PETER W. DE LANGEN

The Performance of Seaport Clusters;

a framework to analyze cluster performance and an application to the seaport clusters in Durban, Rotterdam and the lower Mississippi
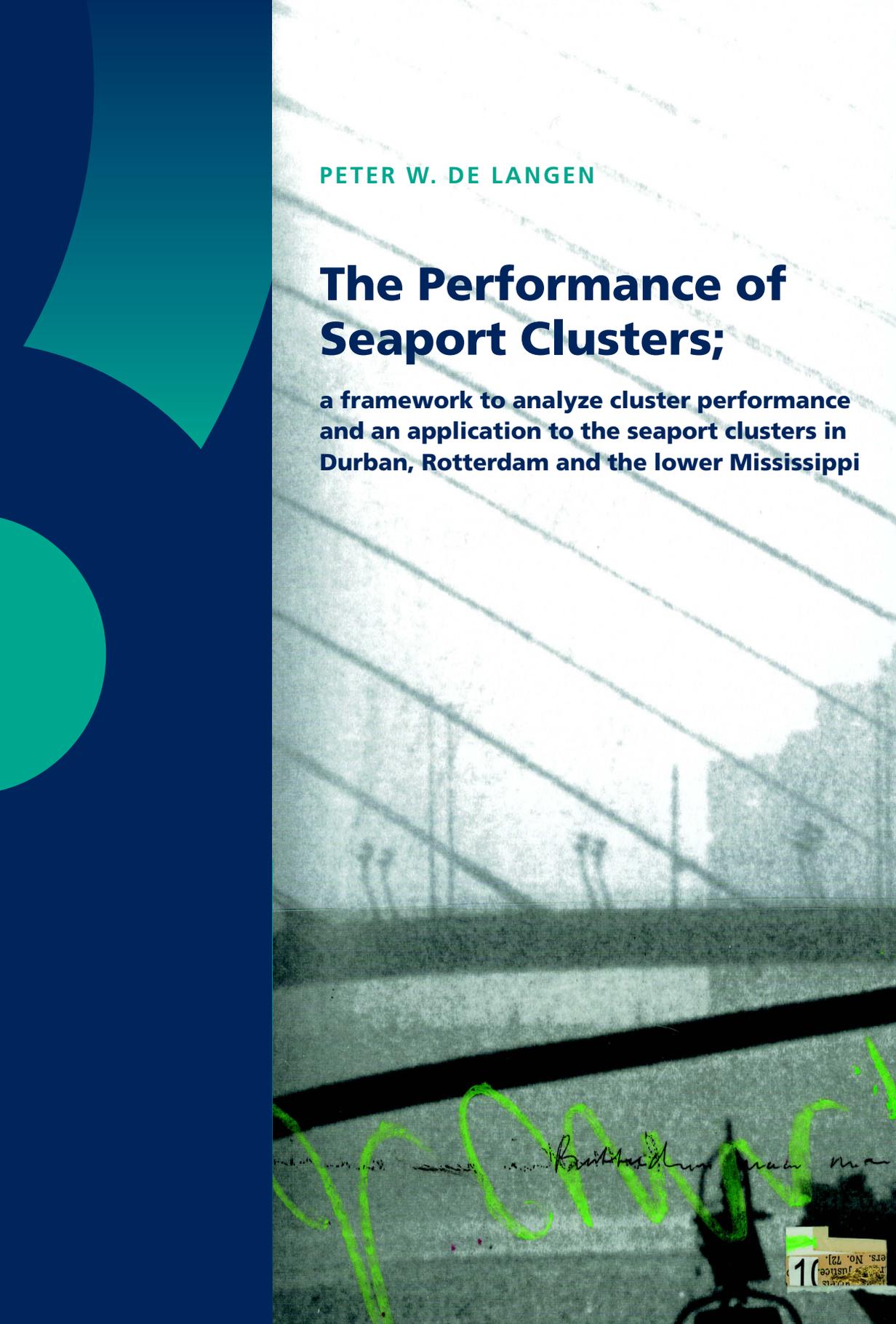
The Performance of Seaport Clusters

A Framework to Analyze Cluster Performance and an Application to the Seaport Clusters of Durban, Rotterdam and the Lower Mississippi

The Performance of Seaport Clusters

A Framework to Analyze Cluster Performance and an Application to the Seaport Clusters of Durban, Rotterdam and the Lower Mississippi

De performance van havenclusters

Een raamwerk om cluster performance te analyseren en een toepassing op de havenclusters in Durban, Rotterdam en de beneden-Mississippi

Proefschrift

ter verkrijging van de graad van doctor aan de
Erasmus Universiteit Rotterdam
op gezag van de
Rector Magnificus

Prof.dr. S.W.J. Lamberts

en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
donderdag 22 januari 2004 om 16.00 uur

door

Peter Wubbe de Langen
geboren te Hekendorp

PREFACE

My first publication on the port of Rotterdam is a work made in primary school, now about 19 years ago. It was hardly scientific, even though in the last chapter 'interview with a pilot', I used the same research technique as I used in this PhD thesis. Perhaps my grandfather, who lived in Rotterdam a large part of his life and had a vivid interest in the port, nurtured my interest for ports. Or perhaps my interest in ports was inherited from my father, who consulted internationally in the field of ports and transportation. In any case, I started writing about ports early. In secondary school, I also wrote an essay on the port of Rotterdam. It recommends a strategy to diversify the port that somehow echoes in this PhD. At university, I chose to specialize in transport, port and regional economics and wrote several papers on the port of Rotterdam. So I think it is fair to say that I am a port specialist by now.

After finishing my studies, I had the opportunity to become involved in two initiatives to build-up something from the start. Arjen van Klink offered me a job at the University with a newly started venture to attract and carry out externally funded research (ETECA) and later I had the opportunity to work together with prof. Harry Welters to develop the chair port economics. His ability to care for and act in the interests of others is rather unique in the university environment, and perhaps any working environment. I hope his example has 'spilled-over' to some extent to me.

I also hope we can continue to build a chair in port economics that is valued both by the Erasmus University and by the port community. In this respect, I would like to thank the Rotterdam Municipal Port Authority and the port association Deltalinqs for their support to the chair port economics. I hope they can be satisfied with this PhD and look forward to future cooperation.

After about three years of research an idea for a PhD thesis started to materialize. The appointment of Bart Nooteboom as professor in 'Organizational Dynamics' at Erasmus University was a great opportunity for me, since from his articles it was clear for me that his theoretical knowledge on clusters is unique in the Netherlands. I am very grateful for his willingness to supervise my PhD. I remember thinking after the first joint meeting with prof. Nooteboom and prof. Welters over breakfast in Scheveningen 'if you mess it up now, you only have yourself to blame, because the supervision team is perfect'. This first impression

The frequent question why I work in a university environment, has never been difficult to answer, because frankly speaking, I consider our department as rather 'hip' (even though I admit it is not really hip to say so). We have a dynamic group of 'young dogs' that create both a pleasant working environment and some competitive pressure that makes us all move forward. Thus, I would like to thank Willem (for being my choir companion) Erik (for his defensive soccer skills), Alexander, Paulus, Paolo, Marco (for his DJ skills), Peter (for being a pleasant roommate), Peran, (for his unavoidable presence when I was working late –until his PhD was finished), Ariane (for being a female soccer expert), Didier (for being a Belgian coping up in the Netherlands), Michiel (for good team work), Larissa (for project management skills hard to find at universities), Jan-Jaap (for last minute support), and Guiliano (for being the most 'ingeburgerde' Italian ever). I hope the 'young dogs' will remain young for some time to come. In this respect, I think it is fair to say that the director of our department, prof. Leo van den Berg, sets a very good example.

I cannot resist the temptation of thanking various persons who strictly speaking did not contribute to this PhD, but whose company I greatly value and who keep me mentally and physically (reasonably) healthy. So thanks to the 'Ragazzi' (Alex, Berend, Charles, Ed, Eric en Maurice), Bart, Klaske en Simone, Tim, my soccer teammates and other friends for 'being there'. Thanks also to Marius, Mieke, Matthijs and Marijn, I hope you are proud, and thanks Maria, for your love and 'energy, energy'.

Rotterdam, November 2003

CONTENTS

Part three: conclusions

1   INTRODUCTION

Economists have always had an interest in factors that govern economic development. This issue has been addressed at different levels, the firm level (Rumelt et al, 1994), regional level (Van den Berg, 1987) and national level (for instance Adam Smith's (1776) classic on the 'wealth of nations'). The economic development of *regions* receives more and more attention. One particular regional environment, to which a relatively prosperous economic development is often attributed, is a *cluster,* defined as a regional concentration of related economic activities (Krugman, 1991).

Scientists and (regional) policy makers have embraced the cluster concept, have identified regional clusters, and have developed policies and strategies to enhance the development of clusters (Markusen, 1996). A large variety of clusters, each with different characteristics (see for instance Van Dijk and Sverrison, 2003), have been identified. Famous examples include Italian industrial districts (Brusco, 1982), high tech clusters such as Silicon Valley (Saxenian, 1992), and service clusters, such as the financial service cluster in London (Amin and Thrift, 1992).

Surprisingly perhaps, the cluster concept has hardly been used to analyze *seaports*, even though port activities are geographically concentrated in a limited number of regions, mainly because geographical conditions are favorable in some regions. These regions attract substantial numbers of port related firms. Therefore, ports can be regarded as 'text-book cases' of clustering (see Fujita and Mori, 1996). Port related economic activities are of substantial importance for the regional economy in many port regions. In this dissertation the cluster concept is applied to seaports, to enhance the understanding of the performance of (seaport) clusters.

1.1   Research objectives

This research has two objectives. The first objective is to contribute to the theoretical knowledge on the factors that govern the performance of clusters. Even though clusters have recently been studied widely, the theoretical knowledge on clusters and factors that govern their performance is still fragmented and based on case studies. The objective of this

research is to enrich this knowledge by developing a framework to analyze clusters that draws from various schools. This framework can also provide a basis for developing policies and strategies to improve the performance of clusters.

The second research objective is to contribute to the theoretical and empirical knowledge on seaports, by applying the cluster concept to seaports. Economic geographers and (maritime) transport economists have studied ports, but hardly with the use of the cluster concept. The cluster perspective can be especially fruitful for analyzing governance in seaport clusters.

The two objectives lead to two research questions, a theoretical one and an empirical one. Both can be split up into three sub-questions. The theoretical research question is:

How can the 'performance' of a cluster be analyzed?

The related sub-questions are:

- How can the cluster concept be defined and how can clusters be identified?

- How can the performance of clusters be measured?

- What cluster specific variables influence the performance of clusters?

The empirical research question is:

How can the 'performance' of port clusters be analyzed and what are the results of such an analysis for the ports of Rotterdam, Durban and the Lower Mississippi?

The related sub-questions are:

- Can activities in ports be analyzed as economic clusters and what activities are included in port clusters?

- How do variables derived from various theories affect the performance of the three selected ports?

- What implications for the governance of port clusters in general and the three ports in particular can be drawn?

1.2   Overview of the study

The study consists of an introduction and three parts: a theoretical part, an empirical part and a concluding part (see figure 1). The theoretical part, comprising chapters 2-6, answers the theoretical research question. In chapter two the cluster concept is discussed and in chapter three the issue of the performance of a cluster is addressed. In chapter four a theoretical framework to analyze the performance of cluster is presented. Central in this framework is a distinction between variables of cluster performance related to the *structure* of the cluster and variables of cluster performance related to the *governance* of the cluster. These are discussed in detail in chapters five and six respectively.

The empirical part, comprising chapters 7-12, answers the empirical research question. Chapter seven presents the research method. Chapter eight deals with port clusters and introduces the three case studies. In chapter nine, the research issues for analyzing the performance of seaport clusters are identified. In chapter ten, the results of the case studies with regard to the effects of cluster structure on the cluster performance are discussed. In chapter eleven the results on the relation between cluster governance and performance are discussed. Chapter twelve, on strengths and weaknesses of the three port clusters, finalizes the empirical part.

The concluding part consists of chapters 12-15. In each chapter the most important conclusions are highlighted and suggestions for further research are presented. In chapter thirteen conclusions relevant for analyzing clusters are discussed. Chapter fourteen discusses conclusions relevant specifically for seaport clusters. In the final chapter opportunities for policy and management in seaport clusters are discussed. Figure 1 shows the structure of the research.

Figure 1: Research structure
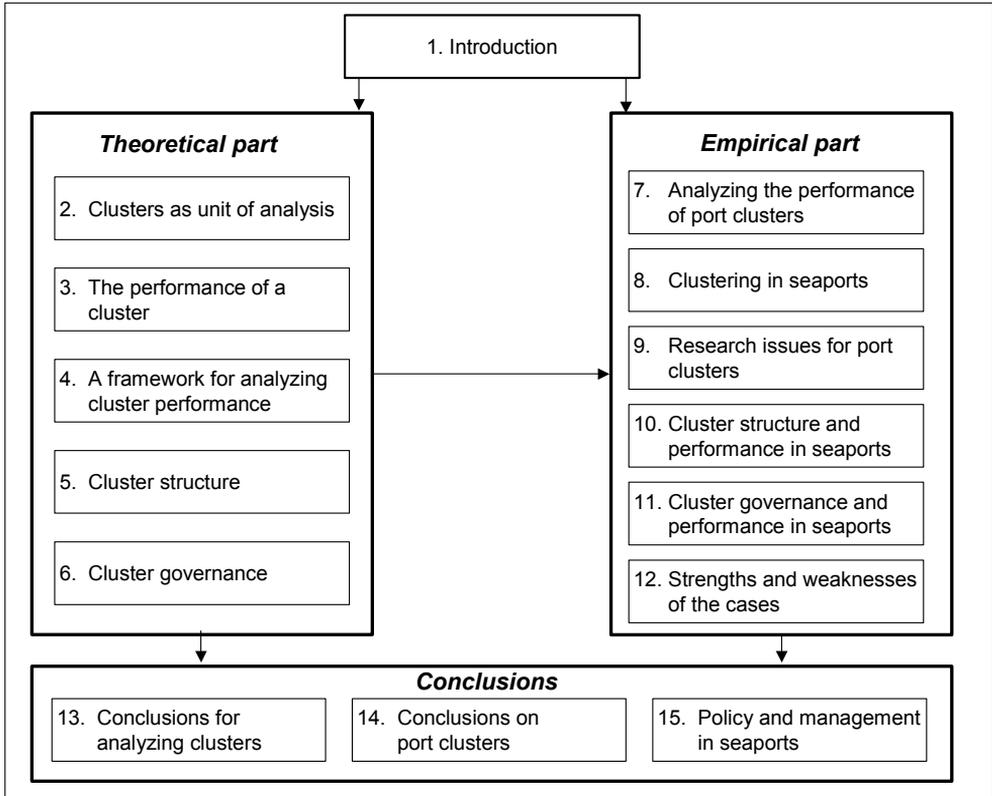
1.3   Scope and limitations of the dissertation

The research questions are quite broad. Therefore limitations in terms of scope and depth are necessary. Five major limitations of the research are recognized.

The number of factors that influence the performance of a cluster is huge. This study only deals with cluster specific variables. A focus on these factors can yield new insights, as it has become clear that these variables have a substantial influence on the development of a cluster (Porter, 1990). Other variables, such as technological developments and (inter)national regulations clearly influence the performance of a cluster, but these are not incorporated in the framework. The relevance of external variables is addressed in each of the case studies, but they are not incorporated in the theoretical framework.

Second, insights from various schools are incorporated in the theoretical framework. These insights are included only when they are widely accepted in these schools. No attempt is made to critically discuss the different schools.

Third, the case studies of port clusters test the usefulness of the framework and the validity of the variables incorporated in the framework. So far, the only other framework that can be used to analyze the performance of clusters is Porter's diamond framework. However, this framework is not well based on existing economic theories and concepts. This study aims to provide an alternative framework that incorporates insights from established economic theories. However, no 'test' is made to evaluate whether the explanatory value of the framework developed in this study is better than Porter's framework. Such a test is hardly possible, given the holistic nature of both frameworks.

Fourth, the framework to analyze the performance of clusters is only applied to seaports. Seaport clusters are likely to differ substantially from other clusters. Conclusions based on the empirical evidence can therefore not be automatically generalized to all clusters.

Fifth, the cases give a description of the three port clusters at one moment in time. The historical background is only provided when clearly relevant. The performance of the cluster over time is not systematically analyzed.

THEORETICAL PART: CLUSTER THEORY

2   CLUSTERS AS UNIT OF ANALYSIS

In this chapter the cluster concept is discussed. First, reasons for choosing clusters as unit of analysis are briefly discussed. Second, a definition of a 'cluster' is presented and discussed. Third, a method to identify and delimit a cluster is developed.

2.1   Reasons for analyzing clusters

Clustering of firms in a region can be observed in many countries (see Krugman, 1991 and Porter, 1990, for some illustrations). Even though clusters have been widely studied recently, the cluster as unit of analysis is still less common than national economies, industries, firms or individuals. In fact, some scholars that study clusters take *firms* as the unit of analysis. Taking clusters as unit of analysis adds to the body of economic knowledge for at least three reasons.

First, clustering cannot be fully understood as simply the result of location decisions of individual firms. The development of clusters is a path dependent and contingent process (see Krugman, 1991 and Arthur, 1994). The cluster as unit of analysis allows for studying aspects of clustering that cannot be addressed with a 'firm level approach'.

Second, the performance of firms can only be understood when their embeddedness is taken into account. The cluster concept allows for this. Economic developments such as outsourcing and 'flexible specialization' increase interdependencies and thereby further raise the relevance of local embeddedness. These developments have led to increased attention for clusters as the unit of analysis (see Piore and Sabel, 1984).

Third, clusters studies yield relevant insights for policy and management in clusters. This practical relevance is increasing because regional specialization increases, (see Krugman 1991) and as a consequence, competition between regions increases. Thus, many regions are in search of 'growth clusters' (Van den Berg et al, 2001). In many regions, cluster initiatives have developed. The practical relevance explains why cluster studies are in many cases policy-oriented (Markusen, 1999).

2.2   Defining a cluster

Various cluster definitions exist, such as 'a spatially concentrated group of firms competing in the same or related industries that are linked through vertical and horizontal relationships' (Porter, 1990, p. 149). We define a cluster as[1]:

> A population of geographically concentrated and mutually related business units, associations and public(-private) organizations centered around a distinctive economic specialization.

First, we regard a cluster as a *population* (not as an entity). This aspect is important because it implies that the internal heterogeneity of clusters has to be taken into account (see Rabellotti and Schmitz, 1999). The notion of a cluster population also implies that the cluster population can change. Indeed, entry and exit are important mechanisms of transformation of the cluster[2].

A second characteristic of a cluster is the *geographical concentration* of the population. This characteristic has been emphasized as cluster analysis progressed[3]. Even though the geographical aspect is widely acknowledged, the delimitation of the *relevant cluster region* is problematic. No matter how a cluster is geographically delimited, firms in the cluster population will be strongly linked to firms outside the relevant cluster region. A method to delimit the relevant cluster region is discussed in the following section.

Third, the cluster population consists of *business units, associations* and *public(-private) organizations*. Business units are more appropriate units than firms, since firms may be present in various different clusters. Business units can be part of 'parent firms' outside the cluster. In the remainder of the paper the term *firm* is used, even though strictly speaking

---

[1]   See Markusen, 1996 and Becattini, 1990 for similar definitions.

[2]   The term 'population' is used in 'Population Ecology' to denote groups of *similar* firms, in most cases firms in the same industry. In this definition, the population consists of complementary and interrelated firms, located in the same region. Thus, the population is more diverse and the majority of the analytical tools from Population Ecology cannot be used to analyze clusters.

[3]   Porter, for instance, did not pay much attention to geographical concentration in his early work on clusters (Porter, 1990), but gradually recognized the importance of geographical proximity (Porter, 1998).

business unit is meant. Associations and public (-private) organizations can also be included in the cluster population. Associations can be defined as 'organizations that provide a host of collective support services to member firms' (see McEvily and Zaheer, 1999).

Fourth, the cluster population consists of *related* business units, associations and public (-private) organizations. Business units are included in the population if they have relatively strong (potential) economic links with one or more other business units in the population[4]. Associations are included in the cluster population if the majority of their members are included in the cluster population and public (-private) organizations are included if they are strongly linked to firms in the cluster. Because linkages are central in the definition of clusters, clusters are populations of *competing and complementary* firms.

Fifth, the cluster population is centered around a particular *economic specialization*. This specialization is mentioned in most cases in the name given to the cluster, such as 'the shipbuilding cluster' (Van Klink and De Langen, 2001) and the 'footwear cluster' (Rabelotti and Schmitz, 1999). A focus on a distinctive economic specialization is necessary to define cluster borders, because in principle, chains of economic linkages are endless. Unless a core is defined, it is impossible to isolate a component of that chain.

2.3   Constructing clusters

Clusters are *constructs*. Clusters have no natural borders, because clusters are by no means 'isolated islands' (see Staber, 1996) in the economy. Linkages between firms inevitably cross cluster borders. As a consequence cluster borders are to some extent arbitrary. Scientists, policy makers and industry professionals *construct* the 'borders' of a cluster[5]. Even though cluster borders are inevitably to some extent arbitrary, it is important to provide a method to delimit clusters. A precise delimitation is a step forward, since it

---

[4]   A firm in a cluster has linkages with some, but certainly not all other firms in the cluster. Conceptually, when linkages are absent, firms are 'potentially linked': when opportunities arise, relations will develop relatively easy, because search costs for partners in the cluster are low.

[5]   Constructing a cluster can be useful -for scientists because analyzing clusters enhances the understanding of economic processes, for policy makers because clusters can provide a basis for economic policies, and for industry professionals because clusters can become platforms for effective coordination and cooperation.

provides a basis for a precise analysis of the evolution of a cluster in time, it enables a detailed comparison between clusters, and it allows for a precise analysis of the influence of certain characteristics of a cluster, such as degree of foreign ownership, diversity in the cluster and entry and exit in the cluster, on its performance.

Clusters differ substantially in size, geographic span, core and strength of cluster ties. Clusters can *overlap* and include 'cliques' or *subclusters* of thick and multiplex networks, with fewer linkages between subclusters' (McEvily and Zaheer, 1999 p. 1135). Consequently, one business unit can be regarded as 'member' of *different* clusters. A method to delimit clusters consists of four steps:

1. Select an economic specialization and a roughly defined region for which the cluster analysis will be made.

2. Identify *economic activities* and non-business organizations included in the cluster.

3. Define the relevant region for the cluster.

4. Identify the cluster population, consisting of business units, associations and public (-private) organizations that are *both* relatively strongly linked to the cluster core *and* located in the relevant cluster region.

These four steps are an iterative process. In some cases, the identification of economic activities included in the cluster will lead to a modification of the economic specialization. In other cases, the analysis of the relevant region will shed new light on the economic activities included in the cluster. The four steps of this process remain the same.

2.3.1   Selecting an economic specialization

The economic specialization for which the cluster analysis is made can be defined rather broadly, such as 'the high-tech cluster' or 'the maritime cluster'. In general, the economic specialization should be relatively *primary*, in the sense that it is not located in a region because of the presence of other economic activities, but because the region offers, or used to offer location advantages. For instance, instead of taking 'computer maintenance' as economic specialization, ICT is likely to be better, because in many cases maintenance activities follow other activities. Furthermore, it is advisable to take an economic specialization that is relatively important in the region. Indicators of geographical

concentration include a high 'localization quotient' (discussed later), and a substantial 'export surplus' to other regions (see Porter, 1990).

2.3.2   Economic activities included in the cluster

A variety of tools can be used to identify e*conomic activities* included in the cluster (Bergman and Feser, 1999). The combination of different tools should allow for an increasingly precise delimitation of economic activities. The final result is a set of industry codes (for instance NAICS or SIC) that can be used to identify firms in the cluster.

A practical tool to start with is an analysis of the presence of a *cluster association* (see Cooke and Morgan, 1998). The membership structure of a regional association of dissimilar and complementary firms gives a good first idea of the kinds of economic activities included in the cluster. Figure 2 shows a typical 'association structure' of a cluster. In this figure, firms in a cluster are members of a regional industry association[6] and these associations are members of the cluster association.

Figure 2: A cluster association
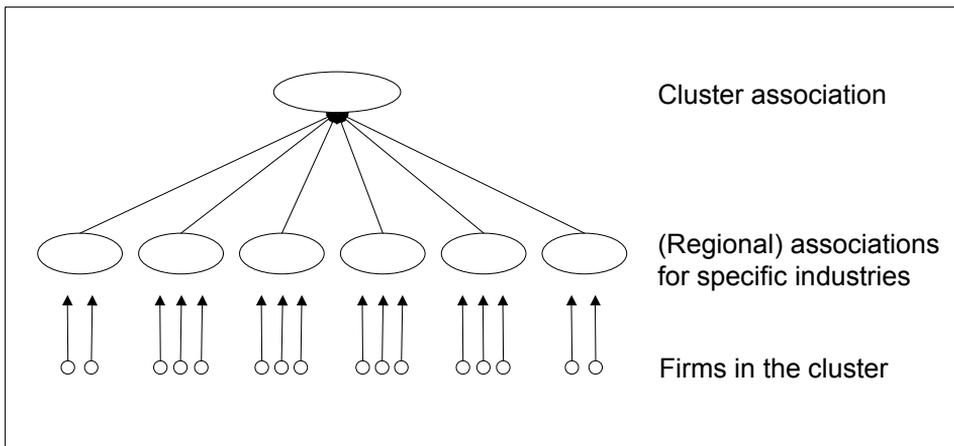
A second tool to identify the economic activities in the cluster is input-output analysis. This analysis shows the importance of transactions between different economic activities. Economic activities that have relatively many transactions with other activities included in

---

[6]   Or a regional department of a national industry association.

the cluster should be included as well. Input-output analysis is in some cases impossible, because data on a sufficiently detailed geographical and functional level are lacking.

A third tool is a *qualitative analysis of the structure of a value chain*, for instance based on a number of expert interviews. Many clusters consist of various economic activities that belong to one value chain (Roelandt and Den Hartog, 1999). Insights in the structure of value chains can be used to identify economic activities that are 'clearly' part of the cluster. A qualitative analysis can reveal the strategic relevance of business transactions. Simple 'arm's length transactions' are a less compelling reason to include economic activities in a cluster than strategic relations. For example, firms that supply specific machinery to shipyards are a part of a shipbuilding cluster, while firms that supply 'general administrative services' are not (see Van Klink and De Langen 2001). A qualitative 'value chain analysis' based on an analysis of interactions, partnerships, ownership structures and joint R&D efforts, is a good tool for analyzing linkages when input-output data are lacking.

A fourth tool is an analysis of 'location quotients' of economic activities in a certain region. These quotients show to what extent a region is specialized in these activities. Assuming that the cluster as a whole is relatively important in the region, the higher the location quotient, the more likely it is that this industry is a part of the cluster. A final tool to identify economic activities included in a cluster is through a survey in which the strength of linkages between various economic activities is addressed[7].

Unlike firms, non-business organizations are not grouped together in industry classifications. Thus, these organizations have to be identified individually, based on expert interviews or desk research. Given the limited number of associations, public-private and public organizations active in a cluster, this is feasible. Associations are included in the cluster population if the 'members' for which their services are provided are predominantly included in the cluster population, and public (-private) organizations are included if they are strongly linked to the firms in the cluster. University departments, knowledge institutes, and schools are frequently included in the cluster population, just as are marketing bodies, innovation centers and planning boards (see Cooke 1998).

---

[7]   In general, a survey covers only a sample of all firms in an industry. Only when all potential firms of a cluster population are surveyed, can a survey be used to define the cluster population directly. This precise 'bottom-up approach' to identify clusters is hardly possible in practice.

2.3.3   The relevant cluster region

All clusters have 'geographical borders', even though in many cases these are not well defined. Many cluster studies simply take regions, provinces or states as relevant cluster region (Van Klink and De Langen, 2001). The tool of a localization analysis can be used to create a detailed geographical cluster delimitation. By dividing the number of firms active in cluster activities in a municipality (in most cases the most detailed statistical unit) by the overall number of firms in the municipality, the relative share of cluster activities in the municipality is obtained. Areas with a relatively high share of cluster activities are included in the 'relevant cluster region'[8]. This method to delimit the relevant cluster region is relatively precise. However, the minimum share of cluster activities required for municipalities to be included in the cluster region is arbitrary and varies case by case. Figure 3 shows the method to delimit the relevant cluster region.

---

[8]   This concept is similar to the construct of a 'local labor market area' (LLMA) that Paniccia (1999) uses to geographically delimit clusters and similar to the analysis of the 'functional urban region' (Van den Berg, 1987). The latter is defined on the basis of commuter flows.

Figure 3: Delimiting the 'relevant cluster region'
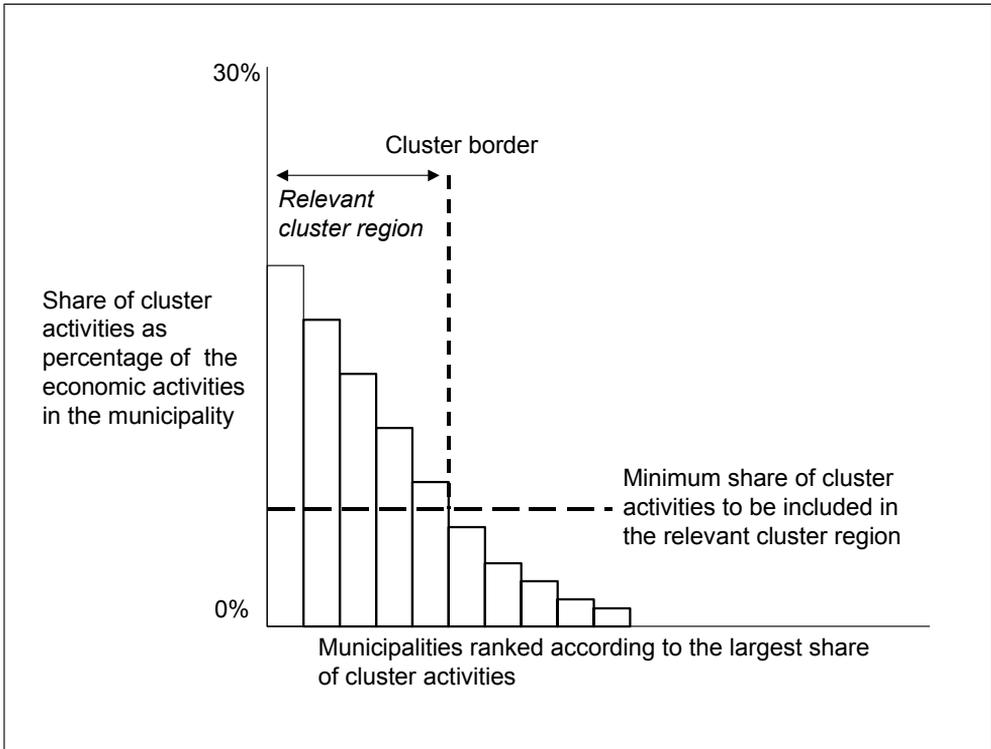
2.3.4   The cluster population

As the fourth step, based on both an economical and a geographical delimitation, the cluster population can be identified. This population consists of all business units active in economic activities included in the cluster and located in the relevant cluster area. Apart from the business units, the vast majority of the cluster population, associations and public (-private) organizations are included in the cluster population. Figure 4 and Figure 5 summarize the issue of delimiting clusters.

Figure 4: The four steps to construct a cluster
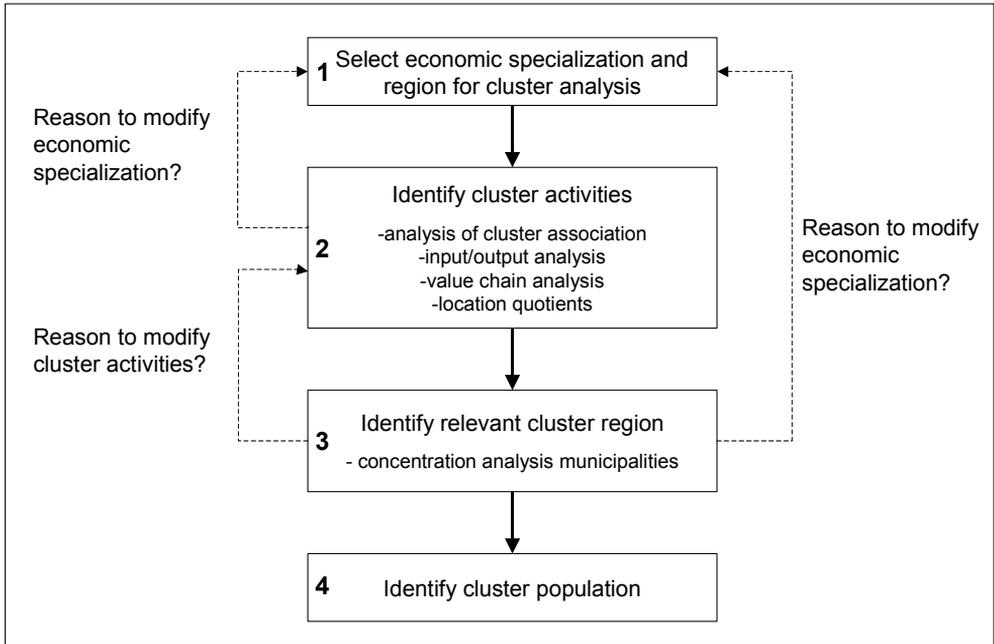
Figure 5: Delimiting clusters
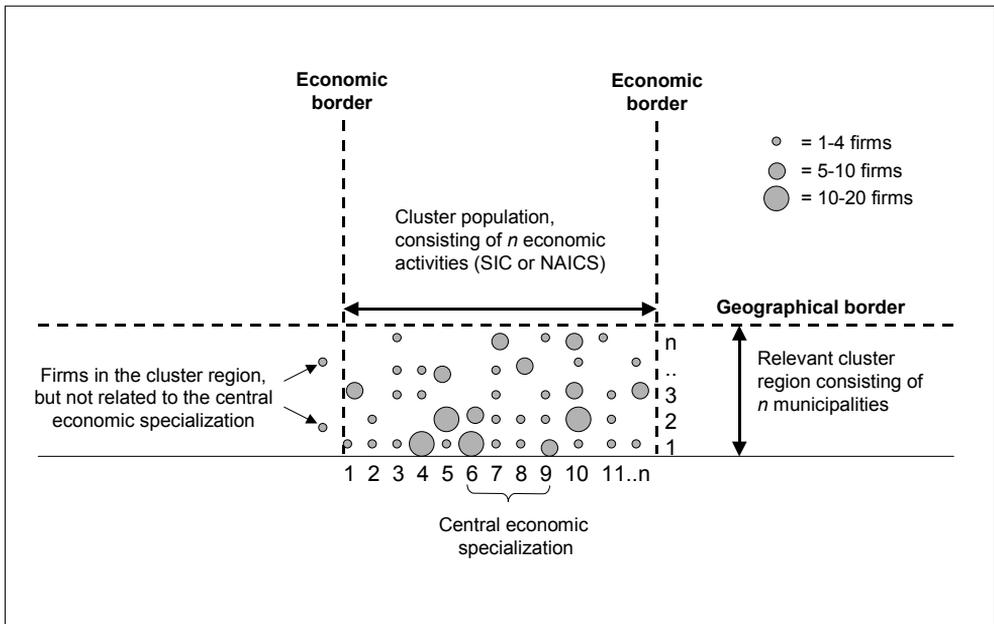
3 THE PERFORMANCE OF A CLUSTER

In this chapter the issue of an appropriate measure for cluster performance is discussed. First, a number of possible indicators are reviewed. It is argued that *value added generated in the cluster* is the most appropriate indicator. Second, two mechanisms leading to a change in the value added generated in the cluster are discussed.

3.1 Measuring cluster performance

The issue of how the performance of clusters can be measured is important for cluster scholars. A variety of indicators of the performance of clusters have been used. Average *profitability* is a problematic indicator, since clustering does not necessarily lead to higher profits of firms in the cluster. A prospering cluster does not imply that the clustered firms are more profitable than the industry average. Indeed, one could argue that high profitability of firms in the cluster indicates a lack of internal competition in the cluster, while some scholars argue that internal competition is beneficial for the performance of a cluster over time (see Porter, 1990 and Baptista, 2000).

Productivity (see Maillat, 1998) is no more than a partial measure of cluster performance, since it does not capture *changes* of the cluster population. The performance of a cluster with a declining population (for instance because of high land prices) is lower than that of a cluster with many new entrants, even if the productivity is equal.

The *share of exports* (Porter, 1990) is not suitable because declining export shares can also be explained by the location of 'downstream activities' in the cluster, with declining exports as a consequence.

Outward foreign direct investment (see Porter, 1990) is not appropriate either, because it can be explained by an outflow of capital, value added and employment. *Inward foreign direct investment* is a better, but partial, measure of performance.

The most complete measure for the performance of clusters is the *value added* generated in the cluster. The value added generated in the cluster is the sum of the value added

generated by the members of the population. The value added consists mainly of labor expenses, depreciation and profit (before tax).

A strong increase in the value added in one particular year can have causes that hamper the growth of value added in the long run. A cluster where the value added increases because wages increased substantially, or profitability is high due to the lack of internal competition, are likely to become less competitive in the long run. Therefore, *the net present value of the future value added generated in the cluster is* the best indicator of the performance of a cluster. This indicator cannot be calculated. However, once time series of the value added generated in a cluster become available, the influence of various variables on the performance of clusters can be analyzed. For instance, variables such as expenses for innovation, and the number of new establishments are likely to influence the future value added generated in the cluster. The value added generated in year t can be written as:

$$VA_p(t) = \sum_{i=1}^{n} Va_i(t) \qquad \text{for i = \{1...n\}}$$

Where:

VA is the total value added of a population P consisting of n firms,

Va_i is the value added of firm i in the cluster P.

The performance of the cluster can be written as:

$$CP_p(t) = VA_p(t) + \frac{VA_p(t+1)}{1+r} + ...\frac{VA_p(t+n)}{(1+r)^n}$$

Where r is the discount rate used to calculate the net present value over the period t to n.

3.2   Two effects that change the value added in the cluster

The value added generated in the cluster changes over time because of two effects: an 'incumbent performance effect' and a 'population effect'. The first effect stems from changes of the value added generated by the firms present in the cluster at the end of a period (t+1) and at the beginning of a period (t). Developments such as new investments, employee lay-

offs or increased profitability affect the value added generated in the cluster. This effect can be termed the 'incumbent performance' effect, since it is related to the behavior and performance of incumbent firms. The second effect stems from changes in the population, because firms enter and leave the cluster. Because of this population effect, the cluster population in the beginning of a period (t) differs from the population at the end of a period (t+1). These two different mechanisms are common knowledge among 'population ecologists':

> *Organizational worlds transform over time in two sharply different ways. Some individual organizations adjust their routines (…). But another key mechanism operates as well –populations of organizations evolve because some existing organizations perish and other (sometimes novel) organizations emerge (Hannan and Freeman, 1977, p.4).*

Both effects can be expressed in formula form:

$$\Delta VA_p(t) = \Delta VAI_p(t) + \Delta VAP_p(t)$$

Where:

> ΔVAI_p (t) is the incumbent performance effect, measuring (in value added) the changes in value added generated by the population in a period.

> ΔVAP_p (t) is the population effect, measuring in value added the effects of entrants to and exits from the cluster in a period.

3.2.1   Population effect

Some economic activities 'leave' a cluster while others establish offices in this cluster. Furthermore, the cluster population changes because of bankruptcies and start-ups. The population effect is the sum of four mechanisms through which the population changes, given in Table 1.

Table 1: Four ways in which cluster population changes

	Population growth	Population decline	
Birth/mortality effect	Start-ups	Bankruptcies	Net birth effect
Shift effect	Entrants	Exits	Net migration effect
Sum of effects	New members	Lost members	Total population effect

An in-depth analysis of the population effect has to address changes in the value added caused by each of those four mechanisms (start-ups, bankruptcies, entrants and exits).

3.2.2   Incumbent performance effect

The incumbent performance effect (over the period from t-1 to t) can be measured by taking the population of firms present in the beginning and the end of the year and comparing the value added generated by those firms in different years:

$$VAI_{p*} = VA_{p*}(t) - VA_{p*}(t-1)$$

Where P* denotes the firms in the population in the beginning and the end of a period.

The sum of the population effect and incumbent performance effect give the overall development of the value added in the cluster. In different clusters the relative importance of both effects is likely to differ substantially; some clusters (mostly in mature capital-intensive industries) are mainly affected by the performance of incumbents, while clusters of firms in knowledge intensive and growing industries change mainly because the population changes.

3.3   Conclusions

In this chapter a variety of alternative indicators of the performance of a cluster were discussed. It was argued that the development of the value added generated in the cluster is the most appropriate indicator of the cluster performance. Changes in the value added generated in a cluster stem from two different effects: the incumbent performance effect and the population effect.

In this chapter formulas were developed to calculate the performance of a cluster. In practice, attempts to measure the performance of clusters are very scarce. Thus, data to analyze how various variables influence the performance of a cluster are lacking.

Nevertheless, a theoretical underpinning of the measurement of the performance of a cluster is useful. Policy makers and associations can start to calculate the performance of clusters. Furthermore, the theoretical clarity of the issue of the performance of a cluster provides a basis for developing a framework with variables that influence the performance of a cluster. This issue is addressed in the next chapter.

4   VARIABLES OF CLUSTER PERFORMANCE

In this chapter a framework with variables of cluster performance is developed. First, four different schools that have addressed this issue are reviewed. Second, a new framework for analyzing cluster performance is presented.

4.1   Relevant theories

In this section we first discuss the issue of integrating insights from different schools. The number of variables that influence, directly or indirectly, the performance of a cluster is huge if not infinite. Most economic theories/schools concentrate on one or a few variables, thus giving only a partial explanation. Given the multitude of variables, the performance of clusters cannot be explained with insights from one economic school only.

An analytical framework that incorporates insights from different schools is required to understand the performance of clusters. The development of such a framework does not require an all-encompassing theory. Such an integrative theory cannot be made because insights from different schools have been developed on the basis of different sets of assumptions, that cannot be united[9] (see Groenewegen and Vromen, 1996). Rather, the framework incorporates insights that are not contradicting *themselves* (such as effects of internal competition or the presence of intermediaries). Combining those different insights leads to a more complete analytical framework and a better understanding of the performance of clusters. Porter (1990) develops a holistic analytical framework (discussed in the following sections), but hardly incorporates research findings of others in his framework. An alternative framework that is based on existing insights is developed in this study.

---

[9]   Different schools are not perfectly complementary, but make contradictory assumptions, for instance about the behavior of firms. Combining insights from theories with contradictory assumptions leads inevitably to some extent to an 'ad-hoc framework'. It is difficult, if not impossible to include all relevant insights, or to justify why certain insights are incorporated and others are not. Therefore, in the cases cluster experts were asked to evaluate the framework and suggest improvements.

4.1.1   Four relevant schools

Clusters have frequently been studied from many different perspectives. Cluster scholars apply existing theories to study (aspects of) clusters (see Becattini, 1990 who argues that approaches as industrial organization, (new) institutional economics, organization science and sociology all can be used to analyze clusters). However, many scholars use one set of theories and do not combine or integrate different theoretical approaches.

The economic literature related directly or indirectly to the performance of clusters can be classified in four 'stylized' schools[10]. These schools and some leading scholars are given in Table 2. We discuss these schools and use the insights of each of these schools to develop a framework to analyze the performance of clusters.

Table 2: Different schools, their focus and some leading authors

School	Leading author(s)	Focus of school
'Diamond School'	Porter (1990 and 1998), Rugman et al (1995)	A holistic approach to understand the competitiveness of national industries.
New Economic Geography	Krugman (1991) and Fujita, Krugman and Venables (1995)	Spatial equilibrium of forces leading to and opposing spatial concentration.
Industrial District School	Piore and Sabel (1984) Staber (1998), Harrison, (1992), Becattini (1990)	Explaining the characteristics of industrial districts and the relative success of this organizational mode.
Population Ecology	Metcalfe (1998), Hannan and Freeman (1989)	Population dynamics.

4.1.2   The 'Diamond School'

The Diamond School has been developed by Michael Porter (Porter, 1990). Even though the title of his book (The Competitive Advantage of Nations) suggests an analysis of competitiveness at the national level, his framework is developed to analyze particular clusters. Porter regards the presence of internationally competitive clusters as key determinants of the competitiveness of nations, since each nation specializes in a few

---

[10]   These are the main schools, not all cluster studies fit perfectly in one of these schools.

clusters/industries (see Auerbach and Skott, 1995). The 'diamond framework' shows variables that influence the competitiveness of clusters. Figure 6 shows Porter's diamond.

Figure 6: Porter's diamond
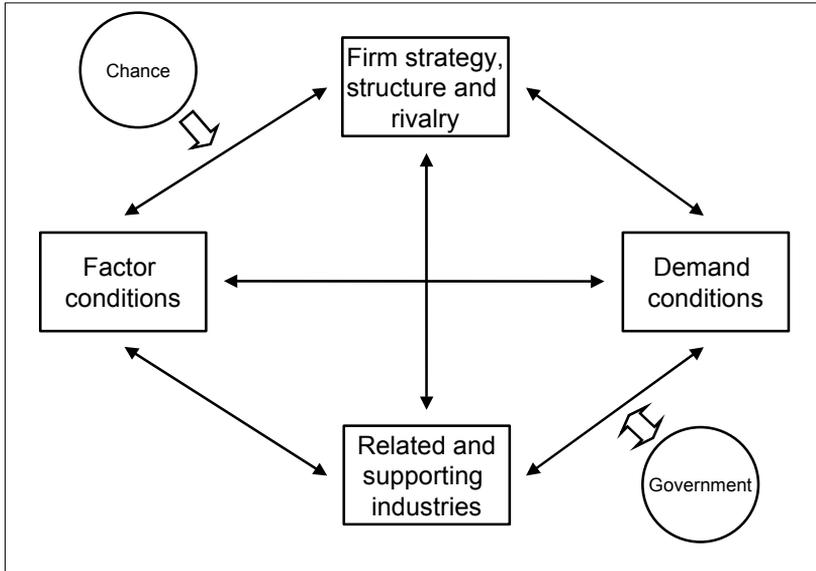
Source: Porter, 1990, p.72

The diamond consists of four elements that are - in Porters view - mutually reinforcing. *Demand conditions* influence the development of products. Porter argues that a sophisticated and demanding *home* market creates good conditions for success abroad. Critics have argued that Porter overemphasizes the importance of the *domestic* - or home - market (see Dunning, 1993, pp. 9-10) but the positive influence of the presence of critical demand in a location on the attractiveness of that location -or cluster- is widely shared.

