join a party in the desert where the two had the opportunity to talk alone. Lesseps spoke to Said about the idea for a canal, strongly advocating the area of the isthmus of Sinai, and stressing that the canal would strengthen the Ottoman Empire and its sultan, who was still Said's sovereign. Lesseps promised that, though the technical obstacles were formidable, they weren't insurmountable, and even Said's chief of public works, Linant Bey, demonstrated that it would be possible to build a direct canal. The real challenges were political and financial. Political, because the British were against a canal and the Sultan did not want to come in conflict with the British. Financial, because it was beyond the capacity of the Egyptian government to finance this huge undertaking alone. Lesseps assured the viceroy that, with effort, both challenges could be met. A canal would set Said apart from other rulers and transform him from the governor of an Ottoman province into a potentate admired throughout the world and immortalised as daring to do what others said was impossible. The canal would place Egypt at the centre of world trade, enriching Egypt and bringing in more revenues than cash crops ever could. The combination of glory and money was hard to resist, and Lesseps had the advantage of selling a vision that he himself fully believed in. At the end of this conversation, Said turned after some thought and said "I am convinced. I accept your plan; for the rest of the trip, we will figure out the actual means of implementing it. The matter is settled, you have my word." With that late-afternoon conversation, the Suez Canal ceased to be only a dream. After half a century of stops and starts, the impasse was finally broken.

The sovereign of Egypt gave his personal word to a private citizen of France and in that moment everything changed. Lesseps himself went back to his tent that evening and formalised his notes into a memorandum that he gave to Said the next day. From that day in November 1854, it would take fifteen years of ceaseless effort to create the Suez Canal. Not until the early 1860s would Lesseps have enough actual physical work done on the canal to ensure that it would be finished. Said's support was an imperative first step, but it was only the beginning of a long, uncertain road that time and again looked as if it would end in failure. Coming back from their trip into the desert, within days Lesseps had his much wanted concession. Granted by "His Highness Muhammad Said, Viceroy of Egypt," it gave "our friend M. Ferdinand de Lesseps … the exclusive power of constituting and directing a universal company for cutting through the isthmus of Suez and establishing a Canal between the two Seas, with power to undertake or cause to be undertaken, all works and constructions." Lesseps was made the director of this soon-to-be-constituted company, and the length of the grant was set at 99 years. The company was to be responsible for all costs of the project, but "the Egyptian government is to give up those portions of the public property, now uncultivated, which would be watered and cultivated at the expense of the said Company. The Company will enjoy possessions of the said property for the term of 10 years from the day of the opening of the canal." For the remaining 89 years of the concession, the company would be required to pay a tithe to the Egyptian government. The other major provision of the concession included an agreement that the Egyptian government would receive 15% of the company's annual net profit, with 10% for the company's founders and the remaining 75% going to the company's shareholders. The concession did not stipulate whether the canal would be a direct line through the isthmus, or whether it would follow the indirect route via the Nile (Karabell 2003, p.71-79).

6.3.2 The second concession

The first concession called for a canal to be built by a private company, but a project of this nature could not avoid becoming political. The Ottoman Empire was a central player in all these politics. Legally, Said ruled Egypt with a weak position towards the sultan. He had no authority to "alienate" Egyptian land without the permission of the sultan. By granting the Canal Company land rights, Said moved into questionable territory, and the first act of concession was silent about the sultan. But Lesseps refused to agree to the principle that Said

would require permission from the sultan, because in doing so he would have to transfer the political question out of Egypt and into a more complicated arena where Lesseps would not enjoy the same advantages (Karabell 2003, p.83).

Between 1855 and 1858 Lesseps spent months in England, months in France, months in Egypt, and months in Constantinople. He passed considerable time in transit between these places, and also travelled to Trieste and Vienna, Spain and the Netherlands, and even to Sudan. With all the diplomatic upheaval, the issues were simple: Lesseps and his allies wanted to build a canal; the Ottomans wanted to avoid offending the British or the French and to retain whatever tenuous control they had over Egypt; Said wanted a canal, but only if that didn't move into alienating the English or the Ottomans; the British government was opposed; and the French supported the idea, but not at the expense of English hostility.

Through all this Said honoured his commitments, and without his generous allowance to Lesseps little of the preparatory work and public-relations campaigning could have been funded. In the fall of 1855 Lesseps assembled an international commission of engineers to conduct an independent audit of the feasibility of the plan. It became clear by 1856 that the commission was going to issue a favourable report, though the British engineer was less persuaded than his colleagues. The final report declared: "The execution is easy; success is assured and the results will be immense for the commerce of the world."

These findings were soon disseminated to the general public, and the report became a public-relations weapon in the canal's favour. In addition, on 5 January 1856, from his palace in Alexandria, Said issued a second act of concession, which supplanted the initial document of November 1954. The new concession once again permitted the formation of a company dedicated to the creation of a canal between the Gulf of Pelusium in the Mediterranean and the port of Suez on the Red Sea. But where the first concession had been vague about the route, the second commission left no doubt that the canal would be a straight line through the isthmus. Said also reaffirmed that a freshwater canal would be dug from the Nile through the Valley of Toumilat to the isthmus at lake Timsah, and he instructed the company to build ports at both Timsah and Pelusium.

Other articles of the concession specified the generous exemptions that the company would enjoy: no import or export duties on any material relating to the construction; ten years of tax free use of whatever land it brought under irrigation as part of the works; and the free right to any mines or quarries. Said authorised Lesseps to form the Universal Company of the

Maritime Canal of Suez, and promised that the company would have "the hearty cooperation of the Egyptian government" (Karabell 2003, p.111-113).

However, the diplomatic situation was unresolved. Little movement had occurred and after three years of effort Lesseps decided to force the issue. He would get the support of the emperor Napoleon, found the company, sell shares, and begin the work, whether or not Said, the sultan, or the British agreed. It was a risky move. It would take a year, but it would succeed (Karabell 2003, p.123).

6.3.3 Financing the Suez Canal Company

The second act of concession allowed Lesseps to formalise the statutes of the Universal Company. The company was to be capitalised at two hundred million francs (which was the equivalent of eight million pounds), divided into four hundred thousand shares worth five hundred francs each. Share certificates were to be issued in multiple capitals, written in Turkish, German, English, French and Italian. The society of shareholders would be administered by a council consisting of thirty-two members who would serve for eight years, and this council would govern the company. There would be a meeting each spring to which all people holding at least twenty-five shares would be invited. The corporate domicile of the company would be in Alexandria, while its administrative offices would be in Paris (Karabell 2003, p.114).

On 14 October 1858, Ferdinand de Lesseps released two letters. In both, Lesseps announced that on 5 November 400,000 shares in the company would be offered to the public at a cost of five hundred francs per share. This was not an inconsiderable sum in 1858, just slightly more than the average annual per capita income in France. The shares sold for twenty pounds in Britain and that was more than a member of the working class could afford.

The cost of construction was estimated at 160 million francs, though with interest charges payable to shareholders, the total cost would equal the two hundred million to be raised from the subscription. Lesseps promised that the anticipated revenues more than justified the expense. Once the canal was complete, at least three million tonnes of goods would pass through the canal at a charge of ten francs per tonne, providing an annual revenue of thirty million francs.

The plan called for money being collected from hundreds of small local banks and then funnelled to the company. By the fall of 1858, the project was known and understood

throughout the continent, and Lesseps had every reason to be confident that the shares would be bought quickly.

When the subscription closed on 30 November, however, the results were disappointing. Slightly more than 23,000 people had purchased shares, but over 21,000 of them were French citizens. All in all French shareholders held more than 200,000, or just over half of all the shares offered. The next-largest block was bought within the Ottoman Empire, including Egypt; the personal stake of Said alone amounted to more than 60,000 shares. Another 4,000 were purchased in Spain, 2,600 in Holland, and 1,300 in Piedmont. And as for those 85,000 shares reserved for Great Britain, Russia, Austria, and the United States, none were bought. The verdict was clear. Ferdinand the Lesseps had sold his vision to 21,000 Frenchmen and one prominent Egyptian (Karabell 2003, p.136-143).

Said had initially agreed to purchase 64,000 shares, but he had also promised Lesseps that the Egyptian government would acquire whatever shares were outstanding once the subscription had closed. Said trusted the assurance of Lesseps that the initial flotation of four hundred thousand shares would succeed. But when none of the 85,000 shares set aside for other countries were sold, Lesseps turned to Said and requested that the ruler would honour his promise. And in the end Said bought 177,000 shares: the original 64,000, plus all the unsold shares. He paid 85 million francs for it, meaning that he owned 44% of the registered capital of the company (Kinross 1968, p116-117).

However the contribution of Egypt to the financing of the company and the construction of the canal did not stop here. It was estimated that Egypt subsidised the canal building up to 30 million francs in the form of the value of the forced labour of the corveé system. When this system was discontinued by the khedive in 1863, an indemnity payment was imposed on the Egyptian government by the 'impartial' arbitrator Napoleon III for 84 million francs. As part of the deal, 60,000 acres of land and the fresh water canal to Ismailia were to return to Egypt, and from 1866 to 1869 Egypt was further obliged to pay 42 million francs in compensation for various alleged services by the company and for return of sovereignty over the canal's terminal ports (Hansen and Tourk 1978, p.940). Altogether, Hansen and Tourk estimate that the Egyptian government from 1859 to 1878 contributed approximately 184 million francs to the company over and above the original purchase of shares. Egypt became the major financier of the canal building.

The share capital and the Egyptian contributions did not suffice to cover direct expenses of the construction, which amounted to 291 millions francs, and to cover the losses of the first

years of the operation of the canal. Therefore obligations were issued in 1867-68 to a total market value of 100 million francs, followed by a sale in 1869 of so-called 'délégations' to a value of 32.4 million francs and an issue of obligations in 1871 at a market value of 20 million francs. However, the financial situation of the company during the first period of operation stayed desperate. Expansion and deepening of the canal continued to be partly financed through further issues of obligations to a total of market value of about 425 million francs in 1918. Surpluses began to emerge after 1875 and from 1918 on retained profits began to suffice not only for all financing of investments in the canal, but also for repayments of old loans and financial investments outside the basic canal activities (Hansen and Tourk 1978, p.939-940).

6.3.4 Distribution of profits

In the statutory rules of the company it was described how to distribute to profits of the company. Therefore the surpluses were defined by the so-called 'bénéfice distribuable,' the total revenues of the company minus costs of operations, allocations to statutory and other reserves, depreciation and the payments listed under the following points (Hansen and Tourk 1978, p.942):

- Annual pensions to the Lesseps family of 120,000 francs after the death of Ferdinand. These costs declined as the number of descendants declined.
- Payments to Egypt of a small annual amount for 'control.' Up to 1937 these costs were 30,000 gold francs a year.
- Interest payments to holders of obligations.
- Preferential dividends to all original shares of 5% per annum. This was the so-called 'intérêt.'

It was not until 1875 that a 'bénéfice distribuable' arose. Again according to the statues this bénéfice was distributed as follows:

1. Dividends to ordinary and preferential shareholders: 71%.
2. To the Egyptian government 15%. In 1880 Egypt surrendered this right to the 15% share in the bénéfice to the 'Credit Foncier de France' which in return paid 22 million francs of the khedive's debts to French creditors.

3. To the Founders of the company 10% was paid. Subscribers to the capital of the original Société d'Etudes pour le Canal de Suez of Enfantin and the Saint Simonians had the right to negotiable shares in the profit. Such shares were in addition given to 166 hand-picked notables.
4. The management received 2% and the empoyees received 2% of the 'bénéfice distribuable' (Hansen and Tourk 1978, p.942).

6.4 Building the canal

6.4.1 Solving concession problems

There were, however, two sticking points in the concession, both of which would later threaten the completion of the canal. The first one was the concession stipulation that four-fifths of the workers would be Egyptian peasants. It was understood that the only way Egyptian workers could be provided was through the corveé, which was not exactly slavery, though was not free labour either. The duties and rights of the workers and of the company were specified in a special decree of Said. The corveé had been used for work on major Egyptian public-works projects for centuries, and Said's decree seemed harmless at the time. No one had objected before, but that would turn out otherwise in this case. The other complication was an amendment concerning the Ottoman ruler. Said made it clear to Lesseps that the work could only begin if the sultan agreed. He wrote in a letter to Lesseps: "As to the works relating to the boring of the Isthmus, the Company can execute them itself as soon as the authorisation of the Sublime Porte, has been be accorded to me." (Karabell 2003, p.114) The Sublime Porte was the official government centre of the Ottoman empire in Constantinople.

As of January 1859 the Suez Canal Company existed. Its primary offices were in Paris and in Alexandria. The company had the money to start the work, but there was still no approval from the Porte. Lesseps decided to start digging in April 1859. The excavation took nearly 11 years, in the beginning mostly through the forced labour of the corveé of Egyptian workers. Between 1859 and 1862 the first part of the canal was completed as an exercise in logistics – moving men to distinct points along the isthmus to move earth. By 1863, the labourers of the corveé system had only managed to complete a fraction of the work and when Said died

suddenly his successor halted the supply of the fellahin (the Egyptian peasants forced to do corveé work). Ismael, the successor of Said, stopped the supply of fellahin more or less under pressure of England and the abolition movement. Certainly in England the corveé was seen as slavery, but the British recognised the canal as an important trade route and perceived the French project as a direct danger to their geopolitical and financial interests. Thus the British government officially condemned the forced labour, though the British consul-general in Cairo took a more moderate and impolitic viewpoint, advising for an altered system to combat its abuses (Kinross 1968, p.173-174). Angered by the British opportunism, Lesseps sent a letter to the British government remarking on the British lack of remorse only a few years earlier when 80,000 forced workers died in similar conditions while building the British railroad in Egypt.

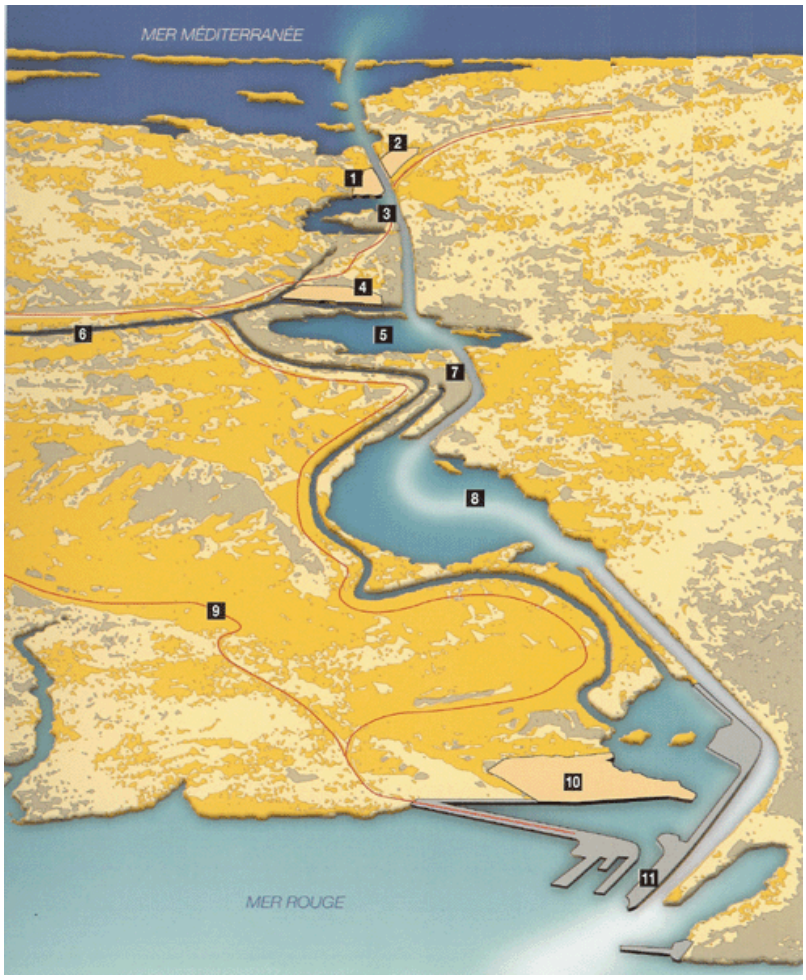
However, the stopping of the corveé system proved to be a blessing. “Had the company continued to rely on manual labour, the project might have been stretched out for many more years and had taxed the patience of its shareholders, even if the technical issues had been resolved with a few tons of dynamite and thousands of bodies toiling away” (Karabell 2003, p.156). Instead, the prospect of a labour shortage forced a rethinking, and in 1864 Lesseps and his engineers turned to machines to do the digging. Manual labour began the endeavour, and steam-powered engines finished it.

The row over the corveé started yet more opposition against Lesseps and the company coming from internal Egyptian patriotic side. But Lesseps had come too far to allow a pair of late arrivals to endanger his life’s passion. Rather than debate the morality of the corveé he tried to alter the terms of the dispute. The Egyptian opposition and the Porte contended that the issue was forced labour and the alienation of sovereign land as granted by Said. Lesseps countered that the problem was the British and hypocritical opportunism from Ottoman ministers and their allies in Egypt and Europe (Karabell 2003, p.193). After Lesseps again appealed to Napoleon III, an international commission was formed in March of 1864 to resolve the problems. The final ruling on 6 July 1864 was an absolute victory for Lesseps and the company: Napoleon accepted the company’s argument that the concession of 1856 had the status of a binding contract, and he agreed with the company’s contention that Said’s promise to supply workers also constituted a contractual commitment.

As the viceroy had the authority to alter the terms of the concession granted by his predecessor, the company had the right to an indemnity. This indemnity amounted to thirty-eight million francs; but on the other hand Said's successor, Ismael, was awarded the

ownership of the Sweet Water Canal and the adjoining lands, and kept his 15% share in the profits of the company (Karabell 2003, p.203-204).

Figure 6.2. The Suez Canal and adjoining facilities



1 Port Saïd

2 Port Fouad

3 Kantara

4 Ismaïllia

5 Lac Timsah

6 Canal d'eau douce

7 Seuil d'El Gisr

8 Lacs Amers

9 Lignes de chemin de fer

10 Suez

11 Port Taufiq

Source: http://www.associationlesseps.org. Taken from Benoît Heimermann. Suez et Panama, la fabuleuse épopée de Ferdinand de Lessep (Arthaud, 1996).

Now that the problems were solved the canal was completed in just three more years. On 17 November 1869 the barrage of the Suez plains reservoir was breached and waters of the Mediterranean flowed into the Red Sea. Numerous technical, political and financial problems had been overcome, and consequently the final costs were more than double the original estimate. In the first years of its existence the canal was not a success. But, combined with the American Transcontinental Railroad completed six months earlier, the canal allowed the entire world to be circled in record time. Therefore, in the 1880s the canal began to play an important role in the "union of East and West", allowing an ongoing European penetration into Asia and Africa. The canal even had an significant effect on the economic growth of

Australia and New Zealand by developing the frozen meat trade (Farnie 1969, p.354-358 and 377-391).

Perhaps, however, the opening of the canal in 1869 was not the most important event for de Lesseps himself. As 'le Figaro' wrote: "M. de Lesseps, after having married the Mediterranean and the Red Sea, then got married himself." Ferdinand Marie Vicomte de Lesseps, at the age of 64, married Hélène Autard de Bragard, the 23 year old daughter of a well to do family from the island of Mauritius. They would be together for the remaining 25 years of his life and she gave him 12 children (Karabell 2003, p.259).

6.4.2 The canal is finished

The first years of the canal were difficult. In 1870 slightly fewer than 500 ships made the passage, carrying a total of approximately 400,000 tonnes. This was much too few compared with the five million tons the company had promised. The next year was only slightly better, but this was so far below projections that the company faced insolvency. As a consequence the value of the shares of the Suez Canal Company shrivelled to two hundred francs a share and dividends failed to materialise. Together with this difficult episode for the company, Ismael went even deeper into debt. In 1873 alone he borrowed more than thirty million pounds to balance his budget, which was double the cost of building the entire Suez Canal. But he only received barely twenty million, with the rest due to interest.

In 1875, European bankers decided that Egypt was on the brink of insolvency. Ismael was in danger of defaulting and he had one attractive asset: his shares in the Suez Canal Company. He was forced to sell his shares in the canal to the United Kingdom.

The shares cost four million pounds. Disraeli, the British prime minister, needed a quick infusion of cash, and so he approached Lionel Rothschild for a loan. Disraeli was able to negotiate better terms on behalf of the British government than as Lesseps had years before tried. Disraeli contracted a loan with Rothschild for four million pounds at 5% interest and a 2.5% commission. Four million pounds was slightly more than the French consortium had offered for the khedive's 177,000 shares. The transaction went smoothly and at the end of November 1875 the British government owned 44% of the Suez Canal Company and became the largest single shareholder.

Disraeli's action had almost as much effect on subsequent world history as the building of the canal itself. The four million pound infusion temporarily allowed Ismail to satisfy his

creditors, but within a year he was faced with the same problems. He now was forced to accept a joint Anglo-French commission to oversee the management of Egypt's finances. The arrangement, known as the Dual Control, consolidated Egypt's outstanding debts and provided an excuse for a consortium of international bankers to take charge of the treasury. One of the things the Dual Control mandated was the sale of the khedive's right to 15% of the canal's profits. Bought by a French bank, the price was twenty-two million francs, which was less than one million pounds. In later years, that 15% would be worth more than a hundred million francs each year. With that sale, the Egyptian government ceased to have a financial stake in the canal that it had financed.

In the summer of 1882, after an anti-European riot, a British fleet bombarded Alexandria, landed an army and routed Egyptian forces at Tel al-Kabir. As part of their offensive, the British seized the canal and in fact essentially occupied the entire country. A British consul held ultimate authority while the khedive ruled in name; a prime minister and an assembly were also formed. By the beginning of the twentieth century, as the volume of trade increased, the British government began to treat the canal as the most vital and most vulnerable point in its empire as the link between England and its overseas colonies (Karabell 2003, p.262-266).

6.4.3 Panama

For Ferdinand de Lesseps the end came also with much misery. Ferdinand and his son Charles founded a new company in 1880 to dig a canal across Panama. Lesseps figured that what had worked for Suez would also work for Central America, and the new company mimicked the old. However, constructing a canal in Panama was a much more complicated and dangerous enterprise. Due to the very bad working conditions, thousands of workers died and the canal also needed locks. These locks presented technical difficulties that caused the cost to increase beyond every estimate. By 1889 the company was in shambles, went bankrupt and was liquidated. "Though the individual losses to the half-million shareholders were manageable, the scandal and the disgrace were not. In 1892, Lesseps, his son and several others, including Gustave Eiffel, were investigated by the Assembly and then they were charged with fraud and conspiracy. Charles de Lesseps, Eiffel, and other company directors were arrested and placed in solitary confinement. Ferdinand was kept from jail, because of his age of eighty-seven, he was too ill to be moved from his bed at his country estate." Both father and son de Lesseps were sentenced to five years in prison, though the court did not enforce the sentence against

Ferdinand. The man who had been a countervailing power to Palmerston and had manipulated the Porte never left his bedroom again. He remained in his bed, only vaguely aware of the utter humiliation, and died on 7 December 1894 (Karabell 2003, p.267-268).

6.5 Control, ownership and operations

In the early 1880s when traffic through the Canal was finally becoming considerable, the leading European governments realised that the bilateral contracts between the Khedive and the Suez Canal Company in the concession contracts did not provide sufficient guarantees for free passage. Therefore, the international Convention of Constantinople, signed on 29 October 1888 by several states, declared the canal a neutral zone under the protection of the British. Under the terms of this international convention the canal was opened to the vessels of all nations without discrimination, in peace and in war (Kinross 1968, p.277-281).
However, Britain considered the canal vital to the maintenance of its maritime power and colonial interests. By the provisions of the Anglo-Egyptian Treaty of 1936, Britain acquired the right to maintain defence forces in the Suez Canal Zone, thus assuming command of the canal approaches. For most of the time after the creation of the state of Israel in Palestine in 1948, the Egyptian government prohibited the transit of vessels to and from Israel.
Egyptian nationalists demanded repeatedly that Britain evacuate the Suez Canal Zone, and in 1954 the two countries signed a seven-year agreement that superseded the 1936 treaty and provided for the gradual withdrawal of all British troops from the zone. By June 1956 all British troops had departed, and Egypt took over the British installations (Kinross 1968, p.282).

6.5.1 Status of the canal

The status of the Suez Canal was defined in several Acts of Concession signed by the Egyptian Government and the privately owned Compagnie Universelle du Canal Maritime de Suez and by the Constantinople Convention (Avram, 1958, p.21). It is beyond the scope of this study to deal with the legal history of the Suez Canal statutes, but it can be said that the Convention of Constantinople was the leading regulation concerning shipments through the

canal up to the Suez crises in 1956. Even the emerging state of Israel in 1949 still referred to the Convention of Constantinople in a request to the Security Council (Avram 1958, p.119).
In the study of Avram (1958) a comparison is made regarding the conventions that regulate three different waterways. These are the Kiel Canal in northern Germany, the Panama Canal and the Suez Canal. This comparison shows that fundamental differences exist, that are revealing for the specific position of the Suez Canal (Avram 1958, p.55).
The Suez Canal was the property of a Company, a for-profit organisation, while the Panama and Kiel Canals belonged to governments. The Convention of Constantinople defines the free rights of other powers regarding the Suez Canal, so that the Suez Canal had remained open to belligerent ships, even when they belonged to an enemy of the territorial state (Avram 1958, p.56). The case of the Kiel Canal was similar to that of the Suez Canal, except that Germany had the right to close the canal to ships of any nation she was in war with.
In the case of the Panama Canal the United States applied the Monroe Doctrine. This doctrine rests on the principle that every nation has a right to protect its own safety, and that if it feels that the possession by a foreign power, for military or naval purposes, of any given harbor or place is prejudicial to national security, there is a right to interfere (Avram 1958, p.55). Under the Suez Canal convention, free passage of all ships, including warships was granted to all states. The canal was free to all states and limited only by the obligation to respect the stipulations of the Convention. In the case of the Panama Canal, passage was a courtesy, whereas in the case of the Suez Canal passage was an irrevocable right granted by multilateral international agreement (Avram 1958, p.56).

6.5.2 Operations by the Suez Canal Company

The greatest difficulty of Lesseps after the death of Negrelli, the Director General of the works since 1857 and the first inventor of the idea of a direct canal through the isthmus, was the shortage of capital caused by the underestimation of costs inevitable with such pioneer work and by the comparative failure of the initial flotation. “His greatest gift was the ability to inspire his shareholders and his employees with confidence in himself and in his dream. As a true merchant of hope he minimised obstacles, magnified achievements and always showed optimism. The Company was nevertheless compelled to rely on financial help of the Government of Egypt, to raise revenue in all possible ways, to develop its financial techniques and operations and so to give financial considerations priority over all others. Thus

from its foundation the Suez Canal Company became a financial company rather than a construction company and dependent on Egypt for capital as well as for labour and water" (Farnie 1969, p.54).

The "Compagnie Universelle du Canal Maritime de Suez" was a legal Egyptian joint stock company, operating upon the basis of firmans [7]issued by the Egyptian khedive (the former viceroy of Egypt) and the Ottoman Sultan. In 1859, and for many years to come, Egypt had no legislation applicable to joint stock companies. The statutes of the company therefore stated that it should follow principles applicable to similar companies in France. According to Hansen and Tourk that meant in practice that Egypt served as a convenience flag for the company, that during its whole lifetime there was no external control for the company's internal affairs, and that in its bookkeeping it could follow such methods as it saw fit (Hansen and Tourk 1978, p.957).

6.6 Transfer: Crises over Suez and the Company

6.6.1 Egyptianisation

During the company's last sixteen years of activities, from 1940 to 1956, popular unrest and nationalist protest were so strong that the main issue for the firm was its very survival in Egypt. The 1936 treaty provided for the concentration of British troops along the Suez Canal. This associated the Suez Company, in the eyes of the Egyptians, with the occupying forces, and after World War II violent student demonstrations denounced the treaty. The Egyptian political community rejected the treaty in 1951, driving the country into guerilla war and sabotage against the British army, and in 1952 the Free Officers took power, only worsening the situation. Gabel Abdel Nasser started negotiations with the British which resulted in the 1954 treaty providing for the withdrawal of British troops. The management of the Suez Canal Company hardly reacted on this new situation (Piquet 2004, p.117). The traditional line of conduct of the company was to favour shareholders and ship owners, and in doing so securing the support of the British government (Piquet 2004, p.118).

[7] A firman is a Royal mandate or decree issued by a sovereign in certain historical Islamic states, including the Ottoman Empire, The word firman comes from the Persian *farmân* (فرمان) meaning "decree" or "order". In Turkish it is called a ferman. (www.wikepedia.org)

Relations between the British government and the Suez Canal Company had always been ambiguous and discreet. In 1883 the British negotiated the entry of its administrators into the company along with the opening of a London office. Although the British government limited its influence in the company to the interest of ship owners, the British did not want to give too much power in Egyptian policy to a French company. With an independent Egypt after the 1936 Anglo-Egyptian Treaty, the company took a long time to modify its old ways. By the end of the 1940s, however, the company understood that it was essential for Egypt to share in the economic benefits of the Suez Canal if the company wanted to continue to operate in that country. Post-war reforms mainly concerned the internal organisation of the company, though, and were inspired by big American firms, a model that was asserting itself in Europe at the time. Instead of favouring greater integration of the company with the country, the Paris Board of Directors exerted greater direct control over local operations. “Despite warnings, … the company never managed to enter the political and economic networks of Cairo and Alexandria. It grew isolated and remained more than ever a French preserve, keeping apart from the national economy” (Piquet, 2004, p.120). An Egyptianisation of the operational part of the company was never set in motion. Negotiations on this subject in the 1930s showed that the concessions on which the legal Egyptian status of the company rested was perceived as a temporary system with a clear colonisation link. Therefore, a law was introduced in Egypt to compel concessionary companies to participate in the national economy. The 1947 Act on Limited Liability Companies promoted Egyptianisation of foreign companies, and to circumvent this legislation, the Suez Canal Company pleaded its international role and status. This was exactly the ground - protecting the international canal - on which the British stayed officially present in the canal zone until the 1954 treaty.

Egyptianisation would have given the possibility to transfer technology, training and eduction to Egypt, in line with the great philanthropic cause of 'progress' the Saint-Simonians so devoutly wished in promoting the canal in the early nineteenth century.

However the Suez Canal Company did not make many efforts as far as education and training were concerned. From the very beginning the company employed only European engineers. Until the 1936 treaty, the Egyptian staff was almost exclusively composed of unskilled workers. The highest post given to an Egyptian was that of principal agent in charge of transit, but it was late in coming, given in June 1956 (Piquet, 2004, p.119-123).

6.6.2 The Suez Crisis and the aftermath

On 26 July 1956, shortly after the United States and the United Kingdom withdrew their offers to help finance the construction of the Aswān High Dam, the Egyptian government seized the Suez Canal in accordance with a decree of nationalisation issued by President Gamal Abdel Nasser. Nasser announced that Egypt planned to use the proceeds from the operation of the canal to finance the dam. On 29 October 1956 Israel invaded Egypt. Two days later British and French military units attacked Egypt for the announced purpose of ensuring free passage through the canal. In retaliation, Egypt sank 40 ships in the canal, effectively blocking it.

Through the intervention of the United Nations (UN), a truce was arranged in November and by the end of the year Israeli, French, and British forces withdrew from the area. Following removal of the sunken vessels by a UN salvage team, the Egyptian government reopened the canal in April 1957. A United Nations force was established to maintain the neutrality of the canal and the Sinai Peninsula. Nevertheless, various conflicts caused the closure of the canal for intermittent periods. Unfortunately, between the Suez Crisis and later wars, the canal was damaged extensively and was not operated for several year after 1967. On 5 June 1975 the canal was again opened, and since then has been updated and enlarged (Karabell 2003, p.268-271). The canal has remained up to the present an important asset of the Egyptian national economy: based on Annual Reports of the Egyptian Suez Canal Authority, Piquet (2004, p.125) concludes that the Suez Canal remains Egypt's second largest source of foreign currency after tourism.