Factor conditions are related to production factors, such as natural resources, capital and infrastructure (Porter 1990, p. 73-74). Porter acknowledges the mobility of production factors across locations, but assumes that relative differences in factor availability persist even if some of these factors are mobile. Porter argues that *advanced factors* have to be improved

continuously and selective disadvantages are beneficial if they 'send the right signals', e.g. if other firms ultimately have to face similar disadvantages[11].

The third element of the diamond is *firm strategy, structure and rivalry*. Many variables are grouped under this heading. The most important variable (according to Porter) is the presence of *internal competition*. Porter argues that internal competition in the cluster leads to such strong competitive pressures that firms become more dynamic and innovate more.

Porter discusses institutional issues, such as the education system and social norms (Porter, 1990, p. 109) under this heading. However, Porter neither uses the term 'institutions', nor insights of institutional economic theories. Harrison (1994) argues that Porter does not fully incorporate institutions in his framework and therefore does not manage to grasp the influence of institutions on competitiveness.

The fourth element of the diamond is '*related and supporting industries'*. This element deals with the presence of local suppliers. This presence enhances competitiveness, because local suppliers facilitate coordination and information exchange, which contributes to innovation and upgrading of products and services.

Apart from the four elements of the diamond, Porter mentions the role of government, as well as the role of chance. The role of chance is especially important in the 'initial formation' of an industry. Government influences each of the four elements of the diamond. Porter's framework incorporates many important aspects of clusters, as illustrated by the following quote:

> *The cluster becomes a vehicle for maintaining diversity and overcoming the inward focus, inertia and inflexibility and accommodation among rivals that slows or blocks competitive upgrading a new entry. The presence of a cluster helps increase information flows, the likelihood of new approaches and new entry from spin-offs, downstream, upstream and related industries (Porter, 1990, p. 151).*

---

[11]   Porter does not fully develop this idea because it would require a more detailed study of change processes. Such an analysis requires a dynamic approach and Porter's approach is essentially static.

In this quote, Porter discusses a number of relevant issues: the role of diversity in a cluster, common mental maps in clusters, interaction in clusters, the role of entry in a cluster and the role of information flows in a cluster. All these aspects are relevant, but Porter does not develop them in much detail. Furthermore it remains unclear how exactly performance is influenced by the elements of the diamond (Martin and Sunley, 2003).

4.1.3   New economic geography

New Economic Geography starts from the observation that clustering - also termed agglomeration - can be widely observed (see Krugman, 1991). This clustering of activities in particular locations has remained largely unexplained by (mainstream) economists. Incorporating space in economic models would therefore, according to Krugman, be a step forward in (mainstream) economics. Krugman, referring to Marshall (1890) identifies three general agglomeration economies: the presence of a labor pool, the presence of suppliers and clients, and knowledge spillovers. We discuss these forces more in detail in the next chapter.

Such agglomeration economies are 'centripetal forces' (Fujita, Krugman and Venables, 1999), forces that promote spatial concentration (clustering). These forces are opposed to agglomeration diseconomies, 'centrifugal' forces that oppose concentration, such as congestion and high land prices. In New Economic Geography an analysis of the equilibrium - and changes in the equilibrium - between these two forces is center stage. When agglomeration economies dominate, clusters will develop. If such economies become less relevant in an industry, this leads to spatial deconcentration. New Economic Geography focuses on processes of agglomeration in general and does not deal with specific clusters and the question how these clusters evolve over time.

4.1.4   The Industrial District School

The Industrial District School analyzes local production systems. These consist of various, mainly small and medium sized firms that are embedded in their environment and cooperate with other firms. In the school relatively much attention is given to behavioral aspects of industrial districts, such as the development of trust, social embeddedness of firms in the region and governance issues in industrial districts. The school argues that clusters are characterized by a specific institutional structure and a specific culture and furthermore, that such variables influence the performance of a cluster (Harrison, 1992). Industrial district

scholars can be regarded as belonging to '*new regional science'* (Cooke, 1998). Apart from a focus on behavior, this school has the following characteristics:

- Focus on regions as important variables in firm competitiveness.

- Emphasis on the importance of institutions.

- Attention for (informal) networks that foster the building of trust.

- Appreciation of the importance of proximity.

- Attention for the importance of an institutional and organizational learning propensity.

The theme of behavior related to learning and innovation has been widely discussed in the 'ID school' (see among others Best, 1990 and Cooke, 1998). The ID school argues that regional concentration fosters innovation, because actors in clusters are more likely to develop trust and because (in many cases unplanned) face-to-face contacts foster innovation. However, at least by some authors in the Industrial District School (Pouder and St. John, 1996) argue that embeddedness in regional networks can make firms blind to developments outside the cluster. The ID school recognizes the importance of cluster specific institutions for the performance of this cluster.

Even though the ID school shows the importance of institutional and behavioral aspects of clusters, a general framework to analyze behavior is lacking. A large part of the literature consists of case studies that are insightful but not generalized in one analytical framework.

4.1.5   Population Ecology

Population Ecology does not deal with clusters, but recent cluster scholars have started to regard clusters as populations (see Staber, 1998 and Belussi and Gottardi, 2000). Clusters are populations of a diverse set of firms. Not only are firms in the same industry included in the population, but also firms from complementary industries. Thus, it cannot be argued that all firms in the population face the same selection pressure. On the contrary: the success of firms in the population has positive effects for the other firms in the cluster. Therefore, models developed in Population Ecology cannot be applied directly to clusters. Even though the models developed in Population Ecology cannot be applied to clusters, some of the basics of 'population thinking' can be applied.

First, regarding clusters as a population allows for exploring the importance of the *variety* of the population. Such variety is regarded as beneficial for the population as a whole:

> *Diversity of organizations may enable societies to adjust quickly to changing environments. As environments change, particular types of organizations may be favored and others may fall into disfavour (…). The greater the variety of organizations available, the wider is the range over which the forces of socio-economic selection can operate (Tisdell, 1996, p.321).*

Clusters consist of a variety of firms, and the characteristics of the population in this respect are relevant for the performance of the population:

> *Industrial districts may follow different paths of growth because they are formed by a different population of economic agents (Belussi and Gottardi, 2000, p. 16).*

Second, entry and exit barriers are relevant in Population Ecology. The concept of barriers to entry or exit can also be applied to cluster populations. C*luster barriers*, e.g. barriers to enter and exit the population (see Staber, 1998) influence the development of clusters. Such barriers differ between clusters.

4.2   A new analytical framework

4.2.1   Shortcomings of the four schools for analyzing the performance of clusters

Economists heavily criticize Porter's diamond framework. Krugman argues that the diamond framework is 'a clever didactic device, but (…) difficult for an economist to work with, because the logic of the linkages is somewhat unclear' (Krugman, 1995, p. 464). Many of the variables included in Porter's diamond are relevant and studied by other scholars. However, the theoretical underpinning of Porter's model is weak. A second point of criticism is that theoretical insights are neglected and consequently the framework is based on old-fashioned or even wrong assumptions (see for instance Auerbach and Skott, 1995 and Dunning, 1993). Thus, Porters framework is not satisfactory for analyzing the performance of clusters.

New Economic Geography is based on a sophisticated theoretical framework, but this framework cannot be used to analyze the performance of *particular* clusters. The following quote clearly illustrates the limits of the 'new economic geography' theories:

> *Why are aircraft manufactured in Seattle (…)? The logic of increasing returns mandates that aircraft production must be concentrated somewhere and Seattle just happens to be where the roulette wheel came to stop (Krugman, 1991, p.2).*

New Economic Geography is not interested in particular clusters, but focuses on processes of agglomeration in general. This has led to important insights, for instance to explain international trade and the differences in economic development between regions, but is not sufficient for explaining the performance of particular clusters.

Population Ecology addresses the issue of the evolution of a population over time. However, this school deals with populations of similar and consequently competing firms. Thus, this school cannot be applied to populations of complementary firms. Furthermore, Population Ecology also does not pay much attention to particular characteristics of populations.

New Economic Geography and Population Ecology do not include *behavior* in the analysis[12], even though behavior is clearly relevant for the performance of *individual* clusters. The Diamond School takes behavioral aspects into account, but is not particularly sophisticated on institutional issues.

The Industrial District School, finally, pays attention to behavior and is interested in the performance of particular clusters. However, no coherent framework has emerged from the ID literature. A large part of the studies are 'success stories' of clusters that cannot be generalized. Another part of the literature addresses specific topics and does not intend to address the issue of the performance of clusters.

In the literature discussed above, a distinction can be made between theories related to *structure* and *behavior*. New Economic Geography and Population Ecology do not deal with behavior. Both schools focus on the influence of structural characteristics, on the agglomeration of industries and the evolution of populations.

---

[12]   In the sense that behavior 'matters' and cannot be reduced to rational choice models.

Behavioral factors also influence the performance of a cluster. Economic actors are *rational*, but only *boundedly* so (see Simon, 1965 and Hodgson, 1998). Therefore, apart from (rational choice based) structural factors behavioral factors influence the performance of clusters. The 'boundaries' of rationality originate from uncertainty, imperfect information and routine behavior (Nelson and Winter, 1982). Analyzing behavior leads to attention for processes of *change*. Such processes differ substantially between firms, countries and clusters.

The central behavioral issue in a cluster is the interaction of firms in the cluster[13]. This interaction affects the performance of the cluster. The term *cluster governance* can be used to describe how actors in the cluster interact.

The distinction between structure and governance allows for classifying variables as either structure variables or governance variables. Both variables influence the performance of the cluster. Furthermore, the structure and the governance of a cluster are interdependent. The structure influences the governance and vice versa. The basic framework is given in Figure 7.

---

[13]   The behavior of particular firms in the cluster is not taken into account, for two reasons. First, it is impossible to analyze the behavior of all firms in the cluster. Second, most firms in clusters are subsidiaries of parent companies outside the cluster. Thus, their behavior is only partially cluster specific.

Figure 7: Structure, governance and performance of clusters
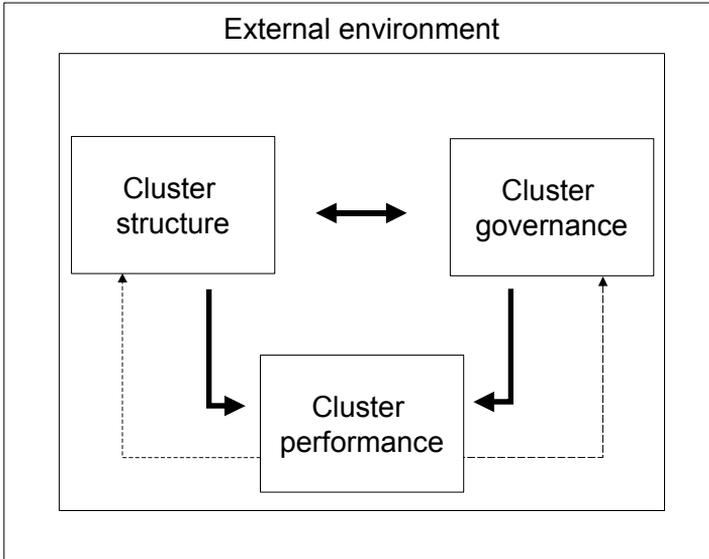
4.2.2   Cluster structure

The cluster structure influences the performance of the cluster. The effect of such 'structural' variables on cluster performance differs in different environments. From all four schools discussed in the preceding paragraph, one or more 'stylized facts' with regard to the influence of the structure of a cluster on the performance of the cluster are widely acknowledged. These are given in Table 3.

Table 3: Stylized facts on cluster structure and performance

School	Stylized facts with regard to cluster structure
Diamond School	Internal competition enhances cluster performance. The presence of a 'critical demand' enhances cluster performance.
New economic geography	Presence of agglomeration economies (presence of suppliers and a labor market and knowledge spillovers) enhances cluster performance. Presence of agglomeration diseconomies (congestion, land rents) hampers cluster performance.
Population Ecology	Heterogeneity of cluster population enhances performance. Spatial entry, start-up and exit barriers influence cluster performance.
Industrial District School	Small firms that cooperate in local production systems are competitive vis-à-vis large multinationals.

We discuss these stylized facts more in detail in the next chapter, where the influence of the structure of a cluster on its performance is center stage.

4.2.3   Cluster governance

Cluster governance can be studied with the use of institutional economic theories. When analyzing cluster governance, attention should be paid to *learning* (Montgomery, 1995), since learning is necessary to change existing routines and capabilities, and *institutions* (see Amin and Thrift, 1992). The term institution is rather broad and includes both formal and informal 'rules of the game'. In change processes institutions play an important role, both on the firm level (see Beckert, 1999) and for aggregated levels such as clusters, networks and industries (see Scott, 1988). Table 4 shows the 'stylized facts' of the four schools with regard to the influence of cluster governance on performance. These stylized facts are explored in some more detail in chapter 6.

Table 4: Stylized facts on the relation between cluster governance and performance

School	Stylized facts with regard to cluster governance
Diamond School	Clusters are 'vibrant environments', where benefits flow between actors in the cluster.
	The presence of a support infrastructure enhances cluster performance.
New economic geography	Knowledge spillovers are a force towards clustering.
Population Ecology	-
Industrial District School	The cooperation of clustered firms among themselves and with the local government adds to the performance of clusters.
	The presence of trust adds to the performance of clusters.
	The behavior of 'leader firms' adds to the performance of clusters[14].

4.2.4   The relation between structure and governance

The governance of firms in a cluster influences the structure of the cluster and the governance is influenced by the structure of the cluster (for general literature on the relation between structure and agency, see Beckert, 1999), this distinction has not been applied to clusters). Lambooy and Boschma (2001) argue that:

> *It is not only the given structure that influences actors, the actors (especially the innovators) also change the structure (Lambooy and Boschma, 2001, p. 114).*

The structure also influences governance: in a different population of firms, different forms of governance develop. Central in this respect is the presence or absence of potential 'leader firms' (Albino et al, 1999) that can play an active role in the governance of a cluster. The level of internal competition also influences the governance in the cluster. Table 5 shows the stylized facts on the relation between structure and governance.

---

[14]   Traditionally, the ID school focused on small and medium sized firms. However, the term 'leader firm' does not imply firms are large multinationals. The concept is used to describe firms that are especially important in clusters.

Table 5: Stylized facts on the relation between structure and governance in clusters

School	Stylized facts with regard to the relation between structure and governance
'Diamond School'	Governance can enlarge agglomeration economies. Cluster governance affects the intensity of internal competition. Institutional inertia is more likely to develop in a cluster predominantly serving a local market.
New economic geography	-
Population economics	-
Industrial District School	SME's have relatively good coordination skills.

4.2.5   Feedback effects

Apart from the effects of structure and governance on performance, *feedback effects* from performance to both structure and governance exist. For example, a bad performance changes the structure of a cluster because firms leave the cluster population. Furthermore, a bad performance can lead to changes in cluster governance, because a 'sense of crisis' develops and governance mechanisms are changed. We acknowledge these effects, but do not study them in the cases.

4.2.6   The environment

Cluster structure and cluster governance variables are incorporated in the framework. Both types of variables are *cluster specific:* they have to be analyzed at the cluster level. The performance of clusters is also affected by changes in the 'environment' of a cluster. For instance, the development of a new solar technology might deeply affect the development of a chemical cluster. Five important effects from changes in the 'environment' on the performance of a cluster can be distinguished:

- The nation effect
- The industry effect
- The policy effect
- The resource effect
- The technology effect

'Nation specific variables' lead to a 'nation effect', on the performance of clusters. Relevant nation specific variables include the judicial structure (North and Douglas, 1990), national

culture (Fukuyama, 1996) and the overall national economic development. Second, 'industry effects' affect the performance of a cluster. In general clusters in growing industries perform better than clusters in mature industries. An information technology cluster is more likely to grow rapidly than an agricultural cluster, regardless of the performance relative to other clusters, simply because the growth of the *industry*. Another example of an 'industry effect' is changes in consumer behavior in an industry.

The 'policy environment' also influences the performance of a cluster. Non-cluster specific local and national (public) policies affect the development of a cluster. A fourth effect is the 'resource effect'. Changes in availability and prices of resources (such as labor and physical resources) also affect the development of a cluster. The 'technology effect' finally, is relevant when a technological breakthrough impacts the performance of a cluster. An example is the development of 'mini-mills' that reduce the minimum efficient scale, for instance for producing steel.

These effects are relevant for the performance of clusters, but the focus of this study is on the influence of the *cluster specific variables* on the performance of clusters[15]. In the case studies, the existence of the 'environment effects' is acknowledged and explored, but the focus is the same. In the next two chapters, these variables are discussed in detail.

---

[15] A practical justification of this choice is that actors in the cluster can influence the cluster specific variables, but this is much more problematic for the other effects.

5   CLUSTER STRUCTURE

In this chapter we discuss the influence of four variables related to the structure of a cluster on the performance of a cluster. The *importance* of the variables is not discussed, since this is cluster specific. Figure 8 shows the four cluster structure variables, derived from the four schools discussed in the preceding chapter (see Table 5 in chapter 4).

Figure 8: Four variables related to the cluster structure
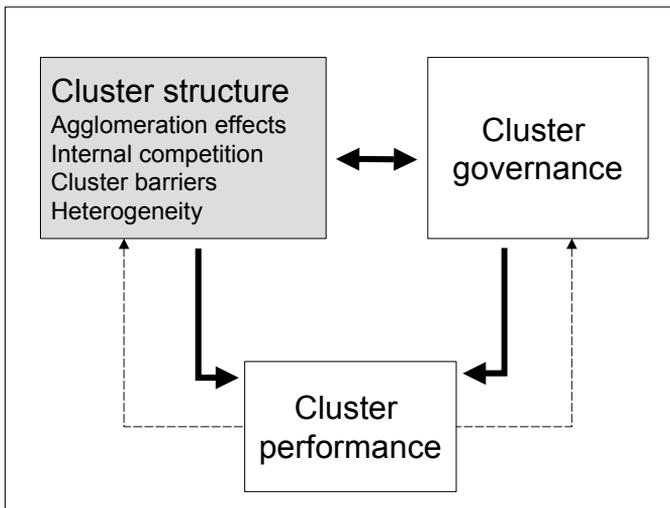
5.1   Agglomeration economies

The study of agglomeration economies started with Marshall who argued that the existence of 'external economies' leads to the concentration of activities. Marshall defines external economies as 'economies arising from an increase in the scale of production, dependent on the general development of the industry' (Marshall, 1890 p. 266). Marshall further argues that 'external economies can often be secured by the concentration of many small businesses of a similar character in particular localities' (Marshall, 1890 p. 266).

The term '*agglomeration economies'* (see Asheim, 1994) is used for all external economies that foster geographical concentration. A widely accepted distinction divides agglomeration

economies in 'localization economies', for specific industries and 'urbanization economies', forces towards the concentration of economic activities in cities. Examples of urbanization economies include the presence of business services and a large (consumer) market.

For clusters, the localization economies are more relevant, since clusters are concentrations of activities with a distinctive economic specialization. However, since the distinction between localization economies and urbanization economies is not crystal clear, we stick to the term agglomeration economies. In line with Krugman (1995), we discuss three 'Marshallian' agglomeration economies.

A first agglomeration economy already discussed by Marshall is a shared *labor market.* In a geographical cluster, labor is widely available because of the presence of a variety of firms with a similar labor demand. Marshall terms this a 'constant market for skill' (Marshall, 1890, p. 271). Skilled workers are attracted to the cluster and clusters also provide a sufficiently large scale for providing specific types of education and training. Because of the 'constant market for skill', it is relatively attractive for workers to invest in specific training and education. Search costs to find qualified labor are relatively low, because of the large labor pool. Intermediaries that specialize in recruiting labor arise in many cases.

A final relevant aspect is the costs of firing labor. Since alternative employment opportunities inside a cluster are relatively high, employees are in general less dependent on one particular employer and therefore firing costs in general are likely to be relatively low. In clusters, job mobility is generally speaking high (see Panniccia, 1999 and for the case of Silicon Valley, Saxenian, 1994).

The second agglomeration economy is the presence of customers and suppliers within a cluster. Locating in a cluster is attractive for firms 'downstream' in the value chain, when other firms in the cluster can provide specialized inputs. For firms 'upstream' in the value chain, the presence of (potential) customers is attractive. The presence of suppliers and customers is an advantage since 'trade costs' are higher for transactions with firms outside the cluster. Furthermore, a concentration of similar firms allows for specialization of firms in the cluster. Specialization enhances the performance of a cluster since firms in the cluster are offered better, tailor-made products and services.

The third agglomeration economy is termed 'knowledge spillovers' (see Marshall, 1890, p. 271 and Krugman, 1995)[16]. Knowledge and information is cheaper and earlier available inside clusters than outside, because it flows more easily locally. This factor has been widely discussed and has become popular among regional policy makers.

Empirical research has demonstrated the positive effect of clustering on innovation (see Baptista and Swann, 2000, Audretsch and Feldman, 1996 and Nooteboom, 1999) and the positive effect of clustering on knowledge diffusion (Baptista, 2000). Audretsch and Feldman (1996, p. 637) empirically prove that 'industries where new economic knowledge tends to play a more important role have a higher propensity to cluster together'. This demonstrates that knowledge spillovers are an agglomeration economy[17].

Apart from the agglomeration economies, 'dispersion forces' exist. Without these forces all activities would be concentrated in one place. Two dispersion forces are widely acknowledged: land scarcity and congestion (see Fujita and Thisse, 1996). Agglomeration forces foster concentration. Since space is limited, land in clusters becomes scarce. This leads to high land prices. Such high land prices in a cluster decrease the attractiveness of locating in a cluster. High land prices - even though they reflect the strength of agglomeration economies - are a dispersion force.

Congestion is a second dispersion force. In general, clusters need investments in transport infrastructure. Given the scarcity of land and concentration of economic activities, congestion is likely to develop. This decreases the attractiveness of a cluster, compared to locations without congestion. Table 6 shows the above-mentioned three agglomeration economies and two dispersion forces.

---

[16]   The argument that proximity influences the diffusion of knowledge does not really fit in Krugman's neo-classical framework, because this is hard to reconcile with arguing that distance influences the diffusion of innovations, since 'transport costs' are irrelevant for the diffusion of ideas, information and knowledge. The importance of proximity is thus at odds with the assumptions of rational actors and perfect information.

[17]   Even though these spillovers are beneficial for the cluster, they are not necessarily beneficial for firms in the cluster. In many cases, firms would rather control and limit the spillover of their knowledge. In clusters this is difficult because information is 'in the air'.

Table 6: Agglomeration and dispersion forces

Agglomeration forces	Dispersion forces
Labor pool	Land rent
Suppliers	Congestion
Knowledge spillovers	

Source: based on Fujita et al, 1999, p. 346

The presence and importance of the three agglomeration economies enhance the performance of a cluster. Such economies increase the attractiveness of locating in a cluster. The presence and importance of dispersion forces in a cluster reduces cluster performance. The balance between these two opposing forces changes over time. When the importance of agglomeration forces increases, the performance of a cluster improves, a growing effect of the dispersion forces reduces the performance of a cluster[18].

The strength of these forces differs between clusters and changes over time. For instance, land scarcity depends on expansion projects and congestion depends on initiatives to improve the transport infrastructure.

5.2   Internal competition

Competition fosters efficiency and is an important engine for growth and change[19]. With regard to clusters, the distinction between *internal competition* (competition between firms located in the same cluster) and *external competition* (competition between a firm in the cluster with other firms outside the cluster) is relevant. Porter has strongly emphasized the

---

[18]   The balance between these forces is partially caused by developments in the environment of the clusters. We do not take these effects into account, since these are not cluster specific but 'industry specific' (for instance changes in the minimum efficient size of production) or the result from changing policies (such as international trade regulations (see Krugman, 1995) or changing trade costs (including transport costs). These effects are not caused by the cluster structure, but by the cluster environment.

[19]   Competition and cooperation can co-exist in a cluster. Competition in clusters is discussed in this section, cooperation in a cluster in the next chapter.

effect of internal competition 'Among the strongest empirical findings from our research is the association between vigorous domestic[20] rivalry and the creation and persistence in an industry' (Porter, 1990, p. 117). Porter's argument is that internal competition leads to dynamism in the cluster:

> *The nature of economic competition is not 'equilibrium' but a perpetual state of change. Improvement and innovation in an industry are never ending processes (…). Today's advantages are soon superseded or nullified. At the core of explaining national advantage in an industry must be the role of the home nation in stimulation competitive improvement and innovation (Porter, 1990, p. 70).*

Porter bases this conclusion on a variety of case studies, but does not provide quantitative empirical results. He focuses on the effects of internal competition on innovation. We develop three arguments for the positive effects of internal competition on cluster performance, one of which is Porter's 'vibrant environment argument'.

The first argument for the positive effect of internal competition is that internal competition lowers 'switching costs' for customers. Internal competition allows firms to shift to an alternative supplier in the same cluster. In general, these switching costs are lower than switching costs to a supplier outside the cluster, because of higher transaction costs. The importance of switching costs varies between industries. Relatively high switching costs give firms in the cluster the opportunity to appropriate 'economic rents', by charging higher prices. This *threat* by itself reduces the attractiveness of a cluster for potential customers.

Second, internal competition fosters *specialization* (see Baptista, 2000 p. 516). Internal competition is competition on a perfect *level playing field* (or to put it differently: cost curves are similar). Competitors face the same regulation, have the same labor market conditions, the same trade costs and the same supplier base. In such a competitive environment specialization of products and services is more likely to develop than when competitors operate in a different environment, because specialization reduces competition and

---

[20]   Porter generally speaks about *domestic* rivalry and the home *nation* because he does not pay attention to the issue of delimiting the relevant cluster region. This is not problematic for small countries but it is problematic for large countries. In such countries, competition between firms in different locations cannot be termed internal competition.

therefore can lead to a higher profitability[21]. This argument can be related to the work of Hotelling (1929) who argues that competition between services provided at different locations is by nature 'oligopolistic' because of the importance of transport costs. The location itself is a 'source' of specialization.

Differentiation and specialization enhance the performance of the cluster as a whole because in a cluster with internal competition customers can purchase products and services that match their specific demand.

Third, internal competition enhances cluster performance because it provides a firm with a 'vibrant environment' (see Porter, 1990). Porter argues that:

> *'Pride drives managers and workers to be highly sensitive to other companies (…). Domestic rivals fight not only for market share but for people, technical breakthroughs and, more generally, 'bragging rights' (Porter, 1990, p. 119).*

Porter claims that internal competition has a positive effect on the performance of firms because domestic rivalry is highly visible and 'in the air' (see also Marshall, 1890). As a consequence, it fosters innovation. Therefore, the presence of a vibrant environment adds to the performance of a cluster[22].

For these three reasons internal competition contributes to the performance of a cluster. Internal competition is likely to arise as a result of market forces in most cases. Two special conditions can prevent internal competition. First, a small market size relative to the minimal efficient scale (MES) can prevent internal competition. Internal competition can only exist in clusters with a large market size relative to the MES. Second, *regulations* can prevent internal competition, for instance because the right to provide services is tendered to one firm.

---

[21]   Porter (1990), stresses the effect of local competition on internationalization. This is explained by the drive to create economies of scale, when the domestic market is not sufficiently large. Expansion helps in this case to *increase competitiveness locally*.

[22]   Some scholars have argued that fierce internal competition leads to shared mental maps (see Pouder and St. John, 1996). This is not a convincing argument. Shared mental maps can perhaps result from dense local interaction, not from fierce internal competition. Instead, competition generally leads to specialization and the development of distinctive capabilities.

The presence of internal competition in a cluster can be analyzed with the concentration ratio. An analysis of the MES, the regulatory regime and the level of switching costs provides insight in the effects of the absence of internal competition and opportunities to increase internal competition.

5.3   Cluster barriers

With the term 'cluster barriers' we mean barriers to enter or exit the cluster, or to start a new venture in a cluster. Thus, cluster barriers differ from 'industry barriers'. The barriers to shift from one industry to another are in general higher than the barriers to shift from one cluster to another (while staying in the industry). Cluster barriers are *location specific* barriers for firms that 'intrinsically' want to leave, or enter the cluster or start-up in the cluster, but face cluster specific barriers that complicate entry or exit[23].

The effects of entry, start-up and exit barriers on economic performance are widely acknowledged (see Geroski, 1995). Specifically for clusters, Staber (1996) argues that start-ups and bankruptcies reflect dynamism and that dynamism improves the performance of a cluster. Entry and start up barriers reduce competitive pressure for firms in the cluster and prevent the inflow of (human and financial) capital and knowledge. Therefore, both entry and start-up barriers reduce performance.

5.3.1   Entry barriers

Entry barriers are defined here in a narrow sense, to separate them from start-up barriers. Entry barriers are barriers for firms outside a cluster that intend to establish activities in this cluster. Given this perspective, c*ultural entry barriers* are relevant, because these influence the *accessibility* of local tacit knowledge and networks. When access to both resources is difficult, entry barriers are high, because 'new' firms need 'local tacit knowledge', for instance knowledge about public organizations, characteristics of local markets and the labor market.

---

[23]   Economic entry barriers such as economies of scale and 'image' (Geroski, 1995) are not taken into account, since these simply make entry unattractive from an economic point of view. Legal entry barriers are not taken into account because these are in general not cluster specific.

Such tacit knowledge can be acquired by 'learning by doing', but this is costly. Alternatively, this tacit knowledge can be acquired through 'learning by interaction'. This learning mechanism depends on the willingness of actors with local tacit knowledge to transfer this knowledge. This willingness differs between clusters. A low willingness to share local tacit knowledge can be regarded as a barrier to entry (see Silverberg, Dosi and Orsinigo, 1988). The access to networks depends on the *legitimacy* of entrants (Hannan and Carrol, 1992). Clusters with inaccessible networks have high entry barriers.

Thus, clusters can range from 'entry prone' to 'entry-adverse'. In entry prone clusters, cultural entry barriers are low (entrants have easy access to local tacit knowledge and networks). In entry adverse clusters, the cluster is 'closed' for outsiders and cultural entry barriers are substantial.

5.3.2   Start up barriers

With regard to start-up barriers, two barriers are widely recognized: administrative barriers and the availability of venture capital[24] (Schenk, 1998). Administrative barriers are predominantly influenced by national legislation and therefore not taken into account. The availability of venture capital can differ between clusters, because of the presence of 'local capital' in clusters (Dei Ottate, 1994). Venture capital for start-ups (especially small ones) is to a large extent provided by 'informal investors' instead of banks or formal investment companies. The presence of such informal investors in a cluster lowers start-up barriers.

5.3.3   Exit barriers

For exit barriers the issue is more complex than for entry and start-up barriers (see Clarke and Wrighly, 1997). When applied to clusters, the term exit barriers might be misleading, this term is associated with barriers to leave a certain industry. Cluster exit barriers are barriers to *move* (leave the cluster). The term *footloose* is used to indicate the level of barriers to move. Examples of footloose firms include many service firms, such as consultants. Other

---

[24]   The distinction between start-ups and 'spin-offs' is relevant in this respect. Spin-offs in general do not face the problems that start-ups face, because they benefit from the networks (and in some case financial support) of the firm that spins them off. The role of leader firms in creating dynamism by encouraging spin-offs is discussed in the next chapter.

firms are 'sticky' to their location: their spatial exit barriers are high. Factors that increase such stickiness to a location are the immobility of their labor force, the immobility of investments (such as plants) and the presence of a huge supplier and client base in a certain place. Thus, these factors are cluster exit barriers.

One effect of the presence of high exit barriers is that they reduce uncertainty: firms with high exit barriers are unlikely to leave. The presence of firms strongly tied to the cluster increases the durability of cluster and reduces the uncertainty about the development of a cluster. For this reason, firms are more likely to make (further) cluster specific investments in clusters where considerable cluster specific investments have already been made. Thus, exit barriers increase the performance of a cluster.

This argument does not imply that barriers for firms to *invest* outside the cluster would be beneficial for the cluster. There is a huge difference between *investing* elsewhere and ending business activities in the cluster. Investments outside the cluster, for instance to relocate activities to locations with a lower cost level, are in many cases beneficial for the cluster performance, because they increase the competitiveness of firms in the cluster.

Three exit barriers can be identified. First 'immobile assets' (such as plants, buildings and specialized local knowledge) are exit barriers. Second, 'sticky labor' (see Markusen, 1996) is an exit barrier. Labor is not perfectly mobile. The 'stickiness' of labor varies between clusters. Entry barriers are high in clusters where labor is relatively sticky. Third, the presence of a strong local base of suppliers and clients is an exit barrier, because relocating outside the cluster implies that trade costs (including transport costs and transaction costs) with firms in the cluster will increase.

5.4   Cluster heterogeneity

The central argument in this section is that variety[25] of *firms* in a cluster adds to performance. Arguments to substantiate the positive effects of variety on performance are discussed first, followed by a discussion of relevant dimensions of variety. We finalize with a brief discussion of the issue of *resource* variety.

---

[25]   The terms heterogeneity, diversity and variety are used interchangably.

5.4.1   Firm variety and performance

Firms are learning agents with different *capabilities* (see Nelson, 1994). 'Firms - even within the same industry - differ in terms of their propensities to commit resources to innovation' (Dosi and Marengo, 1994, p. 158). Faced with large amounts of information, and high costs of processing information, economic agents do not use all potentially available information, but operate on the basis of 'taken for granted rules' and *routines*. Firms are not only boundedly rational, but also have a *selective* rationality (Simon et al 1992). Choices about what information is relevant and what not are based on past search and processing procedures. Paquet (1998) terms this a 'reference framework'. Such frameworks 'filter' information, and influence the interpretation of information. Thus, capabilities are grounded on firm specific cognitive frames. In general, a fit exists between cognitive frames, capabilities and market environments. However, since a firm's logic is deeply embedded in routines and human capital, firms cannot smoothly *change* from one frame to another and consequently cannot change from one set of capabilities to another.

Value chains (or production networks) consist of actors with different capabilities. Business units specialize in different activities that require different capabilities and related cognitive frames. As a consequence of specialization, a 'cognitive division of labor' arises: value chains consist of networks of firms with different capabilities and related cognitive frames[26]. Bellussi and Gottardi argue that 'the cognitive division of labor operates on a system level within each industrial structure [and is thus] an interfirm division of labor[27] (Bellussi and Gottardi, 1999, p.14).

Thus, the cluster population can be regard as a *collection of capabilities* and related cognitive frames. In this perspective, three arguments substantiate the positive effect of

---

[26]   The 'cognitive division of labor' can be explained with arguments derived from transaction cost economics: costs of coordinating activities with different cognitive frames inside a firm are relatively high, compared to market coordination.

[27]   The cognitive division of labor is related to the concept of cognitive distance (Nooteboom, 1992). A high cognitive distance potentially yields much novelty, but the transferability is low, precisely because cognitive distance is high. A low cognitive distance leads to a high transferability but yields little novel information. This concept can be used to explain why a cognitive division of labor arises.

variety in a cluster. First, diversity of capabilities enhances the *opportunities for cooperation* in the cluster. A diverse cluster is a 'fertile' environment for new alliances. In a relatively homogeneous cluster, firms are more likely to develop alliances with actors outside the cluster and such external linkages do not (or to a lesser extent) generate positive effects for firms in the cluster.

Second, clusters with a diverse population are less vulnerable for external shocks. Changes (technological, managerial, or social) affect some firms negatively, while others benefit from changes. Such winners do not necessarily have superior strategies and capabilities, but can also incidentally be well positioned to react to changes. The likeliness of the presence of 'winners' is larger in a diverse cluster. This argument for the positive effect of variety on performance is termed 'Fisher's Principle' by (some) evolutionary economists (see Metcalfe, 1994, p. 64).

A third argument for the positive effect of variety on performance is that diversity enhances opportunities for innovation. Diversity is an important source of 'Schumpeterian new combinations' (Nelson, 1994). More diversity leads to *a more diverse information and knowledge base*, which promotes innovation.

Even though the importance of diversity is widely shared, the issue of measuring diversity and its effects on performance has hardly been addressed. With regard to clusters, studies of the importance of heterogeneity are lacking:

> *As research on industrial districts enters a more mature phase, exploring the internal heterogeneity further seems a critical next step (Rabellotti and Schmitz, 1999, p. 106).*

5.4.2   Dimensions of firm heterogeneity

Firm heterogeneity can be measured on a large number of dimensions. Three relatively unambiguous firm dimensions that can in be analyzed relatively easy are 'economic activity' 'size' and 'international scope'.

The presence of firms engaging in different activities makes a cluster less vulnerable for external shocks, and provides a fertile environment for 'new combinations' and cooperation. The three arguments discussed above also apply to diversity of size. Large and small firms are in general complementary. Small firms are more flexible and co-operate relatively

frequently in networks, whereas large firms possess the scale to engage in 'fundamental R&D'. This provides a good basis for cooperation and joint innovation projects.

International scope is relevant for the three above-mentioned reasons as well. Variety of international scope leads to a higher information inflow because information and knowledge diffuses faster within firms than across markets. Therefore the presence of business units in a cluster with establishments (for instance a parent company) outside the cluster enhances the likeliness of relatively early adoption of innovations. Variety of international scope also increases the likeliness of the 'export' of innovations that were successfully applied in the cluster (Albino et al, 1999). The reaction to external shocks also differs between firms with a different 'international scope'.

5.4.3   Resource variety[28]

Porter (1990) argues that variety of *resources* adds to cluster performance, because a variety of resources reduce the vulnerability to external shocks. A cluster chiefly dependent on one resource is likely to be strongly affected when either the importance of that resource reduces or the availability (in terms of price/quality) deteriorates. A mining cluster is an example of a cluster with a small resource base. Resources of which the availability can differ between clusters include knowledge and information, labor and raw materials.

5.5   Conclusions

In this chapter four variables of cluster performance, related to the structure of a cluster were discussed. The effects of the variables were analyzed, predominantly based on existing literature. Some additional or more precise arguments were developed, in order to understand better how the structure of a cluster influences cluster performance. Table 7 summarizes the effects of cluster structure on cluster performance that were identified in this chapter. These will be tested in the empirical part.

---

[28]   Resource variety is not incorporated in the theoretical framework, since it is not really cluster specific.

Table 7: The effects of cluster structure on cluster performance

Element of cluster structure	Effect on cluster performance.
Agglomeration economies	A shared labor pool attracts firms to the cluster.
	The presence of customers and suppliers attracts firms to the cluster.
	The presence of knowledge (spillovers) attracts firms to the cluster.
	Land scarcity and high land prices 'disperse' firms from the cluster.
	Congestion disperses firms from the cluster.
Internal competition	Internal competition prevents monopoly pricing.
	Internal competition leads to specialization.
	Internal competition promotes innovation.
Cluster barriers	Entry barriers (such as inaccessible networks) and start-up barriers (such as non-availability of local venture capital) reduce competitive pressure and prevent the inflow of (human) capital.
	Exit barriers (such as 'sticky labor' and cluster specific investments) reduce uncertainty for firms in the cluster.
Cluster heterogeneity	Cluster heterogeneity enhances opportunities for innovation.
	Cluster heterogeneity enhances opportunities for cooperation.
	Cluster heterogeneity reduces vulnerability for external shocks.

6   CLUSTER GOVERNANCE

In this chapter the influence of cluster governance on the performance of clusters is discussed. We define cluster governance as *the coordination of activities in a cluster*[29]. Clusters are characterized by frequent interaction and coordination. Different coordination mechanisms are used, market coordination included. Based on a literature review, four variables related to the governance of clusters are distinguished (see Figure 9).

Figure 9: Four governance variables
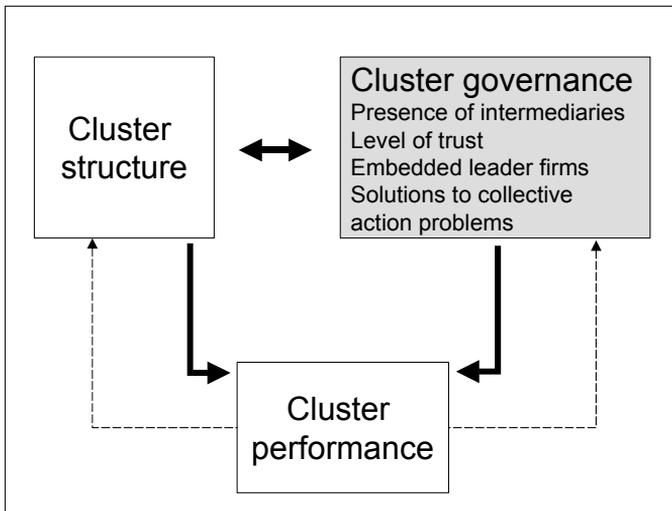
A framework to analyze coordination in a cluster is developed in the first paragraph. The four variables are discussed in the following four paragraphs and a concluding section finalizes the chapter.

---

[29]   Jessop (1997, p. 95) defines governance as 'collaborative interaction between stakeholders'. Our definition is more 'Williamsonian': starting from an analysis of the roles of different mechanisms of 'collaborative interaction'. Issues such as the risks of 'hold-up' and 'hostages' (Nooteboom, 1999A) are not discussed.

6.1   Coordination in a cluster

The need for coordination in clusters is undisputed amongst cluster scholars (see Harrison, 1994). Cluster scholars frequently regard clusters as special solutions to a coordination problem. In this stream of literature (the flexible specialization literature, see Piore and Sabel, 1984) clusters are regarded as networks of (small) firms that cooperate based on trust and cooperation. This 'mode of production' is an alternative to production by large conglomerates. Other scholars question this particular definition of clusters (Markusen, 1996) but acknowledge the importance of coordination in a cluster.

Different modes of coordination (or to use the terminology of Williamson: modes of *governance)* can play a role in clusters (see Hollingsworth et al, 1994). We distinguish six general modes of coordination (see Campbell et al, 1991, Hollingsworth and Boyer[30], 1997, and Williamson, 1985): markets, firms, interfirm alliances, associations, public-private organizations and public organizations[31].

None of the different modes of coordination is 'structurally superior', each mode has advantages and disadvantages. Consequently, different modes of coordination are used in a specific *domain[32]*, to solve different coordination problems. In Table 8, an overview is given of different modes of governance, their advantages, disadvantages and 'domain'.

---

[30]   Hollingsworth and Boyer (1997) identify six modes of governance, five of which (firms, markets, interfirm alliances, associations and public organizations) are included in this study. Public-private organizations are added and 'communities' are omitted, because communities are not designed to coordinate specific activities.

[31]   Campbell et al (1991) argue that government has such special abilities (such as changing property rights, allocating resources and serving as gatekeepers) that it cannot be analyzed as merely an alternative governance mechanism. Hollingsworth and Lindberg (1985) and Hollingsworth and Boyer (1997) do analyze the state as a governance mechanism. We include public organizations in the analysis of governance when they provide public services (such as education). The legislative role of the government is not included in the analysis.

[32]   This is a 'Williamsonian approach', because each mode of governance has a 'structural domain', based on its advantages and disadvantages. However, this does not imply that all modes of governance develop automatically in their 'structural domain'. Thus, this framework is not sufficient to analyze governance regimes in full detail, but a useful starting point.

Table 8: Characteristics of modes of governance

Governance modes	Advantages	Disadvantages	Domain	Capable of solving collective action problem	Mechanisms of pressure
Firms	Smooth coordination	Limited set of capabilities, limited flexibility	Coordination of strongly related economic activities	Not suitable	Market competition Shareholders/ stakeholders
Market	Flexibility and selection pressure	Coordination beyond price is difficult	Exchange of alternatively available products	Not suitable[33]	Market competition (exit)
Inter-firm alliances[34]	Relatively effective coordination	Reduced flexibility	Coordination of complementary activities that require different capabilities	Only suitable for small groups of firms[35].	Market competition
Association	Pursuing collective goals	Free rider behavior	Pursuing collective goals	Suitable, but problem of incentives	Voice of members
Public/private organization	Combination of public and private competencies	Limited selection pressure, limited accountability	Projects in the public interests that require private involvement	Suitable, but risk of opportunism	Private and public voice
Public organization	Capable of acting in the 'public interest'	No clear incentives, no selection pressure	Pursuing public interests	Suitable, but information problems and lack of incentives	Public monitoring

Table 8 also shows whether or not the six governance modes are capable of solving a *collective action problem* (this issue is discussed in more detail later) and under what conditions the coordination modes adapt (or are adapted).

---

[33] Contracts to solve a collective action problem are very costly to specify and monitor.

[34] The term interfirm alliance is used instead of the term networks. Interfirm alliances are more narrowly defined (Nooteboom, 1999A).

[35] Interfirm alliances are 'exclusive partnerships' with a limited number of partners, and thus not suitable for solving collective action problems for the cluster as a whole.

Various case studies of clusters (such as Mistri, 1999) suggest that the quality of governance in a cluster (quality so defined that a higher quality leads to a better performance of the cluster) can differ between clusters. However, no satisfactory framework to analyze the quality of coordination in a cluster has been proposed. Based on a comprehensive literature review, we develop the framework to analyze the quality of cluster governance given in Figure 10.

Figure 10: The quality of coordination in a cluster
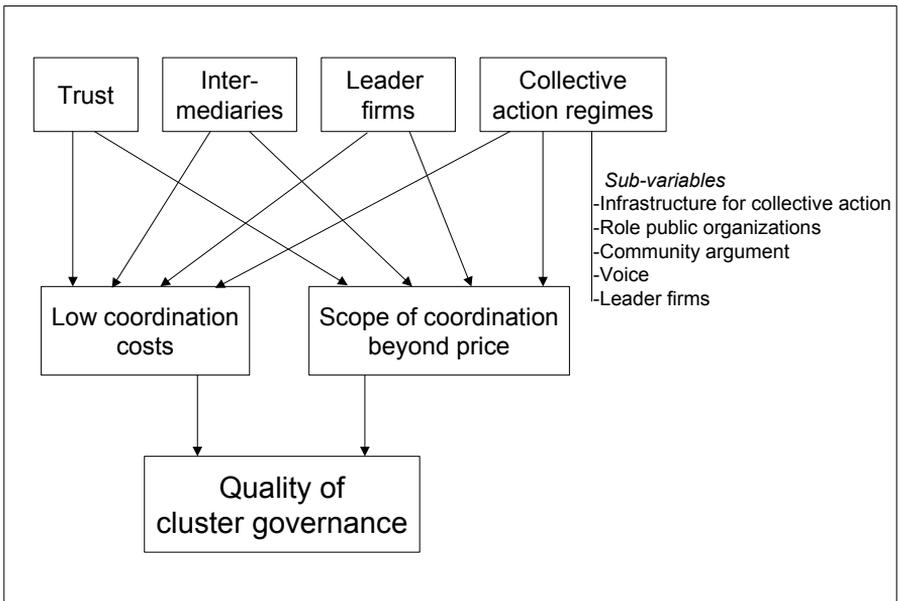
Two factors determine the quality of governance. First, the level of coordination costs, or transaction cost. These costs include the costs of searching for partners, the costs of specifying contracts, the costs of 'monitoring' performance, and the 'pure' interaction costs such as time and travel expenses (Williamson, 1985). Clusters do not 'by nature' have low transaction costs, but it is frequently claimed that transaction costs in clusters can be relatively low (Albertini, 1999).

Second, the quality of coordination in a cluster depends on the '*scope' of 'coordination beyond price'*.   Examples of coordination beyond price include setting of standards, investing in the labor pool, cooperation in innovation projects and information sharing. For at

least three reasons, coordination beyond price (in this section *coordination* is used for coordination beyond price) does not develop 'spontaneously' even when the overall benefits of coordination are higher than the overall costs (Olson, 1971). First, an unequal distribution of benefits can prevent coordination. If one or a few firms are worse off they will obstruct efforts to increase the scope of coordination. Second, opportunistic behavior, such as 'free riders' can obstruct coordination (Olson, 1971). Third, uncertain benefits prevent coordination, because firms are risk-averse when confronted with uncertainty.

These three reasons explain why the scope of coordination in clusters is generally speaking too limited, *assuming that collusion is prevented by regulation*[36]. The performance of clusters where firms manage to enlarge the scope of coordination will increase. Figure 10 shows four variables that both reduce the level of coordination costs and enlarge the scope of coordination beyond price. The four variables are discussed in the following sections.

6.2   Trust

The level of trust influences the level of transaction costs. In clusters where the level of trust is high, (average) transaction costs are relatively low, because of low costs to specify contracts and low monitoring costs[37]. Many cluster studies argue that clusters are 'high trust environments' and that this contributes to the performance of clusters (see Harrison, 1994).

Williamson (1993) claims that 'blind trust', in the sense of non-rational trust, is not likely to survive and that therefore the notion of trust is not relevant for transaction cost economics. Nooteboom (2000) rejects this argument by claiming that trust can be based on experience,

---

[36]   The question whether the scope of coordination can be too large perhaps deserves more attention. We acknowledge that cooperative arrangements can become obsolete and reduce rather than increase the performance of a cluster. Such arrangements can be hard to dismantle, because of vested interests and routines developed over time. However, this does not imply the scope of coordination is too high, it shows cooperation is not effective, or in other words, cooperation costs are too high.

[37]   An additional positive effect of trust is that specific investments are viable when partners trust each other but not viable when the risk of opportunistic behavior is high. Thus, specific investments for partners are more likely to occur in 'high trust clusters'.

and changes through learning. Therefore trust does not have to be blind but whether it is rational or not to trust potential exchange partners depends on the (cluster) environment.

In cluster where the level of trust is high, the scope of coordination beyond price is larger than in 'low-trust clusters', because uncertainty is reduced and the threat of opportunistic behavior is lower.

The level of trust in a cluster is influenced by the importance of *reputation effects* in a cluster. If reputation effects are strong, abusing trust has negative effects and therefore it is worthwhile for firms to build a trustworthy reputation. Because of this, the culture of trust is sustainable. This reputation effect has both an economic and a social aspect: firms strive for a good reputation because it yields positive returns, managers strive for a good reputation because it yields personal career opportunities.

Thus, in clusters where the reputation effect is strong, the likeliness that one can trust a potential exchange partner, even when such a partner has an opportunity and an incentive to damage one's interests (this is Nooteboom's (1996) definition of intentional trust) is high. In such 'high trust clusters', transaction costs are relatively low.

6.3   Intermediaries

The presence or absence of *intermediaries* also influences the quality of coordination in the cluster. Intermediaries reduce coordination costs and expand the 'scope of coordination beyond price'. Three reasons substantiate the positive effect of intermediaries[38]. First, they provide a 'bridging tie' (McEvily and Zaheer, 1999) between two or more otherwise not connected exchange partners. Intermediaries lower search costs for firms looking for exchange partners, and literally 'bridge' gaps between potential exchange partners. Second, intermediaries reduce coordination costs because they 'connect cognitions'. Firms operate in specific markets and develop both capabilities and a cognition matching their market environment. Intermediaries reduce transaction costs because they can bridge cognitive differences between firms that operate in very different market environments. This role of connecting cognitions is especially important in clusters given the fact that clusters are characterized by a 'cognitive division of labor' (Belussi and Gottardi, 2000).

Third, intermediaries can reduce cooperation costs by managing cooperative projects. Especially when cooperation is temporal, intermediaries are used to reduce coordination costs. Intermediaries reduce the costs of starting and disentangling relationships (Nooteboom 1999A), for instance because of their skills and experience in devising complex contracts.

The above-mentioned reasons are the 'raison d'etre' of intermediaries in the first place. They arise when there is a market for their services. However, intermediaries are relatively footloose, and a large part of them operate internationally. The presence of an intermediary in a cluster is advantageous because the costs are lower and they are better situated to act as a bridging tie.

6.4   Leader firms

Lorenzoni and Badenfuller (1995, p. 147) define leader firms as 'strategic centers with superior co-ordination skills and the ability to steer change'. We define leader firms as follows:

> Leader firms are firms that have - due to their size, market position, knowledge and entrepreneurial skills - the *ability* and *incentive* to make investments with positive externalities for other firms in the cluster.

A distinction can be made between *network* externalities (Economides, 1996) and *cluster* externalities. Cluster externalities spread to all firms in the cluster, network externalities spread only to firms included in a relatively closed interfirm network[39]. Leader firms have such a strong market position that they have incentives to create positive external effects[40] for other firms in the network/cluster, because a large part of the benefits of a more

---

[38]   See Nooteboom (1999A) for a discussion of the roles of intermediaries.

[39]   Clusters consist of large numbers of firms, both complementary and competing, both with actual interfirm relations and with *potential* relations. Thus, cluster externalities are more general than network externalities.

[40]   It can be argued that in these cases, the positive effects are not truly externalities. However, firms in the network/cluster benefit and only a part of those benefits are channeled back on to the leader firm. The positive effects are at least partially external effects.

competitive network/cluster end up 'in their pockets'. It is important to note that there is no 'mechanic' relationship between firm size and leader firm behavior. Small firms can also behave as leader firms and multinationals are not necessarily embedded in clusters. Leader firm behavior also strongly depends on the location of the head office and management philosophy of the CEO.

Leader firms have incentives to enlarge the scope of coordination beyond price and to reduce coordination costs. Investments of (leader) firms with substantial *network* externalities include investments in *innovation* and *internationalization*. The benefits of both innovation and internationalization spread to all 'members' of the network. Albino et al (1999) stress the importance of a leader firm for the development of other firms in the cluster. Leader firms can be *enablers* for the *internationalization* of other firms in the clusters. On the basis of 'many cases', they argue that 'leader firm internationalization can be considered the main impulse for district internationalization' (Albino et al 1999, p. 57). Leader firms act as 'launching customers' for the internationalization of their suppliers or sell products from the cluster in foreign markets.

Three investments with substantial *cluster* externalities are identified: investments in *training and education*, *knowledge and information infrastructure*, and an *infrastructure for collective action*. Leader firms have incentives to enlarge the scope of coordination beyond price so that these investments take place. Table 9 shows four important leader firm effects.

Table 9: Leader firm effects on clusters

Most important effects of leader firm behavior
Leader firms invest to improve coordination of innovation networks.
Leader firms coordinate internationalization of firms in the cluster
Leader firms co-invest to improve the infrastructure for training, education and knowledge exchange
Leader firms invest to improve the organizational infrastructure in the cluster

Table 9 shows that when firms in a cluster *behave* as leader firms, the cluster as a whole benefits. The extent to which potential leader firms actually behave as leader firms differs between clusters. Thus, the presence of 'true' leader firms adds to the quality of governance in clusters.

6.5   Collective action regimes

6.5.1   The problem of collective action

The 'problem' of collective action (Olson, 1971) is relevant for all clusters. Even though cooperation to achieve *common* goals (such as marketing and education) would be beneficial for all organizations involved, such cooperation does not always develop spontaneously. Individual firms can 'free-ride' on the cooperative efforts of other firms. Thus, *collective action* does not arise. The performance of clusters where collective action develops - collective action problems are solved - is better than that of clusters where collective action problems are not solved.

In clusters, a number of collective action problems (CAP's) is present. For each specific CAP a 'collective action *regime'* (CAR) arises (see Mossberger and Stoker, 2001)[41]. In this context, a regime can be defined as a 'relatively stable collaborative agreement that provides actors with the capacity to overcome collective action problems' (see Mossberger and Stoker, 2001, for a similar definition).

CAR's are not by definition 'efficient' and do not automatically adapt. Inefficient collective action regimes reduce the performance of a cluster, but there is no process of 'selection and adaptation' that leads to the survival of effective regimes only. A regime is *path dependent* and relatively stable over time[42], because first, energy and capital have been invested in a regime and these investments are 'sunk costs' that prevent adaptations of a regime (see Westlund, 1999) and second, a regime defines the 'rules of the game' and becomes taken for granted. Consequently, collective action regimes differ substantially between countries,

---

[41]   Even though governance regimes differ, a dominant governance style exists at a cluster level (see Campbell et al, 1991). With a 'bottom-up approach' similarities of the different regimes in a cluster will become clear, while such an approach allows for taking into account the possibly large differences between different regimes.

[42]   Campbell et al (1991) argue that 'When actors have already established associations (…) and thus the capacity for selecting far sighted cooperative strategies, they can more easily devise new multilateral governance mechanisms than actors from a sector where shortsighted bilateral mechanisms dominate the governance regime' (Campbell et al 1991, p. 331). This illustrates the path-dependence of regimes

industries and clusters (see Hollingsworth et al, 1994). Hollingsworth et al (1994) even argue that differences in regimes are central in the competition between clusters: '*economic competition is increasingly becoming competition over different systems of production*' (Hollingsworth et al 1994, p. 38).

6.5.2   The roles of modes of governance in collective action regimes

Collective action arises when a large number of firms in a cluster cooperate. Consequently the role of markets, individual firms and interfirm alliances in CAR's is limited (see also Table 8). Associations, public private partnerships and public organizations are governance modes better equipped to solve collective action problems.

Associations act in the interests of their members. Associations are 'vehicles' for collective action. The 'domain' of associations is the provision of collective goods, goods with benefits of which firms cannot be excluded, that are *specific* for the members of an association[43]. An example of a collective good is interest representation and cluster marketing. Associations can only play a role when their membership base is sufficiently large. If the membership base is low (because many firms 'free ride') an association loses legitimacy and costs for (remaining) members go up.

Set up costs for associations are high, because members have to invest substantially in time and capital to establish an association. In general, the free-rider problem prevents the spontaneous development of associations, unless groups are small, *even though collective action would be in the interest of all actors involved*. Since in small groups the collective interest is more closely related to individual interests, associations of small groups are more likely to develop. Olson (1971) distinguishes three kinds of groups: privileged, mediate and latent groups:

> *The small privileged group can expect that its collective needs will probably be met one way or another, and the fairly small (intermediate) group has a fair chance that voluntary action will solve its collective problems, but the large latent*

---

43   Public goods such as safety are in the domain of public bodies (see Streeck and Schnitter [eds.], 1985).

> *group cannot act in accordance with its collective interests so long as members of*
> *the group are free to further their individual interests (Olson, 1971, p. 58).*

In the 'latent group' the problem of free riding prevents the development of an association. Latent groups can become 'mobilized' when potential members have an incentive to become members. Offering sufficient individual incentives is crucial in 'mobilizing' latent groups (Olson, 1971), because individual incentives motivate firms to join an association and, as a side effect, firms also support the 'production' of collective goods. Providing complementary services is a method to create individual incentives for membership (Bennet, 1998). Examples of complementary services are the inclusion in networks, the accessibility of information (Sako, 1996), entrance to training and education programs (Rusaw, 1995) and benefits from collective bargaining agreements with suppliers.

Apart from the individual incentive motive, 'sense of community' triggers firms to join an association[44].

> *Membership of a local Chamber appears to depend on two different ways in*
> *which businesses evaluate this cost benefit relationship, one emphasizing local*
> *community and collective benefits, a second emphasizing specific service*
> *benefits largely excludable from non-members (Bennet, 1998 p. 512)*

The 'sense of community' argument regards the membership of an association as a 'communitarian' act. The 'community argument' is used frequently with regard to clusters.

Associations face only limited 'selection pressure', since they do not face market competition. The threat of 'exit' of members and the 'voice' raised by members are the two mechanisms of adaptation. However, firms only use their voice when it is not costly and time consuming (see Olson, 1971) and firms are unlikely to 'exit' when satisfied or moderately dissatisfied.

The 'domain' of *public private organizations* consists of activities that are both in the public and in the private interest and are best pursued jointly. Activities are best pursued jointly when public capabilities (such as planning, accountability and consistency) and private

---

[44]   A third method to transfer latent groups in mobilized ones could be through developing a
        federative structure (see Olson, 1971, p. 165).

capabilities (such as efficiency and focus on common goals) are required and when both public and private actors are willing to contribute financially to the activities of public private bodies. Examples of this include knowledge and education projects and innovation and knowledge diffusion projects.

Public private bodies have relatively high set-up costs and uncertain pay-offs. Therefore, they develop only when governments provide substantial support. Public-private bodies are only exposed to weak selection pressures, because competition is absent and clear performance monitoring is difficult. Public and private 'voice' creates pressure to adapt.

The domain of *public organizations* is limited to those activities where private initiative is not likely to yield socially desirable outcomes and regulations also do not lead to socially desirable outcomes. Activities such as safety and planning are generally regarded as inside the 'public domain'.

Selection pressures for public bodies are limited, since competitive pressure is absent and voice is limited. Furthermore, public organizations in general have relatively strong 'procedural inertia' that reduces the effectiveness of voice. Figure 11 summarizes this overview of modes of governance and their role in a collective action regime.

Figure 11: The role of various coordination mechanisms in a regime

A collective action regime: a mix of modes of coordination

Markets	No role in regimes, not capable of 'coordination beyond price'.
Hierarchies	Develop spontaneously and are in general efficient. Specific group, leader firms, contribute to collective action regimes.
Alliances	Can develop spontaneously if a relatively small number of firms benefit from collective action and these benefits can be clearly defined and measured.
Associations	Develop when community argument is valid. Substantial contribution to collective action regime. Efficiency depends on voice.
Public-private bodies	Development depends on trust. Substantial contribution to collective action regime. Efficiency depends on monitoring.
Public bodies	Potentially substantial contribution to collective action regime. Efficiency depends on monitoring, public management.

6.5.3   The quality of a collective action regime

We identify five (cluster specific) variables of the quality of a regime. First, the *presence of an infrastructure for collective action* adds to the quality of a regime, because such an infrastructure provides opportunities to solve CAP's. The infrastructure for collective action consists of three kinds of organizations: *associations, public-private organizations* and *public organizations*. *Associations* are well equipped to solve CAP's since they act in the interest of all their members. *Public organizations* can contribute to solve CAP's because they aim to generate collective benefits and *public-private partnerships* also can help overcoming CAP's[45]. Associations and public-private organizations do not develop automatically, but when they exist, they provide a fertile ground for solving CAP's.

---

[45]   Public-private organizations and public organizations can be regarded as elements of the infrastructure for collective action (of a cluster) if they are established to generate *cluster specific collective benefits*.

Second, the *role of public organizations in a regime* influences the efficiency of a regime. Public organizations can play a role in solving CAP's, but unlike private institutions they are not primarily driven by economic incentives. Public organizations can be 'prospective partners' capable and willing to contribute to solving CAP's but can also be organizations with a very modest involvement in solutions to CAP's.

Third, *voice* (see Hirschmann, 1970) of firms is important because associations, public and public-private organizations do not adapt automatically. They face only limited 'selection pressure' and as a consequence, adaptation is more likely when firms use their voice. Since adaptations improve the quality of a regime[46], voice adds to the quality of a regime.

Fourth, the *validity of a community argument* adds to the quality of a governance regime (Bennet, 1998), since a higher willingness to invest in the 'community' enables better solutions for CAP's. Fifth, the role of *leader firms* increases the quality of the regime, because leader firms have incentives and resources to invest in CAP's.

6.6 Can trust, leader firms, intermediaries and CAR's have negative effects on performance?

In the preceding four paragraphs the four variables of cluster governance were discussed. The influence of all four is positive: more trust, more intermediaries, and more leader firm behavior improve the quality of the governance of the cluster. The same applies to the quality of the regimes: more infrastructure for collective action, more leader firms behavior, more involvement of public actors, more sense of community and more voice lead to better collective action regimes.

This leads to the following question: is the influence of these variables always positive? Could there not be a moment where 'more' actually reduces performance. The principle of

---

[46]   Campbell et al note with regard to changing a regime: 'Actors eventually select a new governance regime as streams of action intermingle in complex ways. Trial and error learning as the result of spontaneous interaction may predominate in some instances (…). In this sense, selection is very much a process of muddling through. In other cases, deliberate coordination among organizations will take the place of, or supplement, trial and error' (Campbell et al 1991, p. 331). This illustrates that adaptation of regimes is far from spontaneous.

'diminishing returns' applies here. For instance, more voice is especially likely to contribute to the quality of governance when voice is hardly raised. Theoretically speaking, at some moment the decreasing returns can become negative returns: when a substantial number of firms already raise their voice, additional voice might have a negative effect. Such possibilities cannot be ruled out, but unless there are reasonable theoretical arguments, why 'more' could lead to a worse performance, such eventualities cannot be incorporated in the theoretical framework in a meaningful way. We claim no convincing arguments support the negative influence of any of the four variables.

More trust lowers coordination costs as well as the scope of coordination. Trust in clusters can be an entry barrier, because 'outsider firms' are not trusted and as a consequence, entry is difficult. However, there is no convincing argument why new firms could not build a reputation, for instance by hiring trustworthy managers.

There is also no convincing argument to claim that leader firm behavior has a negative effect on governance. Leader firms can have dominant positions in clusters and strive to maintain those positions. Thus, they might try to prevent entry of competitors. However, such efforts cannot be regarded as leader firm behavior as defined in this study; in fact, all firms strive to reduce competition. A lack of internal competition is incorporated in the framework. It may be that dominant firms do not face internal competitors. This has a negative effect on the performance of the cluster, but it is not related to leader firm behavior.

The presence of intermediaries has positive effects since they enable cooperation and reduce transaction costs. Arguments for the negative effects of intermediaries on governance are also lacking: intermediaries have to serve a market, when there is no demand they will cease to exist. The argument that intermediaries can add transaction costs, because they somehow manage to occupy a position between supply and demand, does not apply in general: whenever firms can 'cut costs' by by-passing intermediaries they will do so.

Finally, with regard to the variables of the quality of a collective action regime, similar arguments apply: the positive effect of the variables is based on arguments that apply in general. It can be questioned whether this general positive relationship also applies in 'extreme situations', but a basis for arguing that the variables have a negative effect is lacking.

6.7   Conclusions: cluster governance and cluster performance

In this chapter, arguments for the influence of four governance related variables of the performance of a cluster were presented. Table 10 summarizes the variables that influence the quality of cluster governance.

Table 10: Variables for the quality of cluster governance

Elements of cluster governance	Effects on cluster performance
The presence of trust	Trust lowers coordination costs because costs to specify contracts decrease.
	Trust increases the scope of coordination beyond price, because the risk of free riding decreases.
The presence of intermediaries	Intermediaries lower coordination costs and increase the scope of coordination beyond price because they specialize in managing coordination.
The presence of leader firms	Leader firms generate positive external effects for firms in their network, mainly by encouraging innovation and promoting internationalization.
	Leader firms generate positive external effects for firms in the cluster, mainly by organizing investments in the training and education infrastructure, the innovation infrastructure and the infrastructure for collective action.
Quality of collective action regimes	The more resources are invested in collective action regimes, the better the performance of a cluster. Five variables influence the amount of invested resources: the role of leader firms, the role of public organizations, the presence of an infrastructure for collective action, the presence of a community argument and the use of voice.

This chapter completes the analytical framework to analyze the performance of clusters. The framework, summarized in Table 7 and Table 10, is tested in the empirical part. The framework provides a basis for an assessment of strengths and weaknesses of the structure and the governance of a cluster. Opportunities for improving the performance of a cluster can be derived from these strengths and weaknesses.

EMPIRICAL PART: THREE CASES OF SEAPORT CLUSTERS

7 ANALYZING THE PERFORMANCE OF SEAPORT CLUSTERS

In the empirical part the framework developed in the theoretical part and summarized in Table 7 and Table 10, is applied to ports. Figure 12 shows the contents of the empirical part.

Figure 12: Contents of the empirical part
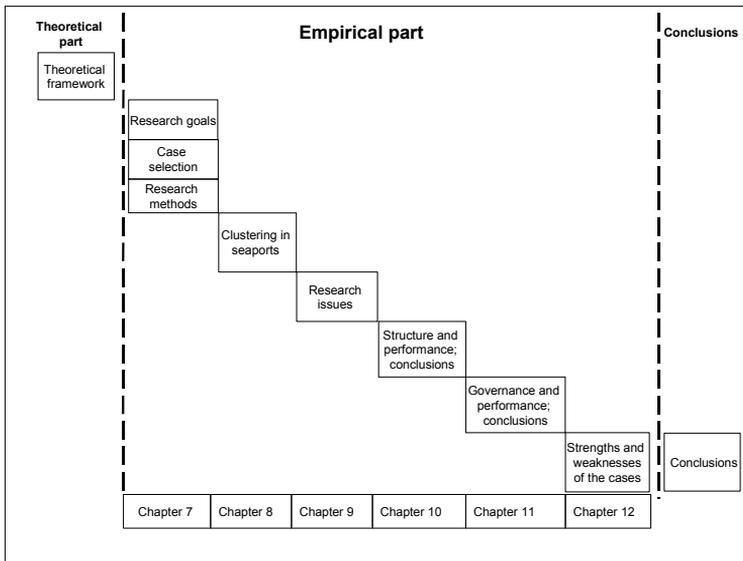
In this chapter, research goals of the empirical part are presented, the selection of cases and research methods are discussed. Furthermore, some basic information of the three cases, Rotterdam, Durban and the 'Lower Mississippi Port Cluster' (LMPC) is provided. In chapter 8 clustering in seaports is analyzed in general and the three port clusters are described. Chapter 9 discusses the research issues with regard to port clusters, based on the theoretical framework and a review of existing literature on ports and port clusters. The results of the case studies with regard to the relation between cluster structure and cluster performance are presented in chapter 10 and the results with regard to the relation between cluster governance and cluster performance are given in chapter 11. In Chapter 12,

strengths and weaknesses of the three port clusters are discussed and these are related to available data on the performance of the three cases.

7.1   Goals of the empirical research

The goals of the empirical part are as follows:

- To improve understanding of the size, composition and relevant region of port clusters.

- To test whether the variables of cluster performance discussed in the theoretical part are relevant and analyze how they affect the performance of a port cluster.

- To identify and discuss opportunities to improve cluster performance in the three cases.

- To improve the analytical framework developed in the theoretical part on the basis of empirical results.

7.2   A case study approach

Data to test the validity of the (holistic) theoretical framework developed in the theoretical part (for instance cluster performance data and indicators of the identified variables) are lacking. Therefore, a case study approach is appropriate. Where available, quantitative data are used in the case studies.

The case studies can be regarded as experiments to test the usefulness of the framework. Three case studies increase the 'robustness' of the results, compared to only one case study (see Yin, 1994). The goal of the case studies is *analytical* generalization: (provisional) acceptance, rejection or moderation of theories (see Yin, 1994, p.36), not *empirical* generalization. The three cases are three different *experiments*, not a *sample* of three observations. Even though all three cases are port clusters, an *analytical* generalization *to clusters in general* can be made. Therefore the results can be fruitful for further cluster research.

With regard to the comparison between cases, this research is *explorative*. Differences in performance are likely, because the (economic, social, institutional) environment of the cases differs. Differences between the cases are analyzed, but no theoretical explanations are suggested beforehand.

7.3   Sources for the case study research

Four kinds of sources are used. The combination of these different types of data allows for cross checks on consistency. First 'quantitative data' such as statistics from the economic census, input output data and port statistics are used. These data are used to 'construct' the port clusters, but are not useful for analyzing the performance of port clusters, because they are not sufficiently detailed.

Second, reports, studies, newspaper articles and annual reports are studied. This source is important for understanding the issues at stake in ports, especially for understanding the 'regimes' in a port.

Third, a series of *expert interviews* are conducted. In each port, over 35 port experts were interviewed. Their opinions are an important source, especially for understanding the factors influencing port performance.

Fourth, a survey was held among the port experts. The survey questions were explained and respondents were asked to explain their answers. Therefore answers were 'checked' so that when respondents had a different interpretation of the questions or were not sufficiently informed to answer the questions, their answers were not taken into account[47]. The survey questions are given in appendix 1. The different survey questions have different ranking scales. In some cases, experts were asked to make rankings of variables in order of importance. In other case, they were asked to indicate one aspect (such as importance or quality) on a scale from 1 to 5. Finally, for the evaluation of the variables, they were asked to use a scale from –5 to +5. This complicates reading, but the different scales improve the

---

[47]   The experts were asked to answer the survey questions in our presence. In a number of cases experts indicated, or if became clear otherwise that the respondents were not sufficiently knowledgeable to provide informed answers to all questions. In these cases questions were skipped or the answers were not included in the data set. Even though some subjectivity is involved, this approach is the best way to identify the expert opinion: only informed answers should be included in the data set.

quality and reliability of the results[48]. The results of the survey are given in tables; below each table the scale used is given.

7.4   Selection of the port experts

The quality of port experts is crucial for the quality of the outcomes of the empirical research. The survey questions require an 'informed opinion'. Only a limited number of all individuals working in the port cluster qualify as experts. We identified industry experts on the basis of three criteria:

- Job position: individuals with a job that requires an understanding of the cluster are likely to be knowledgeable with regard to cluster issues. The majority of the industry experts have senior positions with port firms of substantial size, port specific associations and the (public) port authority.

- Experience in the industry: newcomers to the industry are not likely to have accumulated sufficient knowledge. Therefore, the majority of industry experts are experienced in the industry. Newcomers are only included in the 'expert list' if suggested by other experts.

- Involvement in cluster governance: individuals that are involved in cluster governance, for instance through membership of steering committees etc. are more likely to be knowledgeable with regard to cluster issues. The majority of the experts were either involved in governance at the moment of the survey or had been a member of one or more boards of associations before (see Table 11).

The number of industry experts in a port cluster cannot be determined. A 'hierarchy' of experts exists, with senior managers at cluster associations and the management board of important public organizations (especially the port authority), senior managers of the largest

---

[48]   For instance: a scale from –5 to +5 is more useful when asking an assessment of *quality* (the quality can be bad or good, nil is a 'neutral score'). A ranking from 1 to 5 is better for an assessment of the *importance* of a variable.

firms in the cluster and senior managers of 'embedded small and medium sized firms' at the top of the hierarchy[49].

For each of the three case studies we developed an 'initial expert list' of about 20-30 industry experts, on the basis of internet sources (board members of associations, CEO's of firms in the cluster) and suggestions from one 'embedded academic'. Prof. Welters identified experts in Rotterdam, Prof. Jones in Durban, and Dr. Renner in the LMPC.

The initial list was expanded during the case study by asking industry experts to add new experts, if they felt the list was incomplete. Individuals that were suggested by at least two experts were added to the list[50].

Table 11: Port experts in the three cases

Case	Number of initial experts	Additional experts	Participating experts and 'response rate'	Percentage experts involved in cluster governance[51]	Average number of years experience in cluster
Rotterdam	41	8	N=43, 88%	90%	20
Durban	32	5	N=34, 92%	68%	17
LMPC	26	12	N=31, 80%	71%	19

In all the three cases, the response rate was very high: the vast majority of all the experts that were identified did participate in the study. For this reason, we are confident that the

---

[49]   Since the focus is on cluster performance the vast majority of experts works in firms in the port. Other stakeholders, such as environmentalists or regional planners are less important given the research set-up.

[50]   Since the initial list in all three cases consists of experts with different backgrounds (from public and private organizations and associations, and from firms engaging in different cluster activities), and since the cluster 'community' has a dense network of relations (all experts know the vast majority of the other experts), a biased expert list is unlikely.

[51]   The experts were asked to indicate whether were actively involved in projects in the interests of the cluster. For instance, all experts serving at the board of an association are considered to be involved in governance.

survey results do reflect the expert opinion[52]. Furthermore, due to the fact that all survey questions were answered during the interviews, so that unclear questions could be explained, the interpretation differences between the experts are very limited. This makes the expert opinion more reliable.

The port cluster consists of five components: cargo handling, transport, logistics, manufacturing and trade (these are discussed later). The experts had to indicate in which component(s) their organization was active. The background of the experts is given in Table 12.

Table 12: Background of experts

Component	Durban	Rotterdam	LMPC	Total three cases
Cargo handling	24 %	27%	32%	27%
Transport	30 %	29%	34%	30%
Logistics	31 %	29%	24%	28%
Manufacturing	11%	9%	4%	9%
Trade	4%	5%	7%	6%

Experts with a background in the cargo handling industry are over represented in the sample of experts. Experts with a manufacturing background are somewhat underrepresented.

7.5   Survey structure

The survey consists of four sets of questions:

1. Questions to assess the embeddedness and linkages of the respondent's organization in the cluster.

---

[52]   Most of the sample size logic and 'statistical significance' issues are less relevant in this research, since the survey is not a random sample of a large population of industry experts. We claim to have surveyed the (vast) majority of cluster experts. Statistical significance tests are used, but not with the purpose of demonstrating that the expert opinion is 'representative'.

2. Questions to find out the opinion of the respondents with regard to a number of propositions, derived from the theoretical framework. The experts are asked to indicate whether or not they agree with the propositions. In some cases the propositions are relatively obvious[53]. These propositions were added for the sake of completeness - all the variables of the framework are tested this way - and because what is obvious for certain academics might not be obvious for industry professionals. When possible, alternative propositions were tested (as suggested by Yin, 1994).

3. Questions to assess the relative importance of the various variables of cluster performance. Apart from the *validity* of a variable, the survey questions address the issue of the importance of a variable, compared to other variables.

4. Questions to compare the strengths and weaknesses of the case study port with competing port clusters. These results can be compared with reports and studies to cross check for consistency and to assess the quality of governance, compared to competing ports. This provides a basis for analyzing which governance arrangements are effective.

The survey results are used to identify expert opinions in a port cluster. We test whether expert opinions differ between the port clusters or are the same across the three cases[54]. In the latter case, expert opinions do not depend on the local context and can be expected to be the same in all (port) clusters[55].

A division of experts can be made between experts with over 20 years of experience in the port industry and experts with less experience, and experts working for small organizations

---

[53] An example is the proposition: 'A culture of trust increases the quality of the governance because it lowers transaction costs and enables co-operation'.

[54] Comparing cases should be done with precaution: cultural differences (instead of 'real' differences) might explain different responses. We claim this cultural 'distortion' is of minor importance, given the international nature of the port industry and the fact that all three cases are 'western'.

[55] Yin (1994) objects against adding surveys from different cases, because it implies a study is a survey instead of a case study, is acknowledged. However, adding the surveys offers an opportunity to test whether it is plausible that hypotheses hold for (port) clusters in general.

vis-à-vis experts working with large organizations. When relevant, an analysis of differences in responses of both groups is made.

7.6   Selection of cases

The empirical part consists of three cases. This enables comparison between the cases to find out to what extent results are related to the 'local context' and to what extent they can be generalized. Since the three case studies are in different environments, results that hold for these three cases can be regarded as 'stylized facts' that hold for other cases of port clusters as well. The case selection was based on criteria other than cluster performance, to avoid a focus on 'cluster success stories' that dominate in the empirical research (Markusen, 1999).

Three criteria have been used to select the cases. First, the port clusters should be located in *different environments.* Thus, port clusters had to be located in different port ranges (such as the Hamburg-Le Havre port range). *Second,* a case study should be *feasible*, given limitations imposed by language (English or Dutch). Third, the cases should be '*substantial* clusters', in the sense that port activities are of substantial size, both in absolute terms and in terms of their importance in a regional economy. Ports in very large cities, such as New York and Bombay are not selected, because the port cluster is a small component of the regional economy. As a consequence, the heterogeneity of the cluster population is small compared to the heterogeneity of the urban region, the cluster labor market is strongly dependent on the metropolitan labor market and cluster specific agglomeration economies and diseconomies are also subordinate to metropolitan agglomeration forces. Fourth, the ports should have a 'transit function'. In such ports, competition with other ports is relevant.

On the basis of these criteria, the port clusters in Rotterdam, Durban and The Lower Mississippi were selected. The port of Singapore could also have been selected on the basis of the criteria, but this port was not included, because difficulties were expected with the survey instrument, in terms of 'finding the right experts' and 'getting realistic answers' because cultural differences might lead to different (less outspoken) answers and the questions require a 'self critical attitude' which was thought to be more questionable in the Singaporese context, where governmental organizations are very important.

It can be argued that the three selected port clusters are the largest of their continents. Rotterdam and The Lower Mississippi are the largest in throughput volume. Both have a

diverse traffic base and relatively many activities related to cargo handling. Durban is the port with the second highest throughput of Africa, and has a much more diverse traffic base than the largest African port, Richards Bay, where coal is by en large the dominant commodity.

Furthermore, these three ports are important for the regional economy. All three generate substantial employment (about 8-15 % of all jobs) in the region. The port and related industries are clearly a 'specialization' of the three regions involved.

Finally, all three ports are located in urban regions of similar size. The regions are relatively small in relation to the cargo throughput. All three ports serve large hinterlands: Rotterdam serves North West Europe, Durban serves South Africa and Southern Africa and The Lower Mississippi serves the mid-west of the United States. Thus, all ports have a transit function. Table 13 shows three characteristics of these three cases.

Table 13: Three characteristics of the cases (2002)

Port	Total throughput	Container throughput	Estimate of inhabitants in the metropolitan region
Rotterdam	About 320 million tons	About 6 million TEU	About 1.2 million inhabitants
Durban	About 48 million tons	About 1.2 million TEU	About 1.2 million inhabitants
Lower Mississippi	About 381 million tons (420 million *metric* tons)	About 0.3 million TEU	About 1.4 million inhabitants

Sources: RMPM (2003) Louisiana Ports Association (2003) National Port Authority of South Africa (2003)

7.6.1   The port of Rotterdam

The port of Rotterdam is located centrally in the Northwest of Europe. The port is situated at the end of the rivers Rhine and Maas, Europe's most important inland waterways. Inland connections by inland waterways, rail, highway and pipeline are well developed. The port serves a large hinterland, including parts of Germany, Austria and Switzerland.

Rotterdam is by far the largest port in the Netherlands: about 75% of the total throughput of the Netherlands is handled in Rotterdam and about 45% of all value added in Dutch

seaports is generated in Rotterdam (Nationale Havenraad, 2003). Table 14 shows the throughput figures of Rotterdam.

Table 14: Throughput in the port of Rotterdam (2002)

Commodity	Throughput * 1000 ton
Dry bulk	83,427
Liquid bulk	155,925
Ro-Ro	9,669
Containers	65,849
General Cargo	7,235
Total	**322,107**

Source: RMPM (2003)

7.6.2   The port of Durban

Durban is situated in the South East of South Africa in the province of Kwazulu-Natal. The port is predominantly a general cargo port and handles 20% of South Africa's total port traffic. The port of Durban serves a large hinterland: cargo with origin or destination in other regions of South Africa as well as other countries such as Zimbabwe and Botswana are handled in Durban. The majority of imports for and exports of Gauteng (the most industrialized and populated region of South Africa, in the proximity of Johannesburg and Pretoria) move through the port of Durban. The size of the port area, the diversity of port facilities, the size and diversity of its traffic base, and the large support network of ancillary industries make Durban the leading port of Southern Africa and the largest port of Africa[56]. Durban's Container Terminal is the busiest in Africa and handled more than 1.200.000 TEU in 2002 (National Port Authority of South Africa, 2003).

---

[56]   In terms of throughput volume Richard's Bay is larger, but Richard's Bay is a pure bulk port, over 90% of the cargo is handled by one coal terminal.

7.6.3 The Lower Mississippi Port Cluster

The Lower Mississippi Port Cluster is located in the South of the U.S.A, in the state of Louisiana and strategically located at the mouth of the Mississippi river. The vast majority of cargo is transit cargo to inland destinations, mostly in the Mid-West of the USA. The lower Mississippi port complex is not administered by one port authority, but by five public port authorities each with a jurisdiction over a part of the river system. All port activities along the river are so closely related that they form one port system, the 'lower Mississippi port cluster' that encompasses five port authorities. Table 15 shows the ports included in the 'Lower Mississippi port cluster' and explains why other major Louisiana ports are not included.

Table 15: Ports included in the 'Lower Mississippi port cluster'

Port	Included in the Lower Mississippi Port Cluster
Port of New Orleans	Included, the largest general cargo port of the port cluster.
Port of Greater Baton Rouge	Included, the most upstream port of the lower Mississippi port complex.
Port of South Louisiana	Included, the largest port by volume, especially strong in liquid bulk cargo base.
St. Bernard Port, Harbor and Terminal District	Included, the smallest port in the port cluster.
Plaquemines Parish Port, Harbor and Terminal District	Included, the most downstream port of the port complex, with primarily purely private terminals on private land.
Port of Lake Charles	Not included, not located on the Mississippi.
Port Fourchon	Not included, not located on the Mississippi, predominantly used by the offshore industry.

Table 16 shows the throughput figures of the five port administrations in 1999:

Table 16: Throughput figures of the five port administrations in 1999

Port authority	Parishes in Jurisdiction	Annual volume 1999[57]	River mileage	Major commodities
Plaquemines	Plaquemines	59.900.000	From the mouth of the river to 100 miles inland	Liquid bulk
St Bernard	St Bernard	Small volume	Small jurisdiction	General cargo
New Orleans	New Orleans, Jefferson	90.800.000	From mile 100 to mile 114.9	General cargo, especially containers, steel and coffee
South Louisiana	St James, St. Charles, St. John	217.700.000	From mile 114.9 to mile 168.5	Dry and liquid bulk
Baton Rouge	West Baton Rouge	65.600.000	From mile 169 up to mile 243	Steel, fruit, containers

Source: Louisiana Ports Association (2003)

---

[57]   Volumes are given in long tons. A long ton is about 8% less than the metric tons that are used internationally.

8 CLUSTERING IN SEAPORTS

In this chapter the cluster concept is applied to seaports. The method discussed in chapter two to 'construct' a port cluster is used. First, the relevant literature on ports is discussed. Second, the core specialization of a port cluster is identified and third the economic activities included in the port cluster are identified. Fourth, associations and public (-private) organizations included in port clusters are identified. Fifth, the cluster population of the three cases, and sixth, the relevant port region of the three cases is discussed.

8.1 Literature on port clusters

Various research topics in port economics can be identified. Three of these topics are related to this study. A major topic is the competitiveness of ports as parts of (intermodal) transport chains. In these studies the analysis of port competition is limited to competition for cargo[58]. Important contributions include Hayuth (1981), Kreukels and Wever (1997), and Baird (1996). These scholars emphasize the importance of the geographical location of a port. Others in the same research tradition, such as Notteboom (1997), and Winkelmans and Notteboom (2001) argue that geographical conditions do not completely explain port performance and add factors such as hinterland connections, terminal productivity and a port's reputation.

A second topic is the *economic impact* of ports (see for instance Waters, 1977 and Musso et al 2001). These studies focus on economic *effects*, which arise to a large extent outside the cluster, both regionally and functionally. Furthermore, most economic impact studies concentrate on the impact of one specific infrastructure project.

A third relevant topic is the spatial dynamics of port-related economic activities. Especially the work of Slack (Slack, 1988, 1989, and 1999) has improved the understanding of spatial

---

[58]   When regarding the port as a cluster, ports not only compete for cargo with other ports, but also with other regions to attract investments, for instance in manufacturing, warehousing, and trade. The 'classical' notion of port competition is thus of limited use.

processes that take place in seaports. Slack was the first scholar to pay attention to location decisions of the port service industry. He shows that physical proximity to the terminals becomes less important for the port service industry (Slack 1988). Van Klink (1995) explains the decline of employment in ports by the relocation of logistics activities[59]. He terms this process 'maritime deconcentration'.

The cluster approach has hardly been used to analyze ports. Perhaps the best quantitative port cluster study is the annually repeated study of Antwerp's port cluster, by the Bank of Belgium. In this study, a *cluster population* of about 1000 firms, including logistics and industrial firms is identified. The development of the value added of this cluster is calculated. However, this study does not explain the performance of cluster.

Haezendonck (2001) is the first scholar who uses the term 'port cluster' and draws from cluster theories. She defines a port cluster as 'the set of interdependent firms engaged in port related activities, located within the same port region and possibly with similar strategies leading to competitive advantage and characterized by a joint competitive position vis-à-vis the environment external to the cluster' (Haezendonck, 2001, p. 136).

Haezendonck analyzes the performance of a port cluster with an adapted version of Porter's diamond framework (Porter, 1990, Rugman et al, 1995). She identifies 14 factors that influence the competitiveness of seaports, including internal competition, internal cooperation, client relationships in the cluster, the presence of related and supporting industries and the behavior of (different levels of) the government. This study is a major contribution to understanding port clusters, but has the following shortcomings:

- The issue of identifying firms in the cluster is not addressed. This is relevant since the question of *what actually is* a port cluster is still unclear.

- A focus on two commodity groups: containers and breakbulk. An analysis of the competitiveness of a complete port cluster is still lacking.

---

[59]   Van Klink's work is a shift towards analyzing ports as clusters of economic activities, but he does not use the term cluster, or the literature on clusters. The same is true for Winkelmans (1984). His work can be regarded as a port cluster study 'avant la lettre'.

- Throughput volume is used as performance indicator. This indicator is at best a partial indicator of performance. It might be a good indicator for the performance of the cargo handling industry, but the port cluster encompasses many activities whose performance is not directly related to cargo throughput.

- The use of Porter's work that, even though widely used in practice, is criticized by economists for being simplistic.

This study aims to build on the work of Haezendonck and others, by addressing the issues discussed above and by comparing three port clusters.

8.2   The economic specialization of seaport clusters

The first step to construct a cluster is to identify the economic specialization of the cluster. In the case of seaports the core specialization is *the arrival of goods and ships*. All activities related to the arrival of goods and ships are included in the port cluster.

The importance of favorable geographical conditions, such as the presence of a navigable river and deepwater shelters and the structure of the seabed, combined with economies of scale of port facilities, explain the concentration of the arrival of ships and goods in a limited number of ports (instead of a 'scattered' distribution of terminals along the coast). All economic activities that are required to enable the loading and unloading of cargo and ships are included in the port cluster. These activities include terminal handling, pilotage and towage. The arrival of ships and goods attracts related economic activities. For this reason Fujita et al (1999) and (Krugman 1995) mention the role of ports as drivers of agglomeration in cities.

8.3   Port cluster activities and non-business organizations

The port cluster consists of *all economic activities related to the arrival of goods and ships*. A first impression of port cluster activities stems from the analysis of cluster associations. In one of the three cases, Rotterdam, a port cluster association exists. The structure of this association (Deltalinqs) is given in Figure 13.

Figure 13: The port cluster association in Rotterdam
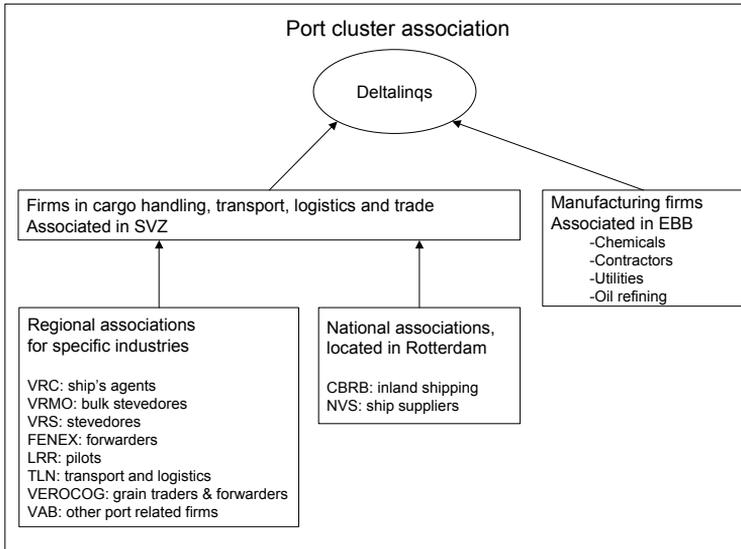
Deltalinqs is the best example of a port cluster association, but in other ports associations that unite various port related firms exist as well. In Rotterdam, the Rotterdam Port Promotion Council (RPPC, http://www.rppc.nl), in the Lower Mississippi, the Mississippi River Trade and Transport Council, and in Durban, the Durban Port Liaison Committee, are examples of associations with different port related members.

On the basis of this preliminary evidence, five broad groups of port cluster activities are identified: *cargo handling* activities, *transport* activities, *logistics* activities, *manufacturing* activities and *trading* activities. Further analysis should provide a basis to identify port cluster activities in more detail.

The first step is a 'qualitative value chain analysis'. Transport activities are part of a port cluster, since a port is a part in a transport chain. Most cargo is transported further by means of inland modes, such as road, rail and inland waterway. Thus, (branches of) transport firms are located in ports and are so strongly related to the arrival of goods and services that they are included in the port cluster. This applies to all firms involved in freight transport.

Logistics activities, such as storage, re-packing and assembling are included in a port cluster, because goods are stored in ports. Differences in the scale of ships and inland

modes make storage necessary (Rijsenbrij, 2000). This necessity of storage is a reason for locating logistics activities (such as blending and re-packing) in seaports. A second reason is that by locating in a port transport costs can be reduced. Both reasons explain the presence of logistics activities in ports and show that these activities are strongly related to the arrival of goods and ships in seaports. Thus, all logistics activities are included in the port cluster.

In the three case studies port experts were interviewed and answered a set of survey questions. One of the survey questions addressed the strength of linkages between the five groups of port related activities. The results are given in Table 17.

Table 17: Integration of the five components in the cluster (N=99)

Component	Integration in cluster
Cargo handling	3.9
Transport	4.0
Logistics	3.5
Manufacturing	3.1
Trade	2.9

Figures on a scale from 1 (not integrated) to 5 (very integrated)

The following conclusions can be drawn from these figures:

- Firms in cargo handling, transport and logistics are the most integrated in the cluster

- Trade is less integrated in the cluster.

- Not all firms have strong relations with activities in other components; the web of relations is relatively dense.

Further evidence for the strength of relations between cargo handling, transport and logistics stems from a survey question to find out more about the activities of the firms of port experts. The vast majority of firms that provide cargo handling, also provide transport and logistics services. This also shows the strength of linkages.