In 1958 Egypt and its nationalised canal company reached an agreement on terms of a financial settlement for the canal nationalisation, and by 1962 final payments had been made to the original shareholders (encarta.msn.com). The Suez Canal Company received a significant compensation of 34 billion francs and transformed itself into a financial company named "Suez." The old shareholders received 27% of this compensation and got back all the money they had invested. Now Suez is a leading French-based multinational corporation, with operations primarily in water, electricity and natural gas supply, and waste management,[8] the

[8] Suez is one of the oldest continuously existing multinational corporations in the world, with one line of corporate history dating back to the 1822 founding of the *Algemeene Nederlandsche Maatschappij ter begunstiging van de volksvlijt* (literally: General Dutch Company for the favouring of industry and its successor: Société Générale de Belgique) by King Willem I of the Netherlands. Its current form is the result of nearly two centuries of reorganisation and corporate mergers. Recently, Suez merged with Gaz de France. (www.wikepedia.org)

result of a 1997 merger between the *Compagnie de Suez* and *Lyonnaise des Eaux*, a leading French water company (www.wikipedia.org).

According to Caroline Piquet (2004, p. 125), her study supports the general view of the influence of the concession system on development of the underdeveloped countries. The concession experience did not lead to a transfer of technologies to Egypt, although these technologies in itself were beneficial for these countries. Investments were made in physical, but not in human capital. The concession system did not serve the national economy of Egypt, but on the contrary favoured European capital, and doing so widening the gap between the economic structures of rich and poor countries.
Perhaps this is not all that can be said about the history of the Suez Canal Company. The vision of Piquet and others does not value the possible influence of a very decisive moment.
That was when the Khedive Ismael was forced to sell his shares to the British government because he had ruined the Egyptian state finances. How different could it have been if the Egyptian government had stayed the largest shareholder in the company?

6.7 Application of the analytical scheme

6.7.1 Concessions as property rights

Here again, as throughout this thesis, the distinction is made between institutional environments and institutional arrangements. The institutional environment is the set of fundamental, political, social and legal ground rules that establishes the basis for production, exchange and distribution: the rules of the game. An institutional arrangement is an arrangement between economic units that governs the way in which these units can cooperate and/or compete (Williamson 1993, p.13). TCE relates to this two-level approach by treating the institutional environment as a set of shift parameters. Changes of these parameters shift the comparative costs of governance.
It is clear from the history of the Suez Canal that these institutional changes occurred and those were mainly located at the level of the institutional environment. The Suez Canal Company turned out to be a stable governance structure. The approach chosen here is that the concessions, together with the Convention of Constantinople formed the institutional

environment. The concessions are seen as the definitions of property rights regarding the canal building.

As is mentioned in chapter 3, property rights are broadly defined as the set of laws and customs, or formal and informal rules, that determine how individuals may gain access to resources and the range of possible uses they may make of them. They include rights and obligations with respect to the use, maintenance and improvement of resources, the rules of exchange or contract, and rules of liability when a particular use of a resource by one individual comes into conflict with the rights of other individuals (Salem 2004, p.5). The characteristic of a property right is that it includes rights and obligations regarding resource use. These aspects of property rights made the concessions for the Suez Canal primarily act as property rights. The concessions constituted the institutional environment in which the Suez Canal Company could operate.

The Suez Canal Company is regarded to be the institutional arrangement. These arrangements are subject to TCE, whereas changes in the property rights and thus changes in the concessions act as shift parameters for economising on transaction costs.

6.7.2 Property rights and the Suez Canal

Table 6.1 presents an overview of the property rights that were relevant for the construction of the Suez Canal. The exact descriptions of the column entries have been given in chapter 3. They are the important characteristics of property rights. The relevance of these characteristics is that they influence the value and the effectiveness of the of the property rights as an institutional environment. This influence is indicated by the in section 4.7 described rating system.

For instance the first concession was formed for a large part by the abusus element. This gave the Suez Canal Company a solid legal base as the constructor and owner of the Suez Canal. The rights were exclusively assigned to Ferdinand de Lesseps. The only problem with the property rights was first the uncertainty about the exact route of the canal and the uncertainty of the right of the khedive to give land rights to the Suez Canal Company. The pressure from the abolition movement to abandon the corvée system turned out to be also a problem. With the help of Napoleon III the more international problem of the land rights was solved in a kind of package deal with the abolition of the corvée system. This latter turned out to be a blessing in disguise. The company received an indemnity for this and without the corvée,

manpower for the actual digging was substituted by steam powered dredge engines, that turned out to be much more efficient. So the transferability of the right to the corvée had a positive effect. This is in accordance with the theory that states that transferability of a property rights contributes to the value and effectiveness of the property right.

The cells of the last four columns of table 6.1 describe the different characteristics of the property rights for building the Suez Canal. It can be noticed from the application of the rating system for these characteristics that non of the elements had a negative effect on the effectiveness of the property rights. Most of the elements had a positive effect. The conclusion, therefore, of the overview of the property rights is that in a general sense the property rights acted as an efficient institutional environment in which the Suez Canal Company could operate for a long time.

Table 6.1 Property rights of the Suez Canal

What Property Right (PR)?	Elements of property rights: usus, usus fructus, abusus	How clearly is the right defined	Is the right transferable	Exclusivity against third parties	Possibility of expropriation of the residual return
1.a The first concession, 1854, for a term of 99 years. The right to form a company to finance and construct the canal. The company is responsible for all cost of the project.	The concession specifies abuses rights for a period of 99 years.	Concession is vague about the precise canal route. (-+)	No. (-+)	High (+)	NA*)
1.b Company receives portions of the public property, now uncultivated that will be irrigates and cultivated by the company. For a period of ten years after the opening of the canal. Remaining 89 years the company pays a tithe to the Egyptian government.	Abuses for the first 10 years. Usus fructus for the remaining 89 years.	Clear (+)	Parts of the concession terms turned out to be transferable. (++)	High (+)	NA
1.c Division of the company's annual net profit: Egytian government: 15% Founders of the company 10% Shareholders 15%.	Abusus	Concession specifies clearly the right to the net profits of the company. (+)	Parts of the concession terms turned out to be transferable. (++)	High (+)	The concession specifies the rights to the net profits of the firm. Consequently the possibility to expropriate the residual returns is small. (+)
2.a The second Concession, 1856. Reaffirmed the creation of a company to build the canal. Ports will be build at Timsah and Pelusium. The fresh water canal will be dug.	Abuses: building the canal and cultivation of land.	Canal route now is specified. The question whether the kedhive is lawfully able to grand land right is not solved. (-+)	Parts of the concession terms turned out to be transferable. (++)	High (+)	Rights to the net profits of the company stayed the same. (-+)

*) NA: Not applicable

Table 6.1 Property rights of the Suez Canal.(Continuation)

What Property Right (PR)?	Elements of property rights: usus, usus fructus, abusus	How clearly is the right defined	Is the right transferable	Exclusivity against third parties	Possibility of expropriation of the residual return
2.b For the company: No import or export duties related to the construction. Ten years of tax free use of land it brought under irrigation.	Usus fructus: partly tax freedom.	Clear (+)	NA	High (+)	NA
2.c The right to the corvée.	Usus	Clear (+)	Yes (+)	High (+)	NA
3.a The ruling of Napoleon III 1864. The concession of 1856 has the status of a binding contract. The viceroy has the right to alter the contract, In return the Suez canal company has the right to an indemnity. The company gives up the right to the corvée.	Abusus and usus (corvée) from the company to the viceroy.	Now problems with the concession are solved. (++)	This ruling concerns a transfer of rights of the company to Egypt. (++)	Exclusivity of the land rights is further specified. (++)	Rights on the residual return are not altered. (-+)
3.b The viceroy gets the ownership of the sweet water canal.	Abusus	Through the ownership of the viceroy this property right ceases to be part of the institutional environment for the building and exploitation of the Suez Canal.			
4. Status of the company: Egyptian but according the French company law.	Abusus	Clear (++)	Probably (-+)	High (++)	NA
5. Convention of Constantinople.	Usus rights	Clear (++)	NA	High (++)	NA

6.7.3 Governance structure for the Suez Canal

In table 6.2 TCE is applied to the institutional arrangements for the Suez Canal. The analytical scheme described in chapter 4 is applied. The first step of the analytical scheme is to describe the stages of the project.

The next step in the analytical scheme is to describe the parties and the transactions involved in each stage of the project and to describe the levels of the characteristics that TCE finds decisive for governance structures in which the transaction have to be concluded to economise on transaction costs. The last step is to describe the governance structures. Also here the rating system is applied with a scale equal to the rating system in table 6.1. Now the ratings indicate whether a governance structure is efficient according to TCE in the sense that the governance structure is aligned with the characteristics of the transaction.

The analysis points out that the recurrence is low except in the own, operate and maintain stage. In this stage the level of uncertainty is not that high compared to the other stages. The activities in this stage mainly concern exploitation: levying of toll, and maintenance. After building of the canal, ownership of the canal stayed with the Suez Canal Company, which also operated and maintained the canal. One can say that certainly in the beginning of the operations uncertainty about toll collections were reasonably high. With regard to maintenance asset specificity is high. For the Suez Canal Company expenses on maintenance only keep their value when it keeps the right to collect tolls. Uncertainty is high in the planning, designing and financing stage. In the planning and designing stage this mainly concerns technical uncertainty. In the financing stage the history of the canal project shows that uncertainty was high. Asset specificity is high in the planning and designing stages. This asset specificity has to do with the body of knowledge that is developed by the organisations that carry out the planning and the design, which gives room for opportunistic behaviour from the side of these organisations. TCE prescribes that in these cases, with high uncertainty and high asset specificity, the more integrated hierarchical governance structure is more efficient than other governance structure. However the governance structures were hybrids in which different parties worked together. But these hybrids can be classified as exploratory control hybrids which are more able to incorporate higher levels of uncertainty.

Asset specificity is relatively low in the building stage, apart from the specifically developed steam powered dredge machines that were operated in the later stage of the construction. The investment in these machines took place within the governance structure of the Suez Canal Company as a reaction on the abandoning of the corvée system. One can say that the fact that the Suez Canal Company was able to react smoothly on the abandoning of the corvée system shows the effectiveness of the hierarchical governance structure.

Table 6.2 Stages in the development and realisation of the Suez Canal, parties involved, transaction and governance structures.

Stage	Year	Parties involved	Transactions and characteristics	Governance structure	Rating
Planning	1799	The French Directorate and Napoleon Bonaparte.	Delivery of the plan. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Hierarchy: The military organisation of Napoleon and the order from the Directorate.	+
	1830s	The Saint Simonians, Enfantin and Lesseps.	Delivery of the plan. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Exploratory control hybrid. Private organisations together with private persons	+
Designing	1854	Ferdinand de Lesseps together with Said Pasha. The first concession from Said Pasha to Ferdinand de Lesseps.	These concessions laid down the fundamentals for the Suez Canal Company. The second concession specified the direct route of the canal between the Mediterranean and the Red Sea. Technical design of the canal: the specifications and drawings.	Exploratory control hybrid	+
	1856	The second concession from Said Pasha to Lesseps.	Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	.	
	1856	The final plan for a direct canal is from Nigrelli. He worked for the Suez Canal Company and also for the Société d'études du Canal de Suez.	Technical design of the canal: the specifications and drawings. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Exploratory control hybrid	+
Financing	1858	The Suez Canal Company.	By its share capital and issuing bond loans. Contributions in kind and in money of the Egyptian government are substantial. Recurrence: low Uncertainty: high Asset specificity: low	Compliance control hybrid	+

Table 6.2 Stages in the development and realisation of the Suez Canal, parties involved, transaction and governance structures. (Continuation)

Stage	Year	Parties involved	Transactions and characteristics	Governance structure	Rating
Building	1859 – 1869	The Suez Canal Company.	Construction of the canal. Recurrence: middle Uncertainty: high Asset specificity: high.	Hierarchy: the Suez Canal Company directly controlled the construction of the canal.	+
Own, operate and maintain	1869 – 1956	Suez Canal Company. Together with the Convention of Constantinople.	Operational activities, toll collection and maintenance. Recurrence: high Uncertainty: low to middle (toll collection) Asset specificity of maintenance: high.	Hierarchy. The Convention of Constantinople formed the institutional environment.	+
Transfer	1875	Britain becomes the largest single shareholder.	Ismael, viceroy of Egypt, sells his shares to the British government, followed by the British political involvement in Egypt.	NA	-
	1956	Nationalisation of the canal by Egypt.	NA	NA	

In general the governance structures are in line with what is prescribed by TCE, as can be seen from the rating system. The market as a governance structure is here not present. The planning and designing stage are characterised by hybrid organisations. The TCE rationale for this is the high asset specificity in the form of human capital. In the designing stage the governance structure is classified as an exploratory design hybrid. This structure is characterised by a general trust agreement that expresses the expectation of a long-term relation. This is what the relation between Ferdinand de Lesseps and Said Pasha was. Certainly in the period from the first concession in 1854 to the foundation of the Suez Canal Company in 1858 a hybrid governance structure existed. This governance structure was partly formed by the concessions given to Ferdinand de Lesseps and partly by the personal relationship between Ferdinand de Lesseps and Said Pasha. Consequently, this interpretation of the governance structure in the design stage implies that the concessions, which formed the property rights, formed also for a large part the governance structure in the designing stage.

From the perspective of NIE and especially from the perspective of TCE it is important to see that one integrated, hierarchical organisation, financed, built, and operated the canal and that this hierarchical organisation was successful. This would imply that the organisation was able to minimise transaction cost in a very uncertain environment. Although one must say that it is questionable whether the Suez Canal Company could have organised the financing of the construction totally on her own. The financial support of Said Pasha, after the partly failed issuing of the share capital, was decisive for the start of the canal construction. Therefore the financing stage is characterised by a compliance control hybrid. Compliance control because here results and actions were reasonably specified in the concession contract and administrative controls were in the form of predefined, contractually anchored standards. In the second concession it was specified that Said Pasha would guarantee the financing of the canal in case the issuing of stocks would not result in sufficient capital.

The uncertain environment was formed by political, financial, organisational and technical risks. For a part these risks were countered by the concessions that formed the basis for the Suez Canal Company. This leads to the conclusion that from a NIE perspective the concessions and the company can be regarded as the institutional structure in which the company formed part of the efficient governance structure. Other parts of the governance structure rested directly on the effectiveness of the property rights.

According to Bonin (2004, p.21) the Company had done well by its responsibilities and had assured the proper functioning of the canal and other related services like repair of ships,

navigation, human resource management, etc. It had successfully kept abreast of the growth, both in quantity and quality, of the traffic passing through the canal. Its continuing programme of investments widened and deepened the canal which allowed it to accommodate a greater number of larger and faster ships. Its engineers and financial directors had hit upon an optimal formula to determine with relative precision the investments required and thus avoid the pitfalls of under or over investing.

6.8 Conclusions: answering the research questions

In chapter 1 a number of more specific research questions were defined, based on the central research question whether it is possible to determine from new institutional economics the characteristics of an efficient governance structure for investments in large infrastructures and for the exploitation of these large infrastructures. By way of conclusion in this chapter the specific research questions will be answered for the case of the Suez Canal.

The first specific question is: What are the main characteristics of the history of the Suez Canal?
This main characteristic was that Ferdinand de Lesseps was the right man at the right time. He managed to receive the concessions from Said Pasha and he managed to provide the Suez Canal Company with the financial means to build the canal. Of course he could act on a lot of preparatory work that was done by other Frenchmen. Decisive here was the moment when it became clear that there was no difference in the sea levels of the Mediterranean and the Red Sea, as it was then that it became clear there were no major technical obstacles in digging the canal. From that moment it was a matter of financing and political decision making. As is indicated above a group of engineers known as the Saint-Simonians and the more scientific organisation of the 'Société d'études du Canal de Suez' played an important role in planning and designing the actual canal. However, it was Lesseps who established the Suez Canal Company on the basis of concessions he personally received. The Suez Canal Company has been from 1858 up to its nationalisation by the Egyptian government in 1956, the sole governance structure for building and operating the canal. The concessions and the

Convention of Constantinople were the property rights that formed the institutional environment in which the Suez Canal Company as governance structure could exist.

The second question is: What are the characteristics of the NIE that can be applied to the study of governance of investments in the building of the Suez Canal?
Also here, as was with the history of the canals of Willem I it turns out that property-right theory is an important element of the application of NIE to the history of the canal project. It is not enough to concentrate only on the governance structures and their possible more-or-less transaction cost minimising settings. This is because property rights act as shift parameters in this transaction cost economising. Thus, property rights as the institutional environment cannot be taken as given, but need to be studied.
But TCE is also applicable in the sense that it shows that in planning, designing and financing stages the parties involved formed more or less hybrid organisations. In the building and operating stage the Suez Canal Company is, according to TCE, identified as a hierarchical governance structure. The activities in this stage mainly concerned, levying of toll, and maintenance.

The third question is: What are the governance structures that were relevant to the investments for the Suez Canal?
As described above, a group of engineers known as the Saint-Simonians and the more scientific organisation of the ‘Société d'études du Canal de Suez’ played an important role in planning and designing the actual canal. But it was Ferdinand de Lesseps who established the Suez Canal Company on the basis of concessions he personally received. Up to its nationalisation by the Egyptian government, the Suez Canal Company has been the sole governance structure for building and operating the canal. The concessions and the Convention of Constantinople were the property rights that formed the institutional environment in which the Suez Canal Company could exist.
The main governance structure, however, was the Suez Canal Company. The Suez Canal Company was active in the designing, financing, building and operating stage of the Suez Canal project. In the planning stage, the dominant governance structures were private organisations together with private persons of the Saint Simonians and the ‘Société d'études du Canal de Suez’. These organisations formed a hybrid governance structure. But also in the designing and financing stage, the Suez Canal Company and the Egyptian government formed

more or less hybrid organisations. After building of the canal, ownership stayed with the Suez Canal Company, which also operated and maintained the canal. One can say that certainly in the beginning of the operations uncertainty about toll collections were reasonably high. With regard to maintenance asset specificity can be regarded to be high. For the Suez Canal Company expenses on maintenance only keep their value when it keeps the right to collect tolls. This asset specificity of the maintenance is the main ratio of the hierarchy of the Suez Canal Company.

The next question is how well the governance structures were able to cope with unexpected technical, economic and political events?
In building the canal there were three main problems to solve. These were the alleged unlawful issuing of land rights by Said Pasha to the Suez Canal Company, the foreign pressure to abolish the corvée system and the decision on the actual canal stretch. This last problem was solved easily in the second concession, but the other two took a ruling of emperor Napoleon III. However, the original concessions were such that this ruling could be based on the provisions in these concessions. After this ruling the concessions formed an adapted set of property rights that turned out to be stable until the nationalisation of the canal. The hierarchy of the Suez Canal Company made it possible to react fast on the abolition of the corvée system and to incorporate a new technical solution that turned out to be superior.

Now the question is: Can NIE help to explain the success or failure of the canal building and the subsequent exploitation of the Suez Canal?
The application of the analytical scheme shows that the property rights acted as an efficient institutional environment in which the Suez Canal Company could operate for a long time. Also for the governance structures the analytical scheme shows that these structures can be expected to be transaction cost minimising structures. They were in line with the characteristics of the transactions in the different stages of constructing the canal, except perhaps for the planning stage. This implies that the success of the building of the canal and the subsequent success of the exploitation of the canal does not falsify transaction cost reasoning. In this respect NIE can offer insights than can be used in a more general sense as will be shown in the last chapter of this thesis.

Therefore the last question is: Can we learn from the history of the construction of the Suez Canal in the light of the insights from NIE?

One of the concluding remarks from the preceding chapter was about the decisive role of King Willem I for the canal building during the first half of the nineteenth century. The constitutional power given to him, made it possible to act as a benevolent ruler and as an entrepreneur. The role of another entrepreneurial person is also a decisive characteristic of realization of the Suez Canal. Without Lesseps there would probably not have been a Suez Canal in 1869. The first concession was given to him personally and he himself organised the financing of the Suez Canal Company. In property rights theory and in TCE entrepreneurial behaviour is not explicitly part of the theory, but one of the lessons that can be learnt from the history of the canals King Willem I in comparison with the history of the Suez Canal is that institutions should support entrepreneurial behaviour. Safe-guards should be present in these institution to make sure that third party interest will not be harmed without compensation by the entrepreneurial behaviour and that all parties involved are incorporated in the decision making process. The concessions and the Suez Canal Company can be seen as such safe-guards. Does this apply to the subjects of the corvee system or the Egyptian society as a whole? The corvee system was a kind of forced labour, well established in Egyptian customs. It can be seen as a tax to be paid in kind. Taxes can be spent at projects that will not be carried out without the taxes and that have societal returns. If these returns to society are big enough, taking into account the negative effects on the national product of the taxes, then the taxes are a sensible thing. In the case of the Suez Canal the problem is that the Egyptian society was withheld much of the returns out of the canal because the viceroy was obliged to sell his shares in the Suez Canal Company in 1875, followed by the Egyptian right to the 15% of profits that was then sold in 1880 to the French bank.

The Suez Canal was and is a success story from an economic point of view. Traffic through the canal has risen year after year, practically from the opening of the canal up to now. However, it is difficult to contribute this success in demand for Suez Canal traffic capacity to the governance structures that were used to design and build the canal. On the other hand the governance structure of the Suez Canal turned out to be a good structure in the cause of events up to the nationalisation of the canal. But the idea on its own of a Suez Canal was just too good of an idea to make the governance structure decisive.

Annex 1 A time line

Circa 1799	Napoleon Bonaparte conquered Egypt and ordered a feasibility analysis. This reported a supposed 10 metre difference in sea levels, and a high estimated cost, so the project was set on standby.
Circa 1840	A second survey demonstrated that the first one was erroneous; a direct link between the Mediterranean Sea and the Red Sea would be possible and would not be as expensive as expected.
Circa 1854	The French consul in Cairo, Ferdinand Marie de Lesseps, created the "Compagnie Universelle du Canal Maritime de Suez."
25 April 1859	The French were officially allowed to begin the canal construction (Said Pacha acquired 44% of the Suez Canal Company, the rest of the shares were controlled by French private holders).
16 November 1869	The Suez Canal opened; operated and owned by Suez Canal Company.
25 November 1875	Britain became a minority share holder in the Suez Company, acquiring 44% of the Suez Canal Company. The rest of the shares were controlled by French syndicates.
25 August 1882	Britain took control of the canal.
2 March 1888	The Convention of Constantinople guaranteed right of passage of all ships through the Suez Canal during war and peace.
14 November 1936	Suez Canal Zone established, under British control.
13 June 1956	Suez Canal Zone restored to Egypt.
26 July 1956	Egypt nationalised the Suez Canal.
5 November 1956	French, British, and Israeli forces occupied the Suez Canal Zone.
22 December 1956	Canal restored to Egypt.
5 June 1967	Canal closed and blockaded by Egypt, against Israel, sparking the Six-Day War.
10 April 1975	Suez Canal reopened.

7 The Rhine-Main-Danube waterway

7.1 Introduction

The Rhine-Main-Danube waterway in South East Germany forms a shipping linkage between the two most important European rivers: the Rhine and the Danube. The waterway makes inland boat travel possible all the way from Rotterdam to the Black Sea. The waterway has three main parts: the first section consists of the canalised Main from mouth in the Rhine to Bamberg in Bavaria. From here begins the second part, a canal to the south that is the actual man-made linkage between the Main and the Danube. The final part of the system is the German stretch of the Danube from the river Altmühl the German-Austrian border crossing.

Figure 7.1 The Rhine-Main-Danube waterway and the Main-Danube canal.

Source: www.rmd.de

The canal is called the Main-Danube canal, sometimes referred to as the Rhine-Main-Danube canal. In this chapter, the complete waterway will be called the Rhine-Main-Danube waterway, and the canal itself will be called the Main-Danube canal.

The Main-Danube canal travels from Bamberg at the Main, over Nürnberg and finally to Kelheim where the canal meets the Danube. Along the way the canal partly follows the beds of the Regnitz river in the north and the Altmühl river, a tributary of the Danube, in the south. One special feature of the canal is its crossing of the European watershed between the river basins of the Rhine and the Danube south of Nürnberg.

Another important feature of the complete waterway, not only of the canal but of also the completed canalisation of the Main and the Danube, is that it took some 70 years to finish construction. The Rhine-Main-Danube waterway project started in 1921 with the canalisation of the Main east of Frankfurt, and was not completed until 1992 when the Main-Danube canal was finally opened for shipping. This long construction history makes it necessary to pay attention in section 2 to the German economic history of the twentieth century as the construction of the waterway was inevitably intertwined with the history of the past century. In sections 3 and 4 a more detailed description will be given of the location and the construction of the waterway. It was constructed by the Rhein-Main-Donau AG (RMD AG), which was owned by the Federal State of Germany and the Free State of Bavaria. The basis for this company, and for cooperation between the Federal Republic and Bavaria, was formed by a series of treaties from 1921 to 1976. These treaties will be addressed in section 5. In section 6 a description will be given of the cost estimates of the construction of the waterway and the canal, though due to the long construction period it is difficult to produce figures about the total costs; official figures are at best informed estimates.

In section 7 the analytical scheme for this thesis will be applied to the case of the Rhine-Main-Danube waterway. In section 8 conclusions for this case are formulated by answering the specific research questions.

7.2 Some German economic history

7.2.1 The 'Kaiserreich'

The foundation of the German nation-state took place relatively late in comparison with other European states. "Das Deutsche Reich" was proclaimed at Versailles in January 1871 after the defeat of the French by the Prussians. This was the first time the term "Germany" matched a single political unit of a modern nation state. According to economic historian Peter Wende (2005), this 'Reich' was the result of a complex development, a mixture of continuity and contingency: unfolding industrialisation, the growth of German nationalism and the construction of the Prussian customs union. One of the contingencies was the fact that a skilful as well as ruthless politician, Otto von Bismarck, was shaping Prussian politics (Wende 2005, p.98).

The acceleration of economic growth and the development of new techniques in production cannot be separated from the rise in population that had taken place in Germany since the middle of the eighteenth century. It provided the economy with an expanding market for new goods as well as with a cheap workforce. The number of inhabitants rose from about 17 million in 1750 to 33 million in 1850, and reached 67 million at the beginning of the First World War. By 1914 two-thirds of the German population lived in towns, and two-third of this urban population lived in big cities of more than 100,000 inhabitants.

With the European trends of the time, industrialisation went together with demographic growth, migration and urbanisation. Also as elsewhere, industrial revolution brought a revolution in transportation systems as an essential part of the expanding economic infrastructure. Between 1834, when the first railway between Nürnberg and Fürth in Bavaria was constructed, and 1873, the German rail network expanded to about 12,000 km. In 1860 the state railways totalled 5,200 kilometres, private railways under government management 1,400 kilometres, and privately administered railways 4,600 kilometres. Only the United States and Great Britain could surpass such figures (Wende 2005, p.102-103).

However Germany also experienced the downsides of this rapid economic growth: it became vulnerable to the ups and downs of what was now becoming a world market. In 1873 the first boom collapsed and was followed by the first Great Depression which lasted until 1896. Over-investment and over-production led to an industrial recession, deflation and unemployment. Yet, though the speed of economic growth had been drastically reduced,

another sustained phase of growth between 1895 and 1913 gave Germany her first economic miracle: at the outbreak of the First World War it had become a major economic world power. In most classical domains of industrial production like iron and steel it had overtaken Great Britain, and it was leading in the world of new sophisticated production fields such as dyes and electrical goods. By the end of the nineteenth century the traditional corporate society dominated by an agrarian economy had been replaced by a predominantly industrial urban society. This rapid change, which affected nearly all Germans, took place at the same time that, with the foundation of the Empire, a new political framework came into existence.

Where most European countries experienced industrialisation and nation-state formation at different stages of their history, in Germany these two situations happened simultaneously, meaning that two extremely different problems had to be dealt with at the same time. Proper management of these problems would, unfortunately, not succeed (Wende 2005, p.107).

In 1914 the Great War broke out. Hopes for quick victory in Germany were soon disappointed in what became a gruesome war of attrition with high losses on all sides. Germany alone counted 1.73 million killed. British control of the sea had a devastating effect on food supply, and starvation was responsible for 750,000 civilian deaths. Ultimate defeat became inevitable when the USA entered the war on the Allied side. In 1917, against the wishes of the Reichstag, Prussian junkers still tried to win the war; however at the urging of the military command, a parliamentary government was finally introduced, and total capitulation was agreed. At the same time, the imperial fleet mutinied in the ports of Kiel and Wilhelmshaven, and socialist revolution broke out in Munich and Berlin. Emperor William II fled to the Netherlands and Germany threatened to sink into chaos. By November 1918 the short history of the 'Kaiserreich' of Prussia's Germany was over. This German Empire had lasted for less than half a century; and the following first German democracy of the Weimar republic collapsed after 14 years. The Weimar republic was not necessarily doomed from the start but it had to not only deal with problems stemming from the past but also with the huge difficulties arising from the future course of events (Wende 1995, p.122).

7.2.2 The Weimar republic[9]

The Weimar republic started with new elections for a parliament which was convened in Weimar, the place of Goethe and Schiller. The resulting constitution was an attempt to

[9] This subsection is based on Wende 2005, p.125-131.

combine the essentials of European parliamentary democracy with the characteristic features of the American presidential system. It defined Germany as a federal republic where the central power and national law took precedence over the member states, known as the 'Länder'. A president was head of state, who was to be elected every seven years. The constitution was very progressive, but as it turned out it was for steady, peaceful times, rather than for the situation of permanent crisis which dominated the era of Weimar Germany. The new republic experienced a catastrophic inflation that came to an extraordinary climax in 1923. The roots of this lay in the earlier choice of financing the war exclusively through borrowing. Instead of increasing taxes, which would have been a sound approach, German national debt rose from a modest 300 million marks on the eve of the war to a massive 51.2 billion by the end. At the same time, currency in circulation had been inflated from 6.6 billion marks in 1913 to 33.1 billion by 1918. When the government began printing more and more paper money in an attempt to meet excessive demands from the economic crises and the payment of war reparations, the value of the currency spiralled out of control. In 1923 hyperinflation was reached: in June an egg cost 800 marks in a typical Berlin market but the mark was still traded at 4.2 against the dollar. In November of the same year the mark traded at 4.2 million against the dollar. It was only after the newly founded 'Rentenbank' (mortgage bank) issued credit-based certificates, with agricultural and industrial debt collateral as a new currency (Rentenmark), that the inflation came to a halt. Unfortunately it was only a short period of partial recovery and stabilisation that set in. By 1927, the industrial sector of the economy entered a period of rapid growth, catching up with pre-war production rates, so that by 1929 Germany again had become the world's second industrial power behind the USA. But unemployment remained relatively high and the financial situation of the Weimar republic was still far from strong. That is why the world-wide depression of 1929 hit Germany particularly hard. It was prone to suffer from this sort of crisis because of the manifold typical German interdependencies of state and economy. In the wake of the great crash production was almost halved and tax receipts fell. With one-third of the workforce without jobs, the state was unable to fulfil its obligations. Accordingly, the last democratic coalition government of the Weimar Republic fell over issues of unemployment insurance.

7.2.3 The Third Reich

In Germany there already existed a close link between state and private capital, more so than in Anglo-Saxon countries, but during the interwar period corporatism was enhanced by an ongoing centralisation. During the Third Reich of Nazi Germany business became especially identified with the state, though private property was maintained. Businessmen directed industry on behalf of the state and reaped profits for themselves. Labour was largely suppressed (Tuma 1971, p.363). The economic management of the state was first given to the former president of the Reichsbank, Hjalmar Schacht, whose policy helped stabilising the Reichsmark, and under his guidance a new economic policy to elevate the nation was drafted. The Reichsbank issued massive loans and credits to industries and the individuals who ran them.

The Germany economy was later transferred to the leadership of Hermann Göring when, on 18 October 1936, the German Reichstag announced the formation of a four year plan to shift the German economy towards a war production base. A huge public works project was started under the leadership of Fritz Todt , rivalling the New Deal in both size and scope. Once the war started, the organisation that Todt founded was used to build bunkers, underground facilities and entrenchments all over Europe. Another part of the new German economy was massive rearmament with the goal to expand the 100,000-strong German army into a force of millions. The four year plan technically expired in 1940, but by this time Hermann Göring had built up a power base in the "Office of the Four Year Plan" which effectively controlled all German economic and production matters during the war (Bendersky 2000, p.126 -132).

7.2.4 After the Second World War

In the last two years of the war discussion arose between the Allies on how to handle the German economy after Germany was defeated, among them the supporters for hard peace negotiations under the direction of US Treasury Secretary Henri Morgenthau. The so called Morgenthau Plan advocated the 'pastoralisation' of Germany and aimed at maintaining a standard of living in Germany demonstrably below that of its former victims while avoiding the kind of mass starvation or chaos that might prevent an early end to the occupation. German industry had to be stripped down and Germany would become an agricultural country. On the other side there were proponents for a soft peace. These people followed the ideas of John Maynard Keynes: avoid a reparations fiasco and approach Germany as an

essential participant in European recovery. Also in the US were second tier officials who wanted to create conditions that allowed a rapid withdrawal of American forces, which meant keeping reparation claims to a minimum, reviving German economic life under non-inflationary conditions and integrating a post-war Germany into the new international financial system (Van Hook 2004, p.21/22).