Table 18 shows the activities of the 62 firms included in the survey that are engaged in cargo handling.

Table 18: Portfolio of activities of firms engaging in cargo handling (N=62)

Economies activities	Number of firms
Cargo handling, transport and logistics	34
Cargo handling and transport	12
Cargo handling and logistics	7
Only cargo handling	9

On the basis of both results of the case studies, the conclusion can be drawn that all activities in cargo handling, transport and logistics, that are located in the port region, are a part of the port cluster. This does not apply to activities in manufacturing and trade. Only a specific set of manufacturing firms are strongly related to the arrival of goods and ships in seaports: those that get their raw materials from the port *and* are located in the port in order to reduce transport and logistics costs. A specific set of trading activities is included in the port cluster as well. Trading and storage (in a port) are closely linked. Commodity trade is, for some commodities, still related to storage and cargo handling.

The first indicator for the likeliness that manufacturing activities are located in seaports is the expenditure on water transport as a percentage of the value added created by the manufacturing activity (see Table 19). Figures from the US were used because of the availability of reliable statistics for this country.

Table 19: The importance of water transport as input for manufacturing activities (1999)

Industry (SIC)	Water transport as % of value added	Relative importance water transportation[1]
Petroleum refining and related products	2.6%	11.47
Crude petroleum and natural gas	1.9%	8.32
Agricultural fertilizers and chemicals	1.7%	7.39
Primary iron and steel manufacturing	1.6%	6.95
Plastics and synthetic materials	1.2%	5.38
Food and kindred products	1.0%	4.44
Gas production and distribution (utilities)	1.0%	4.36
Coal mining	0.7%	3.32
Stone and clay products	0.5%	2.38
Electric services (utilities)	0.5%	2.05
Industrial and other chemicals	0.3%	1.51
Metallic ores mining	0.3%	1.46
General industrial machinery and equipment	0.015%	0.07
Tobacco products	0.005%	0.02

[1]The average importance is 1 and calculated as an average of all manufacturing activities Source: US Department of Commerce, Bureau of Economic Analysis (2003)

Table 19 shows that water transport is especially important for refining activities and other manufacturing related to oil or chemical products and iron and steel manufacturing. All of these require huge volumes of raw materials.

Further evidence to identify manufacturing and trading activities strongly related to the arrival of goods and services is provided by a 'localization analysis'. For a number of manufacturing and trade activities, as well as activities in cargo handling, transport and logistics, the concentration in seaports is analyzed. For this purpose, the number of firms in 17 metropolitan regions with large seaports of the United States of America is counted[60] and

---

[60]   These metro regions are selected by taking the 25 largest ports of the USA and analyzing whether they are part of a metro-area, so that statistics can be collected. Excluded are the

compared with the nationwide number of firms. About 5.7% of all business establishments in the US are located in these 17 metropolitan areas. Thus, when for example 11.4% of all establishments of a certain economic activity are located in the port regions, the localization quotient is two[61]. The same calculation is made for Rotterdam compared with the national average[62].

Table 20 shows the NAICS codes[63] of *all economic activities included in the port cluster* and their localization quotient. In some cases, activities are included in the set of port cluster activities, even though they are not concentrated in port regions. In these cases the concentration analysis is not precise enough[64], and there are other arguments for including these activities in the set of port cluster activities. These arguments are given at the bottom of the table.

---

largest US metro areas (such as New York, LA, and Chicago) because even though these cities have ports, they are by no means port cities. The remaining port regions are Baton Rouge, Beaumont, Charleston, Corpus Christi, Duluth Superior, Galveston, Houston, Huntington, Lake Charles, Mobile, Naples, New Jersey City, New Orleans, Norfolk Harbor, Pittsburg, St Louis and Tacoma.

[61]   In formula form, this can be expressed as $LC_i = 17.5 * Fi_{port\ regions} / Fi_{USA}$, where LC_i is the localization quotient of industry i and Fi is the number of firms in that industry, in the 17 port regions respectively in the entire USA. The constant of 17.5 is explained because the overall number of firms in the USA is 17.5 times higher than the overall number of firms in the 17 port regions).

[62]   The specialization quotient is based on a comparison of the Rotterdam port region with the national average. Since the Netherlands as a whole is specialized in ports, maritime activities and logistics (Policy Research Corporation, 2001) comparing Rotterdam to the European average would have been better, but data on a European level are lacking.

[63]   The corresponding BIK code, a Dutch classification system, is given in appendix 3.

[64]   For instance because the activities are related to commodities that are handled only in a number of the 17 ports, or when only a part of the firms in the industry a port related. In both cases the concentration analysis does not show economic relations.

Table 20: Concentration of port cluster activities by NAICS code (2002)

Component	NAICS code	Description	Total establishments 17 port regions	Localization quotient
Cargo handling	48833	Navigational Services to Shipping	316	6.8
	48832	Marine Cargo Handling	163	4.8
	48831	Port and Harbor Operations	49	4.4
Transport	483111	Deep Sea Freight Transportation	245	9.7
	483211	Inland Water Freight Transportation	113	5.1
	48839	Other Support Activities for Water Transportation	210	4.4
	483113	Coastal and Great Lakes Freight Transportation	120	4.0
	486	Pipeline Transportation	323	2.1
	4889	Other Support Activities for Transportation	123	1.5
	42271	Petroleum bulk stations and terminals	526	1.4
	48412	General Freight Trucking, Long-Distance[1]	1746	0.9
Logistics	49319	Other Warehousing and Storage	128	1.9
	4885	Freight transportation arrangement	1339	1.6
	49311	General Warehousing and Storage	339	1.4
	541614	Process, Physical Distribution, and Logistics Consulting Services[2]	254	1.0
	49312	Refrigerated warehousing and storage[2]	60	0.7
Manufacturing	336611	Ship Building and Repairing	170	4.5
	3251	Basic Chemical Manufacturing	348	2.6
	3252	Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing	113	2.2
	33111	Iron and steel mills	115	1.5
	324	Petroleum refineries	186	1.5
	3314	Nonferrous Metal (except Aluminium) Production and Processing	73	1.4
	31121	Flour milling & malt mfg[3]	21	0.8
Trade	4215	Metal & mineral (except petroleum) whsle	1184	1.8
	42272	Petroleum and Petroleum Products whsle	321	1.7
	4226	Chemical product wholesalers	1381	1.6
	42186	Transportation Equipment and Supplies Wholesalers	282	1.4
	42251	Grain and Field Bean Wholesalers[4]	144	0.4

Source: United States Department of Commerce Census Bureau (2003)

[1] The majority of long distance trucking firms are not concentrated in ports. However, those firms that are located in port regions are included in the port cluster, because they transport port cargoes.
[2] Refrigerated warehouses and logistics consultants that are located in port regions are likely to be strongly linked to firms in the port cluster, and included in the cluster.
[3] When floor milling is located in ports, it is closely related to the arrival of raw material in the port.
[4] When grain wholesalers are located in ports, they do so because grain arrives and is stored in seaports. Thus they are included in the cluster.

This table shows that especially cargo handling and transport activities are concentrated in port regions. Logistics activities are less concentrated in port regions. This is also found in Rotterdam:

Table 21: Concentration of cluster activities in Rotterdam (2002)

Component	Activity description	Localization quotient
Cargo handling	Marine Cargo Handling	7.7
	Port and Harbor Operations	4.7
Transport	Freight Transportation arrangement	4.6
	Inland Water Freight Transportation	4.0
	Coastal freight transportation	3.8
	Other Support Activities for Water Transportation	3.7
	Pipeline Transportation of Crude Oil	3.5
	Deep Sea Freight Transportation	3.2
Logistics	European distribution centers	3.1
	Support activities for transportation	3.0
	Process, Physical Distribution, and Logistics Consulting Services	0.7
Manufacturing	Industrial gas manufacturing	4.9
	Pipeline Transportation of Crude Oil	3.5
	Petroleum refineries	3.4
	Petrochemical Manufacturing	3.1
	Petroleum and Petroleum Products Wholesalers	1.8
	Basic chemical manufacturing	1.7
	Flour milling and malt manufacturing	0.7
	Iron and steel mills	0.6
Trade	Petroleum and Petroleum Products Wholesalers	1.8
	Chemical products wholesalers	1.4
	Metal & mineral (except petroleum wholesalers	1.0
	Grain and Field Bean Wholesalers	1.0

Source: Bureau van Dijk (2003)

The inclusion of manufacturing and trade activities is based on the concentration figures in the 17 large US ports, and the 'value chain analysis'. All manufacturing activities that use

raw materials and are somewhat concentrated in port regions (a localization share of 1.4 is taken as minimum) are included in the port cluster. Trade activities for commodities handled and stored in ports are included when the localization quotient is more than 1.4 as well.

Activities in manufacturing and trade that are not concentrated in port regions are not included in the port cluster, unless there is a convincing reason for including them. Table 22 shows the localization quotients of some activities that are not included in the port cluster.

Table 22: Localization quotient of some manufacturing activities not included in the port cluster (2002)

	NAICS code	Activity	Localization quotient
Manufacturing	3259	Other Chemical Product and Preparation Manufacturing	1.3
	3312	Steel Product Manufacturing from Purchased Steel	1.3
	3255	Paint, Coating, and Adhesive Manufacturing	1.2
	234	Heavy Construction	1.1
	22111	Electric Power Generation	1.1
	3313	Aluminium Production and Processing	0.9
	33611	Automobile and Light Duty Motor Vehicle Manufacturing	0.8
	3315	Foundries	0.8
	3254	Pharmaceutical and Medicine Manufacturing	0.8
	3361	Motor Vehicle Manufacturing	0.7
Trade	52313	Commodity Contracts Dealing	0.7
	52314	Commodity Contracts Brokerage	0.6

Source: United States Bureau of Census (2003)

With regard to associations, regional 'horizontal' business associations for instance for cargo handling, forwarding, and transport are frequently present in seaports. Apart from those industry associations, port marketing and promotion associations (see Van Klink and Van Winden, 1999) and port cluster associations exists in some seaports.

Public-private organizations strongly linked to the core of the cluster and thus included in the cluster population include innovation centers, and labor pools. Public organizations included

in the cluster include traffic control, custom activities, education centers, pilotage services[65] and a port authority. Table 23 shows the associations, public-private organizations and public organizations included in the cluster in the three cases.

Table 23: Associations, public-private and public organizations included in the three case studies

	Durban	LMPC	Rotterdam
Asso-ciations	Container Lines operating Forum (CLOF), Bulk lines operators forum (BLOF), South African Association of freight forwarders (SAAF), Durban branch, Durban Port Liaison committee (DPLC), Maydon Wharf Leaseholders Association, Association of Ship' Agents and brokers of SA (ASABOSA), Durban branch, Association of Shipping Lines	New Orleans Board of trade, Mississippi river maritime association, World trade center of New Orleans, transport committee, International freight forwarders and customs brokers Association of New Orleans, Steamship association of south Louisiana, Mississippi valley trade and transport council, Greater New Orleans barge fleeting association	Port cluster association (Deltalinqs), Dutch association for inland waterway operators, based in Rotterdam (CBRB), Association for forwarders, regional branch (FENEX), Dutch association for container repair companies, based in Rotterdam (HCRA), Dutch association for ship suppliers, based in Rotterdam (NVS), Association of pilots operating in Rotterdam (RLRR), Association of transport and logistics firms in the Netherlands (TLN), regional branch, Association of ship agents in Rotterdam (VRC), Association of container companies in Rotterdam (VRCB), Association of independent grain control and measurement companies in Rotterdam (VEROCOG), Association of 'mechanical' terminal operators in Rotterdam (VRMO), Association of terminal operators in Rotterdam (VRS), Association for port marketing of Rotterdam, with over 300 members (RPPC), Association of trade centers and trading companies located in Rotterdam (RITCA)
Public private organi-zations	No port related public private organization	Maritime cluster initiative, associated with Metrovision (a public private economic development partnership)	Organization aiming to enhance the ICT usage in the port (Port Infolink), Organization aiming to enhance the knowledge infrastructure in Rotterdam (KMR), Portal for the port of Rotterdam (PortofRotterdam.com)
Public organi-zations	Portnet, port operations Durban, Portnet training academy	Five port authorities along the river, New Orleans Public Belt Railroad, US army corps of engineers	Rotterdam Municipal Port management (RMPM), Customs, Specialized school for shipping transport and port vocational education (STC)

---

[65]   In some ports private pilots exist, and the public role is limited to regulating private pilots.

Table 24 summarizes all firms and non-business organizations included in the cluster. For a
small number of firms, identification on the basis of an industry classification, such as NAICS
is not possible, because the classification does not distinguish these firms. The firms have to
be identified 'bottom up' on the basis of industry sources.

Table 24: Cluster activities with relevant industry classifications

Component	Description according to NAICS code
Cargo handling	Port and Harbor Operations (48831), Marine Cargo Handling (48832) Navigational Services to Shipping[1] (48833), Terminal suppliers, Port engineering (No code)
Transport	Pipeline Transportation of Refined Petroleum Products (48691) Pipeline Transportation of Crude Oil (48611), Petroleum Bulk Stations and Terminals (42271) Other Support Activities for Water Transportation (48839), Line-Haul Railroads (482111) Inland Water Freight Transportation (483211), Freight Trucking, Long-Distance (48412) Deep Sea Freight Transportation (483111), Coastal Freight Transportation (483113).
Logistics	Freight Transportation arrangement[3] (4885), Refrigerated Warehousing and Storage (49312) General Warehousing and Storage (49311), Other Warehousing and Storage (49319) Process, Physical Distribution, and Logistics Consulting Services (541614).
Manu-facturing[4]	Ship Building and Repairing[2] (336611), Petroleum refineries (324) Basic chemical manufacturing (3251), Flour milling and malt manufacturing (31121) iron and steel mills (33111), Metal processing (3314) Artificial and synthetic fibers manufacturing (3252) Specialized suppliers of manufacturing firms (No code).
Trade	Transportation Equipment and Supplies (except Motor Vehicle) Wholesalers (42186) Petroleum and Petroleum Products Wholesalers (42272) Metal & mineral wholesale (4215), Grain and Field Bean Wholesalers (42251) Chemical product wholesalers (4226), Commodity related trade intermediaries (No code).
Associations	Port cluster association, business associations, for instance for cargo handling, survey, inland shipping and container repair, marketing and export promotion associations.
Public-private organizations	Organizations enhancing knowledge development, sustainable production, port labor pool.
Public organizations	Educational organizations, customs, traffic control, pilotage (in come cases private) and port authorities.

[1] Towage is regarded as part of cargo handling, other firms as transport.

[2] Only ship repair is included in the cluster.

[3] Logistics service providers and forwarders are classified as 'logistics', ship's agents as transport.

[4] Only activities located at 'deepwater sites' or otherwise closely related to the port cluster (for instance,
by pipeline infrastructure to the port, or the ownership of a terminal in the port).

8.4   The relevant port cluster region

Cargo handling is located in the primary port area (quays and terminals). Other cluster activities are not necessarily located in the primary port area. For instance, some services are located in the central business district of the port city and distribution activities near transport infrastructure to the hinterland. Van Klink (1995) shows that other transport nodes and logistics zones are functionally strongly related to the port. Thus, the relevant cluster region of the port is larger than the primary port area.

The size and structure of the relevant port region differs between ports. The concept of a relevant region implies that beyond a certain distance, municipalities are not included in the relevant port region. The relevant region includes municipalities that meet two conditions: 1) in the proximity of the seaport, and 2) a high concentration of port related activities. The relevant region generally includes:

- The primary port area.
- The business district of the port city (see Slack 1988).
- Secondary nodes in the proximity of the primary seaport (see van Klink 1995).
- Municipalities in the vicinity of the port with a concentration of port service activities.

8.5   The cluster population and port region in Rotterdam

The cluster population of Rotterdam can be analyzed with the use of firm statistics registered by the Chambers of Commerce in the Netherlands. Registration is obligatory, so all firms are included in this dataset. Some of the firms in the dataset are merely 'legal entities' created for fiscal reasons. Therefore the number of 'real' firms is overestimated. This shortcoming is not important for the purposes of this study, because the general picture of Rotterdam's cluster is fairly reliable.

Table 25: Firms in Rotterdam's port cluster (2002)

	Share total number of firms	Activity	Number of firms
Cargo handling	6%	Loading, unloading and transhipment activities	179*
		Pilotage	3
		Port engineering: No code, figure based on expert opinion	20
		Crane construction, No code, expert opinion	1
Transport	36%	Shipping services	171
		Inland shipping services	985**
		Salvage services	24
		Ship brokers	10
		Rail transport	3
		Pipeline transport	3
		Trucking services	101
Logistics	45%	Transport intermediaries	1,321*
		Warehousing and storage	221
		Logistics consultancy services, No code expert opinion	50
Manufacturing	4%	Oil refining	11
		Flour milling	8
		Cokes manufacturing	1
		Basic chemical manufacturing	46
		Other chemical manufacturing	14
		Production of iron and steel	3
		Shipbuilding and repair, no code, expert opinion	10
		Automobile manufacturing, expert opinion	0
		Specialized suppliers to port industries, No code, expert opinion	50
Trade	9%	Trade intermediaries in chemical products (511203)	29
		Trade intermediaries in metals and ores (511202)	18
		Fuel wholesalers (51512)	110
		Grain wholesalers (51211)	33
		Metal and ores wholesalers (51521)	14
		Mineral oils wholesalers (51513)	73
		Trade intermediaries in raw products for food industry (511105)	21
		Trade intermediaries in oil and fuels (511201)	26
Total			3,559

Source: Bureau van Dijk (2003)
* Overestimated as most firms consist of various 'judicial entities'
** Most operators are 'captain owners', owning and operating their own vessel

Even though the number of manufacturing firms is no more than 4% of the total number of firms in the cluster, these firms generate more than 24% of the value added generated in the cluster (Nationale Havenraad, 2003). This is because of the large size of firms in this sector. The opposite applies to transport and logistics.

The size of the primary port area in Rotterdam is about 26,000 acres (10,500 hectares). This area consists of waterways, quays and dry port area. The Rotterdam Municipal Port Management[66] (RMPM) manages the primary port area. Figure 14 shows the primary port area.

Figure 14: The primary port area in Rotterdam
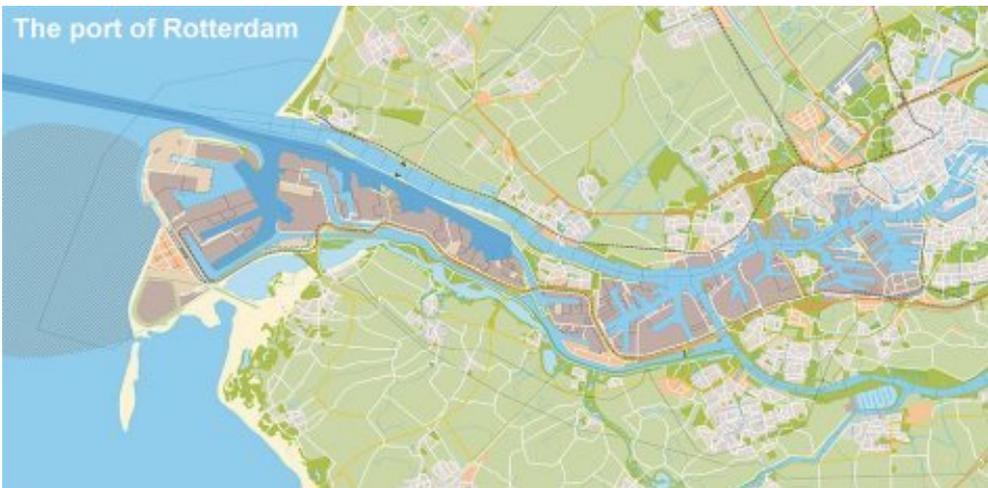
Secondary port areas in the Rotterdam port cluster are Moerdijk and Dordrecht. Moerdijk has an annual throughput of over 9 million tons and Dordrecht of about 2 million ton. The port facilities in both ports are complementary to Rotterdam: private firms are active in different ports and public port administrations cooperate closely.

---

[66]   The Rotterdam municipal port authority (RMPM) is a public landlord port, owned by the city of Rotterdam. The organization operates autonomously. The 'mission' of the port authority is 'To strengthen the position of Rotterdam's port and industrial complex in a European context, in the short and long run' (RMPM, 2001, own translation).

The share of port related firms as a percentage of the total number of firms in the municipality provides a basis to draw a - to some extent arbitrary - cluster border. Table 26 shows the concentration of port activities in the municipalities surrounding Rotterdam.

Table 26: The port cluster region in Rotterdam (based on data for 2002)

Municipality	Total number of firms	Cluster firms	Concentration-index
Moerdijk	537	115	**6.6**
Rhoon/Portugaal	1,744	224	**4.0**
Zwijndrecht	3,214	409	**4.0**
Lekkerkerk/ Krimpen aan de ijssel	2,345	200	**2.6**
Hardinxveld Giessendam	1,629	128	**2.4**
Ridderkerk	3,947	290	**2.3**
Maasland	1,105	80	**2.2**
Papendrecht	2,163	146	**2.1**
Alblasserdam	1,343	88	**2.0**
Krimpen a/d Lek	1,305	79	**1.9**
Rozenburg	567	34	**1.9**
Barendrecht	3,168	185	**1.8**
Rotterdam	55,986	3,253	**1.8**
Dordrecht	9,082	525	**1.8**
Hendrik Ido Ambacht	1,660	93	**1.7**
Spijkenisse	3,424	183	**1.7**
Capelle a/d IJssel	5,617	235	1.3
Brielle	1,414	59	1.3
Geervliet	1,025	42	1.3
The Nederlands	1,417,506	45,656	1.0

Source: based on data from Bureau van Dijk, 2003

All municipalities with a 'concentration index' of 1.7 and more (bold in the table) are included in the cluster region. Rotterdam has a relatively low concentration index, because the city has a large number of residents and as a consequence a large number of service firms, such as shops and restaurants. As a result, the concentration of cluster activities is less pronounced than in other smaller municipalities.

8.6   The cluster population and port region in Durban

A precise identification of the cluster population in Durban is impossible, because firm data are not available. The tax register is the only data source and for reasons of confidentiality not publicly available. The most reliable data set is the Yellow Pages directory. Most firms are included in the Yellow Pages. Compared to the analysis in Rotterdam and the LMPC, the number of firms in Durban's port cluster is underestimated, because a listing in the Yellow Pages is not compulsory and especially holdings or administrative entities are not listed.

Table 27: Firms in Durban's port cluster (most data for 2002)

Cluster component	Share of firms in the cluster	Category	Number
Cargo Handling	7%	Stevedores	7
		Tanks & containers repair	14
		Dredging firms	1
		Freight auditors	28
Transport	48%	Road transport firms	105
		Container manufacturing, rentals, conversion &sales	23
		Containerized freight, depot & transport service	9
		Fleet management firms	12
		Marine equipment suppliers	12
		Marine and offshore services	21
		Ship & cargo brokers	7
		Ship chandlers	7
		Shipping lines & agents	71
		Surveyors & assessors & marine consultants	20
		Truck dealers and repair services	29
Logistics	28%	Customs clearing shipping & forwarding	95
		Distribution consultants	20
		Distribution and packing services	24
		Warehousing & storage	48
Manufacturing	13%	Ship repair and maintenance	45
		Manufacturing firms using commodities as resources	About 20
		Specialized suppliers of manufacturing activities	About 10
Trade	4%	Commodity traders	About 20
		Port related trade agents	About 10
Total	100%		About 680

Source: Jones, 1999, Durban Yellow Pages 2002

Only data on levy payers are available to identify the relevant cluster region. In this data source firms are grouped in a number of industries. These are not detailed enough to single out port related manufacturing and trading firms, but good enough to identify cargo handling, transport and logistics firms. The concentration analysis is based on these firms alone. The results of the concentration analysis are given in Table 28. The municipalities with a concentration index of 1.7 of higher (bold in the table) are part of the port cluster region.

Table 28: The port cluster region in Durban (based on data for 2002)

Municipality	Share cluster activities in municipality
Chatsworth	**6.0%**
Inanda	**4.1%**
Durban	**3.5%**
Camperdown	**2.8%**
Pinetown	**2.7%**
Umzintu	**1.7%**
Umlazi	0.9%

8.7   The cluster population and port region in the LMPC

The cluster population of the LMPC can be determined relatively well, because US Census publishes detailed establishment statistics. Table 29 shows the cluster population of the LMPC.

Table 29: the cluster population of the LMPC (data for 2002)

Cluster component	Share total firms in cluster	Description	Number of firms
Cargo handling	8%	Port and Harbor Operations	20
		Marine Cargo Handling	76
Transport	47%	Petroleum Bulk Stations and Terminals	54
		Line-Haul Railroads	8
		Deep Sea Freight Transportation	63
		Navigational Services to Shipping	86
		Other Support Activities for Water Transportation	61
		Coastal and Great Lakes Freight Transportation	81
		Inland Water Freight Transportation	63
		General Freight Trucking, Long-Distance	114
		Pipeline Transportation of Crude Oil	20
		Pipeline Transportation of Refined Petroleum Products	2
Logistics	19%	Freight Transportation arrangement	159
		General Warehousing and Storage	22
		Refrigerated Warehousing and Storage	6
		Other Warehousing and Storage	20
		Process, Physical Distribution, and Logistics Consulting Services	16
Manufacturing	10%	Ship Building and Repairing (only repair)	52
		Flour milling & malt mfg	3
		Petroleum refineries	9
		Industrial gas mfg	19
		Petrochemical Manufacturing	17
		Primary metal mfg	10
Trade	16%	Metal & mineral (except petroleum) Wholesalers	84
		Transportation Equipment and Supplies Wholesalers	58
		Grain and Field Bean Wholesalers	17
		Petroleum and Petroleum Products Wholesalers	28
Total			1,168

Source: US Bureau of Census (2003)

The availability of data to analyze the relevant cluster region for the LMPC is relatively good. Apart from the port facilities in the LMPC, port infrastructure exists in other Louisiana Counties. Therefore, we have limited the analysis of the relevant cluster region to the counties located at the banks of the Mississippi river. Table 30 shows the results of a concentration analysis for different counties.

Table 30: The relevant cluster region of the LMPC (based on data for 2002)

County	Total number of firms	Of which: cluster activities	Share cluster activities	Specialization index
Plaquemines	737	86	11.7%	**8.2**
West Baton- Rouge	430	38	8.8%	**6.2**
Lafourche	1,836	155	8.4%	**5.9**
St James	313	21	6.7%	**4.7**
St. John	626	37	5.9%	**4.2**
St. Charles	884	52	5.9%	**4.1**
Iberville	542	28	5.2%	**3.6**
Terrebonne	2,698	108	4.0%	**2.8**
St. Bernard	1,191	41	3.4%	**2.4**
Ascension	1,518	45	3.0%	**2.1**
Jefferson	12,842	337	2.6%	**1.8**
Orleans	10,619	220	2.1%	**1.5**
Assumption	248	4	1.6%	1.1
Livingston	1,228	19	1.5%	1.1
St Tammary	4,634	68	1.5%	1.0
East Baton Rouge	11,499	164	1.4%	1.0

Source: US Bureau of Census (2003)

The counties with a specialization index of more than 1.5 are included in the cluster region. The counties Orleans and Jefferson, with by far the largest *number* of port related firms, have a relatively low specialization index. As in Rotterdam, this is explained by the presence of large numbers of service firms in these metropolitan areas.

9 STRUCTURE, GOVERNANCE AND PERFORMANCE IN SEAPORT CLUSTERS; LITERATURE REVIEW AND RESEARCH ISSUES

In this chapter relevant research on ports is discussed and used to develop survey propositions and research issues for the interviews and desk research.

9.1 Structure and performance in port clusters; literature review

In the theoretical part, four performance variables related to the structure of a cluster were identified. For each of those the port specific literature is reviewed.

9.1.1 Agglomeration economies

A number of studies have dealt with the particular agglomeration (dis)economies (knowledge, labor pool, presence of customers and suppliers, land prices and congestion), but not with reference to the term agglomeration economies. Furthermore an analysis of all (dis)economies is lacking.

The effects of a presence of customers and suppliers in ports on the attractiveness of a seaport have not been studied. The 'agglomerating effect' of knowledge is acknowledged (see Slack 1988 and Haynes et al 1997), but empirical studies are lacking. The effect of the presence of a shared labor pool on the attractiveness of a seaport has not been studied. Various studies and reports deal with the changing size of port labor requirements and labor transition problems (Dinwoodie, 2000, Van Driel, 1988)). Whether or not the presence of a labor pool increases the attractiveness of a port cluster has not been studied. Studies do show that port labor is relatively expensive (De Langen et al, 2003).

Musso et al observe that 'many (port) industries, suffering from the relative scarcity and/or high prices of space, (…) have moved to regions where these inputs are available at better conditions' (Musso et al p. 283). They also mention the diseconomy of congestion in

seaports. However, an analysis of the level of land prices and/or congestion in seaports and its effects on the attractiveness of seaports is lacking.

Van Klink's (1995) work is the most sophisticated study on agglomeration in seaports. He identifies factors that influence the attractiveness of ports. These are given in Table 31, together with the 'supply profile' of the port of Rotterdam.

Table 31: Van Klink's assessment of Rotterdam's agglomeration (dis)economies

Agglomeration (dis)economy	Supply profile Rotterdam
Logistics know-how	***
Costs of land	*
Labor climate (including training and work attitude)	*
Efficiency of road network	*

Source: Van Klink, 1995

*: weakness of Rotterdam, ***: strength of Rotterdam

According to van Klink, knowledge is an agglomerating force for Rotterdam's port cluster. The scarcity of land and congestion are agglomeration diseconomies in Rotterdam. Van Klink regards the labor climate as a force towards *deconcentration* of port related activities, because of high wages and limited flexibility of port work. In the economic geography school, the quality of labor is regarded as a force *towards* concentration.

9.1.2   Internal competition

The port specific literature on competition mostly deals with *external competition*: competition between different ports (Verhoeff, 1981). The issue of *internal competition* in seaports has been discussed for a number of port activities, such as towage (see Atkin and Rowlinson, 2000). Internal competition in cargo handling and port services is limited, or even absent in many seaports (World Bank, 2000, Goss and Stevens, 2000). This stems from the fact that the 'minimum efficient scale' of these activities is large compared to the market size. Haezendonck (2001), relying on Porter's framework (Porter, 1990), regards the presence of internal competition as beneficial for the competitiveness of a seaport. Haezendonck's survey results show that industry experts regard the presence of internal competition in Antwerp as a factor enhancing the competitiveness of this port cluster.

In the theoretical part, three arguments for the positive effect of internal competition on cluster performance were discussed. Studies on internal competition in seaports deal only with the monopoly rent argument; the *specialization argument* and *vibrant environment argument* have not been studied.

Following the monopoly argument, the importance of internal competition depends on the fierceness of external competition. When external competition is perfect, the absence of internal competition does *not* affect the performance of the cluster. External competition in *cargo handling* is perfect in two cases[67]:

- When all shippers can switch cargo without costs to different ports. This is the exception rather than the rule: in most ports, industries related to the port generate substantial cargo volumes; these cannot be switched without costs to another port.

- When the *captive* hinterland (where switching costs are high, see Sardent, [1938]) is relatively small compared to the *contestable* hinterland (where switching costs for shippers are low) *and* terminal handling companies cannot charge different prices for cargo, depending on whether cargo is captive or not. In this case the terminal operator does not increase revenues by raising prices, because the '*substitution effect'* (shippers who switch cargo to a different port) is larger than the '*price effect'* (revenue increase because of higher prices).

If the contestable hinterland is relatively large, *or* terminal operators can charge different prices for cargo in the different segments[68], external competition is imperfect. In container shipping, terminal operators cannot segment the market. As a consequence, external competition is sufficient to prevent monopoly pricing unless ports have a large captive

---

[67]   These specific cases are only relevant when *entry barriers* prevent entry of new firms. Legal entry barriers exist in the majority of ports, especially in the cargo handling and port services industries. Furthermore, high specific investments are required in the terminal handling industry and physical conditions limit possibilities for entry. In general, entry barriers are relatively high in the above-mentioned industries.

[68]   This segmentation is conceivable when terminal operators have contractual agreements with *shippers* but impossible when they have agreements with *shipping lines* because shipping lines can shift relatively large amounts of cargo easily between ports.

hinterland. In other cargo handling markets, where shippers have contracts with terminal operators, monopoly pricing for captive customers is possible.

Even when the 'monopoly argument' is not valid, internal competition does add to the performance of a port cluster when at least one of the other two arguments - the vibrant environment argument and the specialization argument - hold. These arguments for promoting internal competition are not (widely) used in the port industry. This issue is addressed in the interviews with experts.

9.1.3   Cluster barriers

The influence of cluster entry and exit barriers on performance has not been studied in port clusters[69]. Nevertheless, the European Union directive (The port package, European Commission, 2001) emphasizes the importance of market access in seaports. The commission argues that market access is limited in many European seaports.

9.1.4   Heterogeneity of the cluster population

The issue of firm heterogeneity in port clusters has not received serious academic attention. Winkelmans (1984) touches on the issue when he argues that:

> *It is important to acknowledge that a port and the port region are one entity (…). When one part is not, or not sufficiently present, the whole entity functions less well. The commercial function is a good example: one easily ignores the fact that the attractiveness of a port is largely influenced by the presence of trading companies, banks, insurance companies and auctions. Such activities are, on top of that, more difficult to develop than the traditional port infrastructure (Winkelmans, 1984, p 6 translation Peter de Langen).*

In Winkelmans' words, 'the sum is more than the individual components'. Winkelmans does not provide a theoretical argument to substantiate this claim, the arguments provided in the theoretical part of this study are not explicitly mentioned, but are in line with Winkelmans' claim.

9.2   Structure and performance in port clusters; research set-up

Table 32 shows the research set-up used for the cases. The survey propositions are derived from the literature review in the preceding section. Some issues receive special attention in the expert interviews and desk research, because they are relevant in seaports, but have not been addressed in the literature.

---

[69]   Haralambides et al (2002) deal with terminal concessions, but not with reference to the issue of entry barriers.

Table 32: Research findings, survey questions and issues related to the structure of port clusters

Issue	Relevant research	Survey propositions (P1 to P16) and additional survey questions	Issues for expert interviews and desk research
Agglo-meration eco-nomies	Knowledge and information are concentrated in ports (Slack 1988) Congestion and high land prices can be observed in some ports (Musso et al, 2000).	P1: The presence of a labor pool is a reason for firms to locate in a seaport. P1a: Because the port labor pool is relatively overpaid and unionized, firms prefer to locate outside seaports. P2: The presence of suppliers and customers is a reason for firms to locate in a seaport. P3: The presence of (specific) knowledge and information is a reason for firms to locate in a seaport. P4: Relatively much congestion in and around seaports causes a relocation of firms to locations outside the seaport cluster. P5: Relatively high land prices and office rent prices in a seaport cluster causes a relocation of firms outside the seaport cluster.	How important is the presence of knowledge and information?
Internal com-petition	Internal competition contributes to the competitiveness of a port (Haezendonck, 2001)	P6:Internal competition reduces 'switching costs' for port users. P7: The presence of internal competition fosters specialization P8:Internal competition is characterized by social involvement and pride. This increases the fierceness of competition Respondents are asked to assess the fierceness of internal competition in five markets.	What are the effects of fierce internal competition?
Cluster barriers	European Commission (2001) claims market access in European seaports is limited.	P9: The access to (tacit) knowledge and networks is a 'cluster specific barrier' for entry and start-up P10: The unavailability of 'local capital' is a cluster specific barrier for start-up P11: The presence of labor that is 'sticky' to the port cluster is a cluster specific exit barrier P12: The presence of port specific investments is a cluster specific exit barrier P13: Barriers that prevent firms from 'leaving the cluster increase the performance of port clusters P13a: High cluster exit barriers have a negative effect on the performance of that cluster in the long run, because they reduce the pressure to renew the economic base of that cluster.	What is the 'dynamic effect' of exit barriers?
Hetero-geneity	No studies, Winkelmans (1984) states that the sum of the port cluster is more than its individual components.	P14: The heterogeneity of the cluster population enlarges opportunities for cooperation and innovation P14a: Cooperation between firms inside clusters is of minor importance compared to cooperation between firms in clusters and others outside clusters. P15: Heterogeneity of the cluster population reduces the vulnerability of a cluster for external shocks. P16: Heterogeneity of the resource base of a cluster reduces the vulnerability for external shocks. Respondents are asked to indicate the importance of three dimensions of heterogeneity.	Do firms cooperate with partners at a relatively large 'cognitive distance'?

9.3   Governance and performance in seaports; literature review

In the theoretical part, four performance variables related to the governance of a cluster were identified. For each of those, the port specific literature is reviewed.

9.3.1   The relation between cluster governance and cluster performance

The concept 'cluster governance' has not been applied to seaport clusters; it is a new approach for analyzing seaports. The role of port authorities[70] has been studied extensively (Goss, 1990A and 1990B, Stevens, 1999). Notwithstanding the important roles of port authorities[71], limiting the analysis of cluster governance to an analysis of the port authority is shortsighted, because it neglects the roles of other actors in the governance of a port cluster. The behavior of the port authority is conditioned by the behavior of other actors in the cluster and port authorities are 'responsive' to initiatives from the private sector. This implies that the role of the private sector should receive attention when analyzing governance in port clusters.

9.3.2   Trust

Even though the notion of a port community has been dealt with (Fleming, 1987) the issue of trust in clusters has not been analyzed. Haezendonck (2001) shows that both cooperation within the cluster and cooperation with actors outside the cluster are relevant; she does not analyze what factors influence cooperation or the role of trust in enabling cooperation.

---

[70]   Stevens (1999) for instance analyzed the institutional position of *port authorities* in seaports, but nevertheless the title of his book is 'the institutional position of *seaports*'.

[71]   Drewry Shipping Consultants put it like this: 'The modern port can be described as a community of independent enterprises tied together by a common interest in maritime affairs. Central to this community is an entity known as the port authority, always a regulator, usually a landowner, often a developer and sometimes a terminal operator' (Drewry Shipping Consultants, 1998, p 6).

9.3.3   The presence of intermediaries

The changing position of intermediaries in the (trans)port industry has been analyzed by Verhoeff (1980), but not with reference to their role in governance. Haezendonck (2001) identifies the presence of intermediaries as a potential source of competitive advantage and finds that the presence of intermediaries, more specifically forwarders and shipping agents, adds to the competitiveness of Antwerp's port cluster. At least six intermediaries play a role in the port cluster:

- Forwarders, mediating between shippers and providers of transport services.

- Non-asset based logistics service providers, mediating between shippers and providers of logistics services, such as storage, quality control and assembling.

- Ship brokers, mediating between shipowners and providers of shipping services.

- Ship's agents, mediating between shipowners and providers of port services and mediating between shipowners and shippers.

- Commodity traders, mediating between producers of commodities and buyers of those commodities.

- Associations. This is a different kind of intermediary, because its aim is to promote the interests of its members, but is included in the analysis of intermediaries, since it has an important mediating role, for instance between different members, between members and the government and between members and research institutes.

9.3.4   Embedded leader firms

In the theoretical part we defined leader firms as 'firms with the ability and incentives to make investment with positive effects for other firms in the cluster'. Studies on the presence and behavior of such firms in the port industry are lacking. The only actor that has been attributed a role of a leader firm is the port authority (Drewry Shipping Consultants, 1998 and Winkelmans and Notteboom, 2001). De Langen and Nijdam (2003) analyze leader firm behavior in the maritime cluster, and show that leader firms do create substantial benefits for other firms in the cluster. Callahan (1981) analyzes the role of 'port barons' in Rotterdam in the 19th century.

9.3.5   Collective action regimes

A variety of firms, such as terminal operators, towage firms, pilots, inland shipping service providers and transport intermediaries contribute to a joint port service. Shippers decide whether or not to use ports on the basis of the quality of the 'total port product'. Investments to improve the port service thus have benefits for various firms in the port cluster. When investments have benefits for a large number of firms in the cluster and these benefits cannot be priced (internalized) effectively, a collective action problem (CAP) is present.

Innovation is a first CAP in seaports. *Innovation regimes*[72] influence the size of 'knowledge spillovers' (see Edquist, 1997, Cooke 1998 Asheim, 1996 and Paniccia, 1999). Innovation regimes differ between clusters and these differences affect performance (Belussi and Gottardi, 2000). *Associations* can play a role as knowledge intermediaries. Public-private knowledge institutes and public research centers can also play a role in an innovation regime. Innovation regimes in seaports have not received attention.

Training and education is a second CAP[73]. Associations can provide education and collective bargaining for education. Furthermore, associations monitor the quality of the 'education and training infrastructure', consisting of public and public-private education institutes. Even though education in the maritime industry has been discussed, (Dinwoodie, 2000) these studies do not analyze 'education regimes' in seaports.

Internationalization is a third CAP. Internationalization of firms is predominantly a market driven process, but the local embeddedness of firms in a cluster[74] can be a barrier for internationalization. This barrier arises because of 'lock-ins', ties that 'blind' (Pouder and St. John, 1996) and a closed inward orientation (Porter, 1990 terms such clusters 'insular clusters'). Internationalization requires firms in clusters to be included in external 'open'

---

[72]   Cooke (1998) uses the term 'regional system of innovation', Brackzyk et al (1998) the term 'regional innovation systems'.

[73]   Since labor is mobile, all firms in a cluster benefit indirectly from investments in training and education.

[74]   Albertini (1999) argues that internationalization is indeed to some extent a 'collective process': 'the main transformation process can be identified in the evolution of the district from closed contextual 'community networks' to 'semantic' and 'market' networks –that are open and integrated with the global economy' (Albertini, 1999, p. 113).

networks (Blackburn et al, 1993). External networks guarantee that a cluster remains open for new developments. Such networks increase the 'propensity to change' (see Best, 1990).

Associations can play a role in an internationalization regime, for instance by providing information, by monitoring export regulations, by organizing collective representation and by acting as a 'bridging tie'. A public port authority can engage in similar activities to reduce the barriers to internationalization. The internationalization of terminal operators has been analyzed, but arrangements to support the internationalization of firms in a port cluster have not been studied.

Marketing and promotion is a fourth CAP. Marketing and promotion activities in seaports can have two goals: first, to attract *companies* to the port cluster; and second, to attract *cargo* to the port. Both activities have collective good characteristics: firms benefit indirectly from these marketing efforts, but these benefits cannot be priced (in advance). Van Klink and Van Winden (1999) have analyzed the 'port marketing regime' in Hamburg and Rotterdam. In Hamburg a collective marketing organization integrates services of the different associated firms into 'packages' for potential customers. In Rotterdam, the marketing organization plays a much more limited role (Van Klink and Van Winden, 1999).

Hinterland access is a fifth CAP. Hinterland access is crucial for the attractiveness of seaports (Kreukels and Wever, 1998). Individual firms cannot fully appropriate the benefits of a good hinterland access: a variety of firms in the cluster receive benefits. Thus, collective action could generate resources to improve the hinterland access.

An important issue in this respect is the role of *inland nodes* in a port network. Van Klink (1995) convincingly argues that ports benefit from creating networks with inland nodes. Investments of the port authority, together with private port operators and other stakeholders, can improve the hinterland access. In some ports port authorities and firms in the port cluster do invest in hinterland nodes, examples include investments of Marseilles in Lyon, Amsterdam in Duisburg and Hamburg in a variety of eastern European countries. Such investments can be analyzed as the results of the 'hinterland access regime'.

The role of port authorities

The role of the (public) port authority in port clusters differs substantially from public involvement in other clusters. The role of the port authority is discussed frequently (see Goss, 1990A and 1990B, and Stevens, 1999), but not from the perspective that a port is a

cluster, where collective action problems have to be solved. We claim that the 'institutional position' of the port authority can be described with the term '*cluster manager*'. For this reason, one could assume that collective action regimes in port clusters are relatively effective compared to other clusters. This issue is not addressed in this study, but deserves further attention.

A 'perfect' cluster manager would be an organization with the following four characteristics:

1. A cluster manager has *incentives* to invest in the cluster, because its revenues are related to the performance of the cluster. The 'perfect' revenue structure of a cluster manager would be a share of the value added generated in the cluster, for instance through a 'cluster tax'.

2. A cluster manager operates self-sustaining: over time investments equal revenues. Cluster managers are not-for-profit organizations, but do not receive subsidies either.

3. A cluster manager aims to recover investment costs *as much as possible* from firms that benefit from the investments, through co-finance arrangements with these firms. However, investments cannot be directly recovered because benefits 'spill-over' to other firms in the cluster. Therefore, cluster managers need revenues (the cluster tax) that are not directly related to expenditures so that they have resources to invest in the cluster.

4. The 'investment rule' of a cluster manager is to invest when 'cluster benefits' exceed costs and when (coalitions of) private firms in the cluster do not invest, because a substantial part of the benefits are 'external' to the (coalition of) firm(s)[75].

The institutional position of landlord port authorities, especially those with a regional jurisdiction, resembles a perfect cluster manager[76]. The port authority owns the land in the

---

[75]   These four characteristics are institutional ones; one could add managerial characteristics to a perfect cluster manager, such as 'legitimacy in the cluster'.

[76]   The 'Hanzeatic port model' (Kreukels and Wever, 1998) where the local or regional administration controls the port authority, is relatively widespread, especially in continental Europe. In this model the port authority has an additional motive, apart from the

port. Its revenue comes from port dues[77] and lease rents[78]. Landlord ports are (in general) self-sustaining and non-profit organizations. The revenues of port authorities are related to the performance of the cluster as a whole: revenues from port dues and lease contracts go up when the cluster performs well. As a consequence, port authorities have incentives to invest in the performance of the cluster. Furthermore, landlord port authorities only invest when private firms are not willing to invest. Port authorities invest in activities such as port safety and port marketing. Since a variety of firms receive benefits of these investments, no individual firm is willing to make such investments. Thus, port authorities have the position to act as a cluster manager[79]. Following the cluster manager perspective they 'should' invest when benefits for the cluster exceed costs for the cluster. Furthermore, they 'should' recover costs as specifically as possible, but given the fact that a part of the benefits cannot be priced directly, both land prices and port dues are mechanisms to recover costs in an *indirect* manner.

In Table 33 a distinction between two types of justifications for investments of port authorities is made: justification with reference to the role of port authorities as *landlords*, and reference to the role of port authorities as *cluster managers*.

---

abovementioned economic incentives, to invest in the port cluster: it generates employment and value added in the port region. For regional policy makers, such effects are important.

[77] Charges for shipowners/ship operators are termed 'port dues' and in most cases related to the size of vessels.