Once the occupation of Germany began, the entire nature of the discussions about Germany in Washington and London changed dramatically. The American 'Office of Military Government-United States' and the British 'Control Commission' played an increasingly important role in the fate of Germany (Van Hook 2004, p.34). As the difficult economic problems of Germany became clearer, such as the chronic shortages of raw materials and food, a broken network of distribution and the worthless currency, these officials argued for a more rehabilitative approach to Germany. They quickly learned that they faced an economic system that had been completely broken down. The extent of the physical damage to housing, factory buildings and equipment varied depending on the military significance of the targets. At first sight the Ruhr area appeared devastated, yet plenty of equipment had either made it through the war unscathed or had been replaced by new machinery. So the damages did not rise to catastrophic levels, but the systems of distribution, transportation, supply and finance had been destroyed.

In a post-war report to US Military Governor Lucius D. Clay it was estimated that the amount of German money in circulation had increased approximately six times since 1936. The Allies felt compelled to maintain the price and wage controls from the Nazi era to avert a hyperinflation (Van Hook 2004, p.32-39).

By 1946, Allied policy in Germany had already begun to work toward the constructive rehabilitation of Germany. This rehabilitation did not reflect an ideological debate, but rather was an interplay of domestic German conditions, diplomatic considerations within Germany and the broader goals for Germany decided in allied capitals. Allied officials tended to allow Germans to take the lead themselves in drawing up reform agendas. At first the Social Democratic Party (SPD) under Kurt Schumacher, who had survived 10 years in Dachau, became the primary beneficiary of the change in Allied attitudes toward Germany, but SPD ideas about a more planned economy did not work in the first years immediately after the war (Van Hook 2004, p.45-47).

Price controls on food made the shortages so severe that some people started growing their own, and others made weekend treks to the countryside to barter for food. Barter also was so

widespread in business-to-business transactions that a new job title in many firms was that of "compensator," a specialist who bartered his firm's output for needed inputs and often engaged in multiple transactions to do so. German economist Walter Eucken wrote that barter and self-sufficiency were two things that were incompatible with an extensive division of labour (Henderson, n.d.). "The economic system," he wrote, "is reduced to a primitive condition." In March 1948 bi-zonal (British and US occupation zones) production was only 51% of its level in 1936.

Because the Allies wanted non-Nazis in the new German government, Ludwig Erhard, whose anti-Nazi views were clear, was appointed Bavarian minister of finance in 1945. In 1947 he became the director of the bi-zonal Office of Economic Opportunity and, in that capacity, advised US Governor-General Clay. Erhard advocated currency reform and price de-control. After the Soviets withdrew from the Allied Control Authority, Clay, along with his French and British counterparts, undertook a currency reform on Sunday 20 June 1948 with the introduction of the Deutsch Mark. The currency reform was highly complex, with many people taking a substantial reduction in their net wealth. The end result was an approximately 93% contraction in the money supply. On that same Sunday the German bi-zonal Economic Council adopted, at the urging of Ludwig Erhard and against the opposition of its SPD members, a price de-control ordinance, allowing and encouraging Erhard to eliminate price controls.

The effect on the German economy was electric: the reforms quickly re-established money as the preferred medium of exchange and monetary incentives as the prime mover of economic activity. Output continued to grow by leaps and bounds, so that by 1958 industrial production was over four times the 1948 annual rate in the six months in 1948 preceding currency reform. Industrial production per capita was over three times as high. Because Erhard's ideas had worked, the first chancellor of the new Federal Republic of Germany, Konrad Adenauer, appointed him as Germany's first minister of economic affairs, and he held that post until 1963 when he became chancellor himself, a post he held until 1966 (Henderson, n.d.).

7.3 Rhine-Main-Danube waterway

7.3.1 Location

With the official opening of the Main-Danube Canal on 25 September 1992, the 3,500 km-long Rhine-Main-Danube waterway from the North Sea to the Black Sea came into existence. Now Rotterdam is connected by inland waterways to Romania. This route from Rotterdam to the black Sea can be divided into three stretches. The first is the Rhine-Main stretch, from Rotterdam to the mouth of the river Regnitz in the Main near Bamberg, with a total length of 924 km. The second stretch, the actual Main-Danube canal, starts here and has a length of 171 km, flowing into the Danube at the mouth of the river Altmühl near Kelheim. The third stretch is the long Danube stretch, 2,411 km from Kelheim to the mouth of the Danube in the Black Sea near Sulina.

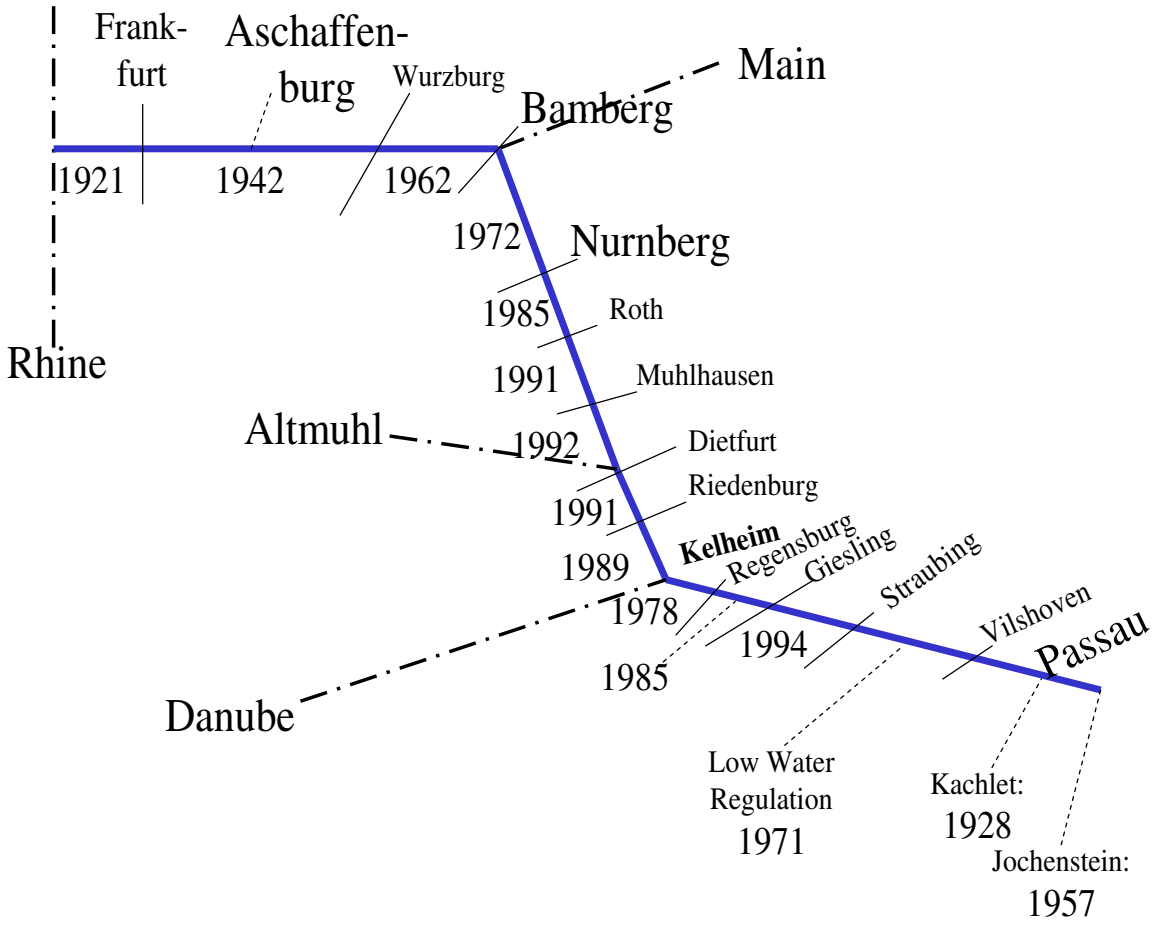
The part of the waterway that was built by the RMD AG, including the canalisation of the rivers, has a total length of 677 km. The RMD AG's basis can be found in the series of treaties agreed upon between the RMD AG, the German Reich and her successor, the Federal Republic, and the 'Länder' Bavaria and Baden. One of the first treaties from 1921 specified the concession of the RMD AG, not only concerning the building of the waterway but also the winning of hydro-electric power. With the returns of winning the hydro-electric power, the building of the waterway would be financed. The concession area for the RMD AG started in Aschaffenburg at the Main and ended with the Danube crossing the German-Austrian border. The Main-stretch of the concession, from Aschaffenburg to the mouth of the river Regnitz in the Main, north of Bamberg, is 297 km long, and the Danube part of the concession area is the 209 km long stretch from Kelheim to Passau at the German-Austrian border (Hauck 1992, p.32).

7.3.2 Rhein-Main-Donau AG

The foundation of the RMD AG on 30 December 1921 was based on a treaty signed by the German Reich and the ‘Länder’ Baden and Bavaria. The treaty gave the RMD AG the right to build and operate hydro-electric power stations on five rivers in the south of Germany. The revenues from the generation of hydro-electric power had to be invested in the construction of the Rhine-Main-Danube waterway, which would need to be built suitable for modern ships to

navigate. With the foundation of the RMD AG an extraordinary model had been chosen for public investments in the construction of the waterway.

Figure 7.2. Overview of the construction periods of the Rhine-Main-Danube waterway.



The section of the Rhine-Main-Danube waterway for which the 1921 treaty gave concessions to the RMD AG to build a high-capacity waterway and the hydro-electric power plants is the stretch from Aschaffenburg on the Main to the Danube's border crossing from Germany to Austria. Thus the RMD AG had a dual function: First, it was the constructor of the Main-Danube canal and second it was, and still is, a hydro-electric power company. Until 1995 the RMD AG was for 1/3 owned by the Free State of Bavaria and for 2/3 by the German Federal Republic. After 1995 it was privatised and sold for 800 million marks to the originally Bavarian electricity producer E.ON Energy AG. E.ON now owns nearly 77.5% of the shares

of the RMD AG, while the local Bavarian energy supplier LEW owns 14% and EnBW, a German electricity supplier originally from Baden Würtenberg, owns 8.5%.

According to a statement on the website of the RMD AG (www.rmd.de), the company is one of the oldest and most successful private models for governance of infrastructural investments. The present day RMD AG has been transformed to a company holding two main tasks, organised into separate divisions: energy production and waterway building. The first task is organised by a number of separate subsidiaries that own 60 different hydro power plants along the Main, the Danube, the Altmühl and the Lech. Waterway construction is organised in the 100% subsidiary RMD-Wasserstrassen GmbH, a construction company that is now responsible for construction activities on the Main-Danube waterway. Activities primarily concern the ongoing construction works for canalisation of the last stretch of the German part of the Danube between Straubing and Vilshoven, as well as construction of high-water protection along the same stretches of the Danube. This work is directly financed by the Federal Republic of Germany and by the state of Bavaria.

7.3.3 Construction

The construction of the actual Main-Danube canal only started in the early nineteensixties. Before this time the construction activities consisted of canalisation on the Main and the Danube and of barrage and hydro-electric power station construction on both rivers. This work had already started in the 1880s with the canalisation of the mouth of the Main in the Rhine up to Frankfurt, and up to 1921 six barrages were built to canalise the Main from Frankfurt eastward in the direction of Aschaffenburg. From 1921 to 1942 the Main stretch Aschaffenburg-Würzburg was canalised under the direction of the RMD AG, who also build the Kachlet barrage together with the Kachlet hydro-electric power plant, which were the first works on the Dunube in this pre-war period. As a consequence of war economy requirements the work came to an end in 1942, but work started again in 1949 with the canalisation of the Würzberg-Bamberg stretch on the Main. This was completed in 1962, and the harbour of Bamberg was put into use. Work then started at the actual canal from Bamberg to Nürnberg. This canal stretch, including the harbour of Nürnberg, was completed in 1972. In a southward direction, the stretch Nürnberg-Roth was completed in 1985, and at the same time work at the canal proceeded from the most southern point of the canal at Kelheim northwards towards

Riedenburg. This stretch followed the Altmühl river valley from Dietfurt, north of Riedenburg, to Kelheim, and the canal is partly built in the river bed of the Altmühl. Reidenburg was reached in 1989. The rest of the construction in the Altmühl valley was finished in 1991 with the completion of the stretch Dietfurt-Riedenburg. In the same year the village of Mühlhausen was reached south of Roth. The rest of the canal, the stretch Mühlhausen-Dietfurt was ready in 1992, which meant that the Main-Donau canal was finally complete.

At the Danube, near the German-Austrian border and north of the mouth of the Isar on the Danube, the barrage and hydro-power plant Jochenstein was finished already by 1957. This made it possible to finish the low water regulation on the Danube, from Regensburg to Vilshoven, as early as l971. The canalisation of the Danube north of Regensburg, from Regensburg to Kelheim, followed in 1978 and the canalisation of the Danube from Regensburg towards the south was finished in 1994 (Hauck, 1992).

At the end of the 1970s, an intense crisis developed which severely threatened the progress of the construction activities: see section 6 of this chapter. Under pressure from the environmental movement in Germany, the SPD federal government did not want to continue financing the construction any longer. The federal German government also had serious doubts about the economic rationale of the canal.

In 1982 the Bavarian CSU party led by Franz Jozef Strauss made financing the construction of the canal a part of negotiations for a new federal government coalition with the CDU. The result of this was the new CDU/CSU and FDP government agreeing to financing so that finally in 1992 the Rhine-Main-Danube waterway could be brought into use.[10]

[10] A citation about the political controversy: "Der alte hanseatische und somit kaufmännisch denkende Sozial-demokrat Helmut Schmidt.....dürfte selbst wohl kaum einen Sinn im Abbruch der fast fertigen Kanals gesehen haben. Er konnte ja rechnen. Doch zum einen sah damals die gesamte Hamburger Lobby quer durch die Parteien mit Sorge, aber auch Mißgunst, daß die Vorteile der neuen Wasserstraße eher in Österreich, im CSU-Regierten "schwarzen" Bayern, in den Rheinhäfen und in Holland lagen, wheil der Rhein eben nicht in den Hamburger Hafen fließt, sondern in den von Rotterdam." Burger H. & H. Kapfinger, Bayerns Weg zum Meer, Passau, 1992, p.88.

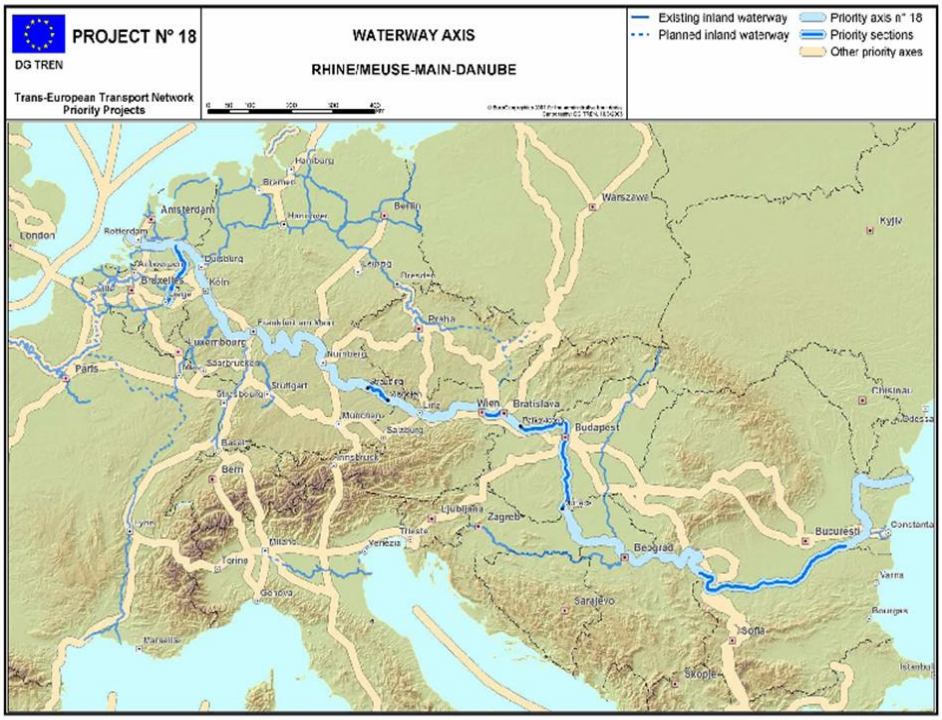
Bavarian politics and the long standing majority position of the CSU was once characterised by the comedian Gerhard Polt who said: "In Bavaria we don't need an opposition, we already have a democracy!" Source: The Economist, 18 August 2007.

7.3.4 Shipping

The canal and the locks on the rivers have been constructed to be able to take ships of at least 1,200 tonnes, even handling two of these ships at one time. However, this doesn't mean that ships of the 'Europe I Class' can sail from Rotterdam to Sulina. The Danube, especially south of Budapest, is not yet accessible to these vessels due to frequent low-water levels.

Also, economically speaking, the significance of the Rhine-Main Danube waterway does not lie in the inland connection from Rotterdam to the Black Sea. I it is still cheaper and quicker to travel by sea from North Sea harbours to the Black Sea.

Figure 7.3 European transport network planning concerning the Rhine-Main-Danube waterway.



The real significance of the Rhine-Main-Danube waterway is its importance for regional transportation, e.g., between Düsseldorf and Bratislava, or between Rotterdam and Linz. Recent EU-membership of Slovakia, Hungary, Romania and Bulgaria has enhanced the significance of local travel on the waterway. This is shown by figure 7.3, where EU transport planning is indicated. Further development and improvement of the Rhine-Main-Danube waterway is foreseen, especially in improvements of canalisation between Straubing and

Vilshoven in Bavaria, together with improvements in Hungary and on the Romania-Bulgaria stretch.

An Austrian study from 1991 already indicated this growing significance of the waterway, not only for Austria but also for Middle and South European countries: thirteen states of the continent are now connected by one waterway. The Rhine-Main-Danube is for land-locked states the only waterway connection with world seas, with Austria as one of the main beneficiaries of the waterway, and accordingly the Austrian federal government has significantly invested in the canalisation of the Danube west of Vienna (Czachay 1991, p.12).

7.4 Planning: From Fossa Carolina to a high capacity waterway

7.4.1 Fossa Carolina and Ludwig-Main-Danube Canal

The idea of linking the Rhine and Danube originates as far back in history as the days of Charlemagne (Bader 1982, p.5-29). The idea has stirred emotions and remained alive throughout the centuries. It was even twice translated into practice, though in both instances technically inadequate in scale.

It was in 793 AD that Charlemagne launched the first project of linking the two rivers with a 2,000 meter long canal to connect two tributaries of the Main and the Danube. Unfortunately, construction could not be completed because of adverse weather conditions, logistic difficulties and changing military situations. Charlemagne's ditch, the Fossa Carolina, near Weissenburg, is a reminder of that first attempt of a Rhine and Danube link-up.

Bavarian king Ludwig I revived the idea of a canal connecting the Main and the Danube in the 1820s. Work started in 1837 and in 1846 the King opened his Ludwig-Main-Danube Canal (Bräunlein 1991, p.15-28). The canal has never really been a success, though, with its top year in 1850 when the total volume of goods transported was 195,962 tonnes. The Ludwig-Main-Danube Canal suffered from insufficient canalisation of the Main and the Danube. Canal barges could not navigate these rivers, so there was no direct shipping connection between harbours at the Rhine and the Main and at the Danube. This severely restricted the profitability of the canal, and consequently horse-drawn vessels on the canal

could not stand up to powerful competition from emerging railways in South East Bavaria. Damages to the canal locks incurred during the Second World War have never been restored.

7.4.2 The Canal and Shipping Society

The idea of a competitive shipping linkage between the Main and Danube continued to inspire the Bavarians. On 6 November 1892 a society was founded in Nürnberg with the name "German Rhine-Main-Danube Canal and Shipping Society" (Deutscher Kanal- und Schiffahrtsverrein Rhein-Main-Donau e.V.) (Hauck, 1992a). From that moment on there was talk of a high capacity waterway ("Großschiffahrtstraße") between the Main and the Danube. Initially, the Bavarian government saw nothing in the idea of a high capacity waterway. However, the attitudes of the government became more positive when the Canal Society produced technical studies proving that the waterway could be realised. This culminated in the founding of the Main-Danube Association ("Main-Donau-Stromverbandes") in 1917 in Nürnberg, formed with the purpose of formulating an elaborate plan for a high capacity waterway from Aschaffenburg to the border of the Reich near Passau, by way of Bamberg and Nürnberg. The Main-Danube Association would go on to be the direct predecessor of the RMD AG.

7.4.3 Motives for building the waterway

It is to be expected that with the long history of the construction of the Rhine-Main-Danube waterway, the motives for building the waterway would evolve through time, not in the least because socio-political and economic environments changed dramatically over time, but also because views, opinions and preferences of people to their physical environment also changed. For instance, the construction of the canal in the bed of the lower Altmühl was very much influenced by the environmental protection movement (Glas 1996, p.57).

In the beginning of the twentieth century the chances for the idea of construction of a high capacity waterway between the Main and the Danube were small. There was already a canal, the Ludig-Donau-Main canal, and railways were capable of supplying sufficient transport capacity in Bavaria as well. This situation changed after the Great War. First there was the view that a high capacity waterway from Main to Danube would have been an advantage for supplying the army with cereals and petroleum from Romania. This was basically the first

view on the role of the waterway benefiting Southeast Europe economically. But much more important was the realisation of a new constitution of the German Reich after the Great War. In this constitution it was determined that all German railroads would fall under the direct control of the Reich. In coherence with this provision it was decided that all special tariffs and subsidies should be abandoned. In Bavaria, this would lead to high transport prices for raw materials and energy in the form of coal. For the economy and industry, especially in the more remote Bavarian areas, this would lead to a disadvantage in comparison to the other areas in Germany. Also, consumers would be afflicted by higher prices for coal and cokes. As compensation for these adverse effects of the federal transport politics, Bavaria was awarded the right to build a high capacity waterway. One final additional motive in the 1920s came from labour market considerations: Germany was struck by massive unemployment, and building a canal would have direct and indirect positive effects on the Bavarian labour market situation.

Then in the national-socialistic era new motives arose for constructing the waterway. These motives had to do with Nazi politics towards Southeast Europe. The canal would support the opening of Danube regions and the colonisation (Lebensraum) of Eastern Europe. After the war the canal building was seen to be used as an instrument of a rapid transformation for Bavaria from an agricultural state into a modern industrial state: due to the poor availability of inland raw materials, industrialisation was not easy in Bavaria. The labour market was also a problem due to a growing population, not only from inside Germany, but also from the high numbers of Eastern European immigrants in the first years after the war. To absorb all these people, the labour market would need extra stimulating circumstances. In this view the availability of hydro-electric power, as a second-order effect of the canal building, was regarded as an important advantage (Glas 1996, p.58).

With the completion of the harbour in Nürnberg in 1972, a new era in discussions about concerning benefits and necessities of completing the canal's south stretch emerged. Now that the economically strong Nürnberg region was connected with the Main and the Rhine system, it was hard to see in 1972 what the extra economic value of completing the total canal was. Moreover, the construction of the canal through the bed of the Altmühl caused environmental problems, which received more and more attention. In a reaction to this critique the southern stretch was given the function of transporting Danube and Altmühl water into the direction of the Regnitz-Main area, which suffered from low precipitation rates.

Also important was the position of Austria with respect to the waterway, and this position changed as a consequence of the political changes brought about by the two world wars. In the time of the Austrian-Hungarian Monarchy the Austrian transport policy was directed towards the south, to the Adriatic coast, and towards the east, to the mouth of the Danube. After 1945 the transport routes to the north became much more important: first the routes to Hamburg and Bremen and then to the sea harbours in the Northwest. This change of interest to the Northwest was partly caused by industrial development in the Linz area, and partly by the division of Europe into two political, military and economic East and West blocs. As a consequence of the fall of the iron curtain and the subsequent expansion of the EU, this orientation, not only of Austria, but also the orientation of the Rhine-Main-Danube waterway, began to change, as indicated by the transport policy of the EU. Graf (1996, p.58/59) concludes that after a construction period of 70 years, and a series of economic and political shocks, the timing of the completion of the waterway at the beginning of the 1990s could not have been better, though this was just good luck.

7.5 Designing and Financing: the treaties

From 1921 up to the sale of the RMD AG to Bayernwerk in 1994 a series of treaties were concluded which determined the position of the RMD AG and that formed the basic governance structure for building the waterway (Hahn 1982, p.6; see also the Rhein-Main-Donau Verträge, published by the RMD AG). These treaties are:

1. Main-Danube state treaty ('Staatsvertrag')	13 June 1921
2. Additional treaty ('Zusatsvertrag')	13 June 1921
3. Concession treaty	30 December 1921
4. Waterway construction treaty ('Bauvertrag')	28 December 1922
5. Additional treaty ('Ergänzungsvertrag')	17 August 1925
6. Transition treaty ('Zwischenvertrag')	9 September 1949
7. Financing treaty ('Finanzierungsvertrag')	28 December 1966
8. Extension treaty ('Ausbauvertrag')	16 September 1966
9. Canalising treaty ('Donaukanalisierungsvertrag')	11 August 1976
10. Settlement treaty ('Bereinigungsvertrag')	11 August 1976

Three periods can be identified. In the first period, from 1921 to 1925, treaties were concluded which organise both general matters as well as those of principle. These treaties constitute the governance structure for building the Rhine-Main-Danube waterway. The second period is the period of the Third Reich and the Allied occupation, which ended with the Transition treaty of 1949. The third period covers the treaties from 1966 and 1976 that governed the financing of building parts of the actual canal and canalisation of the Danube to the German-Austrian border near Passau.

7.5.1 The constituting treaties of 1921

The first treaty was concluded between the German Reich and the Free State of Bavaria in which parties expressed their intention to build the waterway that would connect the river basins of the Rhine and the Danube. This would form a waterway to give passage through Bavaria from the east to the west. The treaty expressed the starting points, the general goals and the framework for the project. In the treaty two matters are settled in more detail. The first detail was the capacity of the waterway. It was defined that the waterway would suit inland ships of 1,200 to 1,500 tonnes. The consequence was that the Main river from Aschaffenburg to Bamberg and the German part of the Danube had to be canalised. The entire passage, including a canal between Bamberg and Kelheim, had to be built with dimensions that would allow passage of ships of up to 1,500 tonnes. The experience from the Ludwig-Main canal must have been important here, because this canal was from the beginning too small to compete with rising railway connections.

The second detail ironed out by the treaty was the agreement that the waterway's construction would be conducted by a company according to private law ("gemischtwirtschaftliches Unternehmen"). In case one failed to establish this company, the Reich and Bavaria were compelled by section B of the treaty to build the waterway themselves. This part of the treaty also recorded the connection between the generation of hydro-electric power and the construction of the waterway, a result of other important negotiations between the Reich and the Länder (Held-Brüschwien 1929, p.140-145). According to the constitution of the German Reich ('Reichsverfassung'), waterways which served general transportation had to be controlled by the Reich. Negotiations over the financial consequences of the transition of the waterways from the states to the Reich were blocked by a difference of opinion between the states of Württemberg and Baden with respect to the revenues of the generation of hydro-

electric power on the river Neckar. The reaction of Bavaria to this situation was to demand special arrangements for the construction of the Rhine-Main-Danube waterway and the generation of hydro-electricity on the Bavarian rivers. The idea of a private company controlled by public bodies evolved during the negotiations to solve the problem of the hydro-electric power property rights. The treaty stated that the private company in the appearance of a limited corporation according to German law ('Aktiengesellschaft') also had to exploit the hydro-electric plants and that the profits from the electricity production needed to be used to construct the waterway (Hahn 1982, p.5).

Baden was not given the position to be one of the parties in the state treaty of 13 June 1921. The additional treaty, concluded at the same time, determined the rights of the state of Baden. Baden was one of the Main waterside states and therefore it was defined that Baden got a say (‘Mitspracherecht’) in the construction activities.

The concession treaty of 30 December 1921 gave the right to build the high capacity waterway ('Grossschiffahrtsstrasse') to the newly-founded Rhein-Main-Donau Aktien-gesellschaft (RMD AG), stretching from Aschaffenburg to the border of the Reich near Passau. The parties to this treaty were the Reich, the states of Bayern and Baden and the RMD AG. The treaty contained provisions with which the property rights of the RMD AG were defined. These were:

- The RMD AG must hand over the waterway facilities to the Reich once these facilities were completed. RMD AG has the right to demand take-over by the Reich of already completed parts of the waterway.
- The Reich will operate and maintain the waterway stretches it has taken over from the RMD AG at its own expense.
- The RMD AG has the right to build hydro-electric production facilities within the border of Bayern at the Main, the Danube and the Lech. The RMD AG has the right to operate and exploit these facilities for a period of 100 years, but no later than 2050.
- The Reich, together with the Free State of Bavaria, takes the obligation to underwrite the loans of the RMD AG.

7.5.2 The construction treaty of 1922

One year later the waterway construction treaty was concluded, again between the Reich, the states of Bayern and Baden and the RMD AG. In this treaty the RMD AG was given the task

to plan the construction of the waterway and to act as the construction principal ('weitgehendes Planungsrecht und den Bauherrenstatus').

This was also the time of hyperinflation in Germany and the financial structure of the just started RMD AG suffered heavily from this. One year after its start, at the end 1922, the gold value of the starting capital of the AG was diminished to approximately 3% of the value at the start. Needless to say, this limited the activities of the RMD AG greatly. The central problem for the RMD AG in this starting period was how to finance the planned investments. As a consequence of low investment in hydro-power plants, the revenues from the electricity production would not be enough to invest in the building of a canal at a sufficiently quick rate. To tackle this problem, parties entered into a new treaty concluded on 17 August 1925. In this additional treaty ('Ergänzungsvertrag') to the Main-Danube state treaty of 1921, it was determined that the required financial means would be provided by the Reich and Bavaria at a ratio of 45:26, in case these means could not be provided by loans other than internal means of the RMD AG (Hahn 1982, p.8). Yet again it was stated that the RMD AG had the obligation to re-invest excess surplus ('Überschüsse') from the power plants into the construction of the waterway.

7.5.3 The Third Reich and Allied occupation

The second 'treaty period' is the period of the Third Reich and accompanying Allied occupation. The command economy of the Third Reich was also expressed in the institutional structure for the Rhine-Main-Danube project. In 1938 laws were passed in which the position of the RMD AG was altered. The so called 'Rhein-Main-Donau Gesetz' from 11 May 1938 was especially important: with this law the Reich took the construction of the waterway under its direct control and the RMD AG lost its position of construction principal. The earlier treaties between the Reich, the states and the RMD AG were superseded. The two functions of the RMD AG, hydro-power plant construction and waterway building, were separated. In 1941 the RMD AG was also exempted from the task of planning and building the actual Main-Danube canal between Bamberg and Kelheim, a job taken over by the German waterway authority ('Reichswasserstrasseverwaltung'). The only task that was left was the canalisation of the Main and of the Danube. As a consequence of the needs from the war economy, the planning and construction works were postponed further and further until they completely stopped in 1942.

Immediately after the war, the RMD AG was placed under the direction of the Allied military government. A trustee was appointed, and on 26 April 1948 the administration of the trustee was brought under the control of the bi-zone authority ('Die Verwaltung des Vereinigten Wirtschaftgebietes').

The bi-zone authority, the Free State of Bavaria and the RMD AG concluded the so-called transition treaty in 1949. With this treaty the RMD AG was returned her pre-war rights and concession duties. The Rhine-Main-Danube Law of 1938 and all the regulations based on this law were placed out of order. Also in this treaty, provisions were repeated from the 1921 and 1925 treaties about financial duties of the pre-war Reich and the Free State of Bavaria. These duties implied that the central government and Bavaria would provide funding for the construction of the waterway in case the RMD AG was not able to finance the construction on its own. The only major difference was the distribution of costs between the bi-zone and Bavaria, established at 2:1 instead of the 45:26 ratio formulated in 1925.

7.5.4 The financing and extension treaties of 1966

The third period of treaties concerning the RMD waterway covers the treaties of 1966 and 1976. Although the transition treaty of 1949 was thought to be only temporary it lasted until 1966, when new commitments were made. In this 1966 treaty, the situation that originated from the 1949 treaty was confirmed. The financing treaty between the Federal republic and the Free State of Bavaria of February 1966 was especially meant to solve issues concerning the financing of the construction of the north stretch of the actual canal, between Bamberg and Nürnberg. To make it possible for the canal stretch to be opened for shipping by 1970, additional financial contributions had to be organised. It was estimated that the completion of the north stretch together with constructions for low water regulation at the Danube would require a total amount of 445.6 million marks. The contributions from the ‘Bund’ and from Bavaria were estimated to be a total of 164.5 million marks: 94.5 million for the Federal Republic and 70 for Bavaria. The rest of the necessary means would come from the city of Nürnberg, at 4.4 million marks, and 276.7 million from the RMD AG. These means had to be formed by the revenues from the power plants or from additional loans (RMD AG. Rhein-Main-Donau Verträge, p.25).

Half a year later the so-called Duisberg treaty was concluded between the Federal Republic of Germany and the Free State of Bavaria. This was a new construction treaty where, in

accordance with the German constitution, the Federal Republic was declared to be the lawful successor of the bi-zone authority. Again, here the treaties of 1921, 1922, 1925 and 1949 were confirmed. It was also formulated that the parties agreed upon an end-date for the south stretch of the canal. Constructions for the stretch from Nürnberg to Vilshofen would begin in 1969 and would at the latest be ready in 1989.

In planning the financial means, the governments of the Bund and of Bavaria would still provide the necessary interest free loans as long as the state of the economy and the government budget would allow this. Also a condition was agreed upon that the law-making institutions of the Bund and Bavaria would need to approve these loans. The distribution of the investment costs for the Bund and Bavaria was again settled at the ratio of 2:1.

In addition to the financial contributions of the Bund and Bavaria, the RMD AG was authorised to issue loans in case one of the parties to the treaty could not provide the necessary financial means. This would give the contracting party that failed to provide the financial means the obligation to guarantee, to pay interest on, and to amortise the loans ('verbürgen, verzinsen und tilgen') issued by the RMD AG.

For the actual construction of the south stretch the treaty contained the provisions that the RMD AG would only be the construction principal ('Bauherr') for the canal from Nürnberg to Kelheim and for the canalisation of the Danube from Kelheim to Regensburg. The RMD AG would carry out the canalisation of the Danube from Regensburg to Vilshofen directly on behalf of the Federal Republic of Germany (Hahn 1982, p.10/11). This canalisation project would be paid half by the Federal Republic and half by Bavaria.[11]

Interesting is also the last section of the extension treaty of September 1966. In this section it was formulated that when there are important reasons, especially from legal measures, that made it necessary to change the treaties or to devise additional provisions to maintain the interests stated in this treaties, such changes or additions would be established in a confident cooperation (RMD AG, Rhein-Main-Donau Verträge, p.30).[12]

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[11] Section 4 of the treaty of 16 September 1966: “Der Freistaat Bayern stimmt zu, daβ die Rhein-Main-Donau AG die Kanalisierung der Donau von Regensburg bis Vilshofen im Auftrag der Bundesrepublik Deutschland durchführt, und ist bereit, mit der Hälfte der Mittel beizutragen, die die Bundesrepublik Deutschland aus Haushaltsmitteln hierzu bereitstellt. ”

[12] Section 6 of the treaty of 16 September 1966. “Ergibt sich aus wichtigen Gründen, insbesondere aus gesetzlichen Maßnahmen, daß Änderungen oder Ergänzungen dieses Vertrages zur Wahrung der darin festgelegten Interessen eines oder beider Vertragschließenden erforderlich werden, so sind sie unverzüglich in vertrauensvoller Zusammenarbeit zu vereinbaren.”

7.5.5 The canalisation treaty and the settlement treaty from 1976

In 1976 two treaties were needed to solve problems concerning the Danube's canalisation, to solve problems concerning the high capacity waterway building concession, and to answer questions that were left open by the transition treaty of September 1949. An additional treaty concerning the canalisation was needed because the RMD AG had already fulfilled obligations stemming from the 1921 treaties, concerning the construction of a low-water regulation system at the Danube. As it turned out, that particular waterway needed additional canalisation (Bader 1982, p.77).

In the Danube canalisation treaty, the question of the RMG-AG carrying out the canalisation of the Danube from Regensburg to Vilshoven in the name, on behalf and for the expense of the Federal Republic was perfectly resolved.. A federal authority to canalise the Danube ('Das Neubauambt Donauausbau') was therefore placed under the RMD AG. Furthermore, the tasks of the RMD AG were that it:

1. had to organise the contracts for the canalisation from beginning to end ('Vergabe von Lieferungen and Leistungen');
2. had to acquire the land needed and other rights;
3. had to make up the agreements to compensate the ones that would suffer from the canalisation.
4. received a general authorisation from the Federal Republic for these tasks to accomplish.

Only limits were set for these general authorisations. With regard to task (1.) these limits were: for a public tender: DM 6 million; for a limited tender: DM 3 million; and for contracts without a tender: DM 5 million. With contracts according to task (2.) the limit was set at 1 million marks. For contracts according to task (3.) the limit was 1 million provided that it concerned a one-off compensation.

Notwithstanding the provision that the RMD AG would carry out the work on the expense of the Federal republic, Bayern would contribute to the necessary means to canalise the Danube covering 1/3 of the expenses. The provisions of the Main-Danube state treaty from 1921 and the construction treaty from 1922 were declared also to concern the power plants that would be built together with this canalisation of the Danube.

In the settlement treaty of 11 August 1976, disputes were solved about the concession of the RMD AG as established in the 1921 concession treaty and confirmed in the 1949 treaty. Further provisions were formulated concerning specific power plants in accordance with the concession treaty of 1921. Consequently, the profits from the electricity production of these power plants had to be used for the construction of the Rhine-Main-Danube-waterway. Also, a dispute was settled about the electricity from the power plants under the supervision of the Rhine-Main-Danube concession, which was used for the operation and the maintenance of the canal. This especially concerned power needed to diverge water from the Danube and Altmühl towards the Main by using the canal. This water was needed to provide the locks in the canal with sufficient water.

Basically the legal basis for construction of the waterway and for the activities of the RMD AG, formed by the treaties, had stayed the same since 1921, but the treaties became subject to a legal opinion brought forward by a German environmental organisation, the 'Bund für Umwelt und Naturschutz Deutschland e.V.' In this opinion the legal arrangements and the validity of the Rhine-Main-Danube treaties were brought into question, but in 1981 a Bavarian court for administrative matters (Verwaltungsgerichtshof) confirmed the legal validity of the Rhine-Main-Danube treaties (Hahn 1982, p.12).

7.6 Building and operating

7.6.1 Estimating the total costs of the waterway

At the end of 1981 the investments of the RMD AG in the waterway amounted to 250 million 'Reichsmark' and 3.84 billion DM (Bader 1982, p.77). Of these investments 72% was used for the waterway and 28% was invested in power plant construction. Construction on the waterway included locks and dams also used for hydro-electricity production. But as Bader (1982, p.78) sees it, the share of the power plants in total investments only refers to the power plant construction as such.

The south stretch of the canal, from Nürnberg to Kelheim, was by the end of 1981 still under construction. It was estimated that this stretch would cost a total of 2.1 billion DM. The treaty of August 1976, stating that the Bund and Bavaria would pay these costs in a ratio of 2:1, still

applied. Of this cost, 57%, or 1.2 billion DM, had already been spent. Furthermore it was estimated that the additional canalisation of the Danube would cost 0.7 billion DM. These figures would give a total cost, including construction of the hydro-power plants, of 6.64 billion DM. By the finishing of construction in 1992 different figures about the total costs of the waterway and the canal became available. Total costs for the waterway from Aschaffenburg to Passau invested by the RMD AG were set at 6.0 billion DM (Hauck 1992, p.39). The investments for the power plants were not included, and additional costs need to be added for the canalisation of the Danube stretch under the direct relationship between the Federal Republic of Germany and the RMD AG. These costs for the Danube Regensburg-Straubing stretch were 1.2 billion DM, and for the Straubing-Vilshoven stretch, that still had to be completed in 1992, an estimated 1.3 billion marks was needed. This would imply total investments for the Rhine-Main-Danube waterway of 8.5 billion DM. The investments for the actual Main-Danube canal from Bamberg to Kelheim total 4.7 billion DM. These numbers imply a cost of 27.5 million per canal kilometre, though in comparison with costs for highways and rail roads the cost of the canal takes a middle position. In 1992 the costs for a highway kilometre was 10-20 million marks and for a railway kilometre the cost were some 35 million (Hauck 1992, p.40).

Very important for the interpretation of the history of the construction of the waterway in the light of NIE is the following remark of Bader in his 1982 publication. Therefore this quote is included here in German:

> "Die Kombination von Wehr, Kraftwerk und Schleuse ermöglicht es, auch bei hältnismässig geringer Fallhöhe Wasserkraftwerke rentabel zu errichten und zu betreiben und damit, wie im Gründungskonzept der RMD vorgesehen, den Bau der Wasserstraße letztlich aus den Erträgen der Kraftwerke zu finanzieren- ein für öffentliche Investitionen einzigartiges Finanzierungskonzept." (Bader 1982, p.78).

Bader here basically says that the combined construction of dam, lock and hydro-power plant made it possible to produce hydro-electricity efficiently, possible even with the relatively small differences in water levels. Consequently it was possible to fulfil the basic idea that formed the basis of the Rhine-Main-Danube construction: namely, financing the construction of the waterway with the returns of the hydro-power production..

But how well did this concept work out in the end? The situation in 1981 was that the RMD AG constructed and operated 51 separate hydro-electric plants along the Main, Regnitz,

Danube and Lech rivers. These plants had a total capacity of 422 MW and produced in a normal year 2.5 billion KWh. Additionally the RMD AG constructed a 'pumped storage plant' (Pumpspeicherwerk) for the production of electricity for the German railroad (Bader 1982, p.78). According to Bader, the returns from this electricity production had a value of approximately 50 million marks per year, expressed in currency from 1981. This meant that in the period from 1948 to 1981 the hydro-electricity production contributed a total of 1.29 billion DM to the investments for the waterway.[13] Since the completion of the north stretch of the canal between Bamberg and Nürnberg in 1972, these revenues were mainly used to pay interest and redemption on loans that were issued by the RMD AG. The south stretch from Nürnberg to Regensburg would need to be financed by contributions of the Bund and Bavaria according to the 1966 treaties (Bader 1982, p.77-78).

It is difficult to assess the economic success or failure of the RMD AG construction in which returns from the hydro-power production were used to partly finance the waterway construction. To conduct this assessment would imply a full scale ex post cost-benefit analysis, which goes beyond the scope of this thesis. Up to now there has been no literature available on this subject. However, important is to know that the RMD AG was sold in 1994 to private energy companies for 800 million marks. The possessions of the RMD AG consisted mostly of the nearly 60 hydro-power plants, for which the company owns the concession on until 2050. The debts of the RMD AG consisted of the loans that the RMD AG had issued to finance the construction of the waterway, coming mainly from the Federal Republic, Bavaria, and the capital market. It can be concluded that for the private investors in 1994, the assets minus the debts were worth some 800 million marks.

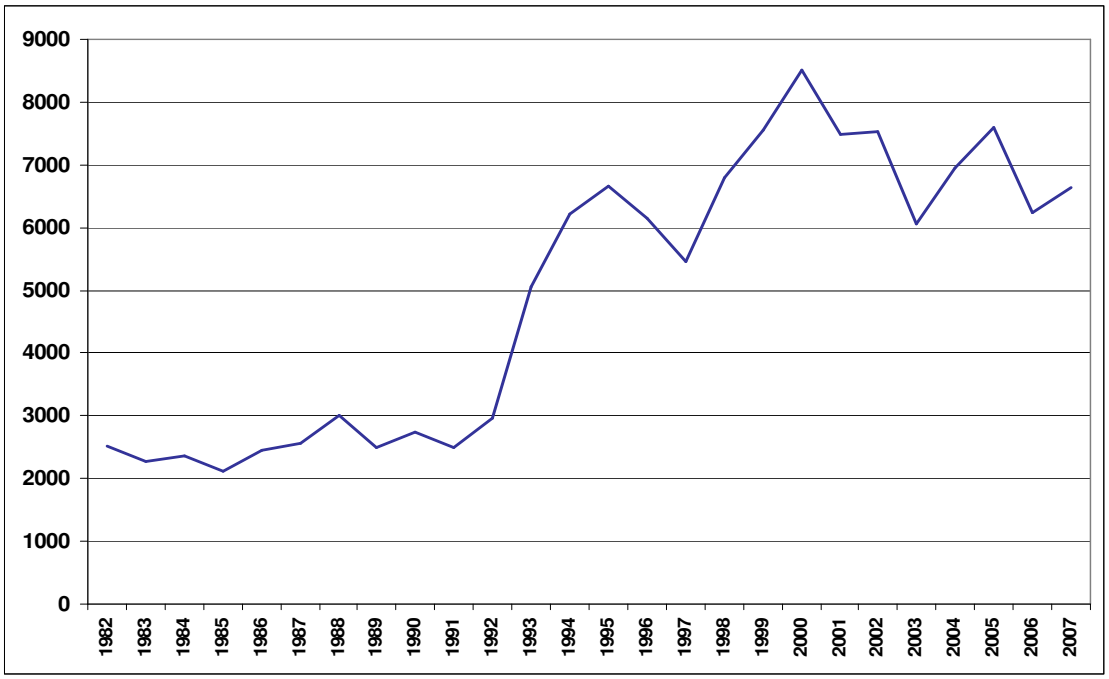
7.6.2 Goods traffic on the canal

Regarding the question of the success or failure of the waterway, one must bear in mind the difference between supply of and demand for canal capacity. TCE and property rights theory deal with matters of supply, in the sense of the institutional environment and governance structures in which this supply takes place. These are not theories to explain demand side

[13] The figures from Baber 1982 raise some questions. The period from 1948 to 1981 implies a period of 34 years. At 50 million a years this results in a total of 1.65 billion DM. This is more than the present 1981 value of 1.29 billion DM. Possibly, discounting has taken place? Or maybe the 50 million per year is not an average over the complete period but only indicates the level of revenues from the recent years?

factors. Consequently this thesis is restricted to studying the governance of the supply of canal capacity.

Figure 7.4 Goods traffic through the Main-Danube Canal 1982 - 2007 (in millions of tonnes)



Source: Wasser- und Schiffahrtsdirektion Sud 2008, p.15.

One can assume that in the phase of the operation of the canal the governance structure in which this operation takes place can also have an effect on the demand for the canal capacity. This is why here attention is paid to the actual utilisation of the Main-Danube canal. This also gives more insight in the effectiveness, in supplement to the TCE efficiency, of the governance structures for planning, designing and building the canals.

An opinion about the success regarding the utilisation of the canal depends among other things on the original traffic estimates. In a cost-benefit analysis from 1976 total traffic through the canals was estimated for 1990 at 2.7 million tonnes per year (Hahn et al. 1982, p.52). From figure 7.4 it can be noticed that in 1982 realised traffic was 2.5 million tonnes, and indeed in 1990 it was 2.7 million.

After completion of the canal in 1992 traffic increased from a level of about 2,750 to 5,100 million tonnes in 1993. In 2007 goods traffic reached a level of 6,600 million tonnes (Wasser- und Schiffahrtsdirektion Sud 2008, p.15). Of cause, the opening up of the Iron Curtain and the ongoing integration of the Danube states into the European Union will certainly have contributed to the success of the canal, compared to the traffic estimates from 1976. But these

events will not have been foreseen in the cost-benefit analysis carried out in that year. This is an illustration of one of the premises of this thesis: with large infrastructures cost-benefit analyses as a basis for the decision making on investments in these large infrastructures are of limited meaning.

7.7 Application of the analytical scheme

Throughout the history of the construction of the Rhine-Main-Danube waterway a nexus of treaties has been concluded, between the German Reich or the Federal Republic, the states of Bavaria and Baden and between the RMD AG. Parties were involved in this contracting in different formations. For example, the state of Baden was only directly involved in the beginning, in 1921 and 1922; after the so-called waterway construction treaty Baden did not play a role anymore.
For the analysis of the history of the Rhine-Main-Danube waterway, a distinction will be made between the institutional environment that was formed by the property rights concerning the waterway construction and the institutional arrangements or governance structures, as was done in the preceding case studies of the canals of King Willem I and the Suez Canal. The treaties, as they were described in section 7.5, are the basis and elaboration of the institutional environment and the governance structure for the Rhine-Main-Danube waterway project. The starting point for the analysis in this section is that the treaties basically constitute the property rights and the governance structures for the project. In the next subsection, first the property rights for the project will be dealt with, and after this the institutional arrangements or governance structures will be analysed by applying TCE.

Table 7.1 gives an overview of the classification of the treaties as property right or as governance structure. It turns out that there is a somewhat complicating factor here: some treaties constituted a property right yet also formed a governance structure or formed part of an already existing governance structure. The first two treaties in 1921 constituted the governance structure to carry out the actual project, because basically they formed the RMD AG. The third treaty in 1921 specified the concession of the RMD AG, and therefore formed a property right. The waterway construction treaty gave the task to plan the waterway to the

RMD AG, and also specified that the company would be the construction principal of the project. Thus the treaty laid down in more detail the property rights of the RMD AG. The additional treaty of 1925 deals with matters of financing the project, as an addition to the Main-Danube state treaty from 1921. This treaty is classified as belonging to the governance structure, because the financial arrangements it specified were based on the property rights given to the RMD AG. This implies that the treaty was an additional specification of the institutional arrangements, it did not belong to the institutional environment.

Table 7.1. Overview of the treaties as property rights and as governance structure.

The treaties	Parties to the treaties	Year	Property rights (Prop) or governance structure (Gov)	Phase of the project
Main-Danube state treaty (Staatsvertrag)	FR,B	1921	Gov	Planning & financing
Additional treaty (Zusatsvertrag)	FR,B,Bd	1921	Gov	Planning
Concession treaty	FR,B,RMD	1921	Prop	
Waterway construction treaty (Bauvertrag)	FR,B,Bd,RMD	1922	Prop	
Additional treaty (Ergänzungsvertrag)	FR,B	1925	Gov	Financing
Transition treaty (Zwischenvertrag)	FR*,B,RMD	1949	Prop & Gov	Financing
Financing treaty (Finanzierungsvertrag)	FR,B	1966	Gov	Financing
Extension treaty (Ausbauvertrag)	FR,B	1966	Prop & Gov	Financing
Treaty to canalise the Danube (Donaukanalisierungsvertrag)	FR,B,RMD	1976	Prop & Gov	Financing & Builing
Settlement treaty (Bereinigungsvertrag)	FR,B,RMD	1976	Prop	Financing

FR: Reich or the Federal Republic of Germany
FR*: 'Die Verwaltung des Vereinigten Wirtschafsgebietes'.
B: The Free State of Bavaria
Bd: Baden
RMD: Rhein Mein Donau AG.

Also, the other treaties or parts of other treaties that concerned matters of financing the project are classified as belonging to the governance structure, especially concerning the two 1966 treaties and the Danube canalisation treaty of 1976. In the transition treaty of 1949 it was determined that the treaties from 1921 to 1925 were restored. Consequently this treaty concerns the institutional environment and the governance structure for the project.

The 1966 extension treaty and the 1976 canalisation treaty described in more detail the tasks of the RMD AG to build parts of the waterway, and the settlement treaty of 1976 solved a problem concerning the concession from 1921: consequently these three treaties are rated as specifying property rights for the RMD AG.
Regarding the parties to the different treaties, it turns out that the RMD AG was involved in the treaties that specified the property rights and not part of the treaties that concerned the governance structures - with the exception of the 1966 extension treaty and the transition treaty of 1949. The 1966 treaty also specified property rights and the 1949 treaty is an exceptional case. Therefore it can be concluded that the RMD AG was only one of the parties to the contract when the treaty concerned the RMD AG's own property rights.

7.7.1 Institutional environment: property rights

The treaties that form the property rights are included in table 7.2. The main treaty here is the concession treaty of 30 December 1921. This treaty between the Reich, Baviaria and the RMD AG gives the RMD AG the rights to build the waterway. The Rhein-Main-Donau Gesetz and the subsequent treaties of 1949 and 1966 can be regarded as an intervening period of nationalisation of the project that started in 1938 and formally ended in 1949.
In table 7.2 the characteristics of the property rights also have been rated. These characteristics are the element of a property right, the unambiguous definition of the property right, the transferability of the property rights, the exclusivity against third parties and the possibility of expropriation. A rating, reflected by the symbol ‘+’ implies that the characteristic is well developed in the concerning property right. The symbol ‘-+’ means that the characteristic is developed on a medium level; and the symbol '-' expresses that the characteristic is badly or not at all represented in the property right.
The conclusion from these ratings of the characteristics of the property rights is that the property rights were well developed for the construction of the waterway and the building of the hydro-power plants. It is remarkable that, with the exception of the period of the Third Reich and the after-war period, the 1921 and 1922 definitions of the property rights could do without any adaptation until 1976. This stability can be regarded as a sign for the effectiveness of the property rights.

Table 7.2 Property rights for the Rhine-Main-Danube waterway

What property Right (PR) The treaties	Elements of property rights: usus, usus fructus, abusus	How clearly is the right defined	Is the right transfer-able	Exclusivity against third parties	Possibility of expropriation of the residual return
The concession treaty; 30-12-1921. Concession to the RMD AG. 1.a The right to build the high capacity waterway from Aschaffenburg to the border of the Reich near Passau.	Usus fructus	+	-	+	-
1.b The RMD AG hands over the waterway facilities to the Reich once these facilities are completed. The Reich will operate and maintain these waterways.	Usus fructus	+	-	+	-
1.c The right to build hydro-electric facilities within the border of Bayern at the Main, the Dunaube and the Lech. Operate and exploit these facilities for a period a 100 years, but no later than 2050.	Abusus	-+	-	+	-
1.d The Reich and the state of Bavaria take the obligation to underwrite the loans of the RMD AG.	Usus fructus	+	-	+	-
The 'Rhein-Main-Donau Gezets': 11-5-1938. 2 Nationalisation: The Reich takes the construction of the waterway under its direct control. The earlier treaties between the Reich, the states and the RMD AG are superseded. Hydro power plant construction and waterway construction are separated.	Abusus	+	-	+	-
Transition treaty: 09-09-1949 3 Between the bi-zone authority, the Free State of Bavaria and the RMD AG. The RMD AG was returned her pre-war rights and concession duties.	Usus fructus	+	-	+	-
The extension treaty: 16-09-1966. 4 The Federal Rebublic of Germany is the lawful successor of the bi-zone authority.	Abusus	+	-	+	-
Canalisation treaty; 11-08-1976. 5 The RMD AG is given the task to canalise the Danube in addition to the 1921 concession treaty.	Usus fructus	+	-	+	-
Settlement treaty; 11-08-1976. 6 Specifications of the concessions from 1921 regarding hydro-electric power plants.	Abusus	+	-	+	-

7.7.2 Governance structures

The economic rationale of organisations under NIE is assumed to be that of economising on transaction costs. According to this hypothesis, governance structures are aligned with transactions in such a way as to effect a transaction cost minimisation. The conclusion from TCE is that with incomplete contracts and opportunism transaction costs will be high in order to counteract opportunism. To minimise these transactions costs, proper governance structures where the transactions will be fulfilled become important. Governance structures are all situated on a continuum that has on the one end the complete competitive market and on the other the hierarchy. Hybrids are intermediary forms of governance structures.

Now TCE predicts that if asset specificity and uncertainty are both high, which is generally the case in long-term contracting, the governance structure will move from more hybrid forms to more hierarchical forms of governance. In cases of a high frequency of transaction recurrence, parties will be inclined to rely more on hybrid forms of governance. Parties then are more mutually dependent and this dependency will protect them against opportunistic behaviour.

In table 7.3 the stages of the construction of the Rhine-Main-Danube waterway are presented. For each of these stages transactions are identified together with the belonging characteristics according to TCE. The governance structures for the project are mainly classified as being of a hybrid form. Only the governance structures of the designing and building stages are hierarchies. The question now is what kind of hybrid governance is used: compliance control or exploratory control. These two forms concern both long term contracts to induce relation specific investments. Compliance control hybrids are characterised by reasonably full specification of results or actions with focused monitoring systems for compliance control based on predefined, contractually anchored standards. Exploratory control hybrids are characterised by general trust agreements, which express expectations of long-term relations to induce relation-specific investments. Here monitoring makes use of standards that are not specified beforehand against which to assess performance. As was concluded in chapter 3, it may well be that a hybrid is less susceptible to uncertainty than other governance structures. This makes a hybrid an efficient governance structure in cases of high uncertainty.

First we have to admit that investments in infrastructure are highly idiosyncratic. Investments for both the waterway and for the hydro-electric power stations are not re-deployable. We

also have to admit that investing in infrastructure demands long-term contracting with a high degree of uncertainty. The asset specificity of the Rhine-Main-Danube project, together with the incomplete contracting, which necessarily stems from the high degree of uncertainty, makes parties vulnerable to opportunistic behaviour.

In the Rhine-Main-Danube project one of the striking characteristics of certainly the first state treaty, but also of all the other treaties, is that they only express intentions. The governance structure that is formed by the series of treaties can be regarded as a form of exploratory control hybrid governance. The long term contracts mainly specify the general terms and objectives for the project and sometimes they specify mechanisms for decision making and dispute resolution. In none of the treaties are contingencies specified. The treaties specify in general terms the goals of the actions to be carried out by the contract parties.

Table 7.3: Stages in the development and realisation of the Rhine-Main-Danube waterway and features from transaction cost economics

Stage	Year	Parties and treaties involved	Transactions and characteristics	Governance structure	Rating
Planning	1892	German Rhine Main Danube Canal and Shipping Society.	Delivery of the plan.		
	1917	Main-Danube Association.	Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity high.	Exploratory control hybrid.	+
	1921	German Reich, the Free State of Bavaria and Baden, on the basis of The Main-Danube state treaty and the Additional treaty.	Agreement on building a waterway. Agreement on the construction of the waterway by a private company. Agreement on connection between waterway construction and hydro-electric power production. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge: human asset specificity, low.	Exploratory control hybrid.	+
Designing	1922	The RMD AG. On the basis of the property rights from the construction treaty. The RMD AG was given the task to plan the construction of the waterway and to act as construction principal.	Technical design of the canal: the specifications and drawings. Recurrence: low Uncertainty: technical uncertainty high Asset specificity: body of knowledge, human asset specificity high.	Hierarchy	+

Table 7.3: Stages in the development and realisation of the Rhine-Main-Danube waterway and features from transaction cost economics. (Continuation)

Stage	Year	Parties and treaties involved	Transactions and characteristics	Governance structure	Rating
Financing	1921	The Reich, and Bavaria: On the basis of the Main-Danube state treaty: RMD AG through production of electricity.	Delivery of the financial means for constructing the waterway, including the financial means for building the hydro-power plants. The principle of partly financing the project by returns of the hydro-power production. Recurrence: low Uncertainty: high Asset specificity: middle.	Hybrid	+
	1925	RMD AG, The Reich and Bavaria. Additional treaty:	Additional financing by the Reich and Bavaria in a ratio of 45:26.		
	1949	The Bizone authority, the Free State of Bavaria and the RMD AG. Transition treaty.	Conformation of the 1921 and 1925 treaties.		
	1966	Federal Republic and Bavaria. Two treaties: the Financing treaty and the Extension treaty.	To provide finances to speed up the construction of the north stretch of the canal. The Bund, Bavaria, the city of Nürnberg together with own means of the RMD AG. The Extension treaty: More specific provisions about the financing by the Federal Republic and Bavaria The obligation by the contacting party that failed to provide the financial means to underwrite the loans issued by the RMD AG.	Hybrid, The basis structure, laid down in the 1921 Main-Danube treaty, has never really been altered.	+
	1976	Federal Republic, Bavaria and RMD AG Treaty to canalise the Danube.	Financing of the canalisation of the Danube by the Federal Republic and Bavaria.		

Table 7.3: Stages in the development and realisation of the Rhine-Main-Danube waterway and features from transaction cost economics.(Continuation)

Stage	Year	Parties and treaties involved	Transactions and characteristics	Governance structure	Rating
Building	1921-1992	The RMD AG on the basis of the property rights of the 1921 concession treaty and the 1922 construction treaty. Together with the property rights from the 1976 treaty for ongoing canalisation of the Danube.	Construction of the canal. Recurrence: middle Uncertainty: high Asset specificity: high.	Hierarchy	+
Own, operate and maintain		Federal agency of water and shipping management. On the basis of the property rights from the concession treaty of 1921.	Operation and maintenance of the canal and the waterway: Water level management. Recurrence: high Uncertainty: middle Asset specificity: high.	Hierarchy	+
		RMD AG and power companies. RMD operates power plants for a period of 100 years. On the basis of the property rights from the concession treaty of 1921.	Operation and maintenance of the hydro-electric plants. Delivery of hydro-electricity. Recurrence: high Uncertainty: middle Asset specificity: high: Locked in.	Market	-
Transfer		Federal agency of water and shipping management and RMD AG. The RMD AG is now owned by E.ON AG.	At completion the canal stretches were handed over to the the federal agency. Recurrence: low Uncertainty: low Asset specificity: low.	Market	+

Another indication for the exploratory control hybrid governance structure for the Rhine-Main-Danube project is that the complete text of all 10 treaties counts only 41 pages. The first two treaties from 13 June 1921 together with the additional treaty from 1925 count only seven pages. Even the 1966 treaties to finance parts of the actual canal are seven pages for two treaties, only specifying that Bavaria and the Federal Republic would pay certain amounts of money for specified canal sections. Another indication of exploratory control hybridization is the text of section 6 of the 16 September 1966 treaty, where it is explicitly stated that when adaptations are needed, these adaptations will be constituted in a trustful cooperation.

For the designing and buildings stage the RMD AG was the governance structure. This is a hierarchy, in which a special kind of integration took part. TCE predicts that if the degree of asset specificity and the frequency of the transactions are high, the most efficient governance structure will be a hierarchy formed by vertical integration. In the Rhine-Main-Danube project asset specificity is high. To see this more clearly think of what the situation would have been like if there were one organisation for the generation of hydro-electric power and another for the construction of the waterway. They would have had to deal with each other perhaps on a daily basis. For instance, constructing a hydro-electric power station near Aschaffenburg would have influenced the Main's canalising not only near Aschaffenburg but also further upstream. Conflicts of interests could easily have emerged between the generation of hydro-electric power on the Main, Danube and the tributaries and the interest shipping has in there being sufficiently high water level in the waterway. Solving these conflicts would have caused transactions costs to rise. The RMD AG therefore, while unifying the generation of hydro-electric power and construction of the waterway, is a transaction cost economising governance structure.

This was also noticed by Bader in his 1982 publication when he said that thee combination of dam and lock building together with power plant construction and management allowed the RMD AG to produce efficient hydro-electricity even with low differences in water levels. As Bader sees it, this created the possibility to partly finance the construction of the waterway from the project itself.

After completion of the canal and the waterway in 1992 the function left for the RMD AG was mainly to operate the hydro-electric plants. The generated power was sold on the market. This made the RMD AG vulnerable to opportunistic behaviour because asset specificty from

the side of the RMD AG, as the owner of the power plants, was high. From a TCE veiwepoint it is not a suprice that in 1994 the RMD AG was sold to German power companies.

7.8 Conclusion: answering the research questions

The first specific research question is to identify the characteristics of the Rhine-Main-Danube waterway's history. First it is the long-existing idea of a waterway to connect the Rhine and the Danube. Already in the nineteenth century did a canal connecting the Main and the Danube exist, the ‘Ludwig-Main Kanal’. But this canal was too small and lost competition to emerging railroads. However the idea of a high-capacity waterway between the Rhine and the Danube stayed alive. Important here was the private organisation of the 'German Rhine Main Danube Canal and Shipping Society,’ that culminated in the Main-Danube Association. This organisation demonstrated that a waterway link between the Rhine and the Danube was technically possible and feasible. In a process of compensating the German state of Bavaria for negative effects of the new federal transport policies, negotiations were opened between the Reich and Bavaria to build a high capacity waterway between the river basin of the Rhine and that of the Danube, implying canalisation of the Main and the Danube. Already from the beginning it was decided that the waterway would be built by a company according to private law, the Rhein-Main-Donau AG (RMD AG), and that the building of the waterway would be connected with the generation of hydro-electricity. A series of treaties was concluded between the Reich, the State of Bavaria and sometimes also the RMD AG, who had got the concession to build the waterway and to generate the hydro-electricity. This structure of the treaties and the RMD AG lived trough the hyperinflation in the 1920s, the Second World War, and the doubts of finishing the canal in the 1970s. Throughout the long construction period from 1921 to 1992 the basic treaties and the concessions established between 1921 and 1925 were never altered, but instead confirmed and adapted to new situations by additional treaties.