[78] Port authorities lease land to firms such as terminal operators, warehousing and manufacturing firms. In some cases cargo owners also pay a charge to the port authority. These charges are termed wharfage and in general related to the volume and/or the value of goods. The latter does not make sense from an economic point of view and is little used. Volume based wharfage is also not widespread, since cargo owners indirectly pay all transport costs anyway and transaction costs are high.

[79] Seaports clusters are special because of the prominent role of port authorities. In many other clusters, such as the Dutch maritime cluster (De Langen, 2002) the shipbuilding cluster in the Northern Netherlands (Van Klink and De Langen, 2001) and Silicon Valley (Hall and Markusen, 1985) a central actor with a similar set of incentives, resources and a similar institutional position is lacking. Therefore, cluster management is likely to be more advanced in seaports than in other clusters.

Investments justified with reference to the landlord role are those investments that a) improve the quality and safety of the *transport node* and b) are recovered directly from the shippers and terminal operators. Investments on top of the landlord investments are justified from the perspective that a port authority is also a *cluster manager*.

Table 33 shows examples of investments whose costs can be recovered with *direct charges* and investments that need to be financed in an *indirect* manner. A distinction is made between 'basic' and 'advanced' investments. The basic investments are standard practice among port authorities across the globe. Only a part of the port authorities make 'advanced investments'. Consequently, the latter are potential sources of superior governance. Table 33 shows examples of investments in each of the four 'quadrants'.

Table 33: The role of port authorities as cluster managers

Role of port authority	Direct cost recovery	Indirect cost recovery
Investments in port cluster (location)	Hinterland terminals (dry ports) Industrial pipeline infrastructure Logistics zones Dedicated freight transport systems Venture capital provision Office space provision for SME's	Web-based port community system ICT system for commodity trade Innovation platforms and research projects Training and education infrastructure Promotion port as working environment
Investments in transport node	Quay construction Land reclamation and development Cargo handling equipment Traffic control Dredging Waste collection	Port security Port marketing and promotion

A high level of investments with indirect financing requires high port charges. Figure 15 visualizes the 'optimal investment quantity' of (port) cluster managers.

Figure 15: Optimal investment quantity of a cluster manager
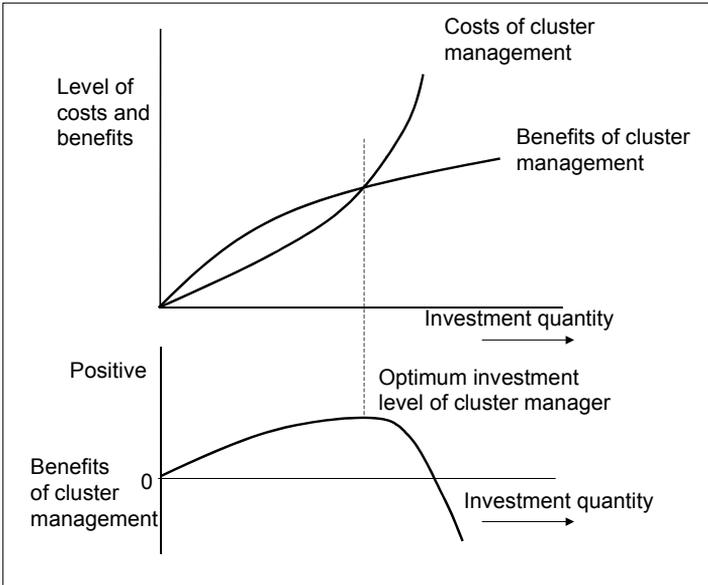
Port authorities have a certain minimum investment level, for instance for dredging and maintenance. Up to a certain point, an increase in port charges combined with more investments in the port cluster increases the performance of the port. After a certain optimum level of investments, further tariff increases combined with more investments reduce the performance of the port cluster. In the optimum investment level marginal costs equal marginal benefits: the effect of an additional investment in the port cluster has the same effect as a marginal reduction of port charges. Furthermore, the marginal benefits of a 'reservation' for future investments also equal marginal costs[80]. This background provides a basis for analyzing the roles of port authorities in the three cases.

---

[80]   Finally, the marginal effects of the two different tariffs are the same as well: a reduction of land prices has the same effect on the cluster performance as the reduction of port dues.

9.4   Governance and performance in port clusters; research set-up

Table 34 shows the research set-up used for the cases. The survey propositions are derived from the literature review in the preceding section. Issues for desk research are relevant in seaports, but have not been addressed in the literature.

Table 34: Research findings, survey questions and issues for expert interviews related to governance.

Issue	Relevant research findings	Survey propositions (P1 to P6) and additional survey questions	Issues for expert interviews and desk research
General	The importance of governance in ports is not widely acknowledged	P1: Differences in the governance of a cluster have an effect of the performance of port clusters. P1a: The development of port clusters is a result of the interplay of market forces and (inter)national policies. The quality of local governance does not have a substantial effect on performance.	What actors play a role in the governance of the port? What is the 'institutional structure' of the port cluster?
Trust	The issue of trust in port clusters has not been studied	P2: The level of trust can vary between port clusters. Trust lowers transaction costs and thus contributes to the performance of a port cluster.	Is there a culture of trust in the port cluster? Are reputation effects important in the port cluster?
Presence of inter-mediaries	The presence of intermediaries adds to the performance of port clusters (Haezendonck, 2001)	P3: The presence of intermediaries adds to the performance of port clusters, because these intermediaries lower the costs of coordination in a cluster.	How relevant are the traditional intermediaries? Are there new kinds of intermediaries?
Presence of leader firms	Leader firm behavior in ports has not been studied	P4: The presence of embedded leader firms adds to the performance of port clusters	What are leader firms in the three cases? Is it their strategy to have a positive impact on the cluster as a whole?
Quality of solutions for CAP's	Marketing and promotion is a relevant regime in seaports (Van Klink and van Winden, 1999). Hinterland access requires cooperation. Forms of cooperation have not been studied.	P5: The quality of solutions to collective action problems influences the performance of the port cluster. P6: The collective action problem in seaports is relevant for the issues innovation, education and training, marketing and acquisition, internationalization and hinterland access. Experts are asked to indicate whether the five CAP's are present, the importance of these CAP's and the quality of the solutions to these CAP's	What forms of cooperation have developed in seaports? How do actors try to create coalitions to solve CAP's? To what extent do port authorities act as cluster managers?

10 STRUCTURE AND PERFORMANCE IN SEAPORT CLUSTERS; RESULTS OF THE CASE STUDIES

In this chapter the effects of agglomeration economies, internal competition, cluster barriers and heterogeneity are discussed, each in one paragraph. The survey results are given in a series of tables, each presented in the same way. Two calculations to analyze the statistical significance of these results are used:

- A calculation of the significance of expert opinions. For instance, only when a relatively large majority of experts agrees or disagrees with a proposition, can their judgment be safely claimed to be the common 'expert opinion'. The 'one sample T-test' can be used to calculate the significance of these survey results. In general, results will be taken to be significant when the majority that agrees or disagrees is so large that the chance that these results are a 'coincidence' (when more experts would have been surveyed the results would not hold) is lower than 5%[81]. This test is done for the overall 'expert opinion' and for the three particular cases.

- An analysis of the significance of the *differences* of results *between the cases*. The significance of these differences can be analyzed by an 'independent samples test'. This test determines whether differences between the cases are significant in the sense that the chance that they are a 'coincidence' is lower than 5%. This test only yields relevant results when it can be assumed that the experts in the three cases have the same reference point. In general this is the case, but the judgment of the quality of trust for instance, experts are likely to have different (nation specific) reference points. For the agree/disagree questions and the rating questions experts do have the same reference point, since these questions deal specifically with port clusters.

The propositions in the table are given in their general form ('the port cluster'). The respondents answered the questions specifically for 'their' port cluster (for instance

---

[81] With regard to the propositions, the 'average response' of the experts is compared with an outcome where half of the experts agree and the other half disagrees.

'Durban's port cluster'). Three answers are possible to the propositions: agree (A), disagree (D) and no opinion (NO).

10.1   Agglomeration economies

Table 35 shows the opinion of the experts in the three cases with regard to six propositions on agglomeration economies.

Table 35: Agglomeration advantages of a port cluster

Agglomeration advantages	Total			LMPC		Rotterdam		Durban	
	A	D	NO	A	D	A	D	A	D
The presence of a cluster specific labor force in port cluster is a reason for firms to locate in the port cluster.	60	37	7	19*	8	29*	11	12**	18**
The presence of cluster related customers and suppliers in the port cluster is a reason for firms to locate in the port cluster.	86*	16	1	17	10	42*	1	27*	5
The presence of cluster related knowledge and information in the port cluster is a reason for firms to locate in the port cluster	77*	20	4	18	6	35*	7	24*	7
Relatively high land prices and scarcity of land in the port cluster induce firms to leave the cluster.	43	54	5	5	21*	24	14	14	19
A relatively high level of congestion in the port cluster induces firms to leave the cluster.	32	70*	2	5	22*	9	32*	18**	16**
The high wage level and power of labor organizations in the port cluster induce firms to leave the cluster.	29	72*	3	3	23*	21**	20**	5	29*

A = agree, D = disagree, NO = no opinion

*   Significant majority of experts (from across the cases or one particular case)

**   Significantly different from other cases

The following conclusions can be drawn on the basis of these results:

- The presence of customers and suppliers is a clear agglomeration force. Firms are attracted to port clusters because customers and suppliers are located in a cluster.

- The presence of information and knowledge is a second clear agglomeration force. A significant majority of the experts claim that knowledge and information attract firms to the port cluster.

- The presence of qualified labor is regarded as an agglomeration force in Rotterdam and the LMPC, but not in Durban. This is because labor is present everywhere in Kwazulu Natal and the labor pool in Durban is not regarded as well trained or skillful.

- Congestion[82] is not regarded as a reason for firms to locate outside the cluster. In Rotterdam and the LMPC, the vast majority of experts do not regard congestion as a 'disagglomeration force', primarily because congestion is currently 'under control'.

- In Rotterdam, relatively many experts indicate that the wage level is higher and union power is stronger in the cluster than outside the cluster. However, the experts still indicate that a cluster specific labor force attracts firms to the cluster. Thus, the quality and availability of labor in the cluster must be relatively good.

The answers to the proposition 'The presence of a cluster specific labor force in port cluster is a reason for firms to locate in the port cluster' depend on the size of the respondent's firm[83]. Experts from small firms agree more than experts from large firms. This is explained by the fact that small firms benefit from the labor pool because they employ only a limited number of people that can be 'sourced' from the shared labor pool, whereas large firms with a continuous demand for labor depend on the 'supply' of new employees and are confronted with the limited attractiveness of the port cluster as a working environment. Table 36 shows the distribution of responses.

---

[82]   Both maritime congestion (waiting ships) and congestion of hinterland modes are relevant. Maritime congestion hardly occurs in the LMPC and Rotterdam.

[83]   The significance of the difference is smaller than 10%, but that is explained by the small number of respondents

Table 36: Distribution of responses with regard to the first proposition of table 34 (on labor) (N=90[84])

	Experts from small firms	Experts from large firms	Total
Agree	34 (68%)	20 (50%)	54
Disagree	16 (32 %)	20 (50%)	36
Total	50	40	90

The importance of the five agglomeration and disagglomeration forces was surveyed, by asking the experts to rank all ten 'cluster structure variables' from 1 (most important variable) tot 10 (least important variable). The average rankings of the five (dis)agglomeration forces are given in Table 37.

Table 37: Importance of five (dis)agglomeration forces

Variable	LMPC	Rotterdam	Durban	Total
Customers & suppliers	2.7*	2.0*	2.2*	2.2*
Labor force	4.7	4.1	3.7	4.0**
Knowledge spillovers	4.1	5.1	7.5***	5.9
Congestion	6.7	6.8	5.1****	6.1
Land prices & office rents	7.9	5.8	6.6	6.4

Average scores on a scale from 1 (most important) to 10 (least important)

*   Significantly more important than other four factors

**   Significantly more important than 3 least important factors

***   Significantly less important than in other two ports

****   Significantly more important than in other two ports

On the basis of these results four important conclusions can be drawn. First, the presence of customers and suppliers is by far the most important agglomeration force in seaports. In all three cases this variable is ranked as more important than the other variables. This is an important finding, especially given the fact that ports are widely analyzed as transport nodes. Cargo moves through seaports when costs are minimized, *firms* locate in ports primarily

---

[84]   This number is lower than in table 34, because some experts did not fill in the number of employees.

because ports are clusters of economic activity. This explains why there is not 'causal relation' between the cargo throughput and value added in ports.

Second, the agglomeration economies are regarded as more important than the diseconomies (congestion and land prices). This indicates that further clustering of activities in seaports is more likely than spatial deconcentration of port related activities.

Third, the presence of knowledge and information is not a strong force towards clustering in seaports. In Durban, this factor is regarded as unimportant, in both other clusters the importance is moderate. Even though transport and logistics chains are closely related to an 'information chain' and even though ports try to develop as 'brainports' (places where knowledge, information and expertise is concentrated), the cluster experts regard the presence of knowledge and information as a moderately important force for agglomeration.

Fourth, contrary to a common opinion, congestion is not regarded as very important for the performance of a cluster. In the open interviews the reason for this was identified: port clusters have to scale to invest in solutions for the congestion problem, such as dedicated freight lanes, dynamic highway management and intermodal transport. Congestion in seaports is not necessary worse than elsewhere.

10.2   Internal competition

Table 38 shows survey results with regard to propositions on the effects of internal competition, presented in the same way as in the preceding section.

Table 38: Survey results on internal competition in port clusters

	Total			LMPC		Rotterdam		Durban	
Proposition	A	D	NO	A	D	A	D	A	D
Since the competitive environment is practically the same for competitors in the same port cluster, internal competition is a stronger force inducing firms to specialize than external competition.	82*	17	2	20*	5	32*	10	30*	2
Internal competition leads to low "switching costs" for port users; switching costs are higher when port services only face external competition.	84*	9	8	19*	2	36*	4	29*	3
Internal competition leads dynamism and a "vibrant competitive environment". Such an environment is conducive for innovation.	91*	9	2	21*	3	40*	3	30*	3
The presence of internal competition adds to the performance of the port cluster.	97*	2	3	25*	1	41*	1	31*	0

A = agree, D = disagree, NO = no opinion

*   Significant majority of experts

Internal competition promotes specialization, it lowers switching costs and fosters innovation. Expert opinions clearly confirm the validity of the three arguments for the positive effects of internal competition on performance.

These results are relevant given the lack of internal competition in cargo handling and port services in many port clusters. The expert assessment of the fierceness of internal competition is given in Table 39.

Table 39: Fierceness of internal competition (IC) in seven market segments in the cases

	LMPC			Rotterdam			Durban		
Activity	No IC	Limited IC	Fierce IC	No IC	Limited IC	Fierce IC	No IC	Limited IC	Fierce IC
Container	1	13	10	3	33 *	4	24*	7	0
Dry bulk	0	6	18*	1	37 *	2	2	18	6
Liquid bulk	1	15	8	5	32 *	2	3	16	6
Breakbulk	0	6	19*	1	28 *	11	0	13	15
Pilotage	26*	0	0	38 *	4	0	31*	1	0
Towage	0	16	9	2	28 *	11	31*	1	0
Mooring	1	16	7	30 *	12	0	31*	1	0
Overall frequency	17%	42%	41%	28%	61%	11%	59%	28%	13%

*   Significant majority

Pilotage is a regulated monopoly in all three ports. Especially in the LMPC, this monopoly has a clear negative effect on the performance of the cluster; this issue is discussed in more detail later. Apart from pilotage, internal competition in the LMPC is moderate to fierce. Two reasons explain the presence of internal competition in the LMPC.

First the LMPC is not administered by one port authority, but by five competing port authorities. Entry is relatively easy because port authorities are eager to accommodate an entrant, even if this entrant duplicates existing port facilities. In contrast, in Rotterdam or Durban, entry is more difficult because the port authority is not necessarily interested in creating internal competition, especially when the minimum efficient scale is relatively large compared to the size of the market.

Most experts indicate that the port authority in Rotterdam traditionally followed a strategy to enable local cargo handling firms to make a reasonable profit, based on the assumption that in this market environment these firms would be willing and able to make investments that improve the competitiveness of the port cluster. According to the experts, the port authority in Rotterdam started to encourage internal competition only recently, partially in response to the internationalization of the cargo handling industry.

A second reason for the fierceness of internal competition in the LMPC is the geography of the cluster: the cluster is not one compact port area, but a collection of port facilities stretched out along the river banks. Space for expansion is widely available, which makes entry easier.

In the expert interviews in the LMPC the 'specialization' argument and 'vibrant environment argument' were validated. Experts indicate that internal competition in the LMPC is very fierce. Firms are willing to make specific investments to attract customers and continuously try to improve their performance. On the other hand, due to fierce competition in the LMPC average profitability is so low that most firms have limited resources for investments.

In Durban, internal competition is limited in most cargo segments. Only in breakbulk is the competition moderate to fierce, in the other segments, including container handling, internal competition is limited or absent. This is widely regarded as a weakness of Durban's port cluster. A tender procedure to lease the container handling facility to *one* private operator is planned. The dominant opinion of the experts from Durban is that this would seriously damage the competitiveness of Durban's port cluster.

In Rotterdam, internal competition is limited. In none of the seven market segments is internal competition fierce, even though Rotterdam is, in tons throughput, the largest seaport in the world. With regard to pilotage and mooring, efforts to introduce internal competition to date have failed.

The argument that internal competition fosters specialization is supported by results from a small additional survey, carried out only in Rotterdam among the executives of four container terminal operators. All four executives agree with the proposition 'internal competition fosters specialization'. These executives scored the importance of a number of variables for the competitive position, both vis-à-vis internal and external competitors. Table 40 shows the results.

Table 40: Factors for the competitive position (N = 4, executives of all four container terminal operators)

Internal competition	Score	External competition	Score
Price of services	4.8	Hinterland connections	5.0
Reliability	4.0	Price of services	4.8
Speed of handling	4.0	Geographical location	4.0
Flexibility	3.8	Political factors	4.0
Image of company	3.3	Reliability	3.8
		Speed of handling	3.5
		Flexibility	3.5

Scale from 1 (not important) to 5 (very important)

These results show that three of the four most important factors for external competition (hinterland connections, geographical location and political factors) differ between ports, but are the same for operators in the same port. These results suggest that internal competition 'sends stronger signals' for increasing the performance than external competition, because a good performance translates directly into a better market position.

Results from an additional survey in Durban show that when the number of internal competitors is two or more, internal competition is *fiercer* than external competition. When the number of internal competitors is less than two, external competition is fiercer. All these survey results provide evidence for the proposition that internal competition adds to the performance of port clusters. This has implications for policy and management in seaport clusters, since the results also show that (fierce) internal competition is not prevalent in most market segments in the three case studies. These implications are discussed later.

The evidence presented above suggests that internal competition contributes to the performance of port clusters, but that, given the relative large minimum efficient scale, the number of internal competitors is likely to be limited. In this market, each service provider can specialize in a particular niche, in order to avoid destructive competition. Thus, perhaps the 'ideal competition' in clusters is between firms with a distinctive specialization that nevertheless compete.

10.3   Cluster barriers

Seven propositions deal with the effects of cluster barriers on the performance of a cluster.

Table 41: Survey results on the effects of cluster barriers

	Total			LMPC		Rotterdam		Durban	
Proposition	A	D	NO	A	D	A	D	A	D
High barriers to start a new business in a cluster reduce the performance of that cluster	87*	10	5	22*	1	34*	6	31*	3
High barriers to 'leave' a cluster increase the performance of that cluster	36	56	10	11	12	13	26	12	18
High barriers to leave a cluster have a negative effect on the performance of that cluster in the long run, because they reduce the pressure to maintain the vitality of that cluster.	73*	20	8	17	5	31	10	25*	5
The inaccessibility of knowledge networks is a relevant barrier for entry and start-up.	71*	32	0	22*	4	26	17	23	11
The unavailability of 'local capital' is a relevant barrier for start-up.	63	34	6	21*	4	17**	22**	25*	8
The presence of labor that is 'sticky' to the port cluster is a relevant exit barrier.	58	43	2	11	14	30*	13	17	16
The presence of specific investments is a relevant exit barrier	86*	9	4	20*	3	38*	4	28*	2

A = agree, D = disagree, NO = no opinion

*   Significant majority of experts (from across the cases or one particular case)

**   Significantly different from other cases

The following conclusions with regard to the effects of entry barriers can be derived from the survey results:

- A significant majority of port cluster experts agree that entry barriers have a negative effect on the performance of a cluster. Most experts indicate that new entrants and start-ups are necessary for the cluster to remain vital.

- The most relevant entry barrier is the *inaccessibility of knowledge and networks*. In all three port clusters, networks are relatively closed and knowledge is relatively inaccessible. In the conversations this was explained with reference to a specific local 'port community'. This port community is internationally oriented but inaccessible for entrants with no prior expertise in the port cluster. Especially in the LMPC, the vast majority of respondents regard the cluster community as closed for outsiders.

- A significant majority agrees that exit barriers have a negative effect on the cluster (in the long run). According to the experts, exit barriers reduce dynamism. This argument is regarded as more important than the 'static' argument that 'firms committed to the cluster (because of high exit barriers) are more likely to invest in the quality of the cluster'.

- Specific investments are regarded as a relevant exit barrier. Experts indicate this can also be regarded as an entry barrier. This underlines the theory that exit barriers are by definition entry barriers as well and provides an argument for port authorities to make specific investments - provided that firms are willing to lease these investments - in order to reduce entry barriers. This is an important result, because it implies that arrangements that lower the need for firms to invest in specific assets contribute to the performance of a port cluster. Possibilities for such arrangements are discussed later.

- With regard to local capital, the difference between Rotterdam on the one hand and Durban and the LMPC on the other is striking. Contrary to Rotterdam, in the latter two clusters, the absence of 'local capital' is regarded as a relevant start-up barrier. This might be explained by the fact that banks in Rotterdam (branches of multinational banks) as well as a venture capitalist partially owned by the port authority (together with partners from the banking industry) actively seek customers in the port cluster. Such organizations are lacking in the other two ports.

10.4   Cluster heterogeneity

Five propositions deal with the effects of heterogeneity on performance (see Table 42).

Table 42: Survey results on heterogeneity

	Total			LMPC		Rotterdam		Durban	
Proposition	A	D	NO	A	D	A	D	A	D
Opportunities for co-operation in a cluster are higher the larger the diversity of the cluster population.	84*	14	4	22*	1	35*	6	27*	7
Opportunities for innovation in a cluster are higher the larger the diversity of the cluster population.	88*	6	8	24*	0	33*	5	31*	1
Diversity of the cluster population reduces the vulnerability of a cluster for changes in the environment.	86*	8	8	17*	4	39*	1	30*	2
Diversity of the resource base of a cluster reduces the vulnerability of a cluster for changes in the environment.	90*	9	3	20*	4	41*	0	29*	5
Co-operation between firms *in* the port cluster is of a minor importance for the performance of this cluster compared to co-operation with firms *outside* the cluster.	27	68*	7	7	19*	14	24	6	25*

A = agree, D = disagree, NO = no opinion

*   Significant majority of experts

**   Significantly different from other cases

The cluster experts agree that diversity strengthens the competitiveness of a port cluster. Diversity stimulates co-operation and innovation and reduces vulnerability for external shocks. According to the vast majority of experts, the diversity of the cluster population and resource base reduce the vulnerability of a cluster.

The experts indicate that co-operation within the cluster is relatively important. This result is important since it provides evidence to reject the argument that local cooperation is not relevant, given the international nature of port related activities. Thus, a diverse *local* set of firms and resources is important for the performance of a cluster.

A second set of questions deals with the importance of three dimensions of diversity, and the diversity of the three port clusters (see Table 43). Both importance and the diversity of the cluster are measured on a scale from 1 (not important/diverse) to 5 (very important/diverse).

Table 43: Importance of diversity

Type of diversity	LMPC	Durban	Rotterdam	Importance overall
International scope	4.2	4.0	4.0	4.1
Economic activities	4.5**	3.9	3.7	3.9
Firm size	3.3	3.3	3.1	3.2*

Scale from 1 (not important) to 5 (very important)

*   Significantly lower than other scores

**   Significantly higher than in two other clusters

Both diversity of international scope and diversity of economic activities are regarded as important dimensions of cluster diversity. Diversity of firm size is less important. Experts were asked to judge the diversity of their cluster. The scores are given in Table 44.

Table 44: The diversity of the cluster according to experts

Type of diversity	Score Durban	Score LMPC	Score Rotterdam
International scope	3.5	2.9**	4.2*
Economic activities	3.9	3.2**	3.9
Firm size	3.8	3.2**	3.8

Scale from 1 (not diverse) to 5 (very diverse)

*   Significantly higher than other clusters

**   Significantly lower than other two clusters

These results show that the LMPC experts rate the diversity of their cluster as moderate. The data analysis and interviews support this judgment: the vast majority of firms in the LMPC are local branches of (inter)national firms that are not committed to the LMPC. Most branches hardly have any 'strategic content': strategic decisions are made elsewhere. There are hardly any headquarters of large firms in the LMPC.

Durban's port cluster is relatively diverse. The port is very diverse in terms of traffic base, virtually all commodities are handled in Durban. Durban is relatively less diverse in terms of international scope: most firms are niche-operators that concentrate on the South(ern) African market.

Rotterdam's port cluster is diverse. The opinions of the experts are in line with data. The cluster is endowed with a diverse set of firms, especially in terms of international scope. Various headquarters of internationally operating firms are located in Rotterdam.

10.5   The importance of the variables of the cluster structure

The issue of the importance of the various variables related to the structure of the cluster is addressed in the survey. The experts were asked to rank 10 structure variables from 1 (most important) to 10 (least important). Table 45 shows the results.

Table 45: Importance of structure variables; average scores

Variable	Importance Durban	Importance Rotterdam	Importance LMPC	Importance Overall
Presence of customers and suppliers	2.2	2.0	2.7	2.2*
Quality of labor pool	3.7	4.0	4.7	4.0**
Diversity of the cluster population	4.6	4.7	5.6	4.8
Presence of internal competition	4.8	4.9	5.6	5.0
Diversity of cluster resources	5.1	5.7	4.5	5.3
Presence of knowledge	7.5****	5.1	4.1***	5.9
Level of entry barriers	6.2	6.3	5.1	6.1
Presence of congestion	5.1***	6.8	6.7	6.1
Level of land prices and land scarcity	6.6	5.8	7.9****	6.5
Level of exit barriers	9.0	9.3	8.3	9.0*****

Average scores on a scale from 1 (most important) to 10 (least important).

*   Significantly more important than other nine variables
**   Significantly more important than eight other variables
***   Significantly more important than in other two cases
****   Significantly less important than in other two cases
*****   Significantly less important than other variables

These results show that two agglomeration economies, the presence of customers and suppliers and the presence of a labor pool, are regarded as the most important for the performance of the cluster. The labor pool however, is not an agglomeration force in Durban. This is a weakness of Durban.

Diversity and the presence of internal competition are judged as relatively important. The disagglomeration effects, land prices and congestion, are regarded as relatively unimportant. Exit barriers are regarded as unimportant.

Experts in Durban attribute a relatively limited importance to the presence of knowledge, whereas in the LMPC, knowledge is regarded as important. This might be explained by differences in context: Durban is the leading South African port. The LMPC faces strong competition from Houston and lacks 'entrepreneurial spirit', partly because knowledge is lacking.

In the LMPC, land is widely available and as a consequence this factor is not as important as in the other two port clusters. Congestion is relatively important in Durban. This can be explained by congestion problems due to the fact that the city surrounds most of the port area and ships have to wait before being served in the port.

10.6   Conclusions: cluster structure and performance

Table 46 summarizes the most important conclusions on the relation between the structure of a cluster and the performance of that cluster.

Table 46: Research findings on structure and performance in clusters

Issue	Research finding
Agglomeration economies	The presence of customers and suppliers is the most important agglomeration force.
	The quality of the labor pool is important, but not, as suggested in theories, a force towards agglomeration in all port clusters, because of high wages and strong labor unions.
	In general, agglomeration economies are regarded as stronger than the diseconomies. Thus, seaport clusters have the potential to attract port related firms.
Internal competition	Internal competition contributes to the performance of port clusters, first of all because monopoly pricing is prevented.
	Even when there is no threat of monopoly pricing, because external competition is fierce, internal competition is desirable because it fosters specialization and innovation.
	In cargo handling and some port services, internal competition is limited or even absent.
Cluster barriers	Start-up and entry barriers have a negative effect on cluster performance. The inaccessibility of networks, as a result of a relatively closed port community is the most important barrier for entry.
	Exit barriers reduce performance. However, their effect on the performance of port clusters is minor. The inability to recover port specific investments is the only relevant exit barrier.
Heterogeneity	The positive effects of heterogeneity on performance are validated by the survey results and interviews.
	Diversity of international scope is the most important dimension of diversity.
	Rotterdam is a diverse cluster; the LMPC is not diverse.

11 GOVERNANCE AND PERFORMANCE IN SEAPORT CLUSTERS; RESULTS OF THE CASE STUDIES

In this chapter the results of the case studies with regard to the relation between cluster governance and cluster performance are discussed. As in the preceding chapter, the survey results are given in a series of tables, and two calculations to analyze the statistical significance are used: the significance of majority opinions and the significance of the *differences* of results *between the cases*. The second test only yields relevant results when it can be assumed that the experts in the three cases have the same reference point. For some questions on the 'score' of a port cluster this assumption is questionable. Thus, the comparison of the outcomes of these questions is done with some precaution.

In the next four paragraphs the four variables (trust, intermediaries, leader firms and collective action regimes) are discussed. First, the relevance of the concept of cluster governance is demonstrated with the results of two propositions (see Table 47).

Table 47: Survey results on the relevance of cluster governance

Proposition	Total			LMPC		Rotterdam		Durban	
	A	D	NO	A	D	A	D	A	D
Differences in the governance of a cluster influence the performance of that cluster.	104**	0	1	28*	0	43*	0	33*	0
The development of port clusters is the result of the interplay of market forces and (inter)national policies. The quality of local governance does not have a substantial affect on the performance of a cluster.	10	95**	1	4	25*	3	40*	3	30*

A = agree, D = disagree, NO = no opinion

**   Significant majority of experts from across the cases

All experts in the three cases recognize the role of governance in a port cluster. All but one of the experts indicate that differences in governance influence cluster performance. As a

'test' to check the consistency of this result, the second proposition claims cluster governance does not have a substantial effect, instead market forces and (inter)national policies are proposed as drivers of the performance of a cluster. The vast majority of experts disagree with this proposition. This validates the importance of cluster governance for the performance of a cluster.

11.1   Trust

The vast majority of experts acknowledge the influence of trust on performance (Table 48).

Table 48: Survey results on trust

	Total			LMPC		Rotterdam		Durban	
Proposition	A	D	NO	A	D	A	D	A	D
A culture of trust increases the quality of the governance of a cluster because it lowers transaction costs and enables co-operation.	104*	1	1	29*	0	41*	1	34*	0

A = agree, D = disagree, NO = no opinion

*   Significant majority of experts from across the cases

The experts agree that the notion of 'port specific trust' is relevant. Most experts indicate there is such a thing as a 'port community' where reputation effects are important and trust can be created. The level of trust is regarded as the most important variable related to governance.

11.2   Intermediaries

Table 49 shows the expert opinion on the effects of the presence of intermediaries.

Table 49: Survey results on intermediaries

	Total			LMPC		Rotterdam		Durban	
Proposition	A	D	NO	A	D	A	D	A	D
The presence of intermediaries increases the quality of the governance of a cluster, because intermediaries lower transaction costs and enable co-operation.	74*	26	6	24*	4	29*	9	21	13
Many firms in the port cluster access knowledge and information through contacts with 'knowledge intermediaries' located in the cluster.	80*	11	3	21*	0	33*	5	26*	6

A = agree, D = disagree, NO = no opinion

*   Significant majority of experts from across the cases

The majority of experts agree that the presence of intermediaries increases the quality of governance. The role of intermediaries to lower transaction costs and enable co-operation is acknowledged.

A substantial minority disagrees with the first proposition, because in their opinion intermediaries *increase* transaction costs. An analysis of the responses reveals that large firms disagree more with the first proposition of table 48, because they have sufficient size to lower transaction costs and develop cooperation in networks. Table 50 shows the distribution of responses over small and large firms.

Table 50: Distribution of responses with regard to the first proposition of Table 49

	Experts from small firms	Experts from large firms	Total
Agree	43 (83%)	21 (55%)	64
Disagree	9 (17%)	17* (45%)	26
Total	52	38	90

*   Significantly higher percentage than small firms

Table 51 shows the results of a question to rank six intermediaries from 1 (most important) to 6 (least important).

Table 51: Ranking of the importance of intermediaries in the three cases, N=95

Intermediary	LMPC	Rotterdam	Durban
Forwarders	3.0	2.0*	2.6
Ship's agents	3.3	3.0	2.6
Associations[85]	3.5	4.0	3.3
Commodity traders	2.9**	4.2	4.0
Shipbrokers	3.3	4.4	4.0
Non asset owning LSP's	4.7*	2.9**	4.1

Scale of 1 (most important) to 6 (least important)

*   Significantly more/less important than other intermediaries in same cluster

**   Significantly more important than in other cluster

The following conclusions can be drawn on the basis of these figures:

- Forwarders are regarded as the most important intermediaries, because they 'control cargo'. The presence of forwarders increases performance because they improve the position of a port in a logistics chain.

- Commodity traders are relatively important in the LMPC. This is explained by the fact that this cluster is strong in commodities that are frequently traded, such as grains, coffee and steel.

- Non-asset owning logistics service providers are especially important in Rotterdam's port cluster. This can be explained by the fact that Rotterdam, and the Netherlands as a whole, has a strong position in logistics. Given the continuous restructuring of logistics chains, 'chain orchestrators' (LSP's) are regarded as important for the performance of Rotterdam's port cluster.

---

[85]   An association is the only non-profit intermediary. Therefore the importance of this intermediary is hard to compare with the others.

The importance attributed to various intermediaries differs strongly between experts. Various experts associate intermediaries with 'traditional' middleman whose importance is slowly reduced. The differences of responses of experts with a long experience in the port industry, versus experts with a short experience are given in Table 52. This shows that opinions about the importance of intermediaries change.

Table 52: The intermediary ranking of two 'experience cohorts'

Intermediary	Average ranking by experts with a 'short' experience	Average ranking by experts with a 'long' experience
Agent	3.2	2.7
Forwarder	2.1	2.5
Shipbroker	4.2	4.0
Trader	3.7	4.6
Associations	3.9	3.4
Non asset owning LSP	3.5	3.7

Scale of 1 (most important) to 6 (least important)

These differences, even though not statistically significant, reveal something also observed in the open interviews; relative newcomers attribute less importance to the presence of *ship related* intermediaries (ship agents and shipbrokers) and more importance to *cargo related* intermediaries (forwarders, traders and non asset owning LSP's). This can be explained as shipping becomes more and more 'commodified': the product becomes more homogeneous, and is purchased more and more electronically. As a consequence, the importance of ship related intermediaries declines vis-à-vis cargo related intermediaries. The survey results provide 'circumstantial evidence' that in Rotterdam shipping is more 'commodified' than in the two other ports: experts rank ship related intermediaries as relatively unimportant.

The experts acknowledge the role of intermediaries as important sources of knowledge. 'Dedicated' knowledge intermediaries have not emerged in seaports; especially forwarders are mentioned as intermediaries that possess and distribute knowledge.

11.3   Leader firms

Table 53 shows the survey results on the presence of leader firms in the cluster.

Table 53: Survey results on leader firms

	Total			LMPC		Rotterdam		Durban	
Proposition	A	D	NO	A	D	A	D	A	D
The presence of 'leader firms' increases the quality of the governance of a cluster.	102*	1	3	29*	0	40*	1	33*	0

A = agree, D = disagree, NO = no opinion

*   Significant majority of experts from across the cases

The positive influence of leader firms in the port cluster is widely acknowledged. In the interviews leader firms were identified. In Table 54 leader firms and their effects, according to various experts, are discussed.

Table 54: Leader firms and their effects

Leader firms in Rotterdam	
P&O Nedlloyd	P&ONedlloyd contributes with international expertise to the development of a 'port information system' in the port. The firm has initiated 'European Rail Shuttle', that developed into the largest European container rail operator. Finally, the firm's top management contributes to efforts to improve Rotterdam's transport related education infrastructure.
Maersk/ SeaLand	Leading partner in the above mentioned ERS. Furthermore, this firm has been active in lobbying for rail deregulation, both at the Dutch and the European level.
ECT	This main container operator is advanced in developing new terminal technologies. The firm develops inland networks and is engaged projects to reduce landside congestion at the terminal. Due to the bad financial performance of the firm and the take-over by Hutchison, ECT behaves now less as a leader firm.
Lyondell Chemical Nederland	Leader firm in the chemical cluster; encourages/enforces competition among local suppliers and leading in cooperation between chemical firms in the port area.
Leader firms in the LMPC	
Central Gulf Lines	Central Gulf Lines' CEO plays an important role in forming a coalition to improve the governance of the port cluster (discussed more in detail in the next section).
Leader firms in Durban	
Rennies group	A leading private terminal operator in the port with various subsidiaries. Rennies is committed to the port of Durban and actively involved in governance issues.
MSC	The largest container shipping line in Durban and initiator of the 'container lines operators forum' (CLOF), to improve the daily operations of the container terminal.
Toyota	The leading shipper/receiver in Durban, critical and involved with regard to the performance of the port.

Table 54 shows that Rotterdam is relatively well endowed with leader firms and the LMPC not. These leader firms contribute to the quality of the governance of the port cluster. The role of leader firms in creating collective action regimes is discussed in the next section.

11.4   Collective action regimes

In this section, the quality of collective action regimes in the three cases is assessed. In the first section the general survey results are discussed. In the next five sections, five relevant regimes are discussed.

11.4.1   Identification of collective action regimes

Table 55 shows the results of a question whether or not collective action adds to the performance of the port cluster. This question is asked for five different potential CAP's, discussed in chapter 9. If collective action has/would have positive effects, the collective action regime (CAR) is analyzed.

Table 55: Identification of CAR's

	Total		LMPC		Rotterdam		Durban	
	Present (P)	Absent (A)	P	A	P	A	P	A
Innovation	81*	22	24*	4	29	12	28*	6
Training & Education	99*	5	27*	2	38*	3	34*	0
Internationalization	61*	38	26*	3	13	28**	22	7
Marketing & Promotion	98*	6	28*	1	37*	4	33*	1
Hinterland access	93*	6	24*	2	37*	4	32*	0

*   Significant majority (across the cases of for one case)

**   Significant differences with respondents in other 2 cases

All five potential CAR's are relevant in port clusters. Four of the five CAR's are relevant across the cases; only internationalization is not regarded as a collective action problem in Rotterdam. This means that an arrangement for 'collective internationalization' is not regarded as an initiative that would enhance the performance of the cluster. In the interviews it was found out that this opinion is based on the argument that the majority of firms in the cluster is already international on the one hand, and can internationalize 'on their own' on the other hand. The importance of the five CAR's according to the experts is given in Table 56.

Table 56: Importance of the five CAR's

Issue	LMPC	Rotterdam	Durban	Overall importance
Hinterland access	4.8	4.6	4.8	4.7*
Training & Education	4.1***	4.4	4.8***	4.4
Marketing & Promotion	4.6	4.3	4.0	4.3
Innovation	4.5	4.1	4.4	4.3
Internationalization	4.4	N.R.	4.0	4.1**

Average scores on the scale of 1 (not important) to 5 (very important)

*   Significantly more important than other regimes

**   Significantly less important than other regimes

***   Significantly different from other cases

The following conclusions can be drawn on the basis of these results:

- All five regimes are regarded as important for the performance of the cluster. The least important regime is internationalization, but even this regime 'scores' 4.1 on a scale from 1 to 5.

- Hinterland access is regarded as the most important CAR. The quality of the 'hinterland access regime' is very important for the performance of the port cluster, with a score of 4.7 on a scale from 1 to 5.

- Training and education is significantly more important in Durban than in the other two cases. This can be explained by the fact that in South Africa, firms have to pay a special charge that can be recovered by investing in training and education. Firms therefore have an incentive to invest in port related training and education, but due to limited 'collective action' no professional training organization has developed.

The importance of the five variables of the quality of a collective action regime according to the experts is given in Table 57.

Table 57: The importance of the five variables of the quality of a CAR

Variable	All cases	Durban	Rotterdam	LMPC
Leader firms	4.4	4.3	4.3	4.5
Organizational infrastructure	4.4	4.5	4.1***	4.6
Involvement public actors	4.3	4.4	4.3	4.2
Voice	4.0**	4.2	3.8***	4.2
Community argument	3.8*	4.1	3.5	3.9

Average scores on the scale of 1 (not important) to 5 (very important)

*   Significantly lower than other scores

**   Significantly lower than three most important factors

***   Significant difference with other cases

These figures show that all five variables are relevant. The least important variable (the community argument) has an average score of 3.8 (on a scale from 1 to 5). Furthermore, the figures show that the three variables, leader firms, the role of public actors and the organizational infrastructure are the most important.

The survey results presented above confirm the existence and importance of five CAR's in port clusters and the relevance of the five variables of the quality of a CAR. In the following paragraphs, the five relevant CAR's are discussed. First, survey results are presented. The experts were asked to assess the quality of each regime. Two statistical tests are performed: one to analyze the significance of differences *between the cases* a second to analyze which variables in a regime are evaluated positive and which negative. The latter analysis is carried out by analyzing the significance of differences between the score of one variable with the average score of all variables in the regime.

Second, a detailed description of each regime is given. On the basis of the expert judgment and desk research, opportunities to improve the regime are discussed. These opportunities were discussed with the experts. Only opportunities that are acknowledged by a number of experts are discussed. In some cases steps to develop joint initiatives to improve the regime have already been taken.

11.4.2   The hinterland access regime

Table 58 shows the expert evaluation of the quality of the hinterland access regime in the three cases. A scale from –5 (very bad) to +5 (very good) was used, so that a score of nil means neither bad nor good. This scale is also used for the other four regimes.

Table 58: Expert evaluation of the quality of the hinterland access regime

Variable	Rotterdam	Durban	LMPC
Leader firms	2*, **	-0.4***	0.2
Public actors	2*, **	0.4	0.8
Organizational infrastructure	0.7	0.1	0.3
Community argument	0.9	0.8**	0.1
Voice	1	0.8**	0.4
Overall score[86]	1.1*	0.1	0.3

Average scores on a scale from –5 (very bad) to +5 (very good)

*   Significantly higher score than in other two port clusters

**   Significantly higher average judgment of all factors in same port cluster

***   Significantly lower average judgment of all factors in same port cluster

On the basis of these results the following conclusions can be drawn:

- The hinterland access regime is not very effective in any of the three cases.

- Rotterdam's HAR is significantly better than in the two other cases, with a score of 1.1 on a scale from –5 to +5.

- The involvement of leader firms and the role of the public actors (most importantly the port authority), are two strengths of the HAR in Rotterdam.

- In Durban, the HAR is not effective. This is predominantly due to the lack of leader firm involvement. Firms in the cluster are willing to become involved, but no firm has the incentive and ability to take the lead.

---

[86]   The overall score of the HAR is computed by multiplying the score for each of the variables with the importance they attach to that variable. The maximum score is +5 and the minimum score –5.

•   The HAR in the LMPC is moderate across the board.

The hinterland access regime in the LMPC

The most important inland mode in the LMPC is inland waterways. Mainly dry bulk is transported over the vast Mississippi river network. Oil is processed to a large extent 'on site' or transported by pipeline. The inland shipping system for bulk is very efficient. The widespread use of push-barges allows for economies of scale and better equipment utilization, while standardization secures efficient cargo handling. This system has already been 'running' for decades, so that improvements are incremental[87]. Table 59 shows the various initiatives/investments to improve the hinterland access regime in the LMPC.

Table 59: Initiatives/investments to improve the hinterland access regime in the LMPC

Mode of coordination	Relevant initiatives/investments
Hierarchies	No single firm has made major investments that have improved the hinterland accessibility.
Interfirm alliances	The number of strategic alliances to improve the hinterland accessibility is very limited.
Associations	The barge fleeting association, the freight forwarders association and the steamship association promote the interests of their members. They are not actively lobbying for more infrastructure or a better interface with the terminals.
Public-private partnerships	Public-private partnerships do not play a role in the HAR in the LMPC .
Public organizations	The Public Belt Railroad is the most important public organization in the hinterland access regime. The port authorities are hardly involved. The port of New Orleans has a (strategic) partnership with the inland port of Memphis, but this partnership has not resulted in joint initiatives to improve the corridor between Memphis and the LMPC.

---

87   One joint initiative that could improve the quality of the hinterland access in inland bulk shipping is by means of better web-based communication systems. Since shippers receive most benefits (better logistics planning), while operators have to make the investments, joint initiatives are problematic. The inland waterways operators associations do not play a leading role in this respect, nor do public organizations. It is unlikely that an initiative in this field would be successful unless large American shippers are willing to act as 'leader firms'. Thus, setting up such a project is beyond the scope of the actors in the LMPC.

Three related initiatives to improve the quality of the hinterland access regime can be identified: *market intelligence*, *promoting containers on barge* and the *rail accessibility* of the port.

Market intelligence

The market intelligence in the LMPC is seriously underdeveloped, due to amongst others competition between the port authorities and absence of an effective private sector organization. Insights in origin-destination patterns of transport flows and strengths and weaknesses of the LMPC compared to competing ports are lacking. Neither the port authorities, nor any other organization in the cluster had developed market intelligence to identify potential customers and map their service preferences.

Recently, a coalition with the name 'maritime cluster initiative' has been set up to improve the market intelligence in the cluster. Partners in this coalition are Metrovision, the five port authorities, the university of New Orleans, the Public Belt Railroad, the pilot associations, the Board of Trade, the Mississippi River Maritime Association, the Steamship Association, the state of Louisiana, and the Millennium Port Authority. This coalition has been initiated by two CEO's of leader firms in the New Orleans region (Central Gulf Lines and Bollinger Industries). Metrovision provides 'support infrastructure' for the initiative. The various partners have agreed to invest in total 600,000 US dollars in the project. After the initial phase structural resources should be attracted[88]. The coalition is the first of its kind to address strategic issues for the LMPC. The project is in its infancy but is an important step towards a more effective hinterland access regime.

---

[88]   In the first phase, the main activity of the project will be creating market intelligence. An analysis of various transport chains that currently move through the lower Mississippi or could be moved through the lower Mississippi is central. The outcomes could be used to investigate elements in the transport chain that put the area at a disadvantage and see how these disadvantages can be reduced or omitted

Rail accessibility of the LMPC

Rail access is especially relevant in the container market. About 35% of all containers are put on rail. All six[89] 'class A railroads' (railroads with a national network) offer train services to or from New Orleans. However, due to the limited size of market, the port is not a priority for these railroads. Thus, even though the railroads serve the LMPC, the quality of the rail accessibility from the port to the hinterland is bad.