Now the question is what the features are of NIE that can be applied to the study of the Rhine-Main-Danube waterway. Also here property-rights theory and TCE can offer valuable insights. Property rights were formed by the treaties between the Federal Republic of Germany or the 'Reich', The Free State of Bavaria and the RMD AG. The governance

structure was also determined by treaties between the Federal Republic and the Free State of Bavaria. The RMD AG did not play a role as one of the parties to the contract in the treaties that specified the governance structures. It turned out that the governance structures for the project could be analysed making use of transaction cost economics. Before 1922 these governance structures were of a hybrid form. With the establishment of the RMD AG a hierarchy was introduced, and remained present in the designing and building stages of the project. The financing stage was again a hybrid form, because here the RMD AG had to cooperate with the 'Reich' or the Federal Republic and the state of Bavaria.

The third question is: what relevant governance structures existed for the investment in the Rhine-Main-Danube waterway? These governance structures are the hybrids structures formed by the treaties together with the hierarchy of the RMD AG. Generally speaking the treaties dealt with the financing of the project and the RMD AG built the waterway and the hydro-power plants. It also operated - and still operates - these plants. An illustration of the power and elegant nature of this structure is that all the treaties together only cover a total of some forty pages.

The next question is: how well were the governance structures able to cope with unexpected technical, economic and political events? The strength of the property rights and governance structures is illustrated by the fact that the pre-war structure was restored after the nationalisation period of the Third Reich. After the Second World War, even the 1921 constituting and concession treaties and the 1922 construction treaties were formally restored.

Can NIE help to explain the success or failure of the canal building and the subsequent exploitation of the canals?
It is difficult to specify a success measure for this long lasting project. It is questionable whether cost-containment as a success measure can be applied here, because the building of the complete waterway took a long time and the building of the different and diverse parts was not based on clear cost estimates but was much more a matter of accumulation in the direction of an endpoint, which was the finishing and closure of the Main-Danube canal stretch. But really remarkable is the robustness of the governance structure for the building of the complete waterway, which stayed unchanged through a long series of socio-political and economic shocks.

The conclusion is that from an NIE point of view it is not surprising that the institutional arrangements for the project has proved so robust, since it was a structure suited for transaction cost minimising. The institutional arrangements of the Rhine-Main-Danube project consisted of hybrid forms of contracting by the 'Reich' or the German federal government, the German states and the RMD AG on the one hand and hierarchy of the RMD AG on the other. This hierarchy did well in coordinating the canal building and the hydro-power plant building. As a result asset specific investments in waterway building or in hydro-power plant construction could not lead to opportunistic behaviour. In this respect the RMD AG is a transaction cost minimising structure.
Furthermore the history of the Rhine-Main Danube waterway is an illustration of the NIE's notion that hybrid modes of governance can deal very well with high degrees of uncertainties.

So what can be learned from the history of the construction of the Rhine-Main-Danube waterway in the light of the insights from NIE?
As has been said above, one of the most special features is the hybrid form of governance of the fairly simple treaties that were concluded throughout the realisation of the project. This structure of contracting is an exploratory control hybrid. The contracts are general trust agreements with expectations of a long-term relation to induce relation-specific investments. In accordance with the transaction cost economy this structure was able to incorporate a series of socio-political and economic shocks. But these hybrid institutional arrangements can not be seen apart from the hierarchy of the RMD AG. This hierarchy made it possible to incorporate hydro-electricity generation and construction of the waterway. Because of the reciprocal high-asset specificity of the investments for these two activities the hierarchy of the RMD AG is consistent with the transaction cost theory. The main lesson is that hybrid forms of governance do well in the planning, designing and financing stages and that a hierarchy is needed to build, operate and maintain the project. But these two sets of arrangements need to be connected by a property rights structure that forms the institutional environment.

The implications from the history of the institutional arrangement of the Rhine-Main-Danube project can be illustrated with a present day example, in which cooperation and governance through international public-private partnership could play an important role. With the entry of Bulgaria and Romania into the European Union the Rhine-Main-Danube waterway has

received an extra dimension: for this route to be meaningful substantial investments need to be carried out, especially where the Danube forms the border of Romania and Bulgaria and also in Serbia and Hungary canalisation of the Danube is needed. The governance structures for the Rhine-Main-Danube waterway could be a model for these works to be organised. As was the case with the Rhine-Main-Danube waterway in Germany also here different governments are involved, perhaps now with the EU in the role of the 'Reich' or the Federal Republic. Power plants will also be part of the canalisation here, as well as taking environmental issues into consideration. A lot of different and sometime conflicting interests are involved in these projects. From the success of the Rhine-Main-Danube-construction, it can be argued that creating a private organisation, perhaps a public limited company according to Austrian law, to be given concession to canalise the Danube at this stretch of the river, could be a sound and transaction cost minimising governance structure.

8. Summary and conclusions

8.1 Introduction

Large infrastructural projects typically take long periods of time to realise, while the subsequent pay back period takes even longer. The central starting point for this thesis is that such long time horizons have consequences for the way decisions are or have to be made. With large infrastructures different layers of governments and governmental bodies are involved, pressure groups representing different stakeholders can have substantial influence, and so-called private parties like industry or public-private partnerships representing special interests are involved. There is also seldom only one decision; it is more a decision process where interaction between parties slowly leads to a more or less definite situation. It is not a linear decision-making process, but most of the time cyclical in nature. Solutions are found during the process and not decided upon at the outset, except for issues related to the project's main direction. Furthermore in the decision-making process the uncertainty that follows from lengthy construction times and even longer economic lifetimes is mostly very large. This all make the institutions and governance structures in which these investments are realised important for the outcome. The premise of this thesis, then, is that the institutional and governance structures through which a large infrastructure project is realised are of great importance for the final result. In studying these structures one can gain insight into the prevailing characteristics of efficient governance structures for the types of infrastructure projects at hand. Fortunately, an economic theory can be used to help identify these prevailing characteristics: new institutional economics (NIE) and more specific transaction cost economics (TCE).

Three case studies will be undertaken in this study analysing governance of large infrastructures using NIE and TCE. These case studies concern 3 canal projects: the canals of the Dutch King William I from the first half of the nineteenth century, particularly the Noordhollandsch Kanaal and the Zuid-Willemsvaart; the Suez Canal, built in the second half of the nineteenth century; and the Rhine Main Danube waterway, which came into existence after the Second World War.

In this concluding chapter of the thesis, an overview will be given of the main characteristics of transaction cost economics (TCE) and property-rights theory which have been applied in this study. This is followed by a summary of the analytical tools and the analytical framework that have been used. In section two, the research questions will be dealt with, as has been done in the preceding chapters, including comparisons between the three case studies followed by some concluding remarks. In the general conclusions section, the central research question will be answered and the general outcomes of this thesis' analysis will be described. On the basis of these general outcomes, a model will be presented that reflects a generalisation of the three canal projects' histories with regard to institutional environments and governance structures.

8.2 Transaction cost economics and property rights theory

Transaction cost economics (TCE) and property-rights theory are both part of new institutional economics (NIE), an interdisciplinary theory combining economics, law, organisation theory, political science, sociology and anthropology. The goal of NIE is to understand the institutions of social, political and commercial life by studying these institutions and how they interact with organisational arrangements. Here, a distinction is made between institutions and organisational arrangements. Institutions are the written and unwritten rules, norms and constraints that humans devise to reduce their uncertainty and control their environment. These include (i) written rules and agreements that govern contractual relations and corporate governance, (ii) constitutions, laws and rules that govern politics, government, finance and society more broadly and (iii) unwritten codes of conduct, norms of behaviour and beliefs. The rules should be clearly distinguished from the players. In simple terms, rules are the institutions and the players are the organisations. Institutions are not necessarily or even usually created to be socially efficient; instead rules, or at least the formal rules, can also be created to serve the interests of those with the bargaining power to devise new rules.

NIE works at two levels of analysis. These levels are based on the distinction between rules and players. There is a macroscopic level of the rules, the institutional environment, and the microscopic level of the organisations or the institutional arrangements. Oliver Williamson's

TCE, geared towards the micro-level, will be used in this study. Property rights theory will be used to deal with the macro-level of matters and will be regarded the canal projects' institutional environments.

The common base for TCE and property rights theory is the neo-classical starting point of economic agents being constrained maximisers: economic agents are assumed to maximise some specified and well-behaved goal function under constraints like budget restrictions.

With this common base TCE and property rights theory are part of the "Efficiency Branch" of NIE and comparative static analysis prevails. Property rights theory and TCE can be said to address the same issue of the existence of some specific type of firm. The TCE of Williamson is not extendable to the issue of the dynamics and the development of firms. It is also not extendable to the level of the individuals that make up the firm. Managerial and certainly entrepreneurial behaviour is outside the scope of TCE and also of property rights theory.

Applying property rights theory and TCE means that this study of the governance of the three canal projects is restricted to the efficiency branch of NIE. It concentrates on a comparative static description of the property rights and the governance structures.

8.2.1 Alignment according to transaction cost economics

The basic assumption of TCE is that organisations economise on transaction costs by aligning governance structures with transactions. In practice, it turns out that transaction costs are very hard to measure directly, because the concept of transaction costs contains very different cost categories that are not all measured in a normal accounting system. This would have formed a critical obstacle in testing transaction cost theory. However, in empirical studies there is no need to measure transaction costs directly. This need was removed by Williamson's reformulation of the transaction cost argument in terms of the effects of observable attributes of transactions on the transaction cost minimising ability of a governance structure.

A relaxation of the neoclassical starting points is that in TCE agents are assumed to be bounded rather than perfectly rational. Consequently, complete contracting is regarded to be infeasible. Given the infeasibility of complete contracting, transaction costs can only be held in check by a proper governance structure. The other starting point of TCE is the existence of opportunism. Opportunism refers to the self-interest of economic agents combined with their own guile, causing people to sometimes say one thing and do another. Both these starting

points can be said to be modifications or extensions of the neoclassical assumption of rational behaviour.

Bounded rationality and opportunism are characteristics of the economic agents. Together with these characteristics, the most important parts of the basic explanatory structure of TCE are the observable attributes of transactions: frequency, uncertainty and asset specificity or idiosyncrasy. Given opportunism and bounded rationality, differences in the attributes of transactions determine which governance structures most efficiently economise on transaction costs.

Uncertainty refers to the problem of specifying intended performance beforehand and predicting the environment within which the contract is to be executed. Asset specificity refers to the degree that an asset can be redeployed for alternative uses and by alternative users without sacrifice of production value. It corresponds to the opportunity losses that may arise when the transaction requires commitment of specialised, custom-made products, processes or knowledge. Frequency does not need to be defined; it has no particular connotation in TCE.

Transaction cost considerations influence what organisational form and design are chosen. The decisions about this choice are particularly sensitive for the role of asset specificity, uncertainty, and frequency. In the empirical literature it is recognised that asset specificity and uncertainty are the two most important and decisive characteristics of transactions.

Transactions are the basic unit of analysis in TCE. The secondary unit of analysis is the governance structure. According to the definition of Williamson, a transaction occurs when a good or service is traded across a technologically separable interface. The organisation of technologically separable activities is not technologically determined but is a matter to which the comparative analysis of alternative forms of governance may usefully be brought to bear.

It this thesis it is argued that in a case of pure collective goods TCE is not applicable. A pure collective good is a good that is not excludable or subject to rivalry. A main characteristic of a collective good is that no private property rights are specified: with no private property rights or no specified usufruct rights, a good becomes an open or restricted access common resource as has been described in chapter 3. Consequently, there are no transactions, and thus the reasoning is that in the absence of private property rights there is no ground for the application of transaction cost economics. The building of a canal is not a collective good since property rights can be specified. Therefore, there are no a priori obstacles for the application of TCE.

8.2.2 Governance structures

The secondary unit of analysis in TCE is the governance structure. Williamson distinguishes three discrete structural modes of governance: market and hierarchy as two opposite poles of a spectrum and the hybrid as an intermediate form. Asset specificity is the attribute with the highest influence on the alignment. When the level of asset specificity increases, a safeguard against opportunistic behaviour is needed in the form of hybrid or hierarchical governance. A rising level of the attribute uncertainty heightens this need.

Table 8.1 specifies the transaction cost economising modes of governance according to the attributes of the transactions. When the level of uncertainty and of asset specificity is low, the market is the proper governance structure. With medium levels of asset specificity, hybrid forms of governance will be most suitable to minimise transaction costs. But when there is a high level of uncertainty in this situation, the most proper governance structure, according to TCE, is the hierarchy. With high levels of asset specificity, no matter what level of uncertainty, TCE predicts that the hierarchy will minimise transaction costs.

Table 8.1 The alignment: Degrees of asset specificity and uncertainty and the appropriate governance structures

	Asset specificity		
Uncertainty	Low	Middle	High
Low	Market	Hybrid	Hierarchy
Middle	Market	Hybrid or Hierarchy	Hierarchy
High	Indeterminable	Hierarchy	Hierarchy

It appeared that a need was present to go beyond a generic treatment of transaction cost economics towards a more elaborate description of recent developments regarding the hybrid governance structure. Hybrid forms of governance are characterised by a great diversity of agreements among legally autonomous entities doing business together, mutually adjusting with little help from the price system and sharing or exchanging technologies, capital, products, and services, but without unified ownership. Based on durable relationships, hybrids often coordinate more efficiently than markets while avoiding integration and its bureaucratic burden of a hierarchy. According to standard theory, hybrids are vulnerable to uncertainty. But it has become clear in the literature that hybrid governance structures frequently occur in situations that are not in accordance with this generic notion in TCE. To deal with this

problem it is suggested to incorporate the effects of trust in governance structures as a new variable into TCE. However, there is also a possible solution to this theoretical problem that focuses on the mechanisms of governance rather than on the variables of transaction cost theory. Speklé (2001) states that there are two ways in which these mechanisms work in hybrid organisations. The first is a more standard class of hybrids with compliance control. Here contracts have specified the results or action with a reasonable level of detail. They are mostly long-term contracts to induce relation-specific investments. The control mechanism focuses on monitoring, based on predefined and contractually anchored standards. Hostage exchange serves as a safeguard against opportunism.

On the other hand, there are hybrids that are characterised by exploratory control. Here contracts are general trust contracts, and most contain an expectation of a long-term relation specified to induce relation-specific investments. Standards against which to assess performance emerge during contract execution, accompanied by broad monitoring of actions and performance. One of the parties usually has the right of preventive interventions, and information and market-based incentives are used as protection against opportunism.

The conclusion of this elaborated specification of the transaction cost theory on hybrids is that it is very well possible for exploratory control hybrids to have an efficient governance structure in situations of high uncertainty. They are less susceptible to uncertainty than has been assumed in the past. To study the phenomenon of hybrid resistance against higher levels of uncertainty, the generic cluster of hybrids can be divided into two subcategories: the compliance control-like type and the class of hybrids that are based on exploratory control. If this is a workable distinction that can be applied in case studies then there would be no need to introduce new variables in the theory, like trust. Also for the case studies on canal building this is an advantage. It can be expected that hybrid forms of governance will play a rather important role in canal building as was explained in chapters five, six and seven. All the more so when hybrid forms of governance are also possible in situations where public governance is involved.

8.2.3 The four-layer model

The four-layer model of Williamson is described in chapter two of this thesis. This model is based on four levels of social analysis. The model presents a framework for analysis depending on the kind of social constraint, institution or governance structure that is present

at a certain level. It is a hierarchical order starting with norm and value systems and ending with the firm as a production function. Level I is the level of the informal institutions and is considered a given by most institutional economists. Institutions at this level change very slowly. Such institutions can be seen as informal constraints with a pervasive influence upon the long-term nature of economies. The second level is the level of the institutional environment. The structures observed here are partly the product of evolutionary processes, but they are also partly the product of deliberate design. The institutional environment consists of formal rules like constitutions, laws and property rights. At this level, the opportunity for first-order economising exists: get the formal rules of the game right. However, cumulative change of a progressive kind is very difficult to orchestrate. Different kind of shocks will occasionally produce a sharp break from established procedures. Major changes in the rules of the game occur on the order of decades or centuries. Much of the economics of property rights is of a level II kind.

On the third level of Williamson's scheme, the institutions of governance or institutional arrangements are located. Here the governance of contractual relations becomes the focus of analysis. The unit of analysis is a transaction, and Williamson's TCE comes into play. With all complex contracts unavoidably incomplete, adaptation becomes the central problem of economic organisation. TCE turns its attention to the ex post stage of contracts. Level III entails, what Williamson calls, second-order economising: getting the governance structures right. The discrete structural analysis of level III is to be distinguished from level IV, which is the level at which neo-classical analysis works. Optimality apparatus, often marginal analysis, is applied in which the firm is represented by a production function.

One of the main analytical tools in this four-layer model is the distinction between the institutional environment on level II and the institutions of governance on level III. One can concentrate on the application of TCE and the economising mechanism of governance structures only when the comparative analysis is concerned with the alignment of governance in relatively short time periods or similar jurisdictions. Then one can assume that the institutional environment - and more important the embedding of the governance structures in the institutional environment - does not change. However, the three canal projects were designed or built in situations of changing institutional environments. Consequently, a study on the governance of the three canal projects needs to pay attention to level II economising and the influence of this economising on the TCE efficiency of level III governance structures. In this study, the institutional environment is represented by the property rights

devised for the canal building. These property rights are taken as shift parameters in the function that describes the TCE of a governance structure, depending on the set of transaction's attributes. All three projects show instances of changing property rights which affected the governance structures of the projects. Therefore, the analyses of the canal projects will first concentrate on property rights for the projects described, and then the governance structures will be analysed by making use of TCE. To account for the broader environment in which the realisation of the projects took place rather than only the property rights, the three case studies also include an overview of relevant aspects of the economic and political history. A full account will be given of each canal's generally long construction period, from the first ideas and plans to the canal's completion. The next section will elaborate on the subject of property rights and will describe the way property rights are used in the analysis of these three canal projects.

8.2.4 Property rights

As mentioned in chapter 3, property rights are broadly defined as the set of laws and customs, formal and informal rules, determining how individuals may gain access to resources and the range of possible uses they may make of them. They include rights and obligations with respect to use, maintenance and improvement of resources, rules of exchange or contract, and rules of liability when use of a resource by one economic agent comes into conflict with the rights of another agent.

It is suggested that many categories of property rights exist, but most authors confine their attention to the specific property rights of ownership. Usually this right is subdivided into three elements:

1. Usus rights: the right to use an asset.
2. Usus fructus: the rights to appropriate returns from the asset.
3. Abusus: the right to change the form and substance of the asset as well as the right to bear the consequences from changes in the value of the asset.

Subsequently, the characteristics of the rights will be identified and assessed. Three essential characteristics of a property right can be distinguished. These are:

a. How clearly the right is defined.
b. The exclusivity of the right.
c. The transferability of the right.

The value of the property right is affected by the clarity of the definition of the right. In general, more clarification means a higher value in terms of the effectiveness of the property right for the outcome of the economic process. Sometimes, however, more clarification implies a lower value, because it then too much limits the possibilities for utility maximising behaviour by economic agents. The second characteristic of exclusivity implies that the holder of an exclusive property right is legally permitted to withhold use of the resource to other individuals, thus affecting the potential value of that resource to the holder of the rights. The third characteristic that defines a property right is the transferability of the rights. This characteristic allows the holder of the right to obtain returns from the resource. Transferability of the right to a resource may be in full, such as in a sale, or in part, such as through a lease. Restrictions may be placed on the transfer of a right, which implies limiting control rights and residual rights.

In theory, a property right has a high quality when it is clearly defined and when the right is transferable, when it offers exclusivity against third parties and when the possibility of expropriation of the residual residue is low.

So what are the implications of rights assignment in terms of its effect on behaviour and resource allocation? Within the neo-classical economic model, private property rights are exercised with the purpose of maximising the total societal value of the resources. Important here is that in the neo-classical model, transaction costs are assumed to be zero. As a consequence of zero transaction costs, the Coase theorem states that the efficient allocation of resources is achieved regardless of how the rights were initially assigned. To describe the consequences of positive transaction costs for the effectiveness of the property rights, a distinction can be made between economic property rights and legal property rights. Economic property rights are the individual's ability, in expected terms, to consume the good directly or indirectly through exchange. Legal property rights are the rights recognised and enforced, in part, by the government. The economic property rights guide the realisation of a transaction in first instance. With positive transaction costs, economic property rights become more effective relative to legal property rights. The result is that the decision-maker, who does not have the legal residual right, may be able to expropriate the right of residual return.

Thus, as a consequence of positive transaction costs, the assignment of property rights can have substantial influence on the efficiency of a governance structure.

What is important for the application of property rights from a TCE perspective is the distinction between institutional environments and institutional arrangements. As Douglass North has pointed out, the institutional environment can be seen as "the rules of the game" and an institutional arrangement as "the play of the game." TCE relates to this two-level approach by treating the institutional environment as a set of shift parameters. Changes to these parameters shift the comparative costs of governance. The level of the transaction costs for a given governance structure not only depends on the attributes of a transaction but also on the existing institutional environment. Property rights belong to the institutional environment.

A change in the property rights influences the level of the transaction costs. But the governance structures are not affected equally. At equal levels of asset specificity and uncertainty transaction costs for the different governance structures will vary due to changing property rights. This implies that changing property rights will change the comparative costs of governance.

Table 8.2 Basic property rights theory questions

What property Right (PR)?	- state PR or - private PR or - communal PR
What elements of property rights?	- usus - usus fructus - abusus
Three characteristics of a property right:	
1. How clearly is the right defined?	Scored according to the rating system. (Explained below)
2. Is the right transferable?	Scored according to the rating system.
3. Exclusivity of the right?	Scored according to the rating system.
Based on the possible difference between economic and legal PR:	
Opportunity of expropriation of the residual return?	Scored according to the rating system.

In table 8.2 a summary is given of the main questions that can be asked regarding property rights theory when carrying out the case studies. This summary will serve as the analytical scheme for the institutional environment of the canal building projects. A rating system will be applied that indicates the quality or value of the property right. The relevance of these characteristics is that they influence the quality of the property rights as an institutional

environment. In theory a property right has a high quality when it is clearly defined and when the right is transferable, when it offers exclusivity against third parties and when the possibility of expropriation of the residual revenue is low. Quality will be indicated by the following rating system:

+	positive
+/-	neutral
-	low.

The score of a '+' implies that this characteristic is regarded to be well developed in the concerned property right. The symbol '+/-' means that the characteristic is developed on a medium level, and the symbol '-' expresses that the characteristic is badly or not at all represented in the property right and that therefore the property right has a low quality.

8.2.5 Framework for applying transaction cost economics

The analytical framework for applying TCE and property-rights theory is built on a theoretical description of the stages of a project. This description of the stages makes it possible to discern the various parties and types of transactions involved in the realisation of a large infrastructure. The stages are placed in a theoretically logical order, which means that in practice the work described by the stages will show a much more complicated pattern. The stages are:

1. Planning
2. Designing and financing
3. Building
4. Own, operate and maintain
5. Transfer

Stage 5 may be relevant for some projects, but it was not for the canals of King Willem I, because they were from the beginning state owned canals. This was not the case with the Suez Canal and the Main Danube canal. The Suez Canal was owned by its builder the Suez Canal Company until the nationalisation of the canal in 1956. The Main-Danube canal was owned by the RMD AG during the stage of its building. At completion of the canal in 1992 the

ownership was transferred to the federal Republic as was determined in the concession treaty, specifying the concessions of the RMD AG.

Planning refers to the stage in which the idea of the project is developed. In this stage, the feasibility of the project is under scrutiny. Normally this stage ends with the decision to start realising the project.

In the second stage, the canal will be designed on the drawing boards. This is the stage of the blueprints. In connection with the technical design, the modes of financing the canals will be decided and actual financing arrangements will be realised. In the building stage, the actual canal is built. Here contractors and subcontractors are involved in carrying out the work.

The next stage is when the canal is finished and taken into operation. It is conceivable that in this stage the matter of ownership with regard to operating and maintaining the canal will be established. Ownership can change over the course of the project, and the 'operations' owner can be a different party than the party in charge of the designing and building stages.

The transfer is the stage in which a possible concession to operate the canal will end and at least some property rights vested in the canal will be transferred to another party. In this stage, the economic lifetime of the canal possibly ends, although the physical lifetime has not yet ended. This framework of stages makes it possible to use TCE for the different stages of a project and to recognize that transactions differ by stage.

On the basis of this framework, a table can be designed which will serve as the analytical scheme for applying TCE. In this table, the columns represent the relevant features from TCE and the rows represent the stages of the project. Table 8.3 presents this analytical scheme. One extra column is added in which the parties are described that are involved in the relevant stage of the project. In the next olumn the transactions and foremost the attributes of the transactions are specified. In this column the question will be answered as to what level of uncertainty and asset specificity is involved in the transaction. The governance structure which prevailed in the various stages of the project will also be identified. In the last column, a rating is presented on the match between attributes of the transactions and the governance structure. Here the alignment hypothesis from TCE will be used, which is: governance structures are aligned with transactions in such a way as to minimise transaction costs. The rating presents the expected effect according to TCE of the alignment between the prevailing governance structures in the stage concerned and the transactions in that stage. This is indicated by the following rating system:

+ positive effect: transaction cost minimising

+/- neutral effect: no effect on transaction costs

- negative effect: transaction costs will increase

Table 8.3 The analytical scheme for applying TCE

	Parties involved	Transactions and attributes	Governance structure	Rating
Planning				
Designing				
Financing				
Building				
Own, operate, maintain				
Transfer				

For each of the stages in this table, the following method has been used to apply TCE and the alignment hypothesis:

1. Identify the parties involved.
2. Identify a certain category of transfer of goods or services between parties across some technologically separable interface.
3. Determine how they score on key attributes.
4. Identify and rate the matching governance structure in terms of the key attributes of the transaction.

In the planning and designing stage, the transfer of goods and services across a technical separable interface is constituted by the transfer of knowledge and information regarding the construction and financing of a canal to other parties. Asset specificity refers to the knowledge built up by different parties in preparing the plan for a canal, and in designing it. It can be assumed that parts of this knowledge base loses its value outside the transaction to plan the canal. Other parts of the knowledge base, for instance the general technical knowledge, can be applied to other projects. Consequently, asset specificity will not be so high in the planning stage.

The situation changes when the decision to build the canal is taken. Then parties are going to undertake actions. They are going to design the canal and start preparing the financing of the

project. They start investing in the more physical side of the project. These investments only keep their value when the transaction is completed. For instance preparing the financing of the project will only be of value when the project goes ahead as planned. This is a form of high asset specificity, being enhanced along the way towards the end of the project. Physical investments in the project will increase more and more. This is not to say that the enhancement of asset specificity is a straight line going up from the beginning of the project to the end, and that towards the end of the project asset specificity will reach its maximum. It is conceivable that a relation expressing asset specificity as a function of time would show local maxima. Consequently, there could be moments when asset specificity is low. This would give room for starting negotiations again about the terms of the transaction to complete the project.

8.3 Research questions

The overall research question for this thesis is:

Is it possible to determine from new institutional economics (NIE) the characteristics of an efficient governance structure for investments in large infrastructures and for the operation of these large infrastructures?

In this thesis, an efficient governance structure is a governance structure that is aligned with the transactions in accordance with the prescriptions of TCE. This implies that the TCE hypothesis is taken for granted. The hypothesis states that governance structures are aligned with transactions in such a way as to minimise transaction costs. This hypothesis is not tested in this study, but the theoretically assumed results of the alignment process, which are summarised in table 8.1, are taken as the starting point for applying TCE.
In this thesis, the research question will be answered by studying three canal projects: the first being the two canals built by king Willem I, and the other two projects being the construction of the Suez Canal and of the German Rhine-Main-Danube waterway.
In chapter 1 six more specific research questions were formulated in order to answer this overall research question. These more specific questions are:

1. *What are the main characteristics of the histories of the three canal projects?*
2. *What are the characteristics of new institutional economics (NIE) that can be applied to the study of the governance of investments in large infrastructures?*
3. *What are the relevant governance structures of the three canal projects in the light of NIE?*
4. *How well were the governance structures able to cope with unexpected technical, economic and political events?*
5. *Can NIE help to explain the success or failure of the canal building and the subsequent operation of the canals?*
6. *Can we learn from the history of the three canals by applying the insights from NIE?*

In the next subsections, these specific research questions will be answered for each of the three canal projects and comparisons will be made between the projects regarding the specific question.

8.3.1 Main characteristics of the history of the canal projects

The first research question is: What are the main characteristics of the history of the canals? For the canals of King Willem I, the main characteristic was the power the King had both concerning water management and state finances. This made it possible from him to act as a benevolent ruler, at least in theory; in practice, matters are more complicated. In theory, he did not have to work together with other interest groups, and for the financing of his projects he could do without a priori agreement with Parliament, certainly in the beginning of his reign. In practice, the power of the King was limited due to the insufficient juridical apparatus of the constitutional and public law. It has been noticed that the autocratic regime of Willem I failed for three fundamental reasons: first the information flows about the state of government finances were suppressed for a long period: second, it was impossible to replace failing decision-makers like Willem I or his ministers; and, third, there was an increasing lack of control over those decision-makers as a result.

When the financial situation became more difficult, Willem I used the vehicle of the so-called ‘Amortisatiesyndicaat’, through which he had a substantial financial power at his disposal for his infrastructural projects, a power that private parties did not seem to have. This is

illustrated by the history of the privately constructed canals in which public organisations had to play an important role, especially as financiers.

Even more important, perhaps, is that the King commanded information flows regarding his projects through his organisation of water management. As we saw both with the Noordhollandsch Kanaal and with the Zuid-Willemsvaart, his organisation of water management and his direct links with the principal engineers were very important for the realisation of the projects. The question is now what the quality of this information was. Technically there was no problem, or the problems could be managed by the State and the regional water management bureaus. The construction periods of the canals, also of the technically difficult Noordhollandsch Kanaal, were surprisingly short. Most of the time, however, there were no sound economic appraisals of the projects, and uncertainties around the estimates in these appraisals were very high. Typically, the King did not need to possess high quality information on the feasibility of his canal projects. He had the power to decide alone and to realise the financing of the projects, so he did not need to convince other parties about the necessity of the projects. King Willem I was highly involved in the specifications and the results of the different tenders for the construction of different canal stretches for the Noordhollandsch Kanaal. More important is that it has been concluded that, although the King had been given nearly absolute powers in the constitution, the execution of these powers was severely hampered by the absence of an adequate legal structure defining the relations between the central and lower levels of government. It is safe to conclude that during the canal building by Willem I the rules of the game started to change. The position of Willem I was decided by his constitutional rights. But this position was altered by pressure from Parliament, causing him to give up part of his power. He had to accept that the budget right of Parliament came into effective existence. This caused him to seek other ways of financing his projects and to use the ‘Amortisatiesyndicaat’. This, however, was unlawful and triggered an amendment of the constitution that was the immediate reason for his abdication.

The main characteristic of the history of the Suez Canal was that Ferdinand de Lesseps was the right man at the right place in time. He managed to receive the concessions from the Egyptian ruler Said Pasha and he managed to provide the Suez Canal Company with the financial means to build the canal. Of course, though, he acted on a body of preparatory work that was done by other Frenchmen. Decisive here was the moment when it turned out that no difference existed between the sea levels of the Mediterranean and the Red Sea, as from that

moment it became clear that no further major technical obstacles in digging the canal existed. It was then a matter of financing and political decision-making.

One of the most prominent characteristics of the history of the Rhine-Main-Danube waterway was the long existing idea of a waterway that would connect the Rhine and the Danube. Already in the nineteenth century there was a canal connecting the Main and the Danube, the 'Ludwig-Main Kanal', but this was too small and lost competition to emerging railroad networks. However, the idea of a high capacity waterway between the Rhine and the Danube stayed alive. The private organisation of the 'German Rhine Main Danube Canal and Shipping Society' was important here, as the activities of this society cumulated in the Main-Danube Association. This association demonstrated that a waterway link between the Rhine and the Danube was technically possible and feasible. In a process of compensating the German state of Bavaria for negative effects of the new federal transport policies in the early twentieth century, negotiations were opened between the Reich and Bavaria to build a high capacity waterway between the river basin of the Rhine to that of the Danube, a plan that implied canalisation of the Main and the Danube. Already from the beginning it was decided that the waterway would be built by a company according to private law and that the building of the waterway would be connected with the generation of hydro-electricity. A series of treaties was concluded between the Reich or the Federal Republic, the State of Bavaria and sometimes also the Rhein-Main-Donau AG (RMD AG), the company which had the concession to build the waterway and to generate the electricity. This structure of treaties and the RMD AG lived through the hyperinflation in Germany in the 1920s, the Second World War, and even the uncertainty surrounding the completion of the canal in the 1970s. Over the long construction period of 1921 to 1992 the basic treaties and the concessions that were established in the period from 1921 to 1925 were never altered, but confirmed and adapted to new situations by additional treaties.

8.3.2 Features of new institutional economics

The next research question is: What features of new institutional economics (NIE) can be applied to the study of the governance of the investments in the canals? In chapter 5 it was argued that property-rights theory and especially some theoretical notions of Douglass North about the interplay between property rights and the polity are important to interpret the history

of the canals of the King Willem I in the light of NIE. Specifically his notions that the essential conditions in this interplay are that the affected parties have both the information and the correct model to accurately appraise the consequences, and that all the affected parties therefore need to have equal access to the decision-making process.
It also turns out that, for the study of governance of investments in the building of the Suez Canal and in the Rhine-Main-Danube waterway, property-rights theory is an important element in the application of NIE to the respective histories.
The digging of the Suez Canal was based on the property rights of the concessions that Ferdinand the Lesseps had received. These were also the fundamentals for the Suez Canal Company. As for the Rhine-Main-Danube waterway property rights were established by the treaties between the Federal Republic of Germany or the 'Reich', the Free State of Bavaria and the RMD AG.
The conclusion is that it is not enough to concentrate only on the governance structures and their potentially transaction cost minimising settings. This is because property rights act as shift parameters in this transaction cost economising. Thus, property rights as the institutional environment cannot be taken as constants but need to be studied. Table 8.3 gives an overview of the scores of the dimensions of the property rights for each of the canal projects.
It is a summary of tables 5.2, 6.1 and 7.2 on property rights of the three case studies. The numbers of the row entry per case study refer to the numbers of the row entry in these tables.

A rating system is applied that indicates the value of the property right depending on the characteristics of property rights discussed earlier. The relevance of these characteristics is that they influence the value and the effectiveness of the property rights as an institutional environment. This is indicated by the following rating system:

+	positive effect
+/-	neutral effect
-	negative effect.

The score of a ‘+’ implies whit a particular characteristic implies that this characteristic is well-developed in the concerning property right. The symbol ‘+/-’ means that the characteristic is developed on a medium level; and the symbol '-' means that the characteristic is badly or not at all represented in the property right.

The conclusion that can be drawn from this table is that the property rights for the canals of King Willem I (Canals KWI) were not clearly defined and exclusivity was relatively low. Apart from transferability, this conclusion is not really applicable in the case of the Rhine-Main-Danube waterway because the property rights were explicitly given to the RMD AG, so the property rights for this case were well-specified in comparison with the other two cases.
The quality of the property rights for the Suez Canal takes a middle position, because in the stage of building the canal it turned out that there were problems for the Suez Canal Company, concerning her land rights and the right to use the corvée, a kind of forced labour. These problems needed a special ruling of Emperor Napoleon III to be solved and were an adaptation of the consisting property rights.

Table 8.4 Summary of the scores on the dimensions of the property rights for each of the canal projects

		property rights	clearly defined	Trans-ferable	Exclu-sivity	expro-priation
Canals KWI	Constitution 1814/15: Finances	1 Abusus	+/-	-	+/-	na
	Constitution 1814/15: Art. 215	2 Abusus	+/-	-	+	na
	Constitution 1814/15: Art. 216	3 Abusus	+	-	+	na
Suez	First Concession: 1854	1a Abusus	+/-	+/-	+	na
		1b Abusus	+	+	+	na
		1c Abusus	+	+	+	+
	Second Concession: 1856	2a Abusus	+/-	+	+	+/-
		2b Usus fructus	+	na	+	na
		2c Usus	+	+	+	na
	Ruling of Napoleon III: 1864	3a Abusus/usus	+	+	+	+/-
		3b Abusus	.	.	.	.
	Status Suez Canal Company	4 Abusus	+	+/-	+	na
	Convention of Constantinople	5. Usus	+	na	+	na
RMD	Concession treaty: 1921	1a Usus fructus	+	-	+	+
		1b Usus fructus	+	-	+	+
		1c Abusus	+	-	+	+
	Nationalization: 1938	2 Abusus	+	-	+	+
	Transition treaty: 1949	3 Usus fructus	+	-	+	+
	Extension treaty: 1966	4 Abusus	+	-	+	+
	Danube canalization treaty: 1976	5 Usus fructus	+	-	+	+
	Settlement treaty: 1976	6 Abusus	+	-	+	+

The numbering of the property rights refer to the numbers of these rights in the tables on property rights of the case studies in the chapters 5 to 7.

Not only property rights theory is applicable in studying the three canal projects, but also TCE, in the sense that it can be used to analyse the governance structures that exist in the different stages of a project. It turned out that in each of these stages - the planning, designing and financing, building and operating stage - specific transaction and governance structures

can be identified and can be tested against the prescriptions of TCE. This will be described in more detail in the next subsection.

8.3.3 Governance structures

The third question is: What are the governance structures that were relevant for investing in the three canal projects and for operating the canals?

With the cases of the canals of King Willem I, the most important governance structures were based on the constitutional rights of Willem I. Consequently, in most stages these governance structures were hierarchical and based on the power of the King with respect to state finances and water management. Exceptions were the governance structures for actually building the Noordhollandsch Kanaal and the Zuid-Willemsvaart, which were compliance control hybrids. The governance structure for financing the Zuid-Willemsvaart was also a hybrid.

For the Suez Canal a group of engineers known as the Saint-Simonians and the more scientific organisation of the ‘Société d'études du Canal de Suez’ played an important role in planning and designing the actual canal in the first decades of the nineteenth century. But it was Ferdinand de Lesseps who established the Suez Canal Company on the basis of concessions he personally received. Up to its nationalisation by the Egyptian government in 1956, the Suez Canal Company has been the sole governance structure for building and operating the canal. The concessions and the Convention of Constantinople were the property rights that formed the institutional environment in which the Suez Canal Company could exist.

The main governance structure, however, was the Suez Canal Company. The Suez Canal Company was active in the designing, financing, building and operating stage of the Suez Canal project. In the planning stage, the dominant governance structures were private organisations together with private persons of the Saint Simonians and the ‘Société d'études du Canal de Suez’. These organisations formed a hybrid governance structure. But also in the designing and financing stage, the Suez Canal Company and the Egyptian government formed more or less hybrid organisations. In the building and operating stage the Suez Canal Company should, according to TCE, be regarded as a hierarchical governance structure.

In the case of the Rhine-Main-Danube waterway, property-rights theory and TCE can also offer valuable insights. Property rights were formed by the treaties between the Federal Republic of Germany or the Reich, the Free State of Bavaria and the RMD AG. The governance structure was also determined by treaties between the Federal Republic and the Free State of Bavaria. The RMD AG did not play a role as one of the contracting parties in the treaties that specified the governance structures. It turned out that the governance structures for the project could be analysed by making use of TCE. Before 1922, these governance structures were of a hybrid form; however, with the establishment of the RMD AG a hierarchy was introduced. This hierarchy was present in the designing and building stage of the project. The financing stage was again a hybrid form, as here the RMD had to cooperate with the Reich, the Federal Republic and the state of Bavaria.

Table 8.5 gives an overview of the governance structures by stage of the project for each canal project. Basically, the structure of this table reflects the analytical scheme discussed in subsection 8.2.5. The overview in table 8.5 is a summary of the tables 5.3, 5.4, 6.2 and 7.3. This results in a presentation of only the governance structures in the different stages of the projects. In the case studies, the analytical scheme involved also information on the active parties and transactions in a certain stage, and the attributes of these transactions according to TCE. In this table the ratings of these governance structures according to TCE-reasoning can be regarded as a connection between the observed governance structures and the observed transactions and attributes of these transactions. Through the rating system, the alignment hypothesis of TCE is applied. A '+' indicates that the governance structure is regarded as being aligned with the transactions as to minimise transaction costs. A '-' indicates the opposite: According TCE, the governance structure cannot be regarded as transaction cost minimising. And a '+/-' indicates a middle position where it is unclear how to interpret the connection between the attributes of the transaction and the governance structure or it indicates a situation where the effect of the alignment is unclear.

The financing stage of the Noordhollandsch Kanaal is the only governance structure rated negative. In the planning stage hierarchical governance structures are not necessary according to TCE. Here hybrid structures would be better suited to minimise transaction costs. The hybrid governance structures in the planning stage of the Rhine-Main-Danube-project are rated as neutral, because in the part of the planning stage in which the first treaties were formed the asset specificity is considered to be low. Strictly speaking, according to TCE a

hybrid organisation would not be necessary; although it is hard to imagine what market structure could have brought about the treaties. It could well be that here the collective good character of the service at hand is much more prominent and that the transaction nature of the service is low.

Table 8.5 Overview of the governance structures of the canal projects and a rating of these structures according to TCE.

	Noordhollandsch Kanaal Governance structure	R.	Zuid-Willemsvaart Governance structure	R.	Suez Canal Governance structure	R.	Rhine Main Danube waterway Governance structure	R.
Planning	Hierarchy. Military and state civil servants controlled by the King.	+/-	Hierarchy Military and state civil servants controlled by the King.	+/-	Hierarchy: The military organisation of Napoleon in Egypt. Hybrids. Private organisations together with private persons.	+ +	Expl. control hybrid: From 1892 the German Rhine Main Danube Canal and Shipping Society and the Main Danube Association. From 1921 the Reich and the states of Bavaria and Baden.	+
Designing	Hierarchy; state civil servants, controlled by the King.	+/-	Hierarchy; state civil servants, controlled by the King.	+/-	Exploratory control hybrid.	+	Hierarchy: The RMD AG.	+
Financing	Hierarchy, mainly. Financing by a law approved by parliament and by the Armortisatie-syndicaat which was based on a specific law.	-	Hybrid, mainly. Because of the involvement of the provinces.	+	Compliance control hybrid.	+	Hybrid, the Reich or the Federal Republic, Bavaria and the RMD AG. The basic structure, laid down in the 1921 Main-Danube treaty, has never really been altered.	+
Building	Compliance control hybrid. Contractors controlled by the state agency for water management.	+	Compliance control hybrid: Contractors controlled by the state agency for water management.	+	Hierarchy: the Suez Canal Company directly controlled the construction of the canal.	+	Hierarchy. The RMD AG	+
Own, operate and maintain	Hierarchy. The state agency of water management.	+	Hierarchy. The state agency of water management.	+	Hierarchy: the Convention of Constantinople formed the institutional environment.	+	Hierarchy. The waterway by the Federal Agency of Water and Shipping management Hierarchy: the power plants by the RMD AG	+
Transfer	NA		Hierarchy: The Amortisatiesyndicaat.	-	NA		Market: the RMD AG to E.ON Energy AG.	+/-

8.3.4 Coping with unexpected technical, economic and political events

Now the question is: How well were the governance structures able to cope with unexpected technical, economic and political events?

It is difficult to identify these unexpected events for the building of the canals of King Willem I during the preparation of the canal projects, or during the actual building of the Noordhollandsch Kanaal and the Zuid-Willemsvaart. There was of course the changing position of Willem I regarding financial matters: During the building of his canals he was still the monarch with nearly absolute constitutional power, at least theoretically; but influence of Parliament on financial decisions was growing. This is likely to have prompted the foundation of the Amortisatiesyndicaat, because this was the vehicle for King Willem I to finance his project outside approval of Parliament. Arguably, the prevailing institutional environment was not able to cope with the problems of financing the canals.

In building the Suez Canal, there were three main problems to solve: first, the alleged unlawful issuing of land rights by Said Pasha to the Suez Canal Company; second, the foreign pressure to abolish the corvée system and third the decision on the actual canal stretch. The latter problem was solved easily in the second concession. But the other two took a ruling of emperor Napoleon III, but the concessions were such that this ruling could be based on the provisions in the concessions. It formed an adapted set of property rights that turned out to be stable until the nationalisation of the canal. The hierarchy of the Suez Canal made it possible to react fast to the abolition of the corvée system and to incorporate a new technical solution that turned out to be superior.

In the case of the Rhine-Main-Danube waterway, the strength of the property rights and governance structures is illustrated by the fact that the pre-war structure was restored after the nationalisation period of the Third Reich. After the Second World War, even the 1921 constituting and concession treaties and the 1922 construction treaties were formally restored. The relevant governance structures for the investments in the Rhine-Main-Danube waterway are the hybrid structures formed by the treaties together with the hierarchy of the RMD AG. This structure also lived through the period of the hyper-inflation in the 1920s and the period of serious opposition against the completion of the canal building in the 1970s.

Generally speaking, the treaties dealt with the financing of the project and the RMD AG built the waterway and the hydro-power plants, and actually still operates these plants. An

illustration of the elegance and 'power' of this structure is that all the treaties together only cover a total of some forty pages.

8.3.5 Possible explanations of success of the investments in the projects

Research question 5 is: Can NIE help us to explain the success or failure of the canal building and the subsequent operation of the canals? In answering this question one must bear in mind the difference between the supply of and demand for canal capacity. TCE and property rights theory deal with matters of supply, in the sense of the institutional environment and governance structures in which this supply takes place. These are not theories to explain demand side factors, and consequently this thesis is restricted to studying the governance of the supply of canal capacity. One can assume that in the operational phase of the canal, the governance structure in which this operation takes place can also have an effect on the demand for canal capacity. This is why the answer to the above question also takes into account the actual (commercial) operation of the canal. It provides an additional insight in the effectiveness of the governance structures for planning, designing and building the canals in supplement to TCE efficiency.

The compliance control hybrids worked well for the canals of King Willem I. According to TCE, high uncertainty is a reason for a more hierarchical organisation, which can be formed by these compliance control hybrids. In the stages of planning and financing the canals, there were hierarchical organisations that reflected the absolute power of the King. Applying the insight of North as discussed in chapter 4, all parties involved need to have a say in the decision-making, and the conclusion that can be drawn is that the hierarchical organisation in the stages of planning and designing the canals were not structures in where everyone concerned participated. For instance, in the case of the Noordhollandsch Kanaal the structure could have involved representatives of the harbour of Amsterdam, the city council, and also private entrepreneurs that had businesses connected with the harbour. This does not necessarily regard the financing of the canal, because it may be that an inadequate capital market made it more effective to finance the project through the hierarchy of the King. However, within more hybrid structures for planning and designing the canals, information and project appraisal built on this information could have been more adequate. As Filarsky noted, perhaps then the Noordhollandsch Kanaal would have been built 20 years later, or perhaps it would not have been built at all.

For the Zuid-Willemsvaart, the governance structures were not much different from the structures for the Noordhollandsch Kanaal. The provinces of Holland and Brabant were only involved in the financing of the canal. This made the governance structure more hybrid. From the beginning, the Zuid-Willemsvaart was a multi-purpose canal. In the phase of operating the canal, this multi-purpose characteristic prevented it from being a failure. Although in the first 20 years of its existence, the canal did not bring substantial revenues, the fact that the city of Eindhoven constructed for its own account a connecting canal with the Zuid-Willemsvaart, indicates that in the 1840s the Zuid-Willemsvaart was highly valued.

From the beginning of the Suez Canal project property rights were well-specified. These property rights were clearly stated and granted the rights to build the canal to the Suez Canal Company.

The Suez Canal Company was well-equipped to counteract opportunistic behaviour based on asset specificity. In fact, this hierarchy did not give room for opportunistic behaviour. Moreover this hierarchy was able to deal with different uncertainties during the building of the canal and during the operational lifetime of the Suez Canal up to the nationalisation. Financially, the Suez Canal Company has been so successful that at the time of the nationalisation, operating the Suez Canal was not even the most important activity anymore. The conclusion is that from a NIE point of view, it is not surprising that the hierarchical governance structure for the project has proven to be so robust. It was a structure suited for transaction cost minimising.

The institutional arrangement of the Rhine-Main-Danube project on the one hand consisted of hybrid contracting forms by the German federal government, the German states and the RMD AG and on the other hand of the hierarchy of the RMD AG. The hierarchy of the RMD AG did well in coordinating the canal building and the hydro-power plant building and as a result asset specific investments in waterway building or in hydro-power plant construction could not lead to opportunistic behaviour. In this respect, the RMD AG was a transaction cost minimising structure. Furthermore, the history of the Rhine-Main-Danube waterway is an illustration of the TCE-notion that hybrid modes of governance, at the beginning stages of a project, can deal very well with high degrees of uncertainty. Any conclusion about the success of the utilisation of the canal depends among other things on the original traffic estimates. In a cost-benefit analysis from 1976 total traffic through the canals was estimated at 2.7 million tonne a year for 1990. In 1982, realised traffic was 2.5 million tonnes, increasing to 2.7 million tonnes in 1990. After completion of the canal in 1992 traffic increased to 5.1 million tonnes in 1993 and it reached a level of 6.6 million tonnes in 2007. Of course, the opening up

of the Iron Curtain and the subsequent ongoing integration of the Danube states to the European Union will certainly have contributed to the success of the canal. However, these events would not have been foreseen in the cost-benefit analysis of 1976. This is an illustration of one of the premises of this thesis: in the case of large infrastructures cost-benefit analyses as a basis for the decision-making on investments in these large infrastructures have limited significance.

8.3.6 Lessons from the case studies

The last question is: Can we learn from the history of canal projects in the light of insights from NIE?

For the Noordhollandsch Kanaal and the Zuid-Willemsvaart the most prominent aspect is the importance of the institutional environment and thus the property rights for the effectiveness of the governance structures.

It is safe to conclude that the inadequate legal structure is a matter of first order economising in the scheme of Oliver Williamson: Get the institutional environment right. But he also argued that cumulative change of a progressive kind is very difficult to orchestrate. Different shocks will occasionally produce a sharp break from established procedures, and rare windows of opportunity are thereby opened. In the absence of such a window, though, major changes in the rules of the game occur in the order of decades or centuries. This stresses the importance of property rights and the definition of property rights. Taken as an example, however, the claim that the legal system will eliminate chaos upon defining and enforcing property rights assumes that the definition and enforcement of such rights is easy and costless. Williamson remarks that rare windows of opportunity occurred in the history of canal building. The nearly absolute power of Willem I, laid down in the constitution, was only changed after financial and political crises in the 1830s.

The inadequate institutional environment can be regarded as a shift parameter in Williamson's second order economising, i.e. get the governance structures right. It may well be that for the canals of King Willem I this shift parameter had a negative effect on the outcome of the second order economising process. In the light of TCE, the governance structures in itself were fairly efficient. They operated in an inefficient environment, though, which had especially negative effects in the planning, designing and financing stage of the Noordhollandsch Kanaal and the Zuid-Willemsvaart.

For the Suez Canal there is the important aspect of an entrepreneurial person who was decisive for the history of the Suez Canal. Without Ferdinand de Lesseps there would probably not have been a Suez Canal in 1869. The first concession was given to him personally and he himself organised the financing of the Suez Canal Company. In property rights theory and in TCE entrepreneurial behaviour is not explicitly part of the theory, but one of the lessons that can be learnt from the history of the canals King Willem I in comparison with the history of the Suez Canal is that institutions should support entrepreneurial behaviour. Safe-guards should be present in these institution to make sure that third party interest will not be harmed, without compensation by the entrepreneurial behaviour and that all parties involved are incorporated in the decision making process. The concessions and the Suez Canal Company can be seen as such safe-guards. The Suez Canal was and is a success story from an economic point of view. Traffic through the canal has risen year after year, practically from the opening of the canal up to now. However, it is difficult to contribute this success in demand for Suez Canal traffic capacity to the governance structure that was used to design and build the canal. On the other hand the governance structure of the Suez Canal turned out to be a good structure in cause of events up to the nationalisation of the canal. But the idea on its own of a Suez Canal was just too good of an idea to make governance structure decisive.

In the case of the Rhine-Main-Danube waterway, one of the most characteristic features is the hybrid form of governance based on the fairly simple treaties that were concluded throughout the realisation of the project. This structure of contracting is an exploratory control hybrid. The treaties are general trust agreements with expectations of a long-term relation to induce relation-specific investments. In accordance with the transaction cost economics, this structure was able to absorb a series of economic and political shocks. But these hybrid institutional arrangements can not be seen apart from the hierarchy of the RMD AG. This hierarchy made it possible to incorporate hydro-electricity generation and construction of the waterway. The main lesson from the three case studies is that hybrid forms of governance do well in the planning, designing and financing stage and that a hierarchy is needed to build, operate and maintain the project. However, these two sets of arrangements need to be connected by a property-rights structure that forms the institutional environment. This structure can consist of concessions like in the case of the Suez Canal, supplemented by a relational form of contracting like in the case of the Rhine-Main-Danube waterway.

8.4 Summary, generalisation, discussion and possible further research

8.4.1 Summary and answer to the central research question

The first three research questions about the history of the three canal projects, the characteristics of NIE and about the relevant governance structures, led to the insight that transaction cost theory and property rights are useful for studying the history of the canal projects. The basis for using these two parts of NIE is the four-layer model of Williamson that establishes a specific relation between governance structures and property rights. It turned out that this theoretical relation was helpful in describing the meaning and influence of the property rights for the governance structures.

The second important starting point for the application of TCE was the scheme in which different stages of a project were discerned. The advantage of this scheme is that it leads to the recognition of different transactions in each of the stages of the project. By using this scheme, it is also possible to identify different parties involved with these transactions and consequently to identify governance structures that differ by stage of the project. Even more important is that now the analysis can be based on the different attributes of transactions in the different stages. Consequently, it was possible to conclude on the basis of TCE that for a specific stage of the project a specific governance structure would be the transaction cost economising governance structure. By comparing the existing governance structure with the transaction cost economising governance structure, the existing governance structures could be rated as having a positive effect, a neutral effect or a negative effect on transaction cost minimising. The advantage of the scheme of stages is that it brings into the foreground the primary unit of analysis in TCE: the transaction.

The answer to the question about the problem-solving capacity of the governance structures is much more complicated. One can conclude that the governance structures for the Suez Canal and the Rhine-Main-Danube waterway were able to deal with uncertainties because these structures lasted for a long time in which circumstances varied considerably. The governance structure and the institutional environment, formed by the Treaty of Constantinople, for operating the Suez Canal has been very stable for approximately hundred years. The governance structure for constructing the Rhine-Maine-Danube waterway was able to incorporate new developments by the specification of new and supplementary treaties. Thus it can be concluded that these governance structures were able to cope with unexpected events. The cases of the Suez Canal and the Rhine-Main-Danube waterway show that governance

structures based on clearly specified property rights and that consist of hybrid forms of governance combined with hierarchies, is best suited to deal with changing technical, economic and political circumstances.

The question about whether a project's success or failure can be explained by the existing governance structures is hard to answer, because basically TCE is a theory about the way supply of goods and services is or can be organised. The application of TCE and property rights theory is restricted to matters of investing in the canals and the supply of canal capacity. Subsequent developments in the use of the canals are outside the scope of this study.

It needs to be further investigated whether a relation can be inferred between efficiency in the sense of cost control, which is always a problem when investing in large infrastructures, and the governance structures that TCE predicts to be transaction cost economising.

Regarding the last question whether we can learn from the history of the three canal projects in the light of the insights from NIE, it is not surprising that in answering this question reference was made to the Suez Canal and the Rhine-Main-Danube waterway. As mentioned in chapter 7 about the Rhine-Main-Danube waterway, the governance structures for this project could form a good model for complicated projects in which different parties and different governments are involved. The more independent these governments are the more valuable the Rhine-Main-Danube model can be.

Two remarks must be made about these conclusions. First, in this thesis only three cases were studied. This is not enough to establish firm conclusions about this issue. But, as will be argued in the next section, a main finding of this thesis is that the analytical approach used in this thesis appears to be fruitful in applying NIE to this sector. The second remark is that one important aspect of the history of all the three canal projects is not covered by TCE and property rights theory, and that is the dominant presence of entrepreneurial behaviour by key players in the projects. The King Willem I and certainly Ferdinand the Lesseps were very important for the realisation of the projects. But even in the history of the Rhine-Main Danube waterway, entrepreneurial behaviour played an important role in keeping the idea of a 'high-capacity waterway' in Bavaria alive. Certainly in the planning stage of the project it was not the State of Bavaria or the Reich but the private committees of the 'German Rhine- Main-Danube Canal and Shipping society' and the 'Main Danube Association' that had the initiative.

The central research question of this thesis is: Is it possible to determine from NIE the characteristics of an efficient governance structure for investments in large infrastructures and for the operation of these large infrastructures? As a general conclusion for this thesis and

based on the answer of the three first specific research questions, this central research question can be answered positively. It turned out that it is possible to determine from NIE, and more specifically from property rights theory and TCE, the efficient governance structures, in a TCE sense, for investments in large infrastructures.

8.4.2 A generalisation

In the light of TCE, an efficient governance structure is a governance structure that is aligned which the transactions in such a way as to effect a minimisation of transaction costs. So first the transactions have to be identified and classified according to the levels of asset specificity and uncertainty incorporated in the transaction. Then the governance structures have to be identified. Confronting this data results in an insight of whether or not the governance structure can be regarded as efficient. This analysis can be performed ex ante or ex post. The central research question of this thesis implies an ex post analysis of the three canal projects. In this section, an attempt will be made to describe a more ex ante identification of an optimal governance structure on the basis of the TCE interpretation of the governance structures of the three canal projects. Using the analytical scheme of different stages in a project, the insight was reached that the characteristic transactions in these stages differ according to their attributes, which are the decisive features in the alignment process. Consequently, the efficient governance structures should also differ by stage. This insight will be used in the following generalisation of the history of the three canal projects.

In the course of the preparation and completion of a project, the efficient governance structure can and perhaps should change from a hybrid form to a hierarchy. In the planning and designing and financing stages of the three projects, there were more hybrid structures and in the building stage mostly hierarchy. What stands out in the history of the three canal projects is that indeed there were different governance structures in different stages of the project, but that there was a certain continuation of the governance structure. As regards the canal building by King Willem I, it was the King himself. As regards the construction of the Suez Canal, it was the Suez Canal Company, and the RMD AG was the central governance structure for building the Rhine-Main-Danube waterway. This gives rise to the question whether TCE can be applied to explain this phenomenon. In order for this to be possible, there have to be transactions across stages of the project. A transaction is said to occur when a good or a service is traded across a technologically separable interface. By definition, the organisation of technologically separable activities is not technologically determined but is a

matter to which the comparative analysis of alternative forms of governance may usefully be brought to bear (Williamson 1993, p. 16). This means that the borders between the stages of a project can be seen as interfaces. The transactions between the stages, up to the building stage, are the transfers of plans and designs to build and to finance the project. In general, these transactions refer to the body of knowledge developed to build the canal and transferred from one stage to the other. This body of knowledge is highly idiosyncratic. Uncertainty around it is high, in a sense that it is very well possible that the knowledge developed in an earlier stage will turn out to be insufficient to solve a problem. And the recurrence is low. This all suggests that a hierarchy across the different stages is the transaction cost minimising structure. Basically, this means that there is a dominant governance structure for all the stages of the realisation of the project. This governance structure can be regarded as the nucleus of the governance structure for each stage of the project. This nucleus can be extended or complemented by governance structures that are specific for the stage of the project. This was the case in the three canal projects, where King Willem I, the Suez Canal Company and the RMD AG formed the nucleus structures of the governance structure of the project. Sometimes this nucleus was complemented by other structures. Sometimes, however, this nucleus acquired different characteristics. For instance, the RMD AG was the designer of the Rhine-Main-Danube waterway, was the principal construction engineer, and after completion of the Main-Danube Canal stayed owner and operator of the hydro-power plants. The Suez Canal Company also experienced more or less the same change of roles, but remained the nucleus of the governance structure. It designed the canal and coordinated the construction and afterwards operated the canal. In the operational stage, it operated in an environment that was shaped by the Convention of Constantinople, which worked as a property right for the users of the canal. The RMD AG also played changing roles, as the operator of the power plants was based on the concession treaty and was also a specification of property rights. These notions lead to the generalisation that the functioning of the nucleus governance structure can change as a result of changing property rights. But also the more flexible parts of the governance structure were based on a definition of property rights, in the form of concession treaties or other kinds of treaties. The conclusion now is that the property rights structure defines the flexibility of the governance structure. Property rights define the role of the nucleus, and also play an important role in defining the existence of the governance structures that are specific for a stage in the project.

The above generalisation of the three case studies can be taken as a model of a governance structure for investing in large infrastructure projects that have governance structures which

differ by stage. There is a constant governance structure that is surrounded by other governance structures, and the existence of this nucleus and also of the orbiting governance structures is defined by the forcefield of the relevant property rights.

8.4.3. Discussion

In this thesis transaction cost economics and property rights theory were applied to the history of the construction of the canals of King Willem I, the Suez Canal and the Rhine Main Danube waterway. In chapter 1, boundaries and limitations of the research for this thesis were described, which follow from the research design for this thesis. These boundaries concern three fields: The first one is that TCE and property rights theory concentrate on supply site factors of a specific nature, namely governance. Market conditions and economies of scale do not play a role here. The second one is that TCE is the comparative static approach within NIE. Questions relating to the evolution of institutions are outside the scope of TCE. The third field is a limitation from the nature of the applied theories. These theories do not concern behaviour of the management or other economic agents. TCE tries to explain forms of governance from attributes of transactions. Consequently entrepreneurial behaviour is outside the scope of TCE.

TCE works from the alignment hypothesis: governance structures are aligned with transactions in such a way as to effect a transaction cost minimisation. This hypothesis is not tested in the thesis but taken for granted. The thesis is about the possibility of determining from NIE, and more specifically from TCE and property rights theory the efficient governance structures for the construction of the three canals. The central tendency from the three case studies is that hybrid forms of governance do well in planning, designing and financing the project and that a hierarchy is needed to build operate and maintain a canal. These two sets of governance structures need to be connected by a property rights structure that makes it possible that these different forms of governance exist in the realisation of one project.

Governance only

The analysis of the three case studies uses the scheme that is presented in chapter 4 of the thesis. It is based on explanatory variables from TCE and the role of property rights as a shift

parameter. The thesis is not about the creation of the governance structures but it applies TCE and property rights theory to the histories of the three canal cases. Influences of the institutional environment on the governance structures are described on the basis of the property rights. TCE concentrates on the ex-post alignment of governance structures with the relevant attributes of the transactions. Governance structures and the relevant attributes of transactions are the variables in the analysis. When applying a much more dynamic approach of NIE represented for instance by the work of Douglas North, one would need to incorporate a much wider set of explanatory variables in the analysis scheme like vested interests, path dependencies and, creative entrepreneurship. However, the analysis in this thesis is restricted to the comparative static approach and does not need to incorporate these variables. The use of property rights as shift parameters in the analysis made it possible to see that a lot of dynamics in the cases, especially with the Suez Canal and the Rhine-Main-Danube waterway, was absorbed by altering the property rights.

Furthermore it must be recognized that TCE is not about interaction between informal institutions and institutional arrangements, although Williamson recognizes in his four-layer model that interaction takes place, certainly between property rights as formal institutions and governance structures. But the interaction of informal institutions and institutional arrangements is outside the scope of the analysis of the thesis. That does not mean that this interaction did not play a role in the cases. For instance it can be understood from the first part of the case study about the Rhine-Main-Danube waterway that it is important that the RMD AG operated in a Bavarian political surrounding which can be regarded to form the informal and formal institutions for this project.

Also for the Suez Canal it can be understood from the case study that informal institutions and the interaction with the formal institutions and governance structures played an important role. The governance structure for the Suez Canal was able to deal with the problems which arose in the early 1860's about some parts of the concessions. To solve these problems the property rights were adapted. For this solution it was important that Ferdinand de Lesseps had relatively easy access to Napoleon III and that the ruling of the emperor was accepted by other parties involved in this conflict, like the English and the Turks. These are matters of informal and formal institutions and also power and thrust play a role here. But the main point is that the governance structure of the Suez Canal project survived this conflict by an adaptation of the property rights.

Also for the case of the canals of King Willem I, specific remarks can be made about the influence of Willem I based on his constitutional position, the insufficient legal structure and

the influence of these elements on the insufficient property rights for the canal building. Studying the influence of the informal institutions on the governance structures in the three canal cases can be a subject for ongoing research in which the analysis will be extended beyond the comparative static nature of TCE.