The *New Orleans Public Belt Railroad* plays a leading role in improving the quality of rail services to and from the LMPC. This organization carries out local inter-terminal traffic between the rail terminals and aims to improve the rail accessibility by offering a 'one stop shop service' for the railroads[90]. The railroads encourage this ambition, since their competence is operating long distance trains, not local operations. When the Public Belt Railroad would become a regional communication and dispatch center, providing information to the railroads, creating complete trains for the railroads and managing the train movements in the region, the rail accessibility of the LMPC would improve.

The Public Belt recently took over the management of the rail terminals of two of the six railroads. They aim to take over the yard activities from the other railroads as well. In order to realize its ambition, the Public Belt needs the support of other organizations in the hinterland access regime.

Containers on barges

The transport of containers by barges has to date not been successful, at least partially because cooperation to create sufficient cargo and investment funds is lacking. Firms have tried to set up services, but the coordinated development of a 'container on barges *system*' is required. Firms have tried to set up one piece of such a system but lacked sufficient scale. Coordination to introduce containers on barges is still limited.

---

[89]   Shortly after the case study, a merger between two railroads was announced; once this merger is completed there are five 'class A railroads'.

[90]   An important strategic asset of the organization is the rail bridge over the Mississippi. The public belt is in charge of all flows over this bridge. The bridge is one of the three bridges over the Mississippi South of Chicago. Therefore, large volumes of transit cargo cross the bridge.

The port authority of Baton Rouge, the most upstream port of the LMPC, invests in the first inland container terminal in the Mississippi, with a substantial annual base volume from one shipper. The majority of the volume will be shipped to *Houston*, since the port of New Orleans is not called by enough shipping services. The cost advantage of shipping barges to New Orleans, compared to Houston, is about US $ 150 per TEU. Due to this large cost advantage, these containers are 'captive' as soon as a good terminal facility is developed.

A promising partner for a 'containers on barges' coalition is the Federal Maritime Commission (FMC). This federal public organization acknowledges the substantial positive (external) effects from shifting containers from road (and train) to barge transport. Such a modal shift would reduce pollution and relieve congestion. Therefore, the FMC intends to start an initiative to promote container barge shipping. For the LMPC, such a project could be an effective way to free up resources for innovation, education and marketing of container barge shipping. However, no major efforts to develop a coalition have been made to date.

A second important partner for a 'containers on barges coalition' is 'Sea Point', a privately funded venture that intends to develop an offshore terminal in the mouth of the Mississippi. Containers are shipped by barge from this terminal to inland ports. Such an offshore terminal would make container on barge more attractive.

The hinterland access regime in Durban

The two dominant hinterland modes in Durban are road and rail transport. The road transport system is relatively well developed in South Africa and not heavily congested. The quality of rail services to the hinterland is less well developed. The public organization Spoornet is the single provider of train services. Spoornet can charge relatively high prices and operate relatively ineffectively. Furthermore, investment policies are not decided on the basis of a clear economic logic but interrelated with political issues. The key challenge of the 'hinterland access regime' is to improve the rail accessibility of Durban. Table 60 shows relevant initiatives and investments in this regime in Durban.

Table 60: Relevant initiatives and investments in the hinterland access regime in Durban

Mode of coordination	Relevant initiatives/investments
Hierarchies	Firms have not made investments to improve the hinterland accessibility by rail, because of Spoornet's monopoly.
Interfirm alliances	No interfirm alliances have developed to improve rail accessibility.
Associations	The port interests are represented in the Chamber of Commerce's Port Liaison Committee, but a 'rail user forum' is lacking.
Public-private partnerships	No public private partnerships to improve the HAR have been developed.
Public organizations	The port authority has to date not made an impact on the HAR.
	Spoornet is a national pubic body with limited decision-making powers located in Durban. The organization has a shortage of equipment and concentrates on large bulk flows from the ports to the hinterland.

A promising opportunity[91] to improve the rail accessibility to/from Durban is the development of a coalition of firms that invest in rail equipment and leases the equipment to Spoornet (which has a serious shortage of equipment) provided the equipment is utilized on tracks from Durban and the coalition can contribute to the efficiency of the deployment of the

---

91   Other opportunities, such as a cargo card or other systems to relieve congestion of trucks at the terminal, or initiatives to reduce the empty hauls of truckers could be viable as well, but both are of less priority and risks of failure are higher.

equipment. Such a coalition needs 'institutional access' on a high level. Given the high potential benefits, firms have incentives to be included in such a coalition. Such a coalition has not developed, especially because potential leader firms (such as MSC for containers and Rennies for bulk) have not been active, the port authority has not been active and existing associations or discussion platforms do not have sufficient decision making power to initiate such ambitious projects. The evaluation of the CAP, given in a preceding section, supports this conclusion: a below average score is given to leader firms and a modest score to the quality of the organizational infrastructure.

The hinterland access regime in Rotterdam

In Rotterdam, inland water transport is the largest inland mode, with a market share of about 47% of all transport flows. Road (22%) and pipeline (27%) are of considerable importance as well, rail has only a modest share in the modal split (4%). The share of rail in container transport, the market where the issue of hinterland access is the most pressing, is larger, 14% (RMPM, 2003). Table 61 shows the role of relevant organizations in the HAR in Rotterdam.

Table 61: Relevant initiatives/investments in the Hinterland Access Regime in Rotterdam

Mode of coordination	Relevant initiatives/investments
Hierarchies	ECT invests in inland terminals to improve their market position.
	DB, the main railway in Germany, has a strong market position on the Dutch market, since they have taken over the cargo division of the former public railway of the Netherlands.
	Vopak invests in innovative chemical tanker barges.
Interfirm alliances	Oil companies have jointly invested in pipeline infrastructure.
	The large dry bulk companies are joint owners of inland shipping firms.
	ERS, a joint venture of P&ONedlloyd and Maersk/Sealand have started container shuttle services from Rotterdam. ERS has developed into a leading European container railway.
Associations	Deltalinqs lobbies for better hinterland connections, but the association is not directly engaged in projects to improve hinterland access. Other associations (CBRB, TLN, VRS en Fenedex) also focus on interest representation.
Public-private partnerships	PCR/RIL engages in projects to improve the 'interface' between the terminals and hinterland modes, for instance by streamlining communication flows and by introducing a 'cargo card' for container truckers.
	A public private partnership is developing new barges to transport pallets on barge.
Public organizations	The RMPM is developing market intelligence of all hinterland markets and partnerships with regions in the hinterland. RMPM also has 'Rotterdam representatives' in the hinterland whose task is to attract cargo.

The HAR in Rotterdam is evaluated relatively well by the experts. The role of leader firms is appreciated. Leader firms include ECT, P&ONedlloyd and Maersk/Sealand and Vopak. The role of public authorities is also appreciated. The port authority has a clear hinterland strategy, created a network of inland representatives and develops market intelligence to identify opportunities.

The quality of the organizational infrastructure in the HAR is regarded as moderate; this is consistent with the limited involvement of associations. Two opportunities to improve the HAR in Rotterdam are identified: automated road transport systems and joint development of intermodal transport systems.

Automated road transport systems

If forms of automated road transport systems could be implemented successfully, Rotterdam would be one of the first places where implementation would be viable, given the huge road transport volumes in Rotterdam. The technical capabilities for an innovative system exist, even though they have never been tested in practice on a large scale. For instance, dedicating one lane of major highway corridors from Rotterdam to the hinterland for trucks with automated vehicle control (perhaps only in off peak hours) would improve the accessibility of the port and reduce congestion. Various coalitions investigate the viability of such forms of automation, but none of the initiatives is likely to be implemented in the short run.

Intermodal transport systems

The importance of inland waterway, rail and short sea shipping make Rotterdam an important intermodal transport node. A key characteristic of intermodal transport is that it is to some extent 'systemic'; various components make up an intermodal chain, and coordination between these components is required. Especially the development of new intermodal services requires coordination. For instance, terminal investments will only be made if transport providers develop services and vice versa. In many cases, the development of new large-scale intermodal connections requires the formation of alliances of multiple actors. In the absence of leader firm behavior, the port authority aims to initiate such coalitions. In Rotterdam, two examples can be mentioned. First, development of a 'barge train service' where goods are shipped to Germany by barge and put on trains there. A *barge-train* coalition is in development, the RMPM plays a pro-active role in the formation of this coalition. Second, Rotterdam is an important RoRo port. All trucks that use RoRo services arrive in Rotterdam by road. An intermodal service to put trucks on a RoRo vessel in an inland port so that trucks do not have to pass the (congested) port area could be viable. Again, a coalition needs to be formed to develop such an intermodal service. Even though the idea has been 'around' for some time, no steps towards realization have been taken.

The hinterland access regime; conclusions from the cases

The hinterland access regime is very important for the competitiveness of seaports. A huge majority of cluster experts agrees that hinterland access is to some extent a 'collective

action problem' and an effective regime will not develop spontaneously. Coordination and the formation of various sorts of coalitions are required. The HAR in Rotterdam is judged as being more effective than the regimes in Durban and the LMPC. This judgment is consistent with the description of the regimes: in Durban, coalitions have hardly developed, in the LMPC, the formation of a coalition has been started recently.

In all three port clusters, opportunities to improve the HAR have been identified, on the basis of interviews and desk research. These initiatives are summarized in Table 62.

Table 62: Initiatives to improve the HAR in the three cases

Port cluster	Opportunity to improve the HAR
LMPC	Market intelligence
	Regional coordination of rail services
	Container on barge
Durban	Coalition to lease equipment to Spoornet, and manage deployment
Rotterdam	Automated road transport
	Coalitions to improve intermodal accessibility

11.4.3   Marketing and promotion

Table 63 shows the expert evaluation of the quality of the marketing and promotion regime in the three cases:

Table 63: Expert evaluation of the quality of the marketing and promotion regime

Variable	Rotterdam	Durban	LMPC
Leader firms	0.5	-0.5	-0.2
Organizational infrastructure	1.3*	-0.8	-0.2
Public actors	1.4	-0.2**	1.3***
Community argument	0.2****	0.1	-0.2
Voice	0.7	-0.5**	0.9***
Overall score	0.7	-0.7	0.2

Average scores on a scale from –5 (very bad) to +5 (very good)

*	Significantly higher score than in other two port clusters
**	Significantly lower score than in two other port clusters
***	Significantly higher score than average of all factors in same port cluster
****	Significantly lower average judgment of all factors in same port cluster

On the basis of these results, the following conclusions can be drawn:

- The marketing and promotion regime in Durban is the worst of the three cases, especially because public actors 'underperform' compared to the other cases and there is a lack of voice.

- The role of public actors in Rotterdam and the LMPC is appreciated.

- The organizational infrastructure in Rotterdam is in place, in contrast to both other ports.

- In general, the community argument is not present in the marketing and promotion regime. Firms are not willing to invest in marketing for the port community as a whole.

The marketing and promotion regime in the LMPC

The five port authorities in the LMPC promote their jurisdiction. The port of New Orleans is the most active in marketing. Until recently, private firms from the LMPC were not involved in joint marketing efforts. As a consequence, the LMPC as a whole is not well marketed. With a

change in the top management of the port authority of New Orleans, more emphasis is placed on joint marketing with the business community. However, marketing efforts still focus on the 'New Orleans jurisdiction' not the whole cluster. For instance, three port authorities (New Orleans, Baton Rouge and South Louisiana) issue a 'port partners' brochure, with partners from their jurisdiction. This is a clear lack of coordination.

Two initiatives to improve the marketing regime have developed, but the marketing and promotion regime is still (winter 2003) weakly developed. The first one is the project to improve the market intelligence, discussed in the preceding paragraph.

Second, the port authorities have agreed to cooperate in marketing. The five port authorities compete with other Gulf ports, such as Houston, Galveston and Mobile. The LMPC even competes with ports on the east and west coast: the Mid West can be served by the LMPC (via the Mississippi) and by ports on both coasts of the USA. The focus on internal competition has prevented cooperation to market common strengths vis-à-vis competing ports. This new initiative could improve the marketing regime in this respect.

Currently, the position of the LMPC as the premier gateway to the USA and possibly the world's largest port complex in tonnage, is not widely known or appreciated. Joint marketing initiatives could be an effective way to attract more cargo to the LMPC. The five port authorities have recently agreed on a joint marketing initiative. The practical implications of this agreement are still unclear, but the agreement is a step towards a more effective marketing and promotion regime.

The marketing and promotion regime in Durban

In Durban, port marketing and promotion is regarded as a relatively unimportant regime. Other regimes, especially the hinterland access regime and training and education regime are more important. In the South African context, marketing is not as important as in other port ranges, because Durban is by and large the dominant port, and relatively widely known. Port marketing is more of an issue for the relatively small competitors of Durban, such as Maputo and Port Elisabeth.

Portnet Durban carries out port marketing for Durban. Private firms do not cooperate to improve the brand name and reputation of Durban and are hardly involved in the marketing and promotion regime.

One opportunity to improve the marketing and promotion regime would be the creation of a coalition to attract new investments in South Africa. The 'geography of production' in South Africa is changing. As a consequence of the integration of South Africa in the global economy, most new production facilities are export oriented. This provides opportunities for port regions. All actors in the port cluster benefit from new activities in logistics and manufacturing. However, such a coalition has not yet materialized.

The marketing and promotion regime in Rotterdam

Table 64 shows the relevant initiatives/ investments in Rotterdam's marketing and promotion regime.

Table 64: Initiatives/investments in Rotterdam's marketing and promotion regime

Mode of coordination	Relevant initiatives/investments
Hierarchies	ECT is active in marketing Rotterdam as 'the gateway to Europe' for containers.
Interfirm alliances	Interfirm alliances do not play a role in this regime.
Associations	Deltalinqs, the port cluster association, and the member associations of Deltalinqs play a limited role in the marketing and promotion regime. Deltalinqs invest in 'public relations' in order to get a 'license to operate'. Deltalinqs occasionally has marketing activities abroad.
	Deltalinqs was involved in mapping opportunities for co-siting in the petro-chemical industry. This has led to an overview of co-siting opportunities and enables specific marketing efforts.
Public-private partnerships	The Rotterdam Port Promotion Council (RPPC) is an association specifically developed for the marketing and promotion of the port of Rotterdam. About 300 firms are member of the organization. Since RPPC also receives funding from the RMPM, it is a public private partnership. The organization focuses on attracting cargo to the port and organizes marketing tours and host representatives from shippers.
Public organizations	RMPM has developed a network of Rotterdam representatives in important markets, both overseas and in the hinterland. These representatives develop contacts with shippers and promote the interests of the port of Rotterdam.

The RPPC and the RMPM contribute most to the marketing and promotion regime. Both organizations invest substantially in marketing and promotion. The institutional structure of the RPPC has the advantage that a part of the RMPM's marketing budget is transferred to

the private sector, with 'financial matching' by the private sector and more involvement as most important benefits.

Even though investments in the marketing and promotion regime in Rotterdam are substantially higher than in the other two cases, the evaluation of the marketing and promotion regime is not positive. In the open interviews experts indicate that they doubt whether RPPC's 'traditional' activities are still effective, given the increasing role of ICT and rationalization of supply chain management. In this view, the RPPC has to pay more attention to 'strategic decision-makers' and less to operational transport and logistics managers.

The marketing and promotion regime; conclusions from the cases

The experts indicate that an effective marketing and promotion regime is important for the performance of the port cluster. The quality of the marketing and promotion regime improves when a specific organizational infrastructure is created. Rotterdam is the only port where such an infrastructure has developed. The marketing and promotion regime in the three ports is judged as moderate. On the basis of interviews, the following opportunities to improve the regime have been identified:

Table 65: Opportunities to improve the marketing and promotion regime in the cases

Port cluster	Opportunity to improve the marketing and promotion regime
LMPC	Improve market intelligence.
	Cooperation between port authorities to position the LMPC as 'gateway for the Mid-West' and USA's largest port complex.
Durban	Coalition to market Durban as location for port related manufacturing and logistics activities.
Rotterdam	Transforming marketing efforts away from 'operational transport managers' towards strategic decision makers.

11.4.4   Training and education

Table 66 shows the expert evaluation of the quality of the training and education regime in all three cases:

Table 66: Expert evaluation of the quality of the training and education regime

Variable	Rotterdam	Durban	LMPC
Leader firms	1.6*	-0.3	-1.9**, ****
Organizational infrastructure	2.0*, ***	-0.4	-1.3
Public actors	0.8	0.2	-0.8
Community argument	1.1	0.7	-1.0**
Voice	1.0*	-0.6	-0.4***
Overall score	1.1*	-0.1	-1.1**

Average scores on a scale from –5 (very bad) to +5 (very good)

*   Significantly higher score than in other two port clusters

**   Significantly lower score than in two other port clusters

***   Significantly higher score than average of all factors in same port cluster

****   Significantly lower average judgment of all factors in same port cluster

The following conclusions can be drawn on the basis of these figures:

- The training and education regime is the best developed in Rotterdam and the worst in the LMPC.

- The main strength of Rotterdam's regime is the quality of the organizational infrastructure.

- The main shortcoming of the LMPC's regime is the lack of leader firms. Firms put the issue on the agenda, but firms are not willing to invest in the training and education regime.

- The training and education regime in Durban is 'moderate' across the board.

The training and education regime in the LMPC

Apart from operational 'training-on the job' there are no specific education programs in transport and logistics[92]. In the past, an initiative to develop an education program for the firms in the cluster failed to materialize, because of the lack of commitment from firms in the industry and a lack of demand for such education services. The experts indicate that training and education is a collective action problem and important for the performance of the LMPC, but at the same time 'lessons learned' make all actors reluctant to invest in improving the training and education regime.

---

[92]   The Port of New Orleans organized a training program for foreign port managers, especially from developing countries, but this program is more relevant in the internationalization regime, since it does not improve the quality of the LMPC labor market.

The train*ing and education regime in Durban*

The training and education regime in Durban is regarded as very important by the experts. The involvement of various organizations is given in Table 67.

Table 67: Relevant initiatives/ investments in Durban's training and education regime

Mode of coordination	Relevant initiatives/investments
Hierarchies	Firms have an incentive to invest in the training of their employees. The firms mostly contract education suppliers individually.
Interfirm alliances	Interfirm alliances do not play an important role in the training and education regime.
Associations	In Durban the associations play a limited role. They do not engage in 'collective bargaining' for their members, nor do they strive to improve the education infrastructure.
Public-private partnerships	No public private partnerships have developed yet, the Portnet Academy (see below) could become such a venture.
Public organizations	The Portnet Academy has the ambition to become the central provider of cluster related training and education. Currently, the Academy only trains the Portnet labor force. Training programs from basic vocational training to specific short courses in port management are offered.
	The university of Natal offers port related education programs, amongst others an MBA. The university has good links with firms in the port cluster.

The key issue in the training and education regime in Durban is the quality of the 'education infrastructure'. For higher education, this infrastructure is good: the University of Natal offers a port related master program. On the vocational level the training infrastructure is poor, as no institution offers good port related training programs. Given the incentives for firms to invest in training, collective action to make sure that these investments lead to a better education infrastructure, is an opportunity to improve the training and education regime. To set up this initiative, strong leader firm involvement is central, but (still) lacking.

The training and education regime in Rotterdam

The main characteristics of the training and education regime are given in Table 68.

Table 68: Initiatives/ investments in Rotterdam's training and education regime

Mode of coordination	Relevant initiatives/investments
Hierarchies	Huntsman and Shell are leader firms for training in the chemical industry. They put efforts in a joint training facility.
Interfirm alliances	Interfirm alliances are of limited importance in this regime
Associations	Associations, especially Deltalinqs, invest in the quality of the training and education infrastructure, for instance through sponsorship of the chair port economics at Erasmus University Rotterdam.
	Deltalinqs also plays a role in finding resources for the 'education and information center' and the 'process college' (see below for a description of both initiatives).
	Third, Deltalinqs is involved in setting up a 'young roundtable' for young 'high potentials' in the port, in order to improve learning and networking and create an environment fertile for the 'creative class' to work in.
Public-private partnerships	Education and information center (EIC, http://www.eic-mainport.nl/) hosts visits from students of all ages and arranges company visits of schools to firms in the port. The center also provides educational material for primary schools.
	Process college (http://www.processcollege.nl/) a public private partnership to provide training for process operators in the chemical industry. The partners are four schools and the chemical industry in the port.
	Knowledge infrastructure mainport Rotterdam (KMR, http://www.kmr.nl/), is a 'network organization' aiming to free up resources to invest in training and education infrastructure. All relevant stakeholders are represented in the organization. KMR aims to develop/support coalitions, not to provide training. The process college' and EIC are 'spin-offs' of KMR.
Public organizations	The training and education infrastructure is relatively good and consists of at least five education providers, four of which cooperate under the name 'Rotterdam Transport Schools'.
	The RMPM finances university chairs in port economics (together with Deltalinqs) and in cargo handling technology. RMPM also made money available for a 'training and education fund' for the cargo handling industry, provided the private sector also invests. No initiatives to use the fund have developed.

Table 68 shows that the training and education regime consists of a large number of initiatives. Various coalitions are formed to improve the quality of the training and education infrastructure, and to increase the attractiveness of working in the port cluster. The large number of initiatives can be explained by the scarcity of well-trained labor in some segments

of the labor market, especially for vocational technical training. The coalitions are successful: the region has become the center of training for many port related functions.

The training and education regime in Rotterdam has *not* been successful with regard to a second, and more difficult objective: the re-training of 'redundant' port workers. Due to containerization, the labor requirements in the cargo handling industry have diminished rapidly. Labor mobility is required to reduce this redundancy. In the Dutch context, forced mobility (firing employees) is very expensive. A program to re-train employees for enrolment outside the cargo handling industry could be an instrument to solve the labor redundancy. In Rotterdam, this has not been successful, with as a consequence persisting labor problems. Given the fact that labor costs are important in the cargo handling industry, this hampers Rotterdam's performance (De Langen et al, 2003).

The training and education regime; conclusions from the cases

Huge differences in the training and education regime can be observed. In the LMPC, coalitions are hardly created and even though the potential benefits of collective action are recognized, actors are reluctant to invest (time) in improving the regime. In Rotterdam, the formation of coalitions is almost a routine. Various initiatives have been set up and add to the quality of the regime. Local and national governments play an 'enabling role' in this regime by providing funds. The organizational structure of this regime in Rotterdam is interesting: it is the only example where one organization (KMR) is specifically set up to *improve* the quality of the regime. The - stylized - role of KMR is visualized in Figure 16.

Figure 16: The regime manager in Rotterdam's training and education regime
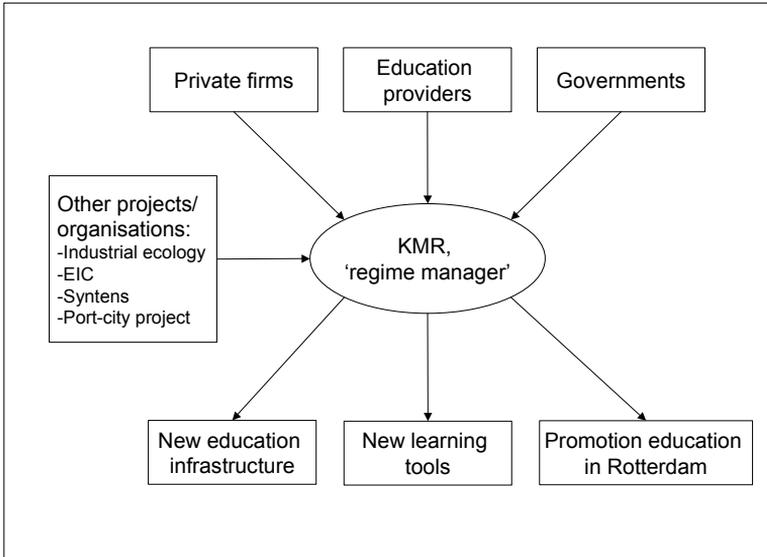
In other cases, such a 'regime manager' could be instrumental for improving the quality of the training and education regime. Opportunities to improve the regimes in the three cases are given in Table 69.

Table 69: Opportunities to improve the training and education regime

Port cluster	Opportunities to improve the training and education regime
LMPC	Initiative to attract external resources to improve the regime.
Durban	Collective action to improve the training and education infrastructure.
Rotterdam	Re-training to solve labor redundancy problems.

11.4.5   The Innovation regime

Table 70 shows the expert evaluation of the quality of the innovation regime in all three cases.

Table 70: Expert evaluation of the quality of the innovation regime

Variable	Rotterdam	Durban	LMPC
Leader firms	1.5***	1.0***	-0.8**
Public actors	0.1	-0.3	-0.5
Organizational infrastructure	0.8	0.1	0.4
Community argument	-0.8****	0.7*	-0.8
Voice	0.0	-0.5****	0.7***
Overall score	0.2	0.2	-0.2

Average scores on a scale from –5 (very bad) to +5 (very good)

*	Significantly higher score than in other two port clusters
**	Significantly lower score than in two other port clusters
***	Significantly higher score than average of all factors in same port cluster
****	Significantly lower average judgment of all factors in same port cluster

These figures lead to the following conclusions:

- The innovation regime is perceived as moderate in all three cases. Strengths and weaknesses differ between the cases.

- In Rotterdam, the involvement of leader firms is relatively good, the main shortcoming is the lack of a 'community argument'.

- In Durban, the leader firm involvement is also a positive factor, the weakness is the lack of voice: firms are not expressing innovation needs.

- In the LMPC, the voice is relatively good, but as is the case with some other regimes, leader firms are lacking and public organizations do not play a leading role.

The innovation regime in the LMPC

The innovation regime in the LMPC is not effective. The scope of coordination is very limited. The firms in the cluster are mostly operational branches without budgets for

innovation. Furthermore, knowledge centers are absent. This is partly because the business environment is not conducive for innovation. The University of New Orleans has technology transfer programs and is a recognized knowledge center. However, it is hardly involved in the port cluster. Port related firms are also hardly involved in the Louisiana Technology Council.

Finally, public funding for investments in R&D is missing. Such funding is necessary given the 'empty pockets' and cost-focus of firms in the LMPC. Two opportunities to create an innovative coalition are innovation in barge shipping and Sea Point.

Innovation in barge shipping

In the section on the hinterland access regime the challenge of creating a system of container-on-barge was discussed. Container on barge is problematic because of its 'systemic nature': it is only viable when sufficient volumes are attracted. Given the advantages of container on barge vis-à-vis road transport - less congestion, environmentally friendly, low costs per kilometer - container on barge is an opportunity. Grasping this opportunity requires cooperation, coordination and *innovation*. A - federally funded - innovation project to simultaneously assess the market potential for container barge shipping and develop innovative solutions to overcome the disadvantages of inland shipping, such as the low speed, the high costs of handling the cargo in ports and imbalanced cargo flows, would greatly improve the quality of the innovation regime in the LMPC.

Sea Point

The most innovative idea in the LMPC is the Sea Point project. Sea point is a small artificial island for transhipping containers from sea-going vessels to barges. The fact that in this concept no landside infrastructure is required is a huge advantage, compared to a traditional terminal, because constructing infrastructure to the mouth of the Mississippi is very expensive. The offshore terminal would complement the existing terminal in New Orleans, since a large part of the cargo would have to be moved to a terminal with rail and road connections.

Two retired industry experts developed the Sea Point idea. The project, even though clearly a contribution to the competitiveness of the LMPC, did not receive any institutional support.

On the contrary, various firms in the LMPC oppose the project and some port authorities are also skeptical. This illustrates the shortcomings of the innovation regime in the LMPC: no institutional support for innovative ideas and an environment not conducive for innovation. In this context, one expert remarked: 'if someone is fired in Houston, he/she starts a new firm, if someone is fired in the LMPC, he/she moves to Houston'.

The innovation regime in Durban

The innovation regime in Durban is at best moderate. The scope of coordination is limited. The experts in Durban have realistic ambitions: Durban is not positioned to develop innovations. The firms in the cluster are mostly part of internationally operating firms, with limited involvement in innovation. The ambition is to become an 'early adopter' in the African context.

Given this ambition, an opportunity is to encourage the knowledge transfer between large, internationally operating leader firms and local firms that are related to these leader firms. Such a project enables these local firms to become early adopters. Such a project also could also support the empowerment of the 'previously disadvantaged' (mainly black South Africans), an important policy objective in the South African context.

The innovation regime in Rotterdam

The innovation regime in Rotterdam is moderate, according to the experts. The port is not an 'innovation prone environment', even though some of the conditions for such an environment are fulfilled: knowledge centers are present (especially the Technical University and the national research center TNO in Delft, and Erasmus University in Rotterdam), government subsidies for innovation projects are available, and organizations that encourage innovation and knowledge transfer are present. Furthermore, the port authority encourages and initiates innovative projects.

The experts frequently mentioned four explanations for the relatively bad regime given the favorable conditions. First, profit margins of the majority of firms in the cluster are small. The industry is to a large extent cost driven and not willing or able to free up resources for innovation. Second, cooperation proves to be very difficult. Firms in the port cluster are not willing to share information and knowledge. The threat of opportunistic behavior prevents cooperation. Third, even though governments (national and regional) encourage innovation,

they focus on 'systemic' technological innovations whereas the majority of firms do not posses the organizational capabilities and market position to engage in such projects. Fourth, some experts argue that past experiences have an influence: in the past innovative projects, especially in the field of ICT-applications, were not successful. This makes it difficult to create coalitions for new innovative projects.

In this respect, it is important to make a distinction between the port related manufacturing activities on the one hand and cargo handling, transport and logistics firms on the other. The manufacturing firms cooperate better. Perhaps the most important coalition in petro-chemical manufacturing is the coalition of chemical firms and various public organizations to encourage the development of 'industrial ecology' (INES, see http://www.inesmainport.nl). This coalition did invest substantially in projects and investigates the viability of others.

The innovation regime; conclusions from the cases

The innovation regime is the most problematic regime. The quality of this regime is regarded as moderate in all three cases. Experts indicate creating coalitions is difficult. Two reasons for these difficulties were identified in all cases. First, financial resources to develop innovative capabilities are lacking, due to the limited returns on investment in the port and the cost-focus of most firms.

Second, firms in the port cluster have difficulties with cooperation in networks on the basis of trust. The port industry is not a high trust industry. Conflicts related to the distribution of potential benefits obstruct cooperation to realize those benefits.

An effective innovation regime is difficult to develop in such a cluster. It has become clear from the cases that without port authority involvement and public funding a good innovation regime does not arise. It has also become clear that in any innovation regime *adoption* is central. Firms in the port cluster adopt technologies developed outside the port cluster (examples are ICT, the use of new materials, new communication systems, and the like). This is hard to reconcile with the need for public funding, since such funds are generally for knowledge development, not for adoption.

11.4.6   The internationalization regime

The internationalization regime is regarded as the least important of the five regimes analyzed in this study. Table 71 shows the expert evaluation of the quality of the internationalization regime in the three cases:

Table 71: Expert evaluation of the quality of the internationalization regime

Variable	Rotterdam	Durban	LMPC
Leader firms	1.3*,***	-1.0****	-0.5****
Public actors	0.2	0.5	0.4
Organizational infrastructure	1.1	-0.9**	0.8
Community argument	-0.4****	0.9*	0.1
Voice	-0.1	0.5	0.5
Overall score	0.4	-0.1	0.2

Average scores on a scale from –5 (very bad) to +5 (very good)

*	Significantly higher score than in other two port clusters
**	Significantly lower score than in two other port clusters
***	Significantly higher score than average of all factors in same port cluster
****	Significantly lower average judgment of all factors in same port cluster

The following conclusions can be drawn on the basis of these figures:

- The internationalization regime is moderate in all three cases.

- In Rotterdam, the majority of experts do not regard internationalization as a CAP. Some leader firms do encourage internationalization of other firms. The organizational infrastructure is relatively good.

- In Durban, the regime is moderate, due to the lack of leader firm behavior and organizational infrastructure.

- In the LMPC, the organizational infrastructure is relatively good, the lack of leader firms is (again) a shortcoming of the regime.

The internationalization regime in the LMPC

In the LMPC the World Trade Center (http://wtcno.org/) is the most important institution in the internationalization regime. The WTC promotes international trade and more generally, the internationalization of the members of the WTC. For this purpose seminars, courses (including language courses) and business trips are organized. The WTC has a broad membership base.

Metrovision, a public private partnership of greater New Orleans, used to organize trade missions. However, the effects were hard to quantify, and the willingness to participate by the business community remained limited; hence, these activities were discontinued. Metrovision now works on a project basis. Even though they still promote the internationalization of firms, the scope has been reduced.

The internationalization regime in Durban

Most firms in Durban engage in internationalization on their own. Even though the experts indicate that some sort of collective action would be in the interest of all actors in the port cluster, no arrangements to coordinate internationalization have been created. Hence, the organizational infrastructure is underdeveloped. Internationalization is important in the South African context. The dominant 'mode of internationalization' is the inclusion of South African firms in international networks. The leader firms are generally well-positioned in international networks, but not willing to include other South African firms. The associations do not play an important role: firms from the cluster do not cooperate to visit foreign trade fairs.

The internationalization regime in Rotterdam

The majority of experts indicate that internationalization is not a CAP. Firms have individual internationalization strategies, coalitions for joint internationalization efforts are not regarded as important. Only for one specific segment of the cluster, firms that are active in port consultancy and training, is a coalition for joint internationalization formed. This coalition, Rotterdam Maritime Group (http://www.port.rmg.nl/) is a 'networking device' and an umbrella to jointly tender for contracts.

The RMPM encourages internationalization by organizing and hosting trade missions. Furthermore, Rotterdam representatives can support the internationalization of firms from

the port cluster. Thus, even though internationalization is not regarded as a CAP, in specific cases collective arrangements are created.

The internationalization regime; conclusions from the cases

The majority of experts indicate that internalization is a collective action problem. Consequently, collective arrangements add to the quality of the internationalization regime. However, the three case studies show that only one port specific arrangement, the Rotterdam Maritime Group exists. In all the other regimes, firms hardly cooperate in the field of internationalization. Even though the experts indicate that some sort of 'community spirit' in a cluster would enable the internationalization in the cluster, there is no clear set of possibilities for collective action. Suggestions include:

- Large firms enabling the internationalization of small firms.

- Collective representation in foreign trade fairs.

- Collective learning of international developments, for instance through seminars.

Even though these suggestions have been made and in some cases firms have grouped together, the benefits of collective action are small compared to some of the other regimes.

11.5   The importance of the variables related to cluster governance

One survey question addresses the issue of the importance of the four variables related to the governance of the cluster. The experts were asked to rank these variables from 1 (most important) to 4 (least important). Table 72 shows the results.

Table 72: The importance of the four governance variables

Variable	Importance Durban	Importance Rotterdam	Importance LMPC	Importance Overall
Presence of trust	1.8	1.7	1.7	1.7*
Presence of leader firms	2.2	2.0	2.4	2.1*
Collective action regimes	2.3	2.8	2.7	2.5*
Presence of intermediaries	3.7	3.5	3.3	3.5*

Average scores on a scale from 1 (most important variable) to 4 (least important variable)

*   significantly different from other average scores

The experts from across the cases agree on the relative importance of the four governance variables: the ranking is very similar in all three cases. Trust is the most important variable for the quality of the cluster performance. The presence of intermediaries is by far the least important variable. Leader firms and collective action regimes are second and third.

11.6   Conclusions: cluster governance and performance

Table 73 summarizes the most important conclusions on the relation between the structure of a cluster and the performance of that cluster.

Table 73: Research findings on cluster governance and performance

Issue	Research finding
Trust	Trust is the most important variable for the quality of the governance of the cluster. Ports are not regarded as high trust environments.
Intermediaries	The presence of intermediaries is the least important variable for the quality of the governance of the cluster.
	A relatively large part of large firms do not agree intermediaries improve the quality of cluster governance.
	Cargo related intermediaries are more important than *ship related* intermediaries.
Leader firms	Leader firms contribute to the quality of cluster governance.
	In all three cases, leader firm behavior takes place.
	Leader firms make their international knowledge/networks available for local firms in the cluster.
	Leader firms improve the quality of collective action regimes.
Collective action regimes	The five collective action regimes (innovation, training and education, marketing and promotion, hinterland access and internationalization) are relevant in seaports.
	Hinterland access is the most important regime and very important in all three cases.
	Internationalization is the least important regime.
	The role of public actors, the infrastructure for collective action and the role of leader firms are especially important for the quality of collective action regimes.
	None of the studied regimes (15 in total) is evaluated very positively, for all regimes opportunities for improvement are present.
	Innovation is the most difficult regime, because of need for cooperation and funding.

12 ANALYZING STRENGTHS AND WEAKNESSES OF SEAPORT CLUSTERS

In the preceding two chapters, the results of the case studies were discussed. The results confirm the relevance of the variables of the performance of a cluster. Furthermore, the relative importance of the variables has been discussed.

In this chapter, a comparative analysis of the strengths and weaknesses of the three cases is made. The strength and weaknesses are related to available performance indicators. As discussed in the theoretical part, the best indicator would be the value added generated in the cluster, but this figure is only available for Rotterdam and Antwerp. Thus, a volume performance indicator is used for the other ports. As discussed in the theoretical part, the aim is not to establish causal relationships between variables and performance, the analysis is meant as a test to see whether the 'big picture' derived from the case studies is in line with the performance indicators.

Rotterdam is compared with Antwerp and Hamburg, Durban is compared with Richard's Bay and the LMPC is compared with Houston. The case study port is also compared with the *average* of the six other ports as a 'benchmark'. However, since the respondents of the three cases have different 'frames of reference' the results of this comparison are questionable. Therefore, this comparison is only made to find out whether a strength or weakness of a port compared to its competitor(s) is also a strength or weakness compared to the average of the six other ports.

The experts in a port were asked to evaluate the quality of each variable (13 in total) on a scale from –5 (very bad) to +5 (very good), for the case study port and the competing port(s). This provides the basis for an assessment of strengths and weaknesses of the port clusters in the three cases. Not all experts were knowledgeable about all the variables in competing ports. When experts did not have an informed opinion, the question was left open. The number of experts that evaluated the ports is given in Table 74. The figures show that between 70% and 85% of the experts felt knowledgeable enough to make an assessment of the competing port(s).

Table 74: Number of experts that assessed strengths and weaknesses

Port	Number of experts
Rotterdam	42
Antwerp	35
Hamburg	29
Durban	32
Richard's Bay	26
The LMPC	30
Houston	22

First, differences between the port regions North-West Europe, US Gulf and Southern Africa in general are discussed. These differences should be treated with some precaution: different points of reference might explain the differences in outcomes.

Table 75: Differences in assessments between ports in three regions

Variable	Average North-West Europe	Average US Gulf	Average Southern Africa	Overall
The presence of customers and suppliers	2.6	1.7**	2.5	2.4
The presence of knowledge spillovers	2.3	1.9	1.8	2.1
The diversity of the cluster population	2.3	1.8	2.0	2.1
The presence of embedded leader firms	2.0	2.1	1.9	2.0
The presence of a labor force	1.6	2.1	1.9	1.8
The presence of a culture of trust	1.4**	2.3	2.1	1.8
The quality of collective action regimes	1.6	1.4	2.5*	1.8
The presence of internal competition	0.9	2.5*	0.8	1.3
The presence of intermediaries	2.1*	0.4	0.5	1.2
The level of land prices and office rents	0.1	1.1	0.6	0.5
The presence of cluster exit barriers (immobile staff and fixed investments)	0.1	1.4*	0.1	0.5
The level of congestion	0.2	1.1*	-0.4	0.3
The presence of cluster entry barriers (access to local knowledge, networks and capital)	-0.2	1.1*	-0.5	0.0

Average scores on a scale from –5 (very bad) to +5 (very good)

*   Significantly higher score than in other two regions

**   Significantly lower score than in two other regions

These figures show that the USA Gulf ports (LMPC and Houston) differ from the other ports in this study in several aspects. First, the level of internal competition is higher. Second, and closely related, entry barriers are lower (the evaluation is more positive). These two variables are in line with expectations: in both Gulf ports the public port authority is less deeply involved (private land ownership, no operational involvement, less involvement in planning) and markets work more freely.

The North-west European ports are well endowed with intermediaries. This can be explained by the relative importance of international transport compared to domestic transport. In the United States, domestic transport is dominant. As a consequence ports, that generally accommodate international transport, are less important in logistics chains.

The North-west European ports are relatively 'low trust environments'. The validity of this research outcome is questionable, since especially trust is evaluated by the experts given

the national background. It can be argued that in North-west Europe ports are low trust environments given the national context, but not necessarily more low trust than African or US Gulf ports. A similar reservation is relevant for the research outcome that collective action regimes are especially well developed in South African ports.

12.1   Strengths and weaknesses of Rotterdam's port cluster

Table 76 shows the score of Rotterdam compared to the scores of Hamburg (H) and Antwerp (A). The average score of the 6 port clusters is used to analyze whether strengths and weaknesses apply when related to ports outside the competitive environment. The variables are ranked from weaknesses to strengths.

Table 76: Strengths and weaknesses of Rotterdam's port cluster

Variable	R	H	A	Conclusion
The level of land prices and office rents	-1.5	-0.2	1.9	Significantly worse than Antwerp, Hamburg and the average of 6 ports
The quality of collective action regimes	1.0	1.6	2.2	Significantly worse than Antwerp and average of 6 ports
The presence of a labor force	1.4	1.0	2.3	Significantly worse than Antwerp
The presence of a culture of trust	0.8	1.7	1.8	
The presence of internal competition	0.9	0.5	1.4	
The presence of cluster exit barriers (immobile staff and fixed investments)	0.2	-0.3	0.4	
The presence of cluster entry barriers (access to local knowledge, networks and capital)	0.1	0.9	0.2	
The level of congestion	0.2	0.8	-0.4	
The presence of embedded leader firms	2.0	1.5	2.3	
The presence of intermediaries	2.1	1.7	2.5	
The diversity of the cluster population	3.0	1.3	2.4	Significantly better than Hamburg and average of 6 ports
The presence of customers and suppliers	3.0	2.0	2.6	Significantly better than Hamburg and average of 6 ports
The presence of knowledge spillovers	2.7	2.2	2.0	Significantly better than Antwerp and average of 6 ports

Average scores on a scale from –5 (very bad) to +5 (very good)

*   Significantly higher score than in other two regions

**   Significantly lower score than in two other regions

The results show that the *level of land prices and office rents* is a serious weakness for the port of Rotterdam. Furthermore, the *collective action regimes* are a weakness, compared to Antwerp and the average score of ports. Third, the *labor pool* is a weakness of Rotterdam.

The strengths of Rotterdam's port cluster are the diversity of the cluster population, the presence of customers and suppliers and the presence of knowledge spillovers. These are relatively 'advanced' strengths: they are not easy to copy by competing ports.

Two indicators of the performance of the port of Rotterdam are available: first the market share of Rotterdam in the throughput in the Hamburg Le Havre range. This market share is given in Table 77.

Table 77: Changes in market share of Rotterdam 1989-2001

Year	1989	2001
Total throughput	43,1	36,6
Agribulk	47,2	31,7
Ores and scrap	45,1	44,5
Coal	35,1	34,0
Oil	62,0	53,7
Chemical products	40,0	28,8
Roll on/roll off	23,2	22,9
Containers	39,9	28,9
Other breakbulk	21,2	17,9

Source: RMPM (2003)

The evolution in market shares for containers is given in Table 78.

Table 78: Market shares major North European ports in container throughput

Year	R'dam	Hamburg	Antwerp	Bremen	Le Havre	Zeebrugge
1991	38%	20%	17%	12%	8%	4%
1992	39%	20%	17%	11%	6%	6%
1993	38%	21%	16%	11%	7%	5%
1994	40%	22%	18%	12%	6%	5%
1995	37%	21%	18%	11%	6%	5%
1996	36%	21%	20%	11%	6%	4%
1997	36%	21%	20%	11%	7%	5%
1998	35%	21%	20%	10%	7%	5%
1999	34%	21%	20%	11%	7%	5%
2000	31%	22%	21%	13%	7%	6%
2001	29%	23%	22%	14%	7%	5%

Source: RMPM, 2003

Figures on the value added generated in Rotterdam's port cluster are given in Table 79.

Table 79: Value added generated in the Rotterdam's port cluster

Year	Value added in € million	Cargo throughput in million ton	Value added (€ per ton)
1987	4,460	255	17,5
1990	5,492	288	19,0
1993	5,431	282	19,2
1996	5,334	288	18,5
1999	5,904	300	19,7
2000	7,451	318	23,4
2001	7,611	314	24,2

Source: Nationale Havenraad, 2003

A comparison can be made between the performance of the port clusters in Rotterdam and Antwerp. For both ports figures on the value added and throughput volume are available. Figure 17shows the evolution of the value added per ton cargo.

Figure 17: Relation between value added and volume in Rotterdam and Antwerp
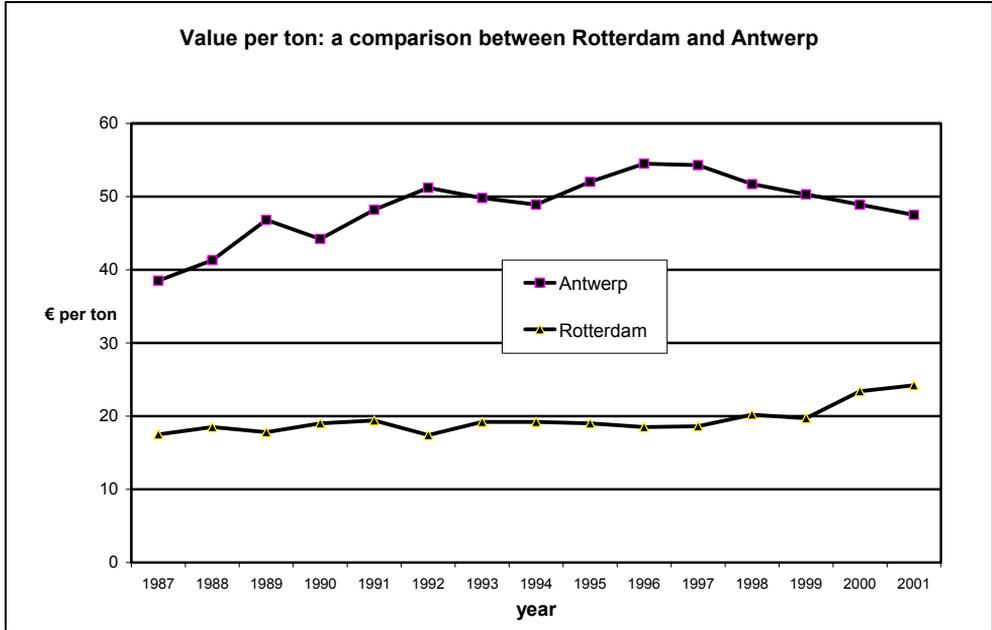
These figures show that Rotterdam's port cluster did not perform very well in terms of throughput performance: market share was lost in most commodities to other ports. Especially Antwerp gained substantial market share between 1995 and 2001. However, in terms of value added generated in the cluster, the performance of Rotterdam was relatively good: while the value added per ton declined in Antwerp from 1996 to 2001, it rose in Rotterdam in the same period. This conclusion can be related to the strengths and weaknesses of the port of Rotterdam, and allows a provisional conclusion: Rotterdam's weaknesses (high land prices and lower quality of the labor pool) have especially had an impact of throughput volumes, while its strengths (input-output relations, knowledge spill-overs and diversity) have secured a relatively good performance in value added.

12.2   Strengths and weaknesses of Durban's port cluster

Table 80 shows the score of Durban's port cluster compared to the score Richard's Bay (RB) and the average score of the 6 port clusters.

Table 80: Strengths and weaknesses of Durban's port cluster

Variable	D	RB	Research findings
The level of congestion	-2.1	1.8	Significantly worse than in Richard's Bay and other 6 ports
The level of land prices and office rents	-1.3	3.1	Significantly worse than in Richard's Bay and other 6 ports
The presence of intermediaries	-0.6	1.7	Significantly worse than in Richard's Bay and other 6 ports
The presence of a labor force	2.2	1.5	
The presence of cluster entry barriers (access to local knowledge, networks and capital)	-0.6	-0.3	
The presence of cluster exit barriers (immobile staff and fixed investments)	0.2	0.0	
The quality of collective action regimes	2.6[93]	2.3	
The presence of knowledge spillovers	2.5	0.9	Significantly better than in Richard's Bay
The diversity of the cluster population	3.3	0.4	Significantly better than in Richard's Bay and other 6 ports
The presence of a culture of trust	3.2	0.8	Significantly better than in Richard's Bay and other 6 ports
The presence of customers and suppliers	3.4	1.5	Significantly better than in Richard's Bay and other 6 ports
The presence of embedded leader firms	2.8	0.6	Significantly better than in Richard's Bay and other 6 ports
The presence of internal competition	1.9	-0.5	Significantly better than in Richard's Bay

Average scores on a scale from –5 (very bad) to +5 (very good)

*   Significantly higher score than in other two regions

**   Significantly lower score than in two other regions

The weaknesses of Durban's port cluster are first the level of congestion, second the level of land prices and office rents and third the presence of intermediaries.

---

[93]   This score is very high compared to the evaluation of the five regimes: compared to Richard's Bay the quality is good, but a comparison with the other cases would be misleading.

The port cluster of Durban possesses various strengths. First, the level of internal competition is high, compared to Richard's Bay. Second and third, Durban is more diverse and has more knowledge spill-overs than Richard's Bay. Fourth, the level of trust is high; fifth, Durban is well endowed with leader firms; and sixth, relatively many customers and suppliers are present in Durban.

These strengths and weaknesses show that Durban is a strong cluster. The cluster economies are stronger in Durban than in Richard's Bay. However, the concentration of cluster activities has led to diseconomies of high land prices and congestion. Addressing those two weaknesses is a central challenge for improving Durban's performance. Only data on container throughput and overall throughput are available. Both are given in Table 81.

Table 81: Market share of Durban, total throughput and containers in South Africa

	Total cargo (tons)					Containers (TEU)		
Year	Durban	Richards Bay	Saldanha	Cape town	Port Elizabeth	Durban	Cape town	Port Elizabeth
1990	24.4%	49.9%	15.6%	4.9%	4.0%	68.0%	19.6%	10.0%
1991	23.4%	52.7%	145.0%	5.1%	3.5%	68.5%	20.1%	9.0%
1992	22.9%	52.7%	14.1%	5.3%	3.7%	65.4%	21.7%	10.4%
1993	20.4%	55.6%	15.4%	4.8%	2.9%	66.7%	21.2%	9.8%
1994	19.8%	53.3%	16.1%	5.7%	3.1%	65.5%	21.0%	10.8%
1995	19.3%	54.6%	16.2%	5.5%	3.7%	63.7%	22.4%	10.9%
1996	21.9%	54.7%	14.2%	4.7%	3.7%	65.5%	20.7%	11.1%
1997	20.6%	55.1%	14.9%	5.0%	3.7%	64.8%	20.9%	11.9%
1998	20.4%	56.3%	14.8%	4.4%	3.8%	65.2%	19.7%	12.4%
1999	18.2%	57.3%	14.9%	4.9%	4.3%	61.1%	20.7%	15.8%
2000	20.1%	56.2%	14.5%	4.7%	4.1%	64.4%	19.7%	14.3%

Source: National Port Authority of South Africa (2003)

This table shows that Durban has lost market share overall, but almost exclusively because coal exports increased substantially. These volumes are handled in Richard's Bay. In containers, Durban still has a dominant market share, only Port Elisabeth managed to gain some market share. However, this is mainly because of increasing volumes in their captive

hinterland. Thus, the strengths of the cluster are in line with the strong position of Durban as South Africa's leading port.

12.3   Strengths and weaknesses of the LMPC

Table 82 shows the score of the LMPC compared to the score of Houston and the average score of the 6 port clusters.

Table 82: Strengths and weaknesses of the LMPC

Variable	LMPC	Houston	Research findings
The quality of collective action regimes	0.3	3.0	Significantly worse than in Houston and other 6 ports
The presence of customers and suppliers	0.5	3.3	Significantly worse than in Houston and other 6 ports
The diversity of the cluster population	0.9	3.0	Significantly worse than in Houston and other 6 ports
The presence of intermediaries	-0.4	1.5	Significantly worse than in Houston and other 6 ports
The presence of a culture of trust	1.5	3.3	Significantly worse than in Houston
The presence of embedded leader firms	1.8	2.5	
The presence of a labor force	1.7	2.6	
The presence of cluster entry barriers (access to local knowledge, networks and capital)	0.5	1.8	
The presence of knowledge spillovers	1.5	2.4	
The presence of cluster exit barriers (immobile staff and fixed investments)	1.6	1.1	
The level of land prices and office rents	1.4	0.6	
The presence of internal competition	2.4	2.7	
The level of congestion	1.6	0.4	Significantly better than in Houston and other 6 ports

Average scores on a scale from –5 (very bad) to +5 (very good)

*   Significantly higher score than in other two regions

**   Significantly lower score than in two other regions

Five weaknesses of the LMPC result from the comparison. First, the quality of collective action regimes is relatively bad. Second, the presence of customers and suppliers is poor,

compared to Houston. Third, the diversity of the cluster is limited, and fourth, the presence of intermediaries is limited. Fifth, the LMPC is a 'low trust cluster' compared to Houston. The only strength of the LMPC compared to Houston is the low level of congestion.

These strengths and weaknesses indicate that the LMPC is a weak cluster. Agglomeration economies are absent; the main strength of the cluster is absence of congestion. These are not 'advanced strengths'. The following performance indicators are available to compare the LMPC with other Gulf ports (see Table 83, Table 84, and Table 85).

Table 83: Market shares of the LMPC and three other gulf ports in the total US port throughput.

Market shares	1990	1997	2000	2001
LMPC	18.0%	18.1%	17.6%	17.2%
Houston	5.8%	7.1%	7.8%	7.6%
Mobile	1.9%	2.1%	2.2%	2.0%
Tampa	2.4%	2.4%	2.2%	1.9%

Table 84: Performance of the LMPC as container port

Year	1980	1985	1990	1995	1998	2001
New Orleans	279,500	380,000	157,000	198,000	245,000	247,000
Houston	300,000	363,000	502,000	705,000	968,000	1072,000
US Gulf	580,000	812,000	822,000	1188,000	1479,000	1652,000
Total USA	7,658,000	11,480,000	15,266,000	22,339,000	26,175,000	30,471,000
Market share LMPC in Gulf	48.2%	46.8%	19.1%	16.7%	16.6%	15.0%
Market share LMPC in USA	3.6%	3.3%	1.0%	0.9%	0.9%	0.8%

Source: US Army Corps of Engineers (2003)

Table 85: Concentration patterns in five US ports (2002)

Economic activity	Mobile	LMPC	Houston	Tampa	LA/Long Beach
Support Activities for Water Transportation	10.4	15.3	3.4	2.2	1.0
Freight Transportation arrangement	1.6	2.3	2.0	0.8	2.3
Petroleum and Petroleum Products Wholesalers	1.6	1.7	3.2	0.7	0.5
Process, Physical Distribution, and Logistics Consulting Services	0.5	0.7	0.3	1.4	0.7

Source: US Bureau of Census (2003)

These figures show that the LMPC has lost market share, especially in container throughput. This is explained to some extent by natural factors, and also because of the LMPC's weaknesses, most importantly its lacking capability to solve collective action problems and develop an adequate system for handling containers and moving them into the hinterland. Apart from containers (the only growth market), the LMPC has not lost market share, predominantly because it can operate at low costs (land prices are low and internal competition secures low handling rates) and does not face congestion problems.

Another indicator of the performance of the LMPC is the relative concentration of various cluster activities. 'Support activities for water transportation', the 'core' of a port cluster, are strongly concentrated in the LMPC. These firms have to be located at deepwater facilities. Activities that *can* locate in seaports, such as logistics consultants and transportation arrangement firms are less concentrated in the LMPC. This indicates that the cluster does not attract a large share of footloose port related activities. This can be explained by its weaknesses: the cluster is not diverse and customers and suppliers are absent in the LMPC.

PART THREE: CONCLUSIONS

13   CONCLUSIONS FOR ANALYZING CLUSTERS

This chapter is the first of three concluding chapters. This chapter discusses research findings of this study that can be generalized to clusters in general. As discussed in the empirical part, this should be regarded as 'analytical generalization' (not as empirical generalization).

In the next chapter, conclusions specifically related to seaport clusters are discussed. The final chapter discusses implications for policy and management in seaport clusters. Some overlap between these chapters is unavoidable, since the same research findings can be relevant for clusters in general, for seaport clusters and for policy and management. All three chapters are finalized with a few suggestions for further research.

13.1   Constructing a cluster

In this study a method to identify the 'cluster population' was developed. The cases show that this method is applicable when 'economic census data' are available at a sufficiently disaggregated level, both economically and geographically. *Cluster activities* have to be identified with the use of input-output data, an analysis of the structure of value chains, an analysis of the association structure and expert interviews. The relevant cluster region can be identified on the basis of a concentration analysis of these cluster activities. The cluster population, consisting of all organizations engaging in cluster activities and located in the relevant cluster region, can be identified with the use of a dataset in which all firms are classified in industries. This method does allow for a precise delimitation of the cluster and consequently a more precise analysis of the development of the cluster over time.

13.2   The theoretical framework

The validity of the theoretical framework developed in the theoretical part (see Figure 18) is broadly confirmed in this research. A few additions to the framework that have resulted from the cases are discussed in the following paragraphs. The relevance of the four variables

related to the structure of a cluster and the four variables related to the governance of the cluster is confirmed in this research.

Figure 18: The theoretical framework
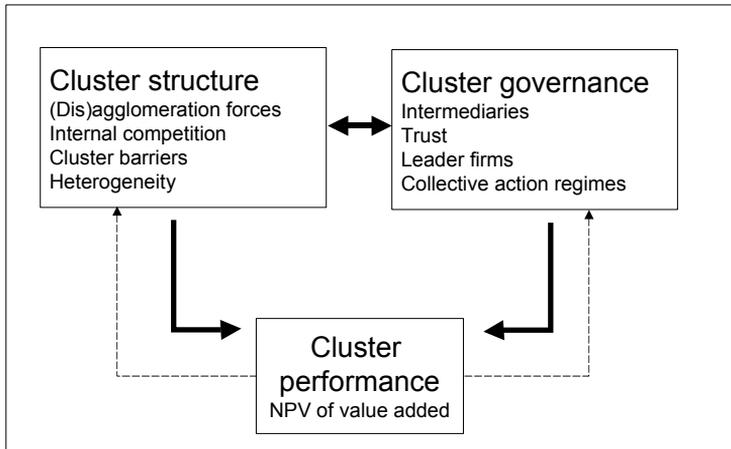
Experts were asked to identify variables that were not addressed in the survey. They identified a number of variables, most importantly 'distortions of the level playing field', 'trends in the shipping industry' and 'the transport policy of a country' (state). These variables are relevant for the performance of port clusters. However, the framework deals exclusively with 'cluster specific variables' and these three variables are not cluster specific. Industry experts focus on the overall picture, but from a theoretical perspective a focus on cluster specific variables makes sense: without such a delimitation, an infinite number of variables can be identified and 'everything is related to everything'.

As far as cluster specific variables are concerned, the framework developed in this study proved to be a useful and complete 'tool' to analyze the performance of (port) clusters. The framework is an alternative for Porters well-known diamond framework and the adapted version of this diamond (Rugman et al, 1995). The most important differences between our framework and both alternatives are:

- The distinction between structure and governance variables. In both alternatives, such a distinction is lacking. This distinction adds to the quality of the framework, in the sense that it is a shift away from the 'mechanic' explanation of the performance of a cluster

towards an explanation that incorporates behavioral aspects. Our study demonstrates the importance of governance in (port) clusters.

- The incorporation of analytical tools to analyze governance, most importantly, the theory of 'collective action', the concept 'leader firms' and the concept 'regimes'. These three analytical tools enrich the analytical framework.

- Recognition of the effects of the *diversity* of a cluster. The positive effects of diversity on economic growth and innovation performance of regions have been acknowledged, but this insight has not been incorporated in cluster research. Industry experts do agree with the positive effect of the diversity of a cluster on its performance, indicate that diversity of international scope is especially important, and rank diversity as a relatively important determinant of cluster performance.

13.3   The role of entry and exit barriers

One important adaptation of the framework resulted from the case studies: the effects of exit barriers are not in line with the theoretical arguments presented in the theoretical part. The argument that exit barriers increase the *embeddedness* of firms in the cluster is dismissed. Embeddedness arises when the cluster environment offers advantages, not when barriers prevent exit. The empirical results show that exit barriers do *not* contribute to the performance of the cluster, as suggested in the theoretical part, but *reduce* the performance of the cluster.

Two reasons explain this effect: first, exit barriers are also entry barriers. Since entry barriers reduce performance, exit barriers reduce performance as well. In this sense, the answers of the experts are coherent. Furthermore, exit barriers reduce dynamism in the cluster. When firms exit, entrants take their place. This dynamism has - according to the survey results - in general positive effects on the cluster. The experts rank exit barriers as by far the least important variable of the performance of clusters. Entry barriers are regarded as more important. In this respect, it is important to note that exit barriers are entry barriers, but the reverse is not true. For instance, the inaccessibility of networks is found to be a relevant entry barrier, but is not an exit barrier.

13.4   Internal competition in clusters

The results of the case studies confirm the importance of internal competition for cluster performance, as emphasized by Porter (1990) and Baptista (1999). In this study, the mechanisms that explain the positive effects of internal competition were studied. Three mechanisms were identified. All three mechanisms (monopoly rents, specialization and the vibrant environment) were found to be relevant in practice. This is an important conclusion, since the issue of internal competition is generally linked to the threat of monopoly power. The case study results show that internal competition has positive effects apart from preventing the abuse of market power. Since internal competitors have similar cost functions, they have strong incentives to specialize (to reduce competition). This also triggers innovation. Both effects are beneficial for the performance of a cluster. In this sense, it could be claimed that internal competition is most beneficial when it can lead to an 'oligopoly' with specialized service providers and less beneficial when it leads to cut-throat competition, on top of the competition with firms outside the cluster.

13.5   The role of leader firms in clusters

The concept 'leader firm' was incorporated in the framework for analyzing the performance of clusters. The leader firm concept is relatively new and not well studied. Leader firms are defined as 'firms with both the ability and the incentives to make investments with positive external effects for other firms in the cluster'.

The case studies demonstrate that the leader firm concept contributes to the understanding of governance in clusters. The experts acknowledge the positive influence of leader firms on the performance of a cluster and they judge leader firms as important for the performance of the cluster. Evidence from the three cases shows the role leader firms can play. Furthermore, the analysis of collective action regimes shows the difficulties that arise when leader firms are absent. These results justify the conclusion that a special set of firms in clusters can have a substantial impact on its performance. These firms can be termed leader firms.

13.6   The role of intermediaries in clusters

The presence of intermediaries was found to contribute to the performance of a cluster. This is an addition to existing theories on governance in clusters, since this function of intermediaries is not widely acknowledged. However, in the three cases the presence of intermediaries is relatively unimportant and especially large firms can do without intermediaries. In seaports large numbers of 'traditional' intermediaries, such as ship's agents and freight forwarders play a role. The traditional value added of these intermediaries declines, because transparency of supply chains and transport services increases. This might explain why the intermediaries are regarded as unimportant.

The study shows intermediaries can play a role in the transfer of knowledge. However, in seaports, intermediaries that position themselves as 'knowledge intermediaries' have not emerged (yet). Comparison with other clusters could yield new insights here.

13.7   Collective action regimes in clusters

The case studies show that the concept of collective action regimes is an important analytical tool for analyzing governance in clusters. At least five collective action problems are relevant: innovation, training and education, internationalization, hinterland access, and marketing and promotion. Four of these are not port specific and likely to be present in other clusters as well. These regimes are important for the performance of a cluster.

The empirical results show that five variables determine the quality of collective action regimes, the most important ones being the infrastructure for collective action (organizational infrastructure), the presence of leader firms, and the role of public actors. The two others are the 'voice' of the business community and the presence of a community argument in the cluster.

The results discussed above contribute to the understanding of governance in clusters. The theory of collective action can be applied to clusters and the concept of a collective action regime contributes to the literature on collective action (in clusters).

13.8   A regime manager

The concept 'regime manager' was developed on the basis of the case studies. The regime manager of the training and education regime in Rotterdam (KMR) is a 'network organization' that brings together all actors that have incentives and resources to contribute to the quality of the training and education regime. The regime manager is a not-for-profit public private organization.

A regime manager is one particular (institutional) arrangement to overcome collective action problems. Only in one of the fifteen regimes (the knowledge and training regime in Rotterdam), does a regime manager exist. The evidence from the cases shows that this regime is effective: its score (on a scale from –5 to +5) was the highest (shared with a second regime) of all fifteen regimes. Furthermore, the evaluation of the organizational infrastructure of the training and education regime in Rotterdam is by far the best of the fifteen regimes that are analyzed, with a score of 1.8 on a scale from –5 to +5. Thus, the regime manager is an arrangement that can improve the quality of collective action regimes in clusters. This addition to theories on governance in clusters resulted from the empirical research.

13.9   Cluster associations

The concept of a 'cluster association' is a second concept to analyze the quality of governance in clusters that has been developed on the basis of the case studies. Firms in clusters set up collective organizations. In all three clusters, various associations, each with a specific membership base, such as an association for forwarders, shipping lines or terminal operators, have developed. In only one cluster (Rotterdam) have these various organizations grouped together to set up a *port cluster association*. In this cluster the quality of the collective action regimes is better than in the other two clusters. This is an indicator that a cluster association can contribute to the quality of the 'organizational infrastructure'. In the two other port clusters, there are initiatives to develop such a cluster association. A schematic overview of a cluster association is given in Figure 19.

Figure 19: A cluster association
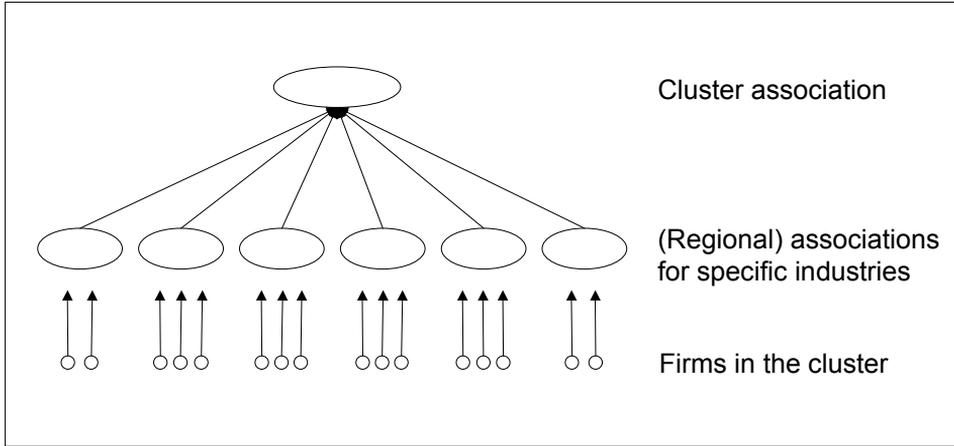
Cluster associations exist in other clusters as well[94], but are relatively new phenomena and have not been addressed in the literature. Thus, the concept of a cluster association is an addition to the theory on clusters and governance in clusters.

13.10 Cluster managers

A final contribution to theories on (governance in) clusters is the concept of a cluster manager. The case studies revealed that the port authority plays a very central role in the governance of the cluster. Especially in Rotterdam, the traditional landlord model of the port authority does not capture the deep involvement of the port authority in the cluster. The alternative developed in this study, is the concept of a 'cluster manager'.

The 'perfect' institutional setting of a cluster manager was analyzed. In this setting the cluster manager is a not-for-profit organization that generates income through a 'cluster tax' and re-invests this income to improve the performance of the cluster in the long run. In the perfect setting, the cluster manager can create co-finance arrangements with firms that benefit from the investments.

---

[94]   Examples include the 'Dutch Maritime Cluster' (www.nml.nl).

The institutional setting of port authorities closely resembles this 'perfect setting': port authorities are mostly not-for-profit, generate revenues from fairly general port charges and make investments to improve the performance of the cluster. Special to the port authority is its revenue structure, which creates substantial resources to act as a cluster manager. This particular institutional setting contributes to the quality of the governance in seaport cluster. The port authority is special in this respect; in other clusters organizations with a similar institutional position are missing. We argue that the cluster manager model of port authorities is a relatively advanced arrangement to govern clusters.

13.11   Relations between the different variables

The different variables of cluster performance are related. For instance, a better training and education regime (governance) strengthens the agglomeration economy of a shared labor pool (structure). These interrelations are assumed to be positive or neutral: when the quality of one of the variables increases, this has either no effect or a positive effect on the other variables. In general, these positive effects run from the governance variables to the structure variables, since some governance efforts aim to *improve* the structure of the cluster. Improvements of the structure of the cluster do not 'automatically' lead to better cluster governance. The following positive interrelations were found in the case studies:

- The presence of intermediaries leads to more knowledge spillovers. Intermediaries also lower the entry barriers of a cluster, since intermediaries make knowledge and networks more open.

- More trust leads to more knowledge spillovers, since firms are more inclined to share knowledge.

- More leader firm behavior leads to more agglomeration forces, since leader firms improve the quality of the labor pool and improve knowledge spillovers in the cluster. More leader firm behavior can also lead to more internal competition. In various cases, including Huntsman in Rotterdam and Rennies in Durban, leader firms induce competition.

- Better collective action regimes lead to stronger agglomeration effects, lower cluster barriers (for example the hinterland access regime in Rotterdam), and more heterogeneity (especially though marketing and promotion efforts).

The effects of governance variables on the structure of the cluster are given in Figure 20.

Figure 20 Governance efforts to improve the cluster structure
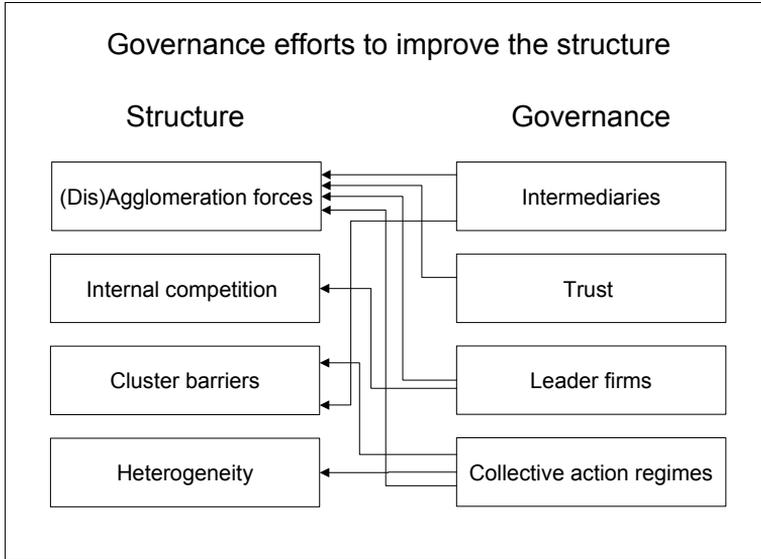
The absence of trade-offs between the various variables is an assumption of the theoretical framework. In the cases, no evidence for the existence of such trade-offs was found. In the interviews the issue of the relation between effective governance and internal competition was raised and discussed. The preliminary conclusion on the basis of the interviews is that fierce internal competition *can* have a negative impact on the quality of the governance of the cluster, but not necessarily so.

13.12 Suggestions for further research

In this study three cases of port clusters were analyzed. Conclusions of the three cases can be used for further research on clusters. Research on the institutional structure of clusters can build on institutional arrangements described in this study, such as a 'regime manager', a 'cluster association', and a 'cluster manager'. Such research will contribute to the understanding of governance in clusters.

A second suggestion for further research that builds on this research is the role of knowledge intermediaries. Port clusters do not seem to be well endowed with knowledge intermediaries. Firms indicate that they do access knowledge and information through intermediaries, but indicate that this is a 'by product'. Further research could analyze the presence of knowledge intermediaries in various different clusters.

A third suggestion for further research addresses the issue of the effects of internal competition on the quality of governance. It has become clear that firms in clusters compete *and* cooperate. However, experts indicate that in some cases, destructive competition can take place. This kind of competition does not go hand-in-hand with cooperation, but prevents it. The question under what conditions competition and cooperation are simultaneously possible, and if there is a threat of 'destructive internal competition' in (seaport) clusters is intriguing and still unanswered. This study suggests that opportunities for specialization might be relevant in this respect, but further research is required.

14 CONCLUSIONS ON SEAPORT CLUSTERS

In this chapter, relevant conclusions with regard to seaport clusters are drawn. These conclusions are especially relevant for scholars with an interest in seaports. Six conclusions are discussed, and the chapter is finalized with suggestions for port research that builds on this research.

14.1 Seaport clusters

The application of the cluster concept has resulted in more clarity on clustering in seaports:

- First, it has become clear that seaports are clusters. In all the three cases, the cluster consists of substantial numbers of firms, all related to the arrival of ships and goods in seaports. The majority of value added and employment in the three clusters in not generated in primary port activities (cargo handling), but in related activities, such as logistics, manufacturing and trade. All these activities are concentrated in seaports.

- Second, it is possible to identify a port cluster region. In all three cases, port activities are distributed over a number of municipalities and not limited to the port city. In fact, in the LMPC and Rotterdam, the port-cities have a lower concentration of port activities than smaller municipalities in the vicinity of the port.

- Third, a 'general' list of cluster activities can be compiled. Such a list consists of all firms active in cargo handling, transport and logistics, and manufacturing and trading firms in a small number of 'chains' such as chemicals and grain. In the empirical part the list of cluster activities, each with the corresponding NAICS, are presented. This list of cluster activities is general and can be used to compare port clusters worldwide.

14.2 Internal competition in seaports

The lack of internal competition is a weakness for seaports, even if external competition is fierce enough to prevent firms from monopoly pricing, because internal competition fosters specialization and creates an innovation-prone environment. Internal competition in cargo handling segments such as dry bulk, containers and fruits, and in most nautical port

services, such as pilotage and towage is limited in the three cases. Since all three cases are large ports, internal competition is likely to be absent to an even larger extent in small and medium sized ports. The lack of internal competition can be explained to some extent by regulation (especially pilotage), but mainly because scale economies are so substantial that the minimum efficient size is so large that internal competition is unstable.

Regulation, to tender and benchmark monopolies might be necessary in some cases to prevent monopoly pricing. However, regulation does not provide incentives for specialization and innovation. Thus, regulation is the least desirable policy direction.

Policies to create internal competition are difficult and only desirable when firms *can* specialize. In these cases an arrangement that reconciles scale economies with the presence of internal competition is desirable. Such an arrangement is only possible when the port authority makes fixed investments and leases these assets to firms. In this case the port authority creates scale economies. An example could be pilotage equipment (ships as well as ICT infrastructure) that can be leased by independent pilotage firms as well as ship-owners. Such opportunities are discussed in the final chapter.

14.3   The organizational infrastructure in seaports

The three port clusters are characterized by 'institutional thickness'[95]. The number of collective organizations (and to some extent public private partnerships) is large. Most of the collective organizations have a long history. Because of this institutional thickness, the infrastructure for coordination is relatively good. However, a consolidation of associations is widely regarded as a step forward, because current associations have limited resources to add value to their members. The results from the survey show that associations are not regarded as important intermediaries. Furthermore, the port experts indicate that the associations are not important as knowledge intermediaries.

Finally, notwithstanding the presence of a substantial number of associations in the three cases, the organizational infrastructure is judged as moderate: in Rotterdam the average

---

[95]   In the sense of a variety of collective organizations and arrangements between governments and firms. This is a particular use of the term 'institutional thickness', others use the term institutions strictly for 'rules' and not for 'organizations'.

overall evaluation is 1.2 on a scale from –5 to +5, in Durban and the LMPC the average is – 0.2 and –0.1 respectively. This assessment shows that the organizational infrastructure in the three ports is not effective. A merger of various associations into one cluster association, as was done in Rotterdam, is probably a step forward.

14.4   Leader firm behavior in seaports

The three case studies show that leader firms can contribute substantially to the performance of port clusters. The experts regard leader firms as relatively important. Examples of leader firm behavior in port clusters include:

• Efforts and investments to improve rail accessibility, by setting up a freight rail company.

• Efforts and investments to improve the quality of the labor force in the cluster.

• Efforts and investments to improve the 'data interchange infrastructure' in a port.

• Efforts to improve the organizational infrastructure in a port and the cooperation between firms and the port authority.

• Efforts to increase the working standards of suppliers in the port.

• Efforts to encourage the introduction of internal competition in a cluster.

In every port cluster the involvement of leader firms will be different. These examples show the huge potential benefits of leader firm involvement.

14.5   Collective action regimes in seaports

Collective action regimes are very relevant in port clusters. The hinterland access regime is especially important for the performance of a port cluster. Innovation, training and education, internationalization and marketing and promotion are also regarded as important regimes in all three ports. Central in improving regimes is the ability to commit resources, such as capital, management involvement, and commitment, to a regime.

The quality of collective action regimes varies between the cases but is generally speaking moderate. Given the importance of the regimes, this is an important opportunity to improve

the governance of seaports. One could even argue that the quality of regimes becomes *more* relevant in port competition: when firms become active in various port clusters, technological differences between ports become smaller and regulations to create a 'level playing field' more strict, these potential sources of competitive advantage become smaller. In such a competitive environment, the quality of collective action regimes becomes more important.

14.6   Port authorities as cluster managers

The role of port authorities has traditionally been described with the 'port models' landlord, toolport and service port. It has become clear that these port models are of limited use for understanding strategies of port authorities (see Heaver et al, 2001). The case studies show that this distinction does not capture the involvement of port authorities in the governance, regardless their port model. On the basis of the case study evidence and theoretical insights stemming from the analysis of governance in clusters, the concept 'cluster manager' was developed. Figure 21 shows the newly proposed scheme to analyze investments of port authorities.

Figure 21: The port authority as cluster manager
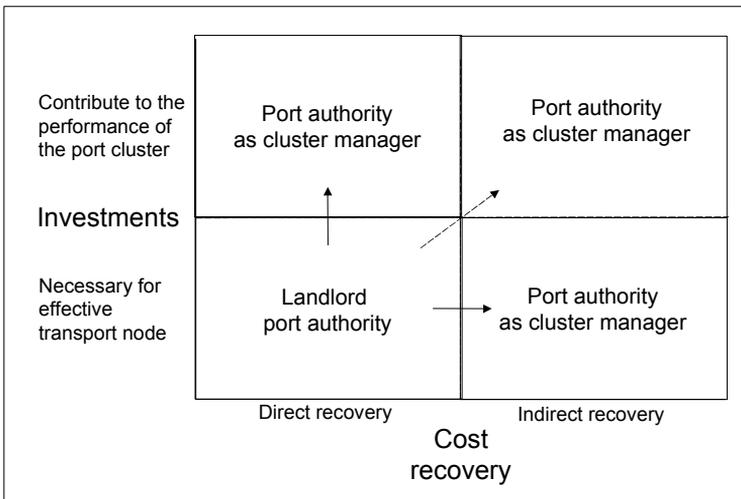
This scheme was used to analyze investments of the port authorities in the three cases. Table 86, Table 87 and Table 88 show cluster manager investments in Rotterdam, Durban and the LMPC.

Table 86: Cluster manager investments in Rotterdam

Role of port authority	Direct cost recovery	Indirect cost recovery
Investments in port cluster (location)	Port consultancy Venture capital provision Office space provision Industrial pipeline infrastructure Hinterland terminals in Middle Europe	Co-funding of university research Co-funding of innovation projects (among other through long term programs Connekt and Klict Co-funding of port labor pool Co-funding of training facility Co-funding of education center EIC
Investments in transport node	'Standard investments' such as dredging, quay construction, traffic control'.	Market intelligence Port marketing: Rotterdam representatives Port marketing: contribution to RPPC

Table 87: Cluster manager investments in Durban

Role of port authority	Direct cost recovery	Indirect cost recovery
Investments in port cluster (location)	Port consultancy City development (under study)	Training facility (currently predominantly for own staff)
Investments in transport node	'Standard investments' such as dredging, quay construction, traffic control'.	Market intelligence Port marketing

Table 88: Cluster manager investments in the LMPC

Role of port authority	Direct cost recovery	Indirect cost recovery
Investments in port cluster (location)	City development Training for foreign port managers	Partnerships with hinterland ports
Investments in transport node	'Standard investments' such as dredging, quay construction, traffic control'.	Market intelligence

These tables show that the port authority of Rotterdam acts to a large extent as cluster manager. The port authorities in both other clusters act cluster managers to a lesser extent. In Durban, the port authority transforms from a service port to a landlord port. The organization has not (yet) developed cluster management routines. In the LMPC, port authorities play a more modest role. The experts expect an increase in cluster management involvement of the port authorities in Durban and the LMPC.

14.7   Suggestions for further research

The conclusions of this study are a basis for further research. Four suggestions for further research are discussed.

- This study claims the role of cluster manager is an important potential competence for port authorities. However, the role of port authorities as cluster managers is little understood. Differences between a cluster manager and a landlord could be explored further. The theoretical basis provided in this study also allows for an analysis of organizational and institutional transformations of port authorities.

- Second, leader firms can improve the quality of the governance of clusters (and the collective action regimes) substantially. Examples of leader firm behavior were found in all three cases. It can be argued that the potential benefits of leader firm involvement are especially large in ports in developing countries, because of the skills and knowledge leader firms can transfer. Thus, the role of (internationally operating) leader firms in port clusters in developing countries is an interesting and relevant research theme.

- Third, the collective action framework could be useful to analyze the increasingly important issue of port security. Port security is likely to be a collective action problem, because the threat of free riding seems present. This issue could be analyzed with the analytical framework developed in this study. For instance, questions such as 'could a network organization act as regime manager', 'would a security charge be a good mechanism to generate resources to improve port security', and 'what is the role of leader firms in the port security regime' are relevant research questions.

- Finally, this thesis has addressed the issue of the performance of port clusters, but has not discussed the issue of the regional economic development of port regions. The performance of the port cluster is relevant for the development of port regions. However, one could claim that port regions run the risk of ending up in a 'lock-in': because of the importance of the port cluster and the specialization of the region in ports, the region becomes less attractive for other economic activities with more growth potential. Thus, the issue of how to align efforts to improve the performance of the port with regional economic development, as well as the issue to what extent the 'quality of life' of the city is important for the port cluster, deserves attention.

15 OPPORTUNITIES FOR POLICY AND MANAGEMENT IN SEAPORT CLUSTERS

In this final chapter, the case study results are used to identify opportunities for policy and management in seaport clusters. These opportunities should be read as *suggestions* that need further exploration. The opportunities for policy and management were discussed with the experts. The opportunities can be relevant for other (port) clusters. The opportunities to improve the collective action regimes were discussed in chapter 11 and are only briefly summarized in this chapter.

15.1 Opportunities to strengthen agglomeration economies and reduce diseconomies

Several opportunities to improve the agglomeration economies or reduce the agglomeration diseconomies have been identified. The most important ones are discussed below.

In Durban land prices are high and congestion problematic. High land prices can be solved by port expansion and by intensifying the land-use of existing facilities. Given geographical conditions, expansion is relatively expensive in Durban, and not an option in the short run. Intensifying the land use is a more viable opportunity in the short run. This can be done by increasing land prices. This does not imply an overall increase in tariffs. Other tariffs, such as the cargo dues and port dues should be reduced. A pricing structure with high land prices 'sends the right signals': firms will have an incentive to increase land-use.

Congestion is a second important agglomeration diseconomy in Durban. Infrastructure expansion is problematic, given the fact that residential areas surround the port. Better traffic management systems, pre-arrival information systems and the development of a 'dry port' outside the congested port area are more cost-effective opportunities to reduce congestion.

In Rotterdam, land prices are high and land availability is limited. The expansion project 'second Maasvlakte' will reduce the scarcity of land in Rotterdam's port cluster. A second opportunity to reduce land scarcity is through encouraging 'co-siting' (especially in the chemical industry). Lease holders, especially chemical plants, lease more land than

effectively needed, because of reservations for expansions. Process intensification reduces the land requirement for chemical facilities. This provides an opportunity to co-locate related firms on one site. Various co-siting projects have been initiated and increased land use. Two challenging opportunities to increase the intensity of land use are first the development of a new space-efficient system to store chemical products, especially oil and second the development of a more systematic approach to co-siting and industrial clustering.

In the LMPC, the transport infrastructure is relatively good and a substantial number of sites are available. These diseconomies do not have to be addressed.

Strengthening agglomeration economies is a more difficult path to improve the structure of a cluster. Through a good 'training and education regime' the quality and quantity of the labor pool can be improved, a good 'innovation regime' can improve knowledge spillovers. Opportunities to improve these regimes have been discussed in chapter 11.

The presence of customers and suppliers (the third agglomeration force) depends on the economic structure and location factors of the port region. In the LMPC and Durban, policies or strategies to improve the location factors are absent. In Rotterdam, actors from the port industry stress the importance of the location factors of the region.

In all three cases, the port cluster would benefit from more establishments in logistics, manufacturing and trade. These activities cannot be attracted with only traditional location factors, such as accessibility and land availability. The two most important 'new' location factors for port clusters are 'the quality of life' in a port region, and the presence of a good knowledge infrastructure. Reducing the negative effects of transport flows, for instance by creating dedicated solutions for freight road transport, can enhance the quality of life. Furthermore, the redevelopment of old port areas is an opportunity to improve the quality of life.

The knowledge infrastructure increases the attractiveness of the port city for higher skilled port related jobs. In many cases, these jobs are not located in ports at all, but in a location where the knowledge infrastructure and quality of life are better. The knowledge requirement differs per port: in Rotterdam, petro-chemical knowledge infrastructure would fit, whereas in the LMPC and Durban, a logistics knowledge base would fit better.

15.2   Opportunities to create internal competition

The lack of internal competition has a negative effect on the performance of the cluster. This negative effect might become more important given the rise of global terminal operators and other (trans)port service providers that are not committed to or embedded in particular clusters.

Internal competition between pilots is lacking in all three ports. The port authority undertakes pilotage in Durban. In the LMPC and Rotterdam, an independent organization provides pilotage services, but prices are not competitive. In the LMPC, port users have joined a 'pilot user group' (PUG) *that started elsewhere in Louisiana*. This shows organizing capacity in the LMPC is limited. The issue of appropriate regulation for the pilots is complicated and not exclusively based on economic arguments. One arrangement that follows from the previous discussion on entry barriers would be to develop a government owned leasing agency that leases equipment to pilots. In this arrangement, licensed pilots can lease equipment and provide services, without the need to make high specific investments.

With regard to the lack of competition in cargo handling, the opportunity - in general terms - is to reconcile scale economies with competition. An arrangement could be to lease a terminal to *two* operators. In principle, two independent operators can use the same gate, berth, stacking space, cranes and a part of the labor force. If the firms are head-on competitors this arrangement is likely to be unstable, but when one terminal operator offers 'multi-user services' while the other *in principle* only handles his own ships the arrangement could be stable and at the same time increase competitive pressure. The possibility that the dedicated terminal operator could start to offer services for third parties disciplines the multi-user terminal. Such an arrangement was discussed with the port experts in Durban and was regarded as a good arrangement to prevent monopolistic behavior.

15.3   Opportunities to reduce cluster entry and exit barriers

Entry and exit barriers reduce performance. The result that exit barriers reduce performance is relevant, since it implies that strategies to 'tie' firms to the cluster are not likely to promote the performance of the cluster.

Since exit barriers are entry barriers, we discuss opportunities to reduce cluster entry barriers[96] and include exit barriers in this discussion. Lowering entry barriers is an opportunity to improve cluster performance. Relevant entry barriers that can be influenced by actors in the cluster are: lack of (venture) capital, inaccessibility of knowledge and networks, and the amount of specific investments that have to be made.

In Rotterdam, the port authority has taken the initiative to develop a venture capitalist that provides capital to start-ups. This venture capitalist is self-sustaining operates in partnership with commercial banks. This initiative has proved to be valuable for start-ups. This arrangement might explain why the availability of venture capital is not regarded as an entry barrier in Rotterdam contrary to Durban and the LMPC.

The second entry barrier, the inaccessibility of knowledge and networks, is not addressed by initiatives in any of the three cases. The inaccessibility can derive from language and cultural differences. These can hardly be addressed. The presence of all kinds of associations as well as 'port clubs' in these ports shows that platforms to meet others in the port industry do exist.

The third entry barrier, the level of specific investments that have to be made, can be addressed by developing arrangements where actors willing to make specific investments invest in assets that are leased to start-ups and entrants. Such arrangements include:

- Developing land and infrastructure and leasing this to the private sector (the primary role of landlord ports). This reduces investments needs of private firms. This policy is common practice in the port industry and is done in Rotterdam, the LMPC and Durban.

---

[96]   For firms present in the cluster, entry barriers are not relevant (anymore), while exit barriers are relevant. Policies to reduce exit barriers are not widespread, one could think of labor laws related to the closure of an establishment, or the take-over of an establishment. However, such laws are not cluster-specific. Furthermore, the experts rated exit barriers as unimportant. For these reasons, we do not deal with exit barriers specifically.

- Investing in specific assets, such as cranes, warehouses and special cargo facilities. These investments imply port authorities invest in the 'tools' and lease these to the private sector. This strategy leads to a reduction of entry barriers and can improve the performance of the port cluster. The port authority in the LMPC and Rotterdam makes such investments. In some cases a 'toolport arrangement' is superior to the (common practice) landlord model.

- The provision of office space in the port area for small and medium sized port related firms. 'Micro-clustering of these firms in the same area has advantages, such as the presence of knowledge and networks. For these reason, port authorities can invest in a self-sustaining organization that provides accommodation at market-prices in targeted areas - when the provision of adequate office space by the market is not effective, for instance because real estate investors are not willing to make the initial investments. Rotterdam is the only one of the three ports where the port authority is involved in providing office space.

- Developing and leasing *modular* warehouse space for clients. This would reduce entry barriers for firms in the logistics industry. With fragmented private ownership of warehouses, the owners have no incentive to invest in the quality of the distribution park as a whole. As a consequence the quality of the zone can decrease. If the port authority invests in warehouse space, it has a clear incentive to maintain a certain quality level. This arrangement was not found in any of the three cases.

15.4   Opportunities to increase the heterogeneity of the cluster population

Policies and strategies to improve the diversity of the port cluster are lacking in Durban and the LMPC. In Rotterdam, the need to attract 'new growth activities' in the cluster, in order to counterbalance the loss in value added and employment in cargo handling and transport, is widely accepted. Attracting new growth activities is an opportunity to improve the diversity of the cluster. In Rotterdam, the following growth activities have been identified (Welters and De Langen, 2003):

- Logistics, especially 'supply chain management' (Haynes et al, 1997).

- Industrial tourism.

- Waste processing and recycling.

- Maritime services.

- Offshore construction and decomposition (RMPM, 2002).

- 'Postponed manufacturing'.

- The manufacturing of high value chemicals, such as medicine and bio-tech products.

- Port leisure.

- Education in port and transport related activities.

Coalitions that aim to attract firms from these industries have to develop. In Rotterdam, such coalitions have developed to attract new manufacturing activities and offshore decomposition. However, results are not up to expectations. One of the reasons for the difficulty in developing successful coalitions is the need to continue making efforts for a long period of time, up to 10 years.

15.5   Opportunities to increase trust

In the short and medium run, the level of trust is 'given' for the actors in the port cluster. Since trust is based on a 'social relation', improving the social embedding of individuals in the port cluster is a method to improve trust. However, most experts are skeptical about initiatives to enhance the level of trust. Once a climate of trust has developed, it can be sustained. One approach that could make sense, is to try to develop 'community spirit' among young professionals in the port.

In Rotterdam, a 'young roundtable' was developed, where young professionals meet about four times a year and discuss common themes. One of the objectives of this initiative is to make these professionals aware of the importance of common themes and to prepare them for later involvement in organizations (especially associations) that promote common interests. In the LMPC and Durban, initiatives to build trust are absent.

15.6   Opportunities to increase the role of intermediaries

The presence of intermediaries, especially 'cargo-controlling' intermediaries such as forwarders and ship's agents, adds to the performance of seaport clusters. These

intermediaries are 'customers' of seaports; they control substantial volumes of cargo. Intermediaries generally speaking have limited assets, and can shift easily between ports. However, most forwarders select one port as consolidation hub.

Attracting consolidation cargo from the intermediaries is predominantly an issue of developing a sound price/quality package, because the price-elasticity of the demand of intermediaries is very high. However, port authorities have no commercial relation with intermediaries: they do not lease land, nor pay port dues. Thus, in Rotterdam, as well as in the LMPC, intermediaries have become 'the forgotten customers' of the port. A form of 'account management' for intermediaries can improve relations with intermediaries and provide the port authority with relevant management information. The port authority in Rotterdam has recently developed a structure with account managers.

Forwarders obtain volume discounts, for instance from shipping lines and inland transport firms. In the port, such discounts are not a common practice since forwarders have no commercial relations with either the port authority or the terminal operators. Nevertheless discounts can be justified with theoretical arguments (e.g. more volume, more purchasing power). Therefore in ports where the absence of (activities of) forwarders is a weakness, port authorities can consider developing a tariff scheme that allows for giving discounts to actors that generate substantial volumes for the port[97].

15.7   Opportunities to encourage leader firm behavior

Leader firm involvement arises when leader firms have both the *ability* and the *incentives* to act as a leader firm. Leader firms generally have incentives to make investments with benefits for other firms in the cluster, simply because they have a substantial market share.

---

[97]   This is an issue that deserves more attention in future studies. Central in the discussion is the (marginal) effect of volume discounts on cargo volumes. In the current situation (in Rotterdam and probably other ports as well), ship-owners get volume discounts, while intermediaries (forwarders) do not. The question is: who of those two would bring more volumes to a port when offered a volume discount. The current practice is only effective when ship-owners indeed react much more to volume discounts than intermediaries. We have the impression that, especially in 'destination ports' (rather than transshipment ports) this is probably not the case.

The ability of firms to behave as leaders, can be improved by providing a '*support infrastructure'*.

Leader firm involvement is in most cases a top management issue. Typical activities where a contribution of leader firms would make sense include:

- Attract financial resources for joint projects.

- Ensure political support for projects with substantial political involvement.

- Provide management expertise and best practices information.

The above-mentioned activities can contribute substantially to the viability and success of projects but only when the leader firm involvement is matched with a professional support infrastructure that deals with the project management and realization. A part of this support infrastructure can be provided by associations, in other cases specific organizations have to be developed, such as KMR in the training and education regime in Rotterdam. In Rotterdam, the support infrastructure is relatively good. This is one of the reasons for the relatively positive evaluation of the involvement of leader firms in the collective action regimes in Rotterdam. In the LMPC, the maritime cluster initiative, initiated by Metrovision, provides the support infrastructure that enables two leader firms to become involved. In Durban, the support infrastructure is not well developed.

15.8 Opportunities to improve collective action regimes

In chapter 12 opportunities to improve five collective action regimes were discussed. Table 89 shows some of the opportunities and initiatives to improve the regimes that could be relevant in other port clusters. These opportunities are not discussed in more detail in this section.

Table 89: Opportunities to improve collective action regimes

Regime	Opportunity
Hinterland access	Improve market intelligence Improve intermodal accessibility Develop a network with hinterland nodes
Marketing and promotion	Developing a collective organization for marketing and promotion, with indirect financing from the port authority
Training and education	Strategic cooperation to improve the quality of the training and education infrastructure Re-training to increase job mobility of employees in declining industries
Innovation	Knowledge transfer between small and large firms A high volumes, low nuisance, freight road transport system
Internationalization	Port representatives in important markets

15.9   Further research on policy and management in port clusters

The conclusions of this research have implications for policy and management in port clusters. In some cases, best practices were found. These best practices cannot be translated into general policy recommendations, further study building on these results is required. Four issues seem especially relevant:

- First, research into the possibilities and likely effects of policies to lower entry barriers would be relevant. Increasingly, assets are owned by leasing firms and operated by others, such as terminal operators, but also operators of chemical plants or warehouses. The investment policies of 'assets owners' are based on risk reduction and diversification strategies, while operators increasingly strive to be as flexible as possible. In a port where it is easy to lease all kinds of assets, entry barriers are lower with positive effects on performance. More research is needed to determine whether the number of lease constructions is indeed increasing, how such constructions are created and how port authorities can contribute to lowering entry barriers.

- Second, the tariff structure in the container shipping market is a relevant research issue. Currently, terminal operators receive a 'terminal handling charge' from the shipping lines and port authorities charge port dues to shipping lines. Neither port authorities nor

terminal operators have commercial relations with shippers or intermediaries. This implies they cannot use the 'pricing instrument' to give shippers and intermediaries incentives to behave in the interest of the terminal operator or the port authority. This is a serious shortcoming. For instance, terminals might want to use the price instrument to avoid huge peaks at their trucking gates, but simply cannot do so. Port authorities might want to give volume discounts to large intermediaries or shippers who shift to environmentally friendly hinterland transport or use an 'intelligent road system'. In the current situation, this is not possible, and one could question whether a tariff structure in which terminal operators and port authorities are paid by shippers and intermediaries, could be better from a welfare economic point of view, since it allows for more differentiation in pricing.

- A third research topic that builds on this research would analyze the possibilities and economic effects of arrangements to reconcile scale economies with internal competition. In this research, the importance of internal competition was demonstrated. The question how to enable internal competition is explored but not analyzed in detail.

- A final research avenue could analyze coalitions to attract growth activities. Port clusters (like all clusters) need to transform to remain vital. In ports, this transformation is at least partially a shift from a transport node to a location for various kinds of activities, from postponed manufacturing and maritime services to recycling industries. Such a transformation depends to a large extent on the capabilities of actors in the port cluster to initiate and sustain coalitions to attract growth activities. This issue is so central to the performance of port clusters that it deserves attention.

REFERENCES

Albertini, S. (1999) Networking and Division of Labour - The Case of Industrial Districts in the North-East of Italy, *Human Systems Management,* vol. 18 (2) pp.107-124.

Albino, V., Garavelli, A., Schiuma, G. (1999) Knowledge Transfer and Inter-firm Relations in Industrial Districts: The Role of the Leader Firm, *Technovation,* vol.19 pp. 53-63.

Amin A. and Thrift, N. (1992) Neo-Marshallian Nodes in Global Networks*, International Journal of Urban and Regional Research,* vol.16 pp. 571-587.

Arthur B. (1994) *Increasing Returns and Path Dependence in the Economy*, An Arbor: Michigan University Press.

Asheim B. T. (1994) Industrial Districts, Inter-firm Cooperation and Endogenous Technological Development: The Experience of Developed Countries, in *Technological Dynamism in Industrial Districts: An Alternative Approach to Industrialization in Developing Countries?* UNCTAD, United Nations, New York and Geneva 1994, pp. 91-142.

Asheim B. T. (1996) *Industrial Districts as `Learning Regions': a Condition for Prosperity?* European Planning Studies vol. 4 (4) pp.379-400.

Atkin, R. and Rowlinson, M. (2000) Competition in Ship Handling: a Study of Market Turbulence in North European Harbour Towage, *Maritime Policy and Management,* vol. 27(3) pp. 267-281.

Audretsch, D. and Feldman, M. (1996) R&D Spillovers and the Geography of Innovation and Production, *The American Economic Review*, vol. 86 (3) pp. 630-640.

Auerbach, P., and Skott, P. (1995) Michael Porter's Inquiry into the Nature and Causes of the Wealth of Nations. J. Groenewegen, S. E. Sjostrand and C. Pitelis (eds.), *The Economy of the Future: Ecology, Technology and Institutions*. Aldershot, UK: Edward Elgar

Baird, A. (1996) Seaports in the United Kingdom, *Tijdschrift Voor Economische en Sociale Geografie*, vol. 87(4) pp. 322-331.

Baptista R. and Swann, P. (2000) Do Firms in Clusters Innovate More? *Research Policy, vo*l.27 (6) pp. 527-542.

Baptista, R. (2000) Do Innovations Diffuse Faster within Geographical Clusters*? International Journal of industrial organization,* vol.18 pp. 515-535.

Beccatini, G. (1990) The Marshallian Industrial District as a Socio-economic Notion, in Pyke, F.; Becattini, G.; Sengenberger, W. (eds): *Industrial Districts and Inter-firm Co-operation in Italy*, Genf, pp. 10-19.

Beckert J. (1999) Agency, Entrepreneurship and Institutional Change, *Organization Studies,* vol.20 (5) pp. 777-799.

Belussi, F. and Gottardi, G. (2000*) Evolutionary Patterns of Local Industrial Systems: Towards a Cognitive Approach to the Industrial District*, Aldershot: Ashgate.

Bennett, R. J. (1998) Explaining the Membership of Voluntary Local Business Associations: The Example of British Chambers of Commerce*, Regional Studies* vol. 32 (6) pp. 503-514.

Berg, L. van den (1987) Urban Systems in a Dynamic Society, Aldershot: Gower.

Berg, L. van den, Braun, E. and Winden, W. van (2001) Growth Clusters in European Cities: an Integral Approach*, Urban Studies,* vol. 38 (1) pp. 186-206.

Bergman, E.M. and Feser, E. J. (1999) Industrial and Regional Clusters: Concepts and Comparative Applications, The Web Book of Regional Science at website: http://www.rri.wvu.edu/regscweb.htm

Best, M. H. (1990) *The New Competition: Institutions of Industrial Restructuring,* Cambridge, Massachusetts, Harvard University Press.

Blackburn, R., Curran, J. and Storey, D. (eds) (1993) *In Search of Spatial Differences: Evidence from a Study of Small Service Sector Enterprises*, Routledge, London and New York.

Braczyk, H.J. Cooke, P. and Heidenreich, M. (1998) *Regional Innovation Systems: the Role of Governance in a Globalized World*, London, UCL Press.

Brusco (1982) The Emilian Model: Productive Decentralization and Social Integration*, Cambridge Journal of Economics,* vol. 6 (2) pp. 167-184.

Bureau Van Dijk (2003) data retrieved from Statistics Programme Reach, Review and Analysis of Companies in the Netherlands. See http://www.bvdep.com

Callahan, M. (1981) *The Harbour Barons: Political and Commercial Elites and the Development of the Port of Rotterdam*, *1824-1892*, Princeton University.

Campbell, J.L., Hollingsworth, J.R. and Lindberg, L.N. (1991) *Governance of the American Economy*, Cambridge, Cambridge University Press.

Clark, G.L. and Wrighly, N. (1997) Exit, the Firm and Sunk Costs: Reconceptializing the Corporate Geography of Disinvestments and Plant Closure, *Progress in Human Geography,* vol. 21 pp. 338-356.

Cooke, P. (1998) Regional Systems of Innovation, an Evolutionary Perspective, *Environment and Planning A,* vol. 30 pp. 1563-1584.

Cooke, P. and Morgan, K. (1998) *The Associational Economy*, Oxford: Oxford University press.

Dei Ottate (1994) Trust, Interlinking Transactions and Credit in the Industrial District*, Cambridge Journal of Economics,* vol.18 pp. 529-546.

Dinwoodie (2000) The Perceived Importance of Employment Considerations in the Decisions of Students to Enroll in Undergraduate Courses in Maritime Business in Britain, *Maritime Policy and Management,* vol. 27 (1) pp. 17-30.

Dosi, G. and Marengo, L (1994) Some Elements of an Evolutionary Theory of Organizational Competences in England, R.W. (ed) *Evolutionary Concepts in Contemporary Economics; Economics, Cognition, and Society series*. Ann Arbor: University of Michigan Press, pp. 157-78.

Drewry Shipping Consultants Ltd. (1998) *World Container Terminals; Global Growth & Private Profit,* London.

Driel, H. van (1988) *Strategie en Sociaal Beleid in het Stukgoed*, Erasmus Universiteit Rotterdam.

Dunning, J.H. (1993) *The Globalization of Business: the Challenge of the 1990s*, London, Routledge.

Durban Yellow Pages (2002) Durban

Dijk, M.P. van and Sverrison, A. (2003) Enterprise Clusters in Developing Countries, Mechanisms of Transition and Stagnation*, Entrepreneurship and Regional Development* vol.15 pp. 183-206.

Economides, N. (1996) The Economics of Networks, *International Journal of Industrial Organization*   vol. 14 (6) pp. 673-699.

Edquist (ed) (1997) *Systems of Innovation, Technologies, Institutions and Organizations*, London, Pinter.

European Commission (2001) Port Package, doc: COM (2001) 35, available at http://europa.eu.int.

Eurostat (2003) Data published on http://www.eu.nl.

Fleming, D.K. (1987) The Port Community, an American View, *Maritime Policy and Management,* vol. 14 pp. 321-336.

Fujita, M. and Thisse, J.F. (1996) *Economics of Agglomeration,* Centre for Economic Policy Research, Discussion Paper 1344.

Fujita, M. and Mori, T. (1996) The Role of Ports in the Making of Major Cities: Self-Agglomeration and Hub-Effect, *Journal of Development Economics,* vol. 49 (1) pp. 93-120.

Fujita, M. Krugman, P. and Venables, A.J. (1999) *The Spatial Economy: Cities, Regions, and International Trade,* Cambridge and London: MIT Press.

Fukuyama, F. (1996) *Trust: the Social Virtues and the Creation of Prosperity*, New York Free Press; New York.

Geroski (1995) What Do We Know about Entry? *International Journal of Industrial Organization,* vol. 13 pp. 421-440.

Goss, R.O. (1990A) Economic Policies and Seaports 2: The Diversity of Port policies, *Maritime Policy and Management,* vol.17 (3) pp. 221-234.

Goss, R.O. (1990B) Economic Policies and Seaports 3: Are port authorities necessary *Maritime Policy and Management,* vol. 17(4) pp. 257-271.

Goss, R. and Stevens, H. (2000) Marginal Cost Pricing in Seaports, *International Journal of Maritime Economics,* vol. 3(2) pp. 128-138.

Groenewegen J. and Vromen, J.J. (1996) A Case for Theoretical Pluralism, in *Groenewegen J.* (ed.), *TCE and Beyond*, pp. 365-380.

Haezendonck, E. (2001) *Essays on Strategy Analysis for Seaports,* Leuven, Garant.

Hall, P.G. and Markusen, A.R. (eds) (1985) *Silicon landscapes,* Boston Massachusetts, Allen & Unwin.

Hannan, M. and Freeman, J. (1977) The Population Ecology of Organizations, *American Journal of Sociology,* vol. 82 pp. 929-964.

Hannan and Freeman (1989) *Organizational Ecology* Cambridge, Massachusetts, Harvard University Press.

Hannan and Carrol (1992) *Dynamics of Organizational Populations: Density, Legitimation, and Competition,* New York, Oxford University Press.

Haralambides, H. Cariou, P and Benacchio, M. (2002) Costs, Benefits and Pricing of Dedicated Container Terminals, *International Journal of Maritime Economics*, vol. 4 (1) pp. 21-34.

Harrison, B. (1992) Industrial Districts: Old Wine in New Bottles? *Regional Studies,* vol. 26 (5) pp. 469-483.

Harrison, B. (1994*) Leand and Mean, the Changing Landscape of Corporate Power in the Age of Flexibility,* New York, Basic Books.

Haynes, K. E., King, Y. M. and Stough, R. R. (1997) Regional Port Dynamics in the Global Economy: the Case of Kaoshiung, Taiwan, *Maritime Policy and Management,* vol. 24 (1) 1995 pp. 93-113.

Hayuth (1981) Containerisation and the Load Center Concept*, Economic Geography,* vol. 57 pp. 160-176.

Heaver, T. Meerman, H. and Van de Voorde, E (2001) Cooperation and Competition in International Container Transport: Strategies for Ports, *Maritime Policy and Management* , vol. 28 pp. 293-305.

Hirschmann, A.O. (1970*) Exit, Voice, and Loyalty: Responses to decline in Firms, Organizations, and States,* Cambridge, Massachusetts: Harvard University Press.

Hodgson, G.M. (1998) Evolutionary and Competence-Based Theories of the Firm, *Journal of Economic Studies,* vol. 25(1) 25-56.

Hollingsworth, J.R. & Lindberg, L.N. (1985) The Governance of the American Economy: the Role of Markets, Clans, Hierarchies, and Associative Behaviour, in W. Streeck & P.C. Schmitter (eds.) *Private Interest Government*. London, Beverly Hills, New Delhi: Sage Publications, pp. 221-255.

Hollingsworth, J.R. Schmitter, P.C. and Streeck, W. (1994) *Governing Capitalist Economies: Performance and Control of Economic Sectors,* New York, Oxford University Press.

Hollingsworth, J.S. and Boyer, R. (eds) (1997) *Contemporary Capitalism: the Embeddedness of Institutions*, Cambridge: Cambridge University Press.

Hotelling, H. (1929) Stability in Competition, *Economic Journal,* vol. 39 pp. 41-57.

Jessop, B. (1997) Capitalism and its Future: Remarks on Regulation, Government and Governance, *Review of International Political Economy*, vol. 4 (3) pp. 561-581.

Jones, T. (1999) *The Port of Durban*, Durban.

Klink, H.A. van (1995) *Towards the Borderless Mainport Rotterdam – an Analysis of Functional, Spatial and Administrative Dynamics in Port Systems*, Amsterdam: Thesis publishers.

Klink, H. A. van and Langen, P. W. de (2001) Cycles in Industrial Clusters: the Case of the Shipbuilding Industry in the Northern Netherlands, *Tijdschrift Sociale en Eonomische Geografie*, vol.92 (4) pp. 449- 463.

Klink, H.A. and Winden, W. van (1999) Knowledge as new Factor in Hinterland Competition: the Case of Rotterdam, *Tijdschrift Vervoerswetenschap*, pp. 41-50.

Kreukels, T. and Wever, E. (eds.) (1998) *North Sea Ports in Transition: Changing Tides,* Assen, Van Gorcum.

Krugman, P. (1991) *Geography and Trade*, Cambridge Massachusetts, The MIT Press.

Krugman, P. (1995) *Development, Geography and Economic Theory,* Cambridge Massachusetts, The MIT Press.

Lambooy, J. and Boschma R. (2001) Evolutionary Economics and Regional Policy, *The Annals of Regional Science,* vol. 35 pp. 113-131.

Langen, P.W. de (2002) Clustering and Performance: The Case of Maritime Clustering in the Netherlands, *Maritime Policy and Management,* vol. 29 (3) pp. 209-221.

Langen, P.W. de and Nijdam, M.H. (2003) *Leader Firms in the Dutch Maritime Cluster*, Paper presented at the ERSA congress, Finland.

Langen, P.W. de, Enthoven, D. van and Nijdam, M.H. (2003) *Einde aan een Eiland*, studie voor CNV Bedrijven Bond, Rotterdam.

Lorenzoni, G. and Baden-Fuller, C. (1995) Creating a Strategic Center to Manage a Web of Partners, *California Management Review,* vol. 37 (3) pp.146.

Louisiana Ports Association (2003) data retrieved from website www.portsoflouisiana.org and links to ports in Louisiana

Maillat, D. (1998) From the Industrial District to the Innovative Milieu: Contribution to an Analysis of Territorialized Productive Organizations, *Recherches Economiques de Luvain*, vol. 64 (1) pp. 111-129.

Markusen, A. (1996) Sticky Places in Slippery Space: A Typology of Industrial Districts, *Economic Geography,* vol. 72 (3) pp. 293-313.

Markusen (1999) Fuzzy Concepts, Scanty Evidence, Policy Distance: the Case for Rigour and Policy Relevance, *Critical Regional Studies,* vol. 33 (9) pp. 869-884.

Marshall, A. (1920) *Principles of Economics* (8th edition originally published in 1890), Basingstoke: MacMillan.

Martin, R. and Sunley, P. (2003) Deconstructing Clusters: Chaotic Concept or Policy Panacea? *Journal of Economic Geography,* vol. 3 pp. 5-35.

Martin, J and Thomas, B.J. (2001) The Container Port Community, *Maritime Policy and Management* vol. 28 pp. 279-292.

McEvily, B. and Zaheer, A. (1999) Bridging Ties: a Source of Firm Heterogeneity in Competitive Capabilities, *Strategic Management Journal,* vol.20 pp. 1133-1156.

Metcalfe (1994) Competition, Fisher's Principle and Increasing Returns in the Selection Process, *Journal of Evolutionary Economics,* vol. 4(4) pp. 327-346.

Metcalfe, S. (1998), *Evolutionary Economics and Creative Destruction,* London, Routledge.

Meijer (1999) *City and Port: Urban Planning as a Cultural Venture in London, Barcelona, New York, and Rotterdam: Changing Relations between Public Urban Space and Large Scale Infrastructure,* Utrecht, International Books.

Mistri, M. (1999) Industrial Districts and Local Governance in the Italian Experience*, Human Systems Management*, vol. 18 pp. 131-139.

Montgomery (ed) (1995) *Resource-based and Evolutionary Theories of the Firm: Towards a Synthesis* Boston, Dordrecht, Kluwer Academic Publishers.

Mossberger and Stoker (2001) The Evolution of Urban Regime Theory the Challenge of Conceptualization, *Urban Affairs Review,* vol. 36 (6) pp. 810-835.

Musso E, Benacchio, M and Ferrari, C (2000) Ports and Employment in Port Cities*, International Journal of Maritime Economics,* vol. 2 (4) pp. 283-311.

National Port Authority of South Africa (2003) http://www.npa.co.za/Ports/Durban/Index

Nationale Havenraad (2003) Homepage statistics at www.havenraad.nl

Nelson, R. and Winter, S. (1982) *An Evolutionary Theory of Economic Change,* Cambridge (Massachusetts), The Belkap Press of Harvard University Press.

Nelson, R. (1994) The Evolution of Comparative or Competitive Advantage: A Preliminary Report on a Study, *Industrial and Corporate Change,* vol. 5 (2) 597-617.

Nooteboom, B. (1992) Towards a Dynamic Theory of Transactions, *Journal of Evolutionary Economics*, vol. 2 pp. 281-299.

Nooteboom, B. (1996) Trust, Opportunism and Governance: a Process and Control Model, *Organization Studies,* vol. 17 (6) pp. 985-1010.

Nooteboom, B. (1999A) *Interfirm Alliances: Analysis and Design,* London, Routledge.

Nooteboom, B. (1999B) Learning, Innovation and Industrial Organization, *Cambridge Journal of Economics,* vol. 23 pp. 127-150.

Nooteboom, B. (2000) Institutions and Forms of Co-ordination in Innovation Systems, *Organization Studies,* vol. 21(5) pp. 915-932.

North, D. (1990*) Institutions, Institutional Change and Economic Performance*, Cambridge, Cambridge University Press.

Notteboom, Th. (1997) Concentration and the Load Center Development in the European Container Port System, *Journal of Transport Geography,* vol. 5 pp. 99-115.

Notteboom, Th. and Winkelmans, W. (2001) Structural Changes in Logistics: how will Port Authorities face the Challenge? *Maritime Policy and Management,* vol. 28 (1) pp. 71-89.

Olson, M. (1971) *The Logic of Collective Action: Public Goods and the Theory of Groups*, Cambridge Massachusetts, Harvard University Press.

Panniccia I. (1999) The Performance of Industrial Districts, Some Insights from the Italian Case, *Human Systems Management,* vol.18 pp. 141-159.

Paquet, G. (1998) Evolutionary Cognitive Economics, *Information Economics and Policy,* vol. 10 pp. 343-357.

Piore, M. and Sabel C. (1984) *The Second Industrial Divide: Possibilities for Prosperity*, New York, Basic Books.

Policy Research Corporation (2001) Economic Impact of Maritime Industries in Europe, via: http://europa.eu.int/comm/enterprise/maritime/maritime_industrial/studies.htm.

Porter, M.E. (1990) *The Competitive Advantage of Nations*, London, MacMillan.

Porter, M.E. (1998) The Adam Smith Address: Location, Clusters, and the "New" Micro Economics of Competition, *Business Economics,* vol. 33 pp. 7-13.

Pouder, R. and St. John, C.H. (1996) Hot Spot and Blind Spots: Geographical Clusters of Firms and Innovation, *Academy of Management Review,* vol. 21 (4) pp. 1192-1225.

Rabelotti, R. and Schmitz, H. (1999) The Internal Heterogeneity of Industrial Districts in Italy, Brazil and Mexico, *Regional Studies,* vol. 33 (2) pp. 97-108.

Rijsenbrij (2000) Grootschalige Systemen in het Transport, Inaugurele Rede, Delft.

RMPM (2001) *Bedrijfsplan 2001-2005*, Rotterdam.

RMPM (2002) *Annual Report*, Rotterdam.

RMPM (2003) homepage statistics: http://www.port.rotterdam.nl/

Roelandt, T. and den Hartog P. (eds) (1999) Boosting Innovation: The Cluster Approach. Paris: OECD

Rugman, A, van-den-Broeck, J. and Verbeke, A. (eds.) (1995) Beyond the Diamond, *Research in Global Strategic Management,* vol. 5 Greenwich, Conn. and London: JAI Press.

Rumelt, R.P. Schendel, D. E. and Teece, D. (eds) (1994) *Fundamental Issues in Strategy: a Research Agenda,* Boston, Massachusetts, Harvard Business School Press

Rusaw (1995) Learning by Association: Professional Associations as Learning Agents, *Human Resource Development,* Quarterly, vol. 6 (2) pp. 215-226.

Sako (1996) Suppliers' Associations in the Japanese Automobile Industry: Collective Action for Technology Diffusion, *Cambridge Journal of Economics*, vol. 20 pp. 651-671.

Sardent, A.J. (1938) *Seaports and Hinterlands*, Black, London.

Saxenian (1994) *Regional Advantage: Culture and Competition in Silicon Valley and Route 128,* Cambridge, Massachusetts, Harvard University Press.

Schenk (1998) *Industrial Policy Rationales for a Virtual Stock Exchange with Regional Counters* Rotterdam: Erasmus Universiteit Rotterdam.

Scott, A.J. (1988) Flexible Production Systems and Regional Development: the Rise of new Industrial Spaces in North America and Western Europe, *International Journal of Urban and Regional Research,* vol. 12 pp.171-186.

Silverberg, G. Dosi, G. and Orsenigo, L. (1988) Innovation, Diversity and Diffusion: a Self Organizing model, *Economic Journal,* vol. 98 pp. 1032-1054.

Simon, H. (1965) *Administrative Behavior: a Study of Decision Making Processes in Administrative Organization* New York, Free Press.

Simon, H. Egidi, M. and Marris, R. (1992) *Economics, Bounded Rationality and the Cognitive Revolution,* Aldershot, Edward Elgar.

Slack, B. (1988) The Evolution of a Port Service Industry Complex, *Canadian Geographer,* vol. 32 pp. 124-132.

Slack, B. (1989) Port Services, Ports, and the Urban Hierarchy, *Tijdschrift voor Economische en Sociale Geografie,* vol. 80 pp. 236–243.

Slack, B. (1999) Satellite Terminals: a Local Solution to Hub Congestion?, *Journal of Transport Geography,* pp. 241-246.

Smith, A. (1776) *The Wealth of Nations,* London, Dent, New York, Dutton (edition 1910).

Staber, U. (1996) Accounting for Variations in the Performance of Industrial Districts: The Case of Baden-Württemberg, *International Journal of Urban and Regional Research,* vol. 20 (2) pp. 299-316.

Staber U, (1998) Inter Firm Cooperation and Competition in Industrial Districts*, Organization Studies,* vol. 19 pp. 701-724.

Staber, U. (2001) The Structure of Networks in Industrial Districts, *International Journal of Urban and Regional Research,* vol. 25 (3) pp. 537-552.

Stevens, H. (1999) *The Institutional Position of Sea Ports: an International Comparison,* Dordrecht Kluwer Academic Publishers.

Streeck, W. and Schnitter, P.C. (eds) (1985) *Private Interest Government: beyond Market and State,* London, Sage.

Tisdell, C. A. (1996) *Bounded Rationality and Economic Evolution: a Contribution to Decision Making*, *Economics and Management,* Cheltenham, Edward Elgar.

US Bureau of Census (2003) data retrieved via website http://www.census.gov/.

US Army Corps of Engineers (2003) data retrieved via website http://www.usace.army.mil/

Verhoeff (1981) Seaport Competition: Some Fundamental and Political Aspects, *Maritime Policy and Management*, vol. 8 (1) pp. 49-60.

Waters, R.C. (1977) Port Economic Impact Studies: Practice and Assessment, *Transportation Journal,* vol.16 pp. 14-18.

Yin (1994) *Case Study Research, Design and Methods, Second Revised Edition*. Thousand Oaks, CA, Sage.

Welters, H.W.H. and Langen, P.W. de (2003) *Het Onzekere voor het Zekere nemen; een Visie vanuit de Wetenschap op de Lange Termijnontwikkeling van het Rotterdamse Haven en Industriecomplex,* Elsevier, Rotterdam.

Westlund, H. (1999) An Interaction Cost Perspective on Networks and Territory, *The Annals of Regional Science,* vol. 33 pp. 93-121.

Williamson, O. E. (1985) *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, New York, The Free Press.

Williamson, O. E. (1993) *The Economic Analysis of Institutions and Organizations in General and with Respect to Country Studies*, Paris, OECD.

Winkelmans, W. (1984) *Paradoxen in de Zeehaveneconomie,* Rotterdam Erasmus Universiteit.

World Bank (2000) Port Reform Toolkit, available from http://www.worldbank.org/

APPENDIX 1: THE SURVEY

Survey on the performance of seaport clusters

The aim of this survey is to identify which factors influence the performance of the Lower Mississippi Port Cluster (LMPC) and how. A wide number of issues are addressed. If you do not know how to answer a question, please leave the question open. About 25/30 *port experts* in the LMPC answer this survey. A list of those experts is provided at the end of the survey. All answers will be treated confidentially. We provide definitions of terms that may be unclear. Below, we show the framework on which this survey is based.
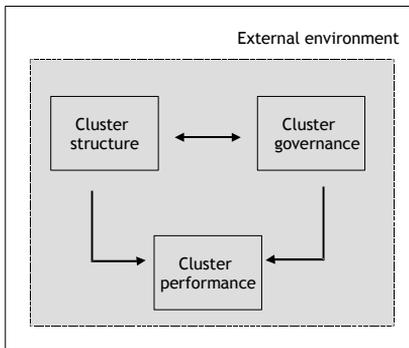
We analyze the influence of both the *structure* and the *governance* on the performance of the LMPC. We have identified a number of variables related to the structure and the governance of the cluster and ask your opinion about the validity and importance of these variables.

The LMPC consists of firms located in the proximity of the port jurisdictions of the port of New Orleans, South Louisiana, Plaquemines, St Bernard and Baton Rouge *and* strongly related to the movement of cargo and ships. The cluster consists of five 'components'. An example of the size of these components in terms of employment in Durban is given the following figure:
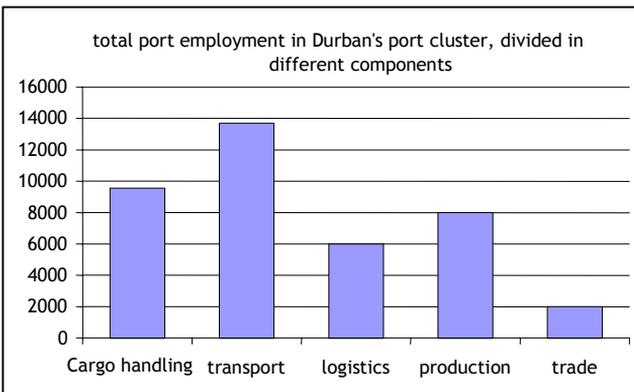
Industry experts

1.   Name and organization: _____

2.   Function   _____

3.   Years of experience in the LMPC   _____

4.   Number of employees of organization   _____

5.   Involvement in cluster governance   YES/NO

Cluster linkages: relations between different actors in the cluster. Relations can be based on transactions, the exchange of knowledge and information and on joint projects.

Components of the port cluster: the five cluster components: cargo handling, transport, logistics, manufacturing and trade.

Cluster linkages

6.   Indicate which component(s) of the port cluster of the activities of your organization can be
         categorized.

1.	Cargo handling	_____%
2.	Transport	_____%
3.	Logistics	_____%
4.	Manufacturing	_____%
5.	Trade	_____%

                                                            100% (total)

7.   Indicate the strength of linkages of your organization with organizations active in the different
         components of the LMPC.

Component	Strength of linkages				
Cargo handling	Very weak	Weak	Moderate	Strong	Very strong
Transport	Very weak	Weak	Moderate	Strong	Very strong
Logistics	Very weak	Weak	Moderate	Strong	Very strong
Trade	Very weak	Weak	Moderate	Strong	Very strong
Manufacturing	Very weak	Weak	Moderate	Strong	Very strong

Internal competition:	competition between firms that are both located in the *same* port (cluster).
External competition:	competition between firms in different ports
Switching costs:	the costs associated with switching to an alternative supplier

Internal competition

8.   Indicate whether you disagree or agree with the following four propositions:

Proposition	Opinion
Since the competitive environment is practically the same for competitors ort cluster, internal competition is a stronger force inducing firms to n external competition.	Agree / disagree/ no opinion
Internal competition leads to low 'switching costs' for port users; switching her when port service providers only face external competition.	Agree / disagree/ no opinion
Internal competition leads dynamism and a 'vibrant competitive Such an environment is conducive for innovation.	Agree / disagree/ no opinion
The presence of internal competition adds to the performance of the port	Agree / disagree/ no opinion

9.   Assess the presence of internal competition in cargo handling and port services in the LMPC.

Activity	Presence of internal competition		
Container handling	No internal competition	Limited internal competition	Fierce internal competition
Dry bulk handling	No internal competition	Limited internal competition	Fierce internal competition
Liquid bulk handling	No internal competition	Limited internal competition	Fierce internal competition
Breakbulk handling	No internal competition	Limited internal competition	Fierce internal competition
Pilotage	No internal competition	Limited internal competition	Fierce internal competition
Towage	No internal competition	Limited internal competition	Fierce internal competition
Mooring	No internal competition	Limited internal competition	Fierce internal competition

Agglomeration economies

10.   Indicate whether you disagree or agree with the following propositions:

Proposition	Opinion
The presence of a cluster related labor force in the LMPC is a reason for firms to locate in the LMPC.	Agree / disagree/ no opinion
The presence of cluster related customers and suppliers in the LMPC is a reason for firms to locate in the LMPC.	Agree / disagree/ no opinion
The presence of the cluster related knowledge and information in the LMPC is a reason for firms to locate in the LMPC.	Agree / disagree/ no opinion
Relatively high land prices in the LMPC induce firms to leave the cluster.	Agree / disagree/ no opinion
A relatively high level of congestion in the LMPC induces firms to leave the cluster.	Agree / disagree/ no opinion
The high wage level and power of labor organizations in the LMPC induce firms to leave the cluster.	Agree / disagree/ no opinion

Diversity of the cluster population

Diversity of economic activities:	The presence of firms active in different markets.
Diversity of firm size:	The presence of small, medium sized and large firms.
Diversity of international scope:	The presence of foreign firms, local firms, and headquarters of internationally operating firms.

11.   Indicate whether you disagree or agree with the following five propositions:

Proposition	Opinion
Opportunities for co-operation in a cluster are higher the larger the diversity of the cluster population.	Agree / disagree/ no opinion
Opportunities for innovation in a cluster are higher the larger the diversity of the cluster population.	Agree / disagree/ no opinion
Diversity of the cluster population reduces the vulnerability of a cluster for changes in the environment.	Agree / disagree/ no opinion
Co-operation between firms *in* the LMPC is of minor importance for the performance of this cluster compared to co-operation with firms *outside* the cluster.	Agree / disagree/ no opinion
Diversity of the resource base of a cluster reduces the vulnerability of a cluster for changes in the environment.	Agree / disagree/ no opinion

12.   Indicate for three dimensions of diversity of the cluster population how important this type of diversity is for the opportunities for co-operation and innovation in the cluster.

Type of diversity	Importance of diversity for opportunities for co-operation and innovation				
Diversity of economic activities	Not important	Of minor importance	Of moderate importance	Important	Very important
Diversity of firm size	Not important	Of minor importance	Of moderate importance	Important	Very important
Diversity of international scope	Not important	Of minor importance	Of moderate importance	Important	Very important

13.   Indicate the diversity of the LMPC for three dimensions of diversity.

Type of diversity	Diversity of the LMPC				
Diversity of economic activities	Not diverse	Small diversity	Moderately divers	Diverse	Very diverse
Diversity of firm size	Not diverse	Small diversity	Moderately divers	Diverse	Very diverse
Diversity of international scope	Not diverse	Small diversity	Moderately divers	Diverse	Very diverse

Cluster barriers

Entry barriers:	Barriers that prevent firms from entering the cluster,
Start-up barriers:	Barriers that prevent individuals from starting a new firm
Exit barriers:	Barriers that prevent firms from an exit of the cluster
Sticky labour:	A labour force not willing to enrol in a job outside the port region or port industry

Indicate whether you disagree or agree with the following seven propositions:

Proposition	Opinion
High barriers to start a new business in a cluster reduce the performance of that cluster.	Agree / disagree/ no opinion
High barriers to 'leave' a cluster increase the performance of that cluster.	Agree / disagree/ no opinion
High barriers to leave a cluster have a negative effect on the performance of that cluster in the long run, because they reduce the pressure to maintain the vitality of that cluster.	Agree / disagree/ no opinion
The inaccessibility of knowledge and networks is a relevant barrier for entry and start-up.	Agree / disagree/ no opinion
The unavailability of 'local capital' is a relevant barrier for start-up.	Agree / disagree/ no opinion
The presence of labor that is 'sticky' to the port cluster is a relevant exit barrier.	Agree / disagree/ no opinion
The presence of specific investments is a relevant exit barrier.	Agree / disagree/ no opinion

Cluster governance

Cluster governance:	The co-ordination of activities in the port cluster. Different mechanisms, such as markets, inter firms alliances, associations and public-private organisations, are used to co-ordinate activities.
Leader firms:	Firms that have a superior ability to coordinate activities.
Knowledge intermediaries:	Firms or associations that possess, gather and 'distribute' knowledge and information.

14.   Indicate whether you agree or disagree with the following propositions:

Proposition	Opinion
A culture of trust increases the quality of the governance of a cluster because it lowers transaction costs and enables co-operation.	Agree / disagree/ no opinion
The presence of 'leader firms' increases the quality of the governance of a cluster.	Agree / disagree/ no opinion
The presence of intermediaries increases the quality of the governance of a cluster, because intermediaries lower transaction costs and enable co-operation.	Agree / disagree/ no opinion
Differences in the governance of a cluster influence the performance of that cluster.	Agree / disagree/ no opinion
The development of port clusters is the result of the interplay of market forces and (inter)national policies. The quality of local governance does not have a substantial effect on the performance of the cluster.	Agree / disagree/ no opinion

15.   Please indicate the importance of six intermediaries for lowering transaction costs and enabling co-operation in the port cluster, by ranking them from 1 (*most* important one) to 6 (*least* important one).

Intermediary	Rank
Ship's agents	
Forwarders	
Shipbrokers	
Associations	
Commodity traders	
Non asset-owning logistics service providers	

16.   Indicate whether you agree or disagree with the following propositions:

Proposition	Opinion
The accessibility of knowledge and information sources influences the performance of the port cluster.	Agree / disagree/ no opinion
Many firms in the port cluster access knowledge and information through contacts with 'knowledge intermediaries' located in the cluster.	Agree / disagree/ no opinion

Solving collective action problems

The collective action problem:	The problem that even though cooperation among a large group of firms would be beneficial for all members of that group, cooperation does not develop spontaneously, because individual firms are even better off when they '*free ride*'.
Cluster governance issues:	Issues for which 'collective action' would be advantageous.

17.   Indicate of the five issues given below, whether or not the collective action problem is present in the LMPC.

Issue	Presence of collective action problem	
Innovation	Present	Absent
Training and education	Present	Absent
Internationalization	Present	Absent
Marketing and promotion	Present	Absent
Hinterland access	Present	Absent

18.   Indicate the importance of these five issues for the performance of the LMPC.

Issue	Importance in the LMPC				
Innovation	Not important	Of minor importance	Of moderate importance	Important	Very important
Training and education	Not important	Of minor importance	Of moderate importance	Important	Very important
Internationalization	Not important	Of minor importance	Of moderate importance	Important	Very important
Marketing and promotion	Not important	Of minor importance	Of moderate importance	Important	Very important
Hinterland access	Not important	Of minor importance	Of moderate importance	Important	Very important

Governance regimes

Regimes:	The way in which firms deal with a CAP-issue.
Infrastructure for collective action:	Organizational infrastructure that facilitates coordination and cooperation.
Community argument:	An argument to persuade firms in the cluster to contribute to joint projects, because they are part of a community.
Voice:	Firms that, when not satisfied with a solution to a collective action problem strive to *improve* it, by raising their voice.

19.   How important are the below mentioned variables for the quality of governance in the LMPC?

Variable	Importance for the quality of governance				
The presence of leader firms	Not important	Of minor importance	Of moderate importance	Important	Very important
The presence of an 'infrastructure for collective action'	Not important	Of minor importance	Of moderate importance	Important	Very important
An appropriate role of the public organizations in the cluster	Not important	Of minor importance	Of moderate importance	Important	Very important
The legitimacy of a 'community argument'	Not important	Of minor importance	Of moderate importance	Important	Very important
The appreciation of voice	Not important	Of minor importance	Of moderate importance	Important	Very important

20.   Indicate the quality of the above-mentioned variables for the five regimes in the LMPC, with scores ranging from –5 (very bad) to +5 (very good).

	The marketing and promotion regime	The innovation regime	The hinterland access regime	The training and education regime	The inter-nationalization regime
The presence of leader firms					
The presence of an 'infrastructure for collective action'					
The appropriateness of the role of the public organizations in the cluster					
The legitimacy of a 'community argument'					
The appreciation of voice					

The weight of the variables of cluster performance

21.   Indicate the importance of four classes of variables for the performance of the LMPC, by ranking them from 1 (most important class of variables) to 4 (least important class of variables).

Classes of variables	Rank
The structure of the port cluster	
The governance of the port cluster	
General economic development	
National and international policies	

22.   Indicate the importance of 10 'cluster structure variables' for the performance of the LMPC, by ranking from 1 to 10, where 1 is the most important variable and 10 the least important variable.

Cluster structure variables	Rank
The presence of a labor force	
The presence of customers and suppliers	
The presence of knowledge spillovers	
The level of land prices and office rents	
The level of congestion	
The presence of internal competition in the port cluster	
The presence of cluster entry barriers	
The presence of cluster exit barriers	
The diversity of the cluster population	
The diversity of the resource base of the cluster	

23.   Indicate the importance of each of the 'cluster governance variables', for the performance of the LMPC, by ranking them from 1 (most important variable) to 4 (least important variable).

Cluster governance variables	Rank
The presence of trust	
The presence of intermediaries	
The presence of embedded leader firms	
The quality of solutions to the collective action problems	

An assessment of the competitive position of the LMPC vis a vis Houston

24.　　　　Assess the quality of the 15 factors discussed above for the LMPC and Houston's port cluster by placing a '□' in the table for the score of the LMPC and a '○' for the score of Houston. The minimum score is –5, the maximum score is +5.

Variable	Score										
The presence of a labor force	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of customers and suppliers	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of knowledge spillovers	-5	-4	-3	-2	-1	0	1	2	3	4	5
The level of land prices and office rents	-5	-4	-3	-2	-1	0	1	2	3	4	5
The level of congestion	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of internal competition	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of cluster entry barriers (access to local knowledge, networks and capital)	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of cluster exit barriers (immobile stall, fixed investments and strong economic ties)	-5	-4	-3	-2	-1	0	1	2	3	4	5
The diversity of the cluster population	-5	-4	-3	-2	-1	0	1	2	3	4	5
The diversity of cluster resources	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of a culture of trust	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of intermediaries	-5	-4	-3	-2	-1	0	1	2	3	4	5
The presence of embedded leader firms	-5	-4	-3	-2	-1	0	1	2	3	4	5
The quality of solutions to the collective action problems	-5	-4	-3	-2	-1	0	1	2	3	4	5

Opportunities for improving the cluster management

25.　　Indicate whether you disagree or agree with the following proposition:

Proposition	Opinion
De 'overall' goal of cluster governance should be to improve the performance of the port cluster.	Agree / disagree/ no opinion
In some cases, policies aimed at improving the performance of the cluster as a whole can be disadvantageous for a few companies in the cluster. In such cases, the cluster performance would benefit when such partial interests are 'overruled'.	Agree / disagree/ no opinion

APPENDIX 2: CLUSTER EXPERTS IN THE THREE CASES

Table A1: Cluster experts in the LMPC

Organization	Name	Job position
Port authority of New Orleans	J. Cocchiara, H. Wilbert	Senior planner/ market analyst
Port authority of New Orleans	D. Schulenkamp	Chairman, Board of Directors
Port of South Louisiana	J. Accardo	Executive Director
Port of Plaquemines	U. L. Truell, Jr.	Port Safety Engineer
Port of St Bernard	R. Scaffidel	Executive Director
Port of Baton Rouge	R. Richard	Executive Director
Millenium port Authority	T. Sands	Executive Director
International Freight Forwarders & Custom Brokers Association of NO	D. Schexnayder	President
Steamship Association of Louisiana	Ch. F. Hayden	President & Executive Officer
UNO	D. Renner	Associate professor
Metrovision	T. Kurtz	Vice President economic development
Louisiana Economic Development	D. Kane	Economic advisor
Mississippi river maritime association	M. Titone	President
Mississippi river trade and transport council	G. Taft	President
World Trade Center of New Orleans	E.J. Schreiber	Managing Director
New Orleans Public Belt Railroad	J. Bridger	General Manager
New Orleans Board of Trade, Ltd.	B. Bourgeouis	Executive Director
Central Gulf Lines	E.L. Johnsen	Managing Director
Sea Point	J. Amos, M. Amos	Managing Director
Associated Terminals	D. Fennelly	President
E.N. Bisso & Son. -	W. Kristiansen	President
Navios ship agencies	G. Duffy	President
General maritime	M. Maloz	President
Jackson Kearney Group	P. L. Diez,	Director, Sales and Marketing
New Orleans Cold Storage	M. Blanchard	Senior Vice President
Con-Tech International, Inc.	R.G. Evans, Jr	President
Cargill	B. Butz	General Manager
Poseidon	T Mantis	President
Schenker	F. Hoffner	President
Bean Dredging Corporation	J.W. Bean	President
Stevedoring Services of America	J. Price	Vice President & General Manager
J.W. Allen & company	W. App	President
P&O ports	M. W. Kearney	Vice President Special Projects

Table A2: Port experts in Rotterdam

Organization	Name	Job position
Gemeentelijk Havenbedrijf Rotterdam	P. Van Essen	Managing director
Deltalinqs	N. Westdijk	Managing director
Vereniging van Rotterdamse Cargadoors (VRC)	B. Rozenkrans	Managing director
Alliantie Zeecontainervervoerders	P. Dijkshoorn	Managing director
PCR/RIL	Van Unen	Managing director
KMR (Kennisinfrastructuur Mainport Rotterdam)	R. Van der Moolen	Managing director
Erasmus University	H.W.H. Welters	Professor port economics
ECT B.V.	S. Lak	adviseur
EMO BV Europees Massagoed Overslagbedrijf	Van Doorn	Managing director
Odfjell Terminals (Rotterdam) B.V.	Van Asch van Wijk	Managing director
Rail Service Center Rotterdam BV	C. Hoenders	Managing