TCE was applied in a more conventional way as formulated by Williamson. New possible explanatory variables that concern the behavioural assumptions of TCE, like trust and farsightedness were not included. Regarding trust, following Speklé (2001), the approach was chosen to alter the mechanism of governance rather that introducing new key variables. This approach leads to the distinction of two kinds of hybrid governance: the compliance control hybrid as the more classical way and the exploratory control hybrid in which trust and the expectation of long-term relations play an important role. In the case studies in turned out that this distinction could be used to classify some forms of governance.
Farsightedness has been introduced in TCE by some theorists to make TCE more dynamic. In this thesis however, the static blueprint approach of TCE was used. Consequently farsightedness could be regarded to be a further precision of the concept of bounded rationality, which in itself does not imply myopia. The main effect of bounded rationality, including farsightedness, is that all complex contracts are necessarily incomplete, which makes governance important. This starting point of TCE was maintained in the thesis.

Entrepreneurial behaviour

In the case studies it turned out that the entrepreneurial role of specific individuals like Willem I and Ferdinand de Lesseps had a decisive influence on the completion of the canal projects. As it has been said before entrepreneurial behaviour is not part of TCE and property rights theory NIE. But it is concluded in this thesis that one of the lessons that can be learned from the history of the canals of King Willem I in comparison of the history of the Suez Canal is that governance structures should support entrepreneurial behaviour, but that safe-guards should be present in the institutions to make sure that third party interest will not be harmed without compensation by the entrepreneur and that all parties involved will be incorporated in the decision making process. For these purposes hybrid governance seems to be suitable.

8.4.4 Some reflections on further research

Further research on the topic dealt with in this thesis could proceed along three lines. The first is that more case studies could be conducted using the analytical scheme applied in this thesis. This approach would regard property rights as the institutional environment, which is considered to be the shift parameter for the governance structures' transaction cost efficiency. This approach would also use the defined stages of a project to study the relation between characteristics of the transaction and the prevailing governance structures.

One case study might add to the insights reached in this thesis, namely the first attempt to dig the Panama Canal by Ferdinand the Lesseps and his son. The attempt turned out to be a complete failure and led to the bankruptcy of the Panama Canal Society, where a lot of investors lost a lot of money. De Lesseps and his son were indicted in a bribery trial and found guilty. As one of the authors on the Suez Canal concluded, Lesseps wanted to copy the success of the Suez Canal, but what had worked in Egypt did not work in Panama. It would be very interesting to apply the analytical scheme of this thesis to the history of this first attempt to build the Panama Canal, to investigate whether a NIE kind of explanation can be found for the failure of this attempt in comparison with the Suez Canal.

The second line of research could be based on the hypothesis of better cost containment by governance structures that are aligned with transactions according to TCE. The testing of this hypothesis, however, would need an extensive data set, which describes characteristics of a substantial number of projects.

The third line is concerned with the more formal testing of TCE. As has been noted by several authors, testing of the alignment hypothesis in empirical studies is yet beyond the scientific horizon. One of the problems here is that it is difficult to operationalise the relevant attributes of a transaction to be used as an empirical quantitative study, and to rate the observed governance structures on the continuum of possible structures.

A possible step forward here could be made by using Rough Set Analysis (Nijkamp, 2002). One could argue that meta-analysis techniques could be applied to a body of empirical studies in the social sciences. But here a researcher will be faced with study results of a nominal, yes or no, or a categorical character, a qualitative ranking order. This severely limits the use of standard meta-analyses regression techniques. Furthermore, the sample size of comparative case-study research is usually small. A possibly promising research technique to tackle these problems is rough set analysis.

It is as yet unknown whether rough-set analysis is used in the field of TCE. Therefore, it is unknown whether this technique could be meaningfully applied. Critical is the codification of

the qualitative data from the case studies. The construction of an informative table describing stimuli and responses is essential in rough set analysis. as the only way to discriminate among objects is to classify their characteristic attributes. (Nijkamp 2002). Maybe the analytical scheme designed for the case studies in this thesis could be the first step on the way to such a table.

Samenvatting

Inleiding

Grote infrastructurele projecten hebben de eigenschap dat ze over een lange periode worden gerealiseerd en dat hun economische nuttige periode een nog langere tijd beslaat. Het centrale uitgangspunt voor dit proefschrift is dat deze lange tijdshorizon gevolgen heeft voor de manier waarop beslissingen worden genomen of moeten worden genomen. In dit verband kan men de vraag stellen wat bijvoorbeeld de betekenis is van een maatschappelijke kosten-batenanalyse bij de beslissing om te investeren in een grote infrastructuur. Zo'n kosten-batenanalyses (MKBA) heeft het voordeel dat het een systematische en rigoureuze aanpak inhoudt, gebaseerd op goed gefundeerde economische uitgangspunten. Een MKBA wordt uitgevoerd vanuit een maatschappelijk perspectief, wat betekent dat alle kosten en baten in aanmerking worden genomen, ongeacht wie daadwerkelijk betaalt. Verdeling van de kosten en baten over de verschillende betrokken partijen wordt in eerste instantie niet in de beschouwingen betrokken. In een MKBA wordt aangenomen dat er slechts één welwillende beleidsmaker is die de kosten tegen de voordelen afweegt.

Bij de voorbereiding van investeringen in grote infrastructuren zijn deze veronderstellingen niet realistisch. Er zijn vaak verschillende overheidslagen en verschillende overheidsinstanties betrokken bij deze voorbereiding. Verschillende belangengroepen spelen een belangrijke rol en ook meer of minder private partijen zijn vaak betrokken. Er is dan ook zelden sprake van een duidelijk voorbereidingstraject dat leidt naar een duidelijk besluit. Het is meer een beslissingproces dat wordt gekenmerkt door een interactie tussen de betrokken partijen, dat langzaam leidt tot een min of meer definitieve situatie. Dit proces is niet-lineair van aard. Het is veel meer een cyclisch proces, waarbij oplossingen en besluiten naar een eindsituatie groeien.

Dit heeft tot gevolg dat rationele criteria over kosten en opbrengsten van een project slechts van beperkte betekenis zijn als basis voor besluitvorming over de realisatie van het project. De onzekerheid die voortvloeit uit de lange bouwtijd en uit de nog langere economische levensduur is vaak te groot.

Daarmee is niet gezegd dat kosten-batenanalyses niet moeten worden uitgevoerd. Het is ook niet gezegd dat de methodologische uitgangspunten van een MKBA voor grote

infrastructuren te problematisch zijn. Maar het argument is hier dat naast de meer rationele criteria om tot een beslissing te komen, ook rekening moet worden gehouden met de instituties en beheersstructuren die een rol spelen bij de realisatie van de investeringen. Het uitgangspunt voor dit proefschrift is dat de institutionele- en beheersstructuren voor een groot infrastructuurproject van belang zijn voor het eindresultaat. Onderzoek naar deze structuren kan inzicht geven in de kenmerken van efficiënte beheersstructuren voor deze projecten. Gelukkig kunnen we nu een economische theorie toepassen die ons kan helpen om de kenmerken van efficiënte structuren te identificeren. Dit is de nieuwe institutionele economie (NIE) en speciaal de transactiekosteneconomie (TKE), die volgens Oliver E. Williamson als uitgangspunt heeft dat beheersstructuren[14] er zijn om transactiekosten te minimaliseren.

De centrale onderzoeksvraag

De centrale onderzoeksvraag van dit proefschrift is:

Is het mogelijk om vanuit de nieuwe institutionele economie de kenmerken van een efficiënte beheersstructuur vast te stellen voor investeringen in grote infrastructuren en voor de exploitatie van deze grote infrastructuren?

De centrale onderzoeksvraag zal worden beantwoord door het toepassen van inzichten uit de NIE, met de nadruk op twee van de belangrijkste richtingen hierin: de theorie van de eigendomsrechten en de TKE. In dit proefschrift wordt er van uitgegaan dat de hypothese van de TKE kan worden toegepast. Deze luidt dat beheersstructuren transactiekosten minimaliseren als deze beheersstructuren in overeenstemming met de theorie zijn afgestemd op de relevante transacties. De hypothese wordt niet getest in deze studie, er wordt aangenomen dat ze geldig is. Het doel van de studie is om te bepalen of de inzichten uit de TKE en de theorie van de eigendomsrechten vruchtbaar kunnen worden toegepast bij de realisatie van grote infrastructuren.

In de centrale onderzoeksvraag is een specifieke definitie van het begrip 'efficiëntie' gebruikt, die verbonden is met de NIE. Men kan echter verschillende economische theorieën onderkennen die ieder een eigen definitie hebben van efficiëntie. In de neoklassieke

[14] In deze samenvatting wordt de term 'governance structure' uit de TKE vertaald door 'beheersstructuur'.

aanbodeconomie gaat efficiëntie over de minimalisatie van de productiekosten. In deze standaard 'mainstream' theorie brengt de markt evenwichtsprijzen voort die economische actoren informeren over de efficiënte, dus kostenminimaliserende allocatie van productiemiddelen. In de NIE handelt efficiëntie over de minimalisatie van de transactiekosten. De NIE richt zich op de vraag hoe transacties te coördineren op een zodanige wijze dat de transactiekosten worden geminimaliseerd. Deze definitie van het begrip efficiëntie zal worden gebruikt in dit proefschrift.

De drie kanaalprojecten

Voor dit proefschrift zijn drie projecten gekozen van transportinfrastructuren die het kenmerk hebben van een meer privaat goed zodat in beginsel diverse beheersstructuren mogelijk zijn. Deze drie projecten zijn twee van de kanalen gebouwd door de Nederlandse koning Willem I, in de eerste helft van de negentiende eeuw; het Suezkanaal in de tweede helft van de negentiende eeuw en de Rijn-Main-Donau-waterweg in Beieren, die voor een groot deel gebouwd is na de Tweede Wereldoorlog.

Koning Willem I regeerde van 1813 tot 1840 over het koninkrijk der Verenigde Nederlanden, waartoe Nederland en België behoorden. Hij was een sterke promotor van handel en industrie. Hij realiseerde hoge investeringen in transportinfrastructuur waarin kanalenbouw een groot aandeel had. Willem I wordt ook wel de Kanalenkoning genoemd. In deze studie wordt de totstandkoming van twee van Willem's kanalen bestudeerd. Deze zijn het Noordhollandsch Kanaal en de Zuid-Willemsvaart.

Het Noordhollandsch Kanaal was voor die tijd een van de grootste scheepvaartkanalen van de wereld. Het kanaal was ook erg duur. Het werd gebouwd ter verbetering van de waterweg naar Amsterdam, dat moeilijk te bereiken was voor schepen van en naar de Noordzee. Zeeschepen moesten eerst vanuit de Noordzee de Zuiderzee opvaren, wat soms moeilijk was en dan moest een zandbank, die voor de Amsterdamse haveningang lag, gepasseerd worden. Deze zandbank was ontstaan in het laatste deel van de zeventiende eeuw.

Het kanaal volgt vanuit Amsterdam een noordelijke route naar Den Helder. Het zou logischer zijn geweest om vanuit Amsterdam een westelijke route te kiezen, direct naar de Noordzee. Maar dit werd in het begin van de negentiende eeuw te gevaarlijk en technisch niet haalbaar geacht, omdat het kanaal dan een natuurlijke zeewering moest doorsteken.

De Zuid-Willemsvaart is een kanaal dat, ten tijde van de bouw, door een van de armste delen van Nederland liep. Het doel was om verbinding te maken tussen bevaarbare stukken van de Maas, in het noordwesten van Nederland en Luik in het zuidoosten van Willem's koninkrijk. Kort na zijn inhuldiging liet Willem I een onderzoek uitvoeren naar verbeteringen voor de binnenvaart van Den Bosch in de richting van Maastricht. De verbetering van de bevaarbaarheid van de Maas werd onderzocht, naast andere mogelijkheden. Maar vanwege ongunstige omstandigheden op de Maas, soms hoge stroomsnelheden en dan weer lage waterniveaus, werd geschat dat kanalisatie te duur zou zijn. Er werd gekozen voor het graven van het 123 km lange kanaal tussen Den Bosch en Luik, met een traject ten westen van de Maas. De werkzaamheden begonnen in 1822 en het eerste gedeelte was klaar in 1826. De verbinding tussen Maastricht en Luik werd pas geopend in 1850. Dit belemmerde het succes van het kanaal in de eerste decennia na de opening. Als gevolg van de vijandelijkheden tussen de noordelijke en zuidelijke Nederlanden werd het kanaal in de periode 1830 tot 1839 tijdelijk gesloten.

Het tweede project is de bouw van het Suezkanaal. Met de bezetting van Egypte door Napoleon Bonaparte kwam een oud idee van een kanaal tussen de Middellandse Zee en de Stille Oceaan weer tot leven. In 1854 en 1856 verkreeg Ferdinand de Lesseps persoonlijk de concessie om zo'n kanaal te bouwen van de onderkoning van Egypte, Said Pasja. De Lesseps was in de jaren dertig van de negentiende eeuw de Franse consul geweest in Egypte en uit die tijd hij kende hij Said Pasha goed. Said Pasha verleende met de concessies goedkeuring aan de oprichting van een onderneming met het doel om een kanaal door het schiereiland van Suez te bouwen dat open zou zijn voor zeeschepen van alle naties. De Suez Canal Company (Compagnie Universelle du Canal Maritime de Suez) ontstond in 1858. De bouw van het 163 kilometer lange kanaal duurde bijna elf jaar. Tal van technische, politieke en financiële problemen moesten overwonnen worden met als gevolg dat de uiteindelijke kosten van de bouw hoger waren dan de oorspronkelijke ramingen op een schaal die goed past bij de statuur van dit project. Sommige schattingen wijzen op een overschrijding met 1900%. Het kanaal werd geopend op 17 november 1869 en in 1875 werd Groot-Brittannië de grootste minderheidsaandeelhouder van de Suez Canal Company door het verwerven van 44% van aandelen. In 1956 werd het Suezkanaal het onderwerp van de Suezcrisis. De Egyptische president Nasser kondigde in dat jaar de nationalisatie van het kanaal aan. Zijn besluit was een reactie op de Britse, Franse en Amerikaanse weigering om een lening te verstrekken voor de bouw van de Aswandam. Als reactie op de nationalisatie vielen Groot-

Brittannië, Frankrijk en Israël, Egypte binnen. De internationale gemeenschap veroordeelde deze actie en op het einde claimde Nasser de overwinning bij de terugtrekking van de alle buitenlandse troepen.
In 1967 werd het kanaal gesloten vanwege de Zesdaagse Oorlog, toen Israël de Sinaï bezette, waardoor het kanaal fungeerde als een bufferzone tussen de strijdmachten. De Egyptenaren wonnen de kanaalzone terug in de Arabisch-Israëlische Oorlog van 1973. De heropening vond plaats in 1975. Sindsdien is het kanaal door Egypte voortdurend uitgebreid om tegemoet te komen aan de eisen van de moderne scheepvaart. Tegenwoordig varen dagelijks zo'n 50 tot 60 moderne en grote zeeschepen door het kanaal.

Met de officiële opening van het Main-Donaukanaal op 25 september 1992 is een 3500 km lange binnenvaartroute ontstaan van de Noordzee tot de Zwarte Zee. Nu is in principe via binnenscheepvaart Rotterdam verbonden met Constansa in Roemenië. Deze waterweg kan worden verdeeld in drie stukken: het eerste traject is het Rijn-Main gedeelte, van Rotterdam tot aan de monding van de rivier Regnitz in de Main bij Bamberg. Dit gedeelte heeft een lengte van 924 kilometer. Hier begint het eigenlijke Main-Donau kanaal, als tweede gedeelte van de vaarroute. Dit kanaal heeft een lengte van 171 kilometer en komt uit in de Donau met de monding van de rivier de Altmühl bij Kelheim in Beieren. Het kanaal loopt voor een deel door de bedding van de Altmühl. Het derde stuk is het lange Donaustuk, van 2411 kilometer, van Kelheim tot aan de monding van de Donau in de Zwarte Zee. In dit proefschrift wordt met de naam 'Rijn-Main-Donau-waterweg' het deel van de route bedoeld vanaf de monding van de Main in de Rijn tot aan het punt waar de Donau de Duits-Oostenrijkse grens passeert. Het feitelijke kanaal, vanaf Bambergen tot aan Kelheim, is het Main-Donaukanaal. Het bestaan van het kanaal betekent niet dat er op regelmatige basis vrachtverkeer plaatsvindt via deze binnenlandse route van Rotterdam naar de Zwarte Zee. Economisch gezien ligt de betekenis van de Rijn-Main-Donau-waterweg niet in de verbinding tussen Rotterdam en de Zwarte Zee, maar veel meer in het regionale verkeer.
Het idee van een verbinding tussen de Rijn en de Donau vindt zijn oorsprong ver terug in de geschiedenis. Het idee van een concurrerende scheepvaartverbinding tussen de Main en de Donau bleef Beieren door de eeuwen heen inspireren. Op 6 november 1892 werd in Neurenberg een vereniging opgericht met de naam 'Duitse kanaal en Scheepvaart Maatschappij Rijn-Main-Donau-eV' (Deutscher Kanal-und Schiffahrtsverrein Rhein-Main Donau-eV). Vanaf dat moment werd gesproken van een 'hoge-capaciteit' waterweg tussen de Main en de Donau. Dit cumuleerde uiteindelijk in de oprichting van de Rhein-Main-Donau

AG. (RMD AG). Deze onderneming bezat de concessie voor de bouw en exploitatie van waterkrachtcentrales centrales aan vijf rivieren in het Zuid-Duitsland en in samenhang hiermee was ze verplicht de Rijn-Main-Donau-waterweg te bouwen. Tot voor kort was de RMD AG voor 1/3 eigendom van de Vrijstaat Beieren en voor 2/3 van de Bondsrepubliek. Nu is de RMD AG eigendom van E.ON AG en enkele andere elektriciteitsproducenten in Duitsland.

In het volgende wordt eerst een overzicht gegeven van de voornaamste karakteristieken van de transactiekosteneconomie (TKE) en van de theorie van de eigendomsrechten, die in deze studie zijn toegepast. Dit overzicht mondt uit in een samenvatting van het gebruikte analysekader. Daarna wordt een samenvatting gegeven van de beantwoording van de specifieke onderzoeksvragen, waarbij per onderzoeksvraag een vergelijking wordt gemaakt tussen de drie casussen. In de paragraaf over de algemene conclusies wordt de centrale onderzoeksvraag beantwoord en worden enige centrale tendenties beschreven. Op basis van deze centrale tendenties uit de drie casestudies wordt een gegeneraliseerd model opgesteld van een beheersstructuur voor investeringen in grote infrastructurele werken.

De transactiekosteneconomie

De fundamentele aanname van de TKE is dat organisaties besparen op transactiekosten door de beheersstructuur voor de totstandkoming en afwikkeling van transacties aan te passen aan bepaalde kenmerken van deze transacties. In de praktijk blijkt dat de transactiekosten zeer moeilijk direct te meten zijn. Dat is ook niet nodig omdat het in de theorie gaat om de kenmerken van de beheersstructuren in relatie tot de kenmerken van de transacties. Theoretisch zijn transactiekosten een analytisch begrip zonder een directe empirische connotatie.

In de TKE wordt verondersteld dat economische agenten een beperkte in plaats van een perfecte rationaliteit hebben. Dit heeft tot gevolg dat compleet gespecificeerde contracten, waarin iedere contingentie is voorzien, een onmogelijkheid worden. Het andere uitgangspunt van de TKE is het bestaan van opportunisme. Opportunisme verwijst naar gedrag om het eigenbelang ten koste van heel veel voorop te stellen. Deze beide uitgangspunten zijn een modificatie of uitbreidingen van de veronderstelling over rationeel gedrag uit de neoklassieke economie. Begrensde rationaliteit en opportunisme zijn kenmerken van de economische agenten. Daarnaast zij er de drie relevante attributen van een transactie. Deze zijn:

1. de frequentie waarmee een transactie plaatsvindt;
2. de onzekerheid rondom de totstandkoming en afwikkeling van de transactie;
3. de specificiteit of idiosyncrasie verbonden aan de transactie.

Dit laatste attribuut verwijst naar de mate waarin het verhandelde goed kan worden gebruikt in een alternatieve aanwending, buiten de oorspronkelijke transactie om, zonder opoffering van de waarde van het goed. De specificiteit is hoog als de mogelijkheid van een dergelijke alternatieve aanwending gering is. Gelet op de gedragskenmerken opportunisme en begrensde rationaliteit en tengevolge van de attributen van de transacties is gegeven welke beheersstructuur het meest transactiekostenefficiënt is. Hierbij is het attribuut van de frequentie vaak niet zo belangrijk, omdat er dan een negatieve relatie bestaat tussen frequentie en onzekerheid. Hoe hoger de frequentie, hoe lager de onzekerheid. In het vervolg worden daarom alleen maar de attributen onzekerheid en specificiteit in ogenschouw genomen.

Transacties zijn de fundamentele eenheid van analyse in de TKE. De secundaire eenheid in de analyse is de beheersstructuur. Williamson onderscheidt drie discrete structurele vormen van beheer voor de afwikkeling van transacties. Deze zijn: de markt en de hiërarchie als de twee polen van een spectrum en de hybride beheersvorm als een tussenvorm. Een onderneming wordt gezien als een hiërarchische beheersvorm.

Het transactiekenmerk van de specificiteit of de idiosyncrasie heeft de grootste invloed op de transactiekostenefficiëntie van de beheersvorm. Bij een redelijk tot hoog niveau van idiosyncrasie is een waarborg tegen opportunistisch gedrag nodig in de vorm van een hybride of hiërarchische beheersvorm. Een stijgend niveau van het attribuut onzekerheid vermeerdert deze behoefte.

De markt is de aangewezen beheersstructuur wanneer de onzekerheid en de specificiteit laag zijn. Met een gemiddeld niveau van specificiteit is de hybride vorm het meest geschikt om de transactiekosten te minimaliseren. Maar wanneer in deze situatie de mate van onzekerheid toeneemt, is volgens de TKE de hiërarchie de meest adequate beheersstructuur. Met een zeer hoge mate van specificiteit, ongeacht het niveau van onzekerheid, voorspelt de TKE dat alleen een hiërarchie in staat is om de transactiekosten te minimaliseren. Met toenemende niveaus van onzekerheid, gecombineerd met toenemende specificiteit zal de efficiënte beheersstructuur steeds meer een hiërarchie zijn. De onderstaande tabel geeft een overzicht van het verband volgens de TKE tussen de niveaus van de attributen van de transactie en de bijbehorende beheersstructuren.

Tabel 1. De niveaus van de attributen van de transactie en de bijbehorende beheersstructuren.

	Specificiteit		
Onzekerheid	Laag	Middel	Hoog
Laag	Markt	Hybride	Hiërarchie
Middel	Markt	Hybride of Hiërarchie	Hiërarchie
Hoog	Onbepaald	Hiërarchie	Hiërarchie

In tegenspraak tot de theorie, wordt in de empirische literatuur geconstateerd dat hybride beheersvormen goed overweg kunnen met gemiddelde tot hoge niveaus van onzekerheid. Deze schijnbare inconsistentie kan worden opgelost door een meer uitgebreide beschrijving van de werking van hybride beheersstructuren. Hierbij wordt onderkend dat er twee manieren zijn waarop hybride organisaties werken. De eerste is de meer standaard werking gebaseerd op een gedetailleerde en van te voren bepaalde controle op de naleving van het contract ('compliance control'). Hier zijn in de contracten de te behalen resultaten of de uit te voeren acties redelijk gedetailleerd beschreven. De beheersing richt zich vooral op het toezicht, op basis van de vooraf gedefinieerde en contractueel verankerde normen.

Aan de andere kant zijn er hybriden die worden gekenmerkt door een meer verkennende vorm van beheer ('exploratory control'). Hier worden in het contract alleen een te behalen doel vastgelegd en wordt impliciet het vertrouwen uitgesproken dat dit doel gehaald gaat worden. Meestal zijn het contracten waarin een verwachting voor de ontwikkeling van een lange-termijnrelatie is beschreven. Normen voor het beoordelen van de prestaties binnen het contract ontstaan tijdens de uitvoering van het contract.

De conclusie van deze theoretische uitwijding over de hybride beheersvormen is dat het goed mogelijk is dat de hybride beheersvorm die gebaseerd is op de verkennende soort van beheer een efficiënte beheersstructuur is in situaties van substantiële onzekerheid.

Het vier-lagenmodel

Het vier-lagenmodel van Williamson bevat vier niveaus van sociale analyse, waarbij de analyse afhankelijk is van de onderkende soorten instituties per niveau. Het model is hiërarchisch opgebouwd, beginnend bij normen en waarden en eindigend met de institutie van de onderneming als een productiefunctie. Op het eerste niveau zijn dus de informele instituties van de normen en waarden actief. Door de meeste institutionele economen worden deze informele instituties als een gegeven beschouwd. Instituties op dit niveau veranderen

heel langzaam. Zij kunnen worden gezien als informele beperkingen met een bepalende invloed op de lange termijn economische ontwikkeling. Op het tweede niveau bevindt zich de institutionele omgeving. Deze bestaat uit formele regels zoals grondwetten, wetten en eigendomsrechten. Ze worden ook wel de regels van het spel genoemd. Op dit niveau bestaat de mogelijkheid tot, wat Williamson noemt, 'de eerste orde afweging' (first order economizing): dat wil zeggen: zorg dat de regels van het spel efficiënt zijn. Veel van de economie van de eigendomsrechten speelt zich af op dit niveau.

Op het derde niveau van de sociale analyse bevinden zich de beheersstructuren, ook wel institutionele arrangementen genoemd, voor het afwikkelen van de transacties. Het beheer van de contractuele betrekkingen is hier de focus van de analyse. De eenheid van analyse is een transactie en de TKE van Williamson wordt toegepast. Dit leidt tot de tweede-orde afweging: zorg dat de beheersstructuren efficiënt zijn. Op het vierde niveau geldt de analyse uit de neoklassieke economie. Op basis van een productiefunctie als een abstractie van een onderneming wordt in de analyse de inzet van de productiefactoren kapitaal en arbeid geoptimaliseerd.

Een van de belangrijkste analytische instrumenten van dit vier-lagenmodel is het onderscheid tussen de institutionele omgeving op niveau 2 en de institutionele arrangementen of beheersstructuren op niveau 3. Dit geeft de mogelijkheid om bij de casestudies van de drie kanaalprojecten aandacht te besteden aan de invloed van de instituties van niveau 2 op de transactiekostenefficiëntie van de beheersvormen op niveau drie. In deze studie wordt de institutionele omgeving van niveau 2 vertegenwoordigd door de relevante eigendomsrechten voor de bouw van de kanalen.

Eigendomsrechten

Er bestaan verschillende categorieën van eigendomsrechten, maar de meeste auteurs beperken hun aandacht tot de specifieke rechten van privaat eigendom. Dat wordt in het navolgende ook gedaan Deze eigendomsrechten kunnen worden onderverdeeld in drie soorten rechten:

1. Usus recht: Dit is het recht om een goed te gebruiken.
2. Usus fructus: het recht op het vruchtgebruik van het goed
3. Abusus: het recht om de vorm en inhoud van het goed te veranderen, alsmede het recht om de verandering van de waarde van het goed te incasseren.

In het analyseschema dat in dit proefschrift wordt gebruikt, worden daarna de kenmerken van deze drie elementen van eigendomsrechten geïdentificeerd en beoordeeld. Deze kenmerken worden vertegenwoordigd door de volgende drie vragen die in de analyse worden beantwoord, namelijk:

a. Is het recht duidelijk gedefinieerd?
b. Wat is de exclusiviteit van het recht?
c. Is het recht overdraagbaar?

Daarnaast wordt nog een vierde kenmerk afgeleid uit de omstandigheid dat transactiekosten positief zijn en dat er daarmee een verschil bestaat tussen de economische en juridische eigendomsrechten. Hierdoor kan in beginsel de mogelijkheid bestaan dat een derde partij, die het economische eigendomsrecht heeft, beslag legt op de winst (residual return) uit een transactie tegen het juridische eigendomsrecht in.
De waarde van een eigendomsrecht voor de voortbrenging van goederen en diensten is hoog als het recht duidelijk is gedefinieerd, als het een exclusief recht is en als het recht overdraagbaar is.

Fasen in een project en analyseschema

Het analytisch kader voor de toepassing van de TKE en de theorie van de eigendomsrechten is gebouwd op een min of meer theoretische beschrijving van de stadia van een project. Deze beschrijving van de stadia maakt het mogelijk verschillende partijen en verschillende transacties te onderscheiden die betrokken zijn bij de realisatie van een grote infrastructuur. In een min of meer theoretische volgorde zijn de stadia:

4. Planning
5. Ontwerp en financiering
6. Feitelijke bouw
7. Eigendom, exploitatie en onderhoud
8. Overdracht

Planning verwijst naar de fase waarin het idee van het project wordt ontwikkeld. In deze fase wordt de haalbaarheid van het project bestudeerd. In de tweede fase wordt het kanaal

ontworpen op de tekentafels en wordt de financiering van de kanaalbouw geregeld. Hierbij moet een onderscheid worden gemaakt tussen financiering en bekostiging. Financiering betreft het beschikbaar stellen van middelen voor de realisatie van het project. Bekostiging gaat over de uiteindelijke betaling van de rentelasten en aflossingen op de investeringen, samen met andere exploitatiekosten van het project. De bekostiging is onderdeel van fase 4. In de derde fase wordt het kanaal werkelijke gebouwd. Hier worden aannemers en onderaannemers betrokken bij de uitvoering van de werkzaamheden. In de volgende fase is het kanaal voltooid en in gebruik genomen. Het is denkbaar dat in fase vijf, van de overdracht, een eventuele concessie om het kanaal te exploiteren wordt beëindigd of dat een aantal eigendomsrechten voor deze exploitatie worden overgedragen aan een andere partij. Hier kan ook de economische levensduur van het kanaal eindigen, hoewel de fysieke levensduur nog niet is beëindigd.

De indeling in stadia maakt het mogelijk om te onderkennen dat per fase de relevante transacties verschillende niveaus van de attributen onzekerheid en specificiteit kunnen hebben. Hiermee wordt de TKE per fase toegepast. Voor iedere fase worden de partijen geïdentificeerd die betrokken zijn bij de specifieke fase van het project. Daarna worden de transacties en vooral de kenmerken van de transacties per fase gespecificeerd. Hierbij wordt de vraag beantwoord wat de mate van onzekerheid en de mate specificiteit is van de relevante transacties. Daarna worden de beheersstructuren in de betreffende fase van het project geïdentificeerd en geclassificeerd. En als laatste wordt een oordeel gegeven over de 'match' tussen de attributen van de transacties en de waargenomen beheersstructuren per fase. Dit gebeurt op basis van de theoretisch veronderstelde transactiekostenminimaliserende relatie tussen deze attributen en de beheersstructuren zoals die blijkt uit tabel 1 van deze samenvatting.

Specifieke onderzoeksvragen

Op basis van de centrale onderzoeksvraag zijn zes meer specifieke onderzoeksvragen geformuleerd, namelijk:

1. Wat zijn de belangrijkste kenmerken van de geschiedenissen van de drie kanaal-projecten?

2. Wat zijn de kenmerken van de nieuwe institutionele economie (NIE) die kunnen worden toegepast bij de studie naar de beheersvormen van investeringen voor deze drie kanaalprojecten?
3. Wat zijn de relevante beheersstructuren van de drie kanaalprojecten in het licht van de NIE?
4. Hoe goed waren de beheersstructuren in staat om onverwachte technische, economische en politieke gebeurtenissen te verwerken?
5. Kan de NIE helpen om het succes of het falen van de kanalenbouw en de latere exploitatie van de kanalen te verklaren?
6. Kunnen we leren uit de geschiedenis van de drie kanalen door toepassing van de inzichten uit de NIE?

In het navolgende zullen deze specifieke onderzoeksvragen worden beantwoord waarbij ook vergelijkingen tussen de drie kanaalprojecten in het antwoord worden betrokken.

De belangrijkste kenmerken

De eerste onderzoeksvraag naar de belangrijkste kenmerken van de geschiedenis van de kanalenbouw betreft de beschrijving van de dries cases. Voor de kanalen van Koning Willem I is het belangrijkste kenmerk de macht die koning had, zowel met betrekking tot waterstaatskwesties als op het gebied van de overheidsfinanciën, gebaseerd op grondwettelijke bepalingen over deze beleidsterreinen. Dit maakte het voor hem mogelijk op te treden als een welwillende heerser, althans in theorie. In de praktijk zijn de zaken ingewikkelder. In theorie hoefde hij niet samen te werken met belanghebbenden en voor de financiering van zijn projecten kon hij het stellen zonder overeenstemming met het Parlement, zeker in het begin van zijn regeerperiode. In de praktijk was de macht van de koning beperkt door een onvoldoende uitwerking van het staats-en publiekrecht waardoor in de praktijk van alledag de rechten en plichten van de verschillende overheidsinstanties onduidelijk waren. In de literatuur worden drie oorzaken genoemd voor de ineffectiviteit van het autocratische bewind van Willem I, die ook van toepassing zijn op zijn kanalenbouw. Ten eerste werden de informatiestromen over de financiën van de rijksoverheid voor een lange periode onderdrukt. De tweede oorzaak was de onmogelijkheid om falende ambtsdragers zoals Willem I of zijn ministers door acties vanuit het Parlement te corrigeren

of te vervangen en ten derde, als een resultaat hiervan, was er een toenemend gebrek aan controle over deze beleidsmakers.

Toen het moeilijker werd voor de koning om de financiering van de kanalenbouw te regelen zonder voorafgaande toestemming van het Parlement gebruikte hij het Amortisatie-syndicaat, waardoor hij belangrijke financiële mogelijkheden tot zijn beschikking kreeg. Mogelijkheden die private partijen niet leken te hebben. Dit wordt bijvoorbeeld geïllustreerd door de geschiedenis van de in België particulier aangelegde kanalen, waarbij in een aantal gevallen uiteindelijk Willem I of het Amortisatiesyndicaat voor de financiering van de totstandkoming van deze kanalen garant moesten staan.

Ook belangrijk is dat de koning de informatiestromen over zijn projecten kon beheersen en naar zijn hand kon zetten, door zijn controle over de waterstaatsorganisatie. Zowel bij de totstandkoming van het Noordhollandsch Kanaal als ook bij de Zuid-Willemsvaart was de organisatie van de waterstaat en de directe verbindingen die Willem I had met de hoofdingenieurs erg belangrijk voor de realisatie van de projecten. De vraag is nu wat de kwaliteit van deze informatie was? Technisch was er geen probleem, of de problemen konden worden opgelost door de staat en de regionale bureaus voor de waterstaat. De feitelijke bouwperiodes van de twee kanalen, ook van het technisch moeilijke Noordhollandsch Kanaal, waren verrassend kort. Maar er waren meestal geen goede economische evaluaties van de projecten, of onzekerheden rondom de schattingen in deze evaluaties waren zeer hoog. Kenmerkend is dat de koning het niet nodig vond om hoge kwaliteit informatie te hebben over de economische haalbaarheid van zijn kanaalprojecten. Hij had de macht om alleen te beslissen en om alleen de financiering van de projecten te realiseren, zodat hij andere partijen niet hoefde te overtuigen van het nut en de noodzaak van de projecten. Daarnaast was Koning Willem I op detailniveau zeer betrokken bij de specificaties van de aanbestedingen en bij de resultaten van de verschillende offertes voor de feitelijke bouw van de twee kanalen.

Belangrijk is ook dat door andere auteurs is geconcludeerd dat, hoewel de koning bijna absolute grondwettelijke macht had, de uitvoering van deze absolute macht ernstig werd belemmerd door het ontbreken van een adequate juridische structuur waarin de betrekkingen tussen de centrale en lagere overheden goed waren geregeld. Men kan zeggen dat tijdens de kanalenbouw door Willem I de regels van het spel begonnen te veranderen. De positie van Willem I werd bepaald door zijn grondwettelijke rechten, maar deze grondwettelijk bepaalde positie veranderde. Onder druk van het Parlement moest hij een deel van zijn financiële macht opgeven. Dit leidde ertoe dat hij ging zoeken naar andere manieren van financiering

van zijn projecten, waardoor hij het Amortisatiesyndicaat ging gebruiken. Men kan zeggen dat tijdens de kanalenbouw de institutionele omgeving, waarin Willem I opereerde, veranderde.

Het belangrijkste kenmerk van de geschiedenis van het Suezkanaal is dat Ferdinand de Lesseps de juiste man was op de juiste plaats op het juiste moment. Hij slaagde erin concessies te verkrijgen van de Egyptische heerser Said Pasja en hij slaagde erin om de Suez Canal Company te voorzien van de financiële middelen om het kanaal te bouwen. Hij bouwde voort op de kennis en plannen van het voorbereidende werk dat door andere Fransen in de eerste tientallen jaren van de negentiende eeuw is uitgevoerd. Beslissende hier was het moment waarop duidelijk werd dat er geen verschil was in de zeespiegel van de Middellandse Zee en de Rode Zee. Want toen werd het duidelijk dat er geen grote technische belemmeringen meer waren voor het graven van het kanaal. Vanaf dat moment was het een kwestie van financiering en van politieke besluitvorming, waarbij op beide terreinen de rol van Ferdinand de Lesseps beslissend was.

Een van de meest opvallende kenmerken van de geschiedenis van het Rijn-Main-Donau-waterweg is het lang bestaande idee van een waterweg die de Rijn en de Donau zou verbinden. Al in de negentiende eeuw was er een kanaal tussen de Main en de Donau: het 'Ludwig-Main Kanal'. Maar dit kanaal bleek te klein zijn en het verloor de concurrentie met de opkomende spoorwegen. Maar het idee van een 'hoge capaciteit waterweg' tussen de Rijn en de Donau bleef in leven. Belangrijk hiervoor was de particuliere organisatie van de 'Duitse Rijn-Main-Donau-kanaal en Scheepvaart Maatschappij'. De activiteiten van deze particuliere organisatie cumuleerde in de Main-Donau-Vereniging. Door het werk van deze organisatie bleek dat een waterweg tussen de Rijn en de Donau technisch mogelijk en ook haalbaar was. In een proces van schadeloosstelling van de Duitse deelstaat Beieren voor de negatieve effecten van het nieuwe rijksvervoersbeleid in de beginjaren van de twintigste eeuw, werden onderhandelingen geopend tussen het Rijk en Beieren over de bouw van deze hoge capaciteit waterweg tussen het stroomgebied van de Rijn en dat van de Donau. Dit plan impliceerde kanalisatie van de Main en de Donau. Al in deze initiële onderhandelingen werd besloten dat de waterweg zou worden gebouwd door een privaatrechtelijke vennootschap en dat de bouw van de waterweg zou worden verbonden met de opwekking van waterkracht. Een reeks verdragen werden gesloten tussen het Rijk of de Bondsrepubliek, de Vrijstaat Beieren en soms ook de Rhein-Main-Donau AG (RMD AG). De RMD AG kreeg de

concessie de waterweg en de waterkrachtcentrales te bouwen en deze laatste voor een periode van 99 jaar te exploiteren. Deze structuur van de verdragen tussen de verschillende Duitse overheden en de RMD AG overleefde de hyperinflatie in de jaren twintig, de Tweede Wereldoorlog en overleefde ook de twijfels aan het totstandkoming van het feitelijke Main-Donaukanaal in de jaren zeventig. Tijdens de lange bouwperiode van 1921 tot 1992 zijn de verdragen en de concessies uit de periode 1921-1925 nooit veranderd. Ze werden alleen bevestigd en aangepast aan nieuwe situaties door aanvullende verdragen.

Onderdelen van de NIE

De tweede onderzoeksvraag betreft de vraag naar onderdelen van de NIE die kunnen worden toegepast bij de casestudies van de drie kanaalprojecten. In hoofdstuk V over de kanalenbouw door Koning Willem I werd beschreven dan de theorie van de eigendomsrechten en vooral enige theoretische noties van Douglass North over de wisselwerking tussen eigendomsrechten en het staatsbestel van belang zijn voor de geschiedenis van de kanalen van Koning Willem I. Vooral het idee van North dat de essentiële voorwaarden in deze wisselwerking zijn dat de betrokken partijen over de goede informatie kunnen beschikken en het juiste model hebben om nauwkeurig de gevolgen te beoordelen van het te voeren beleid. En dat alle betrokken partijen daarom een gelijke toegang tot het besluitvormingsproces moeten hebben.

Ook voor de casestudies over de bouw van het Suezkanaal en van de Rijn-Main-Donau-waterweg bleek de theorie van de eigendomsrechten een belangrijk element in de toepassing van de NIE. De bouw van het Suezkanaal was gebaseerd op de eigendomsrechten, gevormd door de concessies die Ferdinand de Lesseps had ontvangen. Deze eigendomsrechten waren ook de fundamenten voor de Suez Canal Company. Voor de Rijn-Main-Donau-waterweg werden de eigendomsrechten gevormd door de verdragen tussen het Duitse 'Reich' of de Bondsrepubliek Duitsland, de Vrijstaat Beieren en de RMD AG. In het eerste verdrag werd aan de RMD AG de concessie verleend om waterkrachtcentrales te bouwen langs de Main en de Donau en om de waterweg te construeren.

De conclusie met betrekking tot deze onderzoeksvraag is dat het niet genoeg is om bij de toepassing van de TKE alleen de beheersstructuren te bestuderen en hun eventuele meer of minder transactiekosten minimaliserende capaciteiten. Ook de eigendomsrechten moeten in ogenschouw worden genomen. Dit omdat eigendomsrechten fungeren als shiftparameters voor het niveau van deze transactiekostenbesparende capaciteiten van de beheersstructuren.

Daarmee kunnen de eigendomsrechten voor de kanalenbouw in de drie projecten niet als een gegeven worden beschouwd.

Niet alleen de theorie van de eigendomsrechten is van toepassing bij de bestudering van de drie kanaal projecten, maar ook de TKE. Het bleek in de casestudies dat in elk van de onderscheiden fasen van de projecten transacties met de specifieke niveaus van de attributen en de specifieke beheersstructuren konden worden onderscheiden die konden worden geconfronteerd met de voorschriften uit de TKE.

Relevante beheersstructuren

In aansluiting op het bovenstaande luidt de derde vraag: Wat zijn de relevante beheersstructuren voor de investeringen in de drie kanaalprojecten?

In de casus van de kanalen van Koning Willem I zijn de belangrijkste beheersstructuren gebaseerd op de grondwettelijke positie van Willem I. In de meeste van de onderscheiden fasen waren de beheersstructuren hiërarchisch van aard. Uitzonderingen waren de beheersstructuren voor het daadwerkelijk bouwen van de Noordhollandsch Kanaal en de Zuid-Willemsvaart. De inschakeling van aannemers bij de bouw gebeurde via hybride beheersstructuren van de ‘compliance control’ soort. Ook de beheersstructuur voor de financiering van de Zuid-Willemsvaart was van een hybride vorm.

Zoals in de casestudie over het Suezkanaal beschreven speelde een groep ingenieurs, bekend als de Saint-Simonisten, en de meer wetenschappelijke organisatie van de 'Societé d'etudes du Canal de Suez' een belangrijke rol bij het plannen en ontwerpen van het kanaal. Maar het was Ferdinand de Lesseps, die de Suez Canal Company vestigde op basis van de concessies die hij persoonlijk ontving. De Suez Canal Company is tot aan de nationalisatie door de Egyptische regering in 1956, de enige beheersstructuur geweest voor de bouw en de exploitatie van het kanaal. De concessies en het Verdrag van Constantinopel uit 1888 vormden de institutionele omgeving waarin de Suez Canal Company opereerde. De belangrijkste beheersstructuur was echter de Suez Canal Company. Deze was actief bij het ontwerpen, de financiering, de bouw en de exploitatie van het Suezkanaal. In de planningsfase was de dominante beheersstructuur de samenwerking tussen de bovengenoemde particuliere organisaties. Deze organisaties vormden een hybride beheersstructuur. Maar ook bij het ontwerpen en de financiering van het kanaal vormde de Suez Canal Company en de Egyptische regering een min of meer hybride organisatie. In de

fase van de bouw en de exploitatie van het Suezkanaal was de de Suez Canal Company een hiërarchische beheersstructuur.

Voor de Rijn-Main-Donau waterweg werden niet alleen de eigendomsrechten gevormd door de verdragen tussen het Rijk of de Bondsrepubliek Duitsland, de Vrijstaat Beieren en de RMD AG. De beheersstructuur werd ook bepaald door deze verdragen tussen Duitsland en de Vrijstaat Beieren. De RMD AG was geen partij bij de verdragen die de beheersstructuur vorm gaven. Vóór 1922 waren de beheersstructuren voor planning en ontwerp van een hybride vorm. Met de oprichting van de RMD AG werd een hiërarchie ingevoerd. Deze hiërarchie was actief bij het ontwerpen en het bouwen van de hele waterweg. De financiering van het project geschiedde in een hybride vorm, omdat hier de RMD AG moest samenwerken met het 'Reich' of de Bondsrepubliek en de staat Beieren.

Concluderend kan opgemerkt worden dat in vergelijking tussen de geobserveerde en theoretisch wenselijke beheersstructuren vanuit de TKE is gevonden dat in de fase van financiering van het Noordhollandsch Kanaal de beheerstructuur als enige negatief beoordeeld moet worden. Daarnaast waren er in de fase van de planning en het ontwerp van Het Noordhollandsch Kanaal en de Zuid-Willemsvaart de hiërarchische structuren waarvan de transactiekostenminimaliserende capaciteiten in deze omstandigheden onbepaald zijn te achten.

Onverwachte ontwikkelingen

Bij het antwoord op vraag over de capaciteit van beheersstructuren om onverwachte ontwikkelingen te kunnen verwerken moet een onderscheid worden gemaakt tussen de beheersstructuren van het Suezkanaal en de Rijn-Main-Donau-waterweg aan de ene kant en de beheersstructuren voor de bouw van de kanalen van Koning Willem I aan de andere kant. Het blijkt dat de beheersstructuren voor het Suezkanaal en de Rijn-Main-Donau-waterweg in staat waren onzekerheden goed te verwerken. Deze structuren waren een lange tijd stabiel, waarbij in de institutionele omgeving aanzienlijke veranderingen optraden. De beheersstructuur voor het Suezkanaal is zeer stabiel geweest over een periode van ongeveer tachtig jaar. De beheersstructuur voor de bouw van de Rijn-Main-Donau waterweg was in

staat om nieuwe ontwikkelingen te internaliseren door het sluiten van nieuwe en aanvullende verdragen.

Het is lastiger om op deze vragen een bevestigend antwoord te geven ten aanzien van de kanalen van Koning Willem I. De beheersstructuren voor de bouw van deze kanalen bestonden niet zo lang. De bouw van de kanalen duurde een relatief kort en de afwikkeling van de financiële gevolgen van de kanalenbouw vond plaats in een veranderende institutionele omgeving waarbij ook de beheersvormen veranderden. De algemene observatie kan zijn dat de beheersstructuren van het Suezkanaal en de Rijn-Main-Donau-waterweg, die gebaseerd zijn op duidelijk omschreven eigendomsrechten en voor een klein deel bestaan uit de standaard hybride vormen, voor een deel uit hybride vormen van de verkennende soort (exploratory control) en voor een groot deel uit de hiërarchieën, goed konden omgaan met verschillende technische, economische en politieke veranderingen.

Mogelijke verklaringen voor succes of falen

Bij de beantwoording van de vraag naar een mogelijke verklaring van succes of falen op basis van de theorie van de eigendomsrechten en de TKE moet de strekking van deze twee theorieën in ogenschouw worden genomen. Het verschil tussen vraag naar en aanbod van kanaalcapaciteit is belangrijk. NIE gaat over de institutionele omgeving en de beheersstructuren waarin aanbod van goederen en diensten wordt afgewikkeld. De NIE is geen theorie om vraagfactoren verklaren. De studie uit dit proefschrift is dus beperkt tot de institutionele factoren die gaan over het aanbod van kanaalcapaciteit. De conclusies hebben dus ook alleen maar betrekking op deze aanbodkant. Wel zou de veronderstelling gebruikt kunnen worden dat het succes van een kanaal als vervoerscapaciteit wijst op een goede beheersvorm waarin de planning en het ontwerp plaatsvonden.

Deze beperking van de NIE in gedachten houdend is het toch lastig om op deze vraag een eenduidig antwoord te geven. Dit geldt vooral voor de kanalen van Koning Willem I. De feitelijke bouw van deze kanalen werd in relatief korte tijd voltooid. Dit betekent een succes voor de hybride vormen waarin deze bouw gestalte kreeg. Erkend moet worden dat het Noordhollandsch Kanaal op de lange termijn een mislukking was, hoewel het een functie heeft gehad als regionaal kanaal. De Zuid-Willemsvaart is veel meer een succes geweest. Dit zou kunnen wijzen op gebrekkige structuren voor de planning en het ontwerp van vooral het

Noordhollandsch Kanaal. Maar de beheersstructuren in de fasen van de twee projecten verschillenden niet veel.

Veel meer onthullend voor het antwoord op de vraag of de theorie van de eigendomsrechten en de TKE verklaringen kunnen bieden voor het succes of falen van de kanalenbouw is de geschiedenis van het Rijn-Main-Donau-waterweg. De waterweg is nu een succes, afgaande op het huidige vrachtvervoer door het kanaal in vergelijking met een schatting midden jaren zeventig van de vorige eeuw. Maar dit succes wordt gevormd door de politieke en economische veranderingen in Midden-Europa sinds de val van de Berlijnse muur. Dit kon niet worden voorzien in de jaren zestig, zeventig en tachtig van de vorige eeuw, toen de verdragen werden afgesloten en de besluiten werden genomen om het Main-Donau-kanaal te voltooien. Alleen al vanwege het grote tijdsverschil tussen het initiële besluit om de waterweg en het kanaal te gaan bouwen en de uiteindelijke realisatie van het kanaal is het antwoord op de vraag naar een verklaring van het succes of falen vanuit de theorie van de eigendomsrechten en de TKE van beperkte betekenis. En voor het Suezkanaal werd in hoofdstuk zeven geconcludeerd dat het kanaal gewoon een te goed idee was om de beheersstructuur beslissend te maken.

Op basis van deze drie casestudies, moet de conclusie dus zijn dat er voorlopig niet een directe relatie tussen de beheersstructuren en het succes of falen van een infrastructuur gelegd kan worden. Er zou wel onderzocht kunnen worden of er een verband aangetoond kan worden tussen transactiekostenefficiënte beheersvormen en efficiency in de meer neoklassieke zin van beheersing van de kosten. Deze kostenbeheersing lijkt altijd een probleem te zijn bij investeringen in grote infrastructuur

Twee opmerkingen kunnen worden gemaakt bij deze conclusie. De eerste opmerking is dat slechts drie casestudies werden uitgevoerd. Dit is waarschijnlijk te weinig om harde conclusies te trekken over deze kwestie. De tweede opmerking is dat een belangrijk aspect van de geschiedenis van de drie projecten niet wordt gedekt door de theorie van de eigendomsrechten en de TKE. Dit aspect is de dominante aanwezigheid van ondernemend gedrag van de belangrijkste actoren in de projecten. Koning Willem I en zeker Ferdinand de Lesseps waren als ondernemers erg belangrijk zoniet beslissend voor de totstandkoming van de projecten. Zelfs bij de totstandkoming van de Rijn-Main-Donau-waterweg speelde ondernemend gedrag van de in 1892 opgerichte 'Rijn-Main-Donau kanaal en scheepvaartvereniging' een belangrijke rol door het idee van een 'hoge capaciteit vaarweg' in Beieren levend te houden. Zeker in de planningsfase van het project was het niet Beieren of het Duitse Rijk die het initiatief hadden, maar was het deze privécommissie.

Kunnen we leren?

De laatste specifieke onderzoeksvraag is de vraag of we kunnen leren van de geschiedenis van de drie kanaalprojecten in het licht van de inzichten uit de NIE? De beantwoording van deze vraag richt zich vooral op de geschiedenis van het Suezkanaal en van de Rijn-Main-Donau-waterweg. Zoals beschreven in de conclusies van het hoofdstuk over de Rijn-Main-Donau-waterweg kunnen de beheersstructuren voor dit project een goed model zijn voor gecompliceerde projecten waarbij verschillende partijen en verschillende overheden zijn betrokken. Het model kan extra waarde krijgen als van elkaar onafhankelijke overheden betrokken moeten zijn bij een project. Onafhankelijk betekent hier dat de overheden niet in een hiërarchische relatie tot elkaar staan. Dit kan worden geïllustreerd met een actueel voorbeeld, waarin samenwerking door middel van een internationale publiek-private constructies zou kunnen worden vormgegeven. Dit project is de voortdurende ontwikkeling van de Donau als een transportroute van Noordwest-Europa naar Midden- en Zuidoost-Europa. Om deze scheepvaartroute effectief te maken moeten investeringen worden gedaan voor de bevaarbaarheid van de Donau door moderne schepen. Vooral waar de Donau de grens vormt tussen Roemenië en Bulgarije en tussen Servië en Hongarije zou de beheersstructuur van de Rijn-Main-Donau-waterweg een voorbeeld kunnen zijn. Zoals het geval was met deze waterweg zijn ook hier verschillende overheden van verschillende landen betrokken, misschien nu met de EU in een coördinerende rol. De kern van de transactiekostenminimaliserende beheersstructuur zou een organisatie naar privaat recht kunnen zijn, een naamloze vennootschap naar bijvoorbeeld Oostenrijks recht, die op basis van concessies en internationale verdragen, waarbij de beginselen van een 'exploratory control hybrid' worden toegepast, de kanalisatie van de Donau op deze stukken van de rivier ter hand neemt.

Beantwoording van de centrale onderzoeksvraag

De centrale onderzoeksvraag van dit proefschrift is of het mogelijk is vanuit de NIE de kenmerken te bepalen van een efficiënte beheersstructuur voor investeringen in grote infrastructuren en voor de exploitatie van deze grote infrastructuren?

Deze vraag kan in het algemeen positief worden beantwoord. De TKE en de theorie van de eigendomsrechten kunnen op een zinvolle manier worden toegepast. Mogelijke andere delen van NIE werden niet gebruikt in de analyse, dus deze conclusies heeft alleen betrekking op

de TKE en de theorie van de eigendomsrechten. De basis voor het gebruik van deze twee onderdelen van NIE is het vier-lagenmodel van Williamson, dat een specifieke relatie legt tussen de beheersstructuren en de eigendomsrechten. Het bleek dat deze theoretische relatie behulpzaam was bij de beschrijving van de betekenis en invloed van de eigendomsrechten voor de beheersstructuren. Voor het Suezkanaal en de Rijn-Main-Donau-waterweg vormden de eigendomsrechten die speciaal voor deze twee projecten werden gedefinieerd, een juiste institutionele omgeving waarin de beheersstructuren konden bestaan. Voor de kanalen van Koning Willem I is het argument in dit proefschrift dat de eigendomsrechten niet goed gedefinieerd of niet goed ingeburgerd waren. De beheersstructuren waren hierbij niet zozeer het probleem. Maar de conclusie is dat de transactiekostenefficiëntie van de beheersstructuren voor de kanalen van Willem I werd gehinderd door de gebrekkige eigendomsrechten.

Het tweede belangrijke uitgangspunt voor de toepassing van de TKE is de indeling van een project in verschillende stadia: planning, ontwerp en financiering, de bouw en exploitatie en de eventuele overdracht van het project. Het voordeel van dit uitgangspunt is dat dit leidt tot de onderkenning van de verschillende transacties en de verschillende beheersstructuren in elk van de stadia van het project. Hiermee wordt het ook mogelijk beheersstructuren te identificeren die verschillen per stadium van het project. Belangrijker nog, voor de toepassing van de TKE, is de mogelijkheid om te zien dat de kenmerken van de transacties, frequentie, idiosyncrasie en onzekerheid, verschillen voor deze verschillende transacties in de verschillende stadia. Hierdoor was het mogelijk om per stadium de waargenomen beheersstructuur te vergelijken met de transactiekostenminimaliserende beheersstructuur die wordt voorgeschreven door de TKE.

De algemene conclusie van dit proefschrift is dus dat het mogelijk is om op basis van de NIE en meer specifiek op basis van de TKE en de theorie van de eigendomsrechten de transactiekostenefficiënte beheersstructuren, voor investeringen in de drie kanaalprojecten te identificeren. Hierbij bleek het vier-lagenmodel van Williamson en de onderverdeling van een project in de verschillende stadia zeer behulpzaam te zijn.

Een generalisatie

Volgens de TKE is een efficiënte beheersstructuur afgestemd op de transacties op een zodanige wijze dat de transactiekosten worden geminimaliseerd. Dit houdt in dat eerst de

transacties moeten worden geïdentificeerd en ingedeeld naar de niveaus van de relevante kenmerken van de transactie. Dan moeten de relevante beheersstructuren worden geïdentificeerd. Confrontatie van deze twee gegevens, resulteert in het inzicht of de beheersstructuur kan worden beschouwd als efficiënt in de zin van de TKE. Deze analyse kan ex-post worden uitgevoerd waarbij gekeken wordt naar bestaande structuren of ex-ante waarbij een beschrijving wordt gegeven van een optimale beheersstructuur. De centrale onderzoeksvraag van dit proefschrift impliceert een ex-post analyse. In deze paragraaf zal een poging worden gedaan om een optimale beheersstructuur te beschrijven op basis van de interpretatie van de beheersstructuren van de drie kanaalprojecten.

In het ex-post analyseschema is gebruik gemaakt van een indeling van het totale project in een aantal fasen. De toepassing van deze structuur in de analyse is bepalend voor het bereiken van conclusies uit dit proefschrift. Daarom wordt deze indeling ook gebruikt in de volgende generalisatie van de geschiedenis van de drie kanaalprojecten.

In de loop van de voorbereiding naar de voltooiing van een project veranderen de efficiënte en optimale beheersstructuren van een hybride vorm naar een hiërarchie. In de planning-, de ontwerp- en de financieringsfase van de drie projecten waren er meer hybride structuren en in de fase van het bouwen waren het vooral hiërarchieën. Hierbij waren er niet alleen verschillende beheersstructuren in verschillende stadia van het project, maar was er ook een zekere continuïteit. Bij de bouw van de kanalen door koning Willem I was het de koning zelf. Voor het Suezkanaal werd de continuïteit gevormd door de Suez Canal Company en de RMD AG, was de centrale en continue beheerstructuur voor de bouw van het Rijn-Main-Donau-waterweg. Dit geeft aanleiding tot de vraag of dit verschijnsel vanuit de TKE verklaard kan worden. Belangrijk hierbij is de definitie van een transactie in de TKE: Van een transactie is sprake wanneer een goed of een dienst wordt verhandeld via een technologisch gescheiden interface. Dit betekent dat de grenzen tussen de fasen van een project kunnen worden gezien als interfaces. De transacties in de fasen van plannen en ontwerpen en financieren hebben betrekking op het overdragen van kennis, vormgegeven in meer of minder uitgewerkte plannen om het kanaal te bouwen. Deze kennis is in hoge mate idiosyncratisch. Onzekerheid hierbij is hoog, in de zin dat het goed mogelijk is dat de kennis ontwikkeld in een eerder stadium niet voldoende blijkt te zijn om een probleem op te lossen. Dit suggereert dat een hiërarchie tussen de verschillende stadia de aangewezen bestuursstructuur is om de transactiekosten te minimaliseren. In principe betekent dit dat er een dominante beheersstructuur voor alle fasen in de realisatie van het project zou moeten zijn. Deze beheersstructuur kan worden beschouwd als de kern van de beheersstructuur voor

elke fase van het project. Deze kern kan worden uitgebreid of aangevuld met beheersstructuren die specifiek zijn voor de fase van het project. Dit was het geval in de drie kanaalprojecten, waarbij koning Willem I, de Suez Canal Company en de Rhein-Main-Donau AG, de kernstructuren vormden. Soms echter kreeg deze kernstructuur een andere functie. Bijvoorbeeld, de RMD AG was de ontwerper van de Rijn-Main-Donau waterweg, was de hoofdingenieur voor de bouw en na de voltooiing van het Main-Donau kanaal bleef de RMD AG eigenaar en exploitant van de door haar gebouwde waterkrachtcentrales. Ook voor de Suez Canal Company deden zich min of meer dezelfde verandering van de rollen voor, maar bleef de onderneming de kern van de beheersstructuur. In de exploitatiefase werd de institutionele omgeving onder andere gevormd door de Conventie van Constantinopel. Dit verdrag werkte als een eigendomsrecht voor de gebruikers van het kanaal. Ook de veranderende positie van de RMD AG als de exploitant van de centrales is gebaseerd op het concessieverdrag dat ook de specificatie van de eigendomsrechten inhield. Deze noties leiden tot generalisatie dat de kern van de beheerstructuur van functie kan veranderen op basis van veranderende eigendomsrechten. Maar ook de meer flexibele delen van de beheersstructuren waren gebaseerd op de definitie van eigendomsrechten, in de vorm van concessies of andere vormen van verdragen. De conclusie kan zijn dat de eigendomsrechten de flexibiliteit van de beheersstructuren definiëren. Eigendomsrechten definiëren van de rol van de kern, maar ze zijn ook bepalend voor het bestaan van de beheersstructuren die specifiek zijn voor een projectfase.

Dit model voor de beheersstructuren voor de investeringen in een groot infrastructuurproject, heeft dus als kenmerkt dat de optimale beheersstructuur verschilt per stadium. Maar er is een constante beheersstructuur die wordt omringd door andere, per fase wisselende structuren. Het bestaan van de kern en ook van wisselende structuren wordt bepaald door het krachtenveld van de relevante eigendomsrechten.

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Curriculum Vitae Tom Weijnen

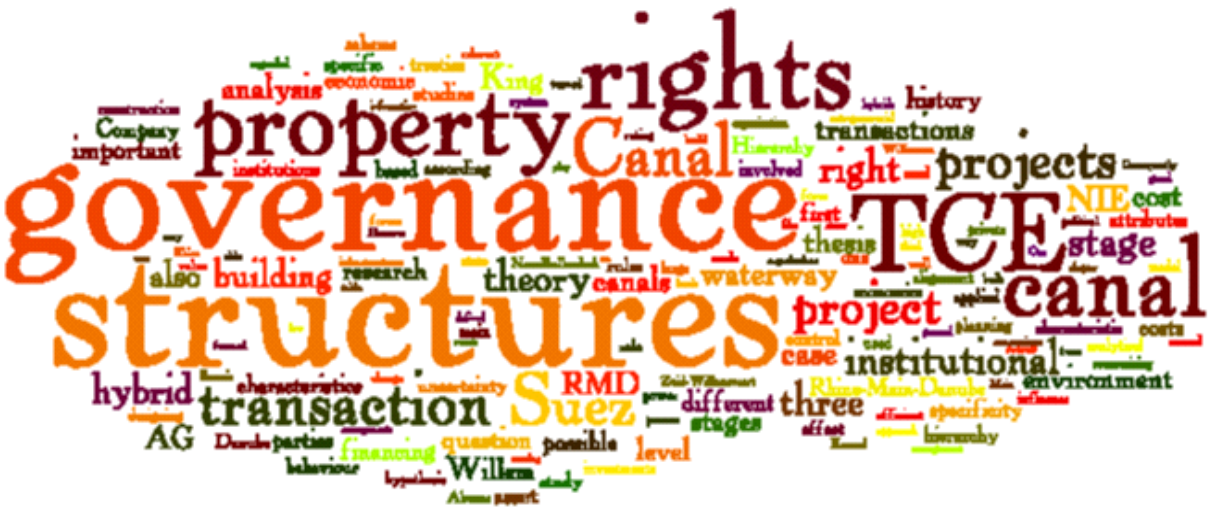
Tom Weijnen (1952) studied economics at the Erasmus University Rotterdam. Tom specialized in applied economics in health care, regulation and public economics. Until 2006 he worked at the Centre for Health Care Policy and Law of the Erasmus University. He has extensive experience with cost-effectiveness analyses and quality of life measurement in health care. He participated in a European research project on output measurement in health that resulted in publications on this topic.

In 2006 and 2007 he was involved with projects concerning regulatory impact assessments and the measurement of administrative burdens. Tom was coordinator of the Expert group on Methodology of the European Network for Better Regulation.

Tom has published on subjects like regulatory impact assessment, quality of life measurement, cost-effectiveness analyses in health care and on health regulation and shop renting regulation.

In 2006 he began to write his PhD thesis about governance of large infrastructures. His supervisor is Prof. Dr. P.B. Boorsma of the University of Twente.

In January 2008 he started as a senior researcher at the Institute for Research on Public Expenditure (Instituut voor Onderzoek van Overheidsuitgaven: IOO). Here he is involved with research on different topics in public economics. He was one of the researchers on a project, commissioned by the province of Noord-Brabant, to review a study of the Financial Relations Counsel (Raad voor de Financiële Verhoudingen) about the finances of the provinces. Currently he is carrying out a cost-effectiveness analysis of service dogs for the disabled, commissioned by the Dutch health insurance authority CVZ.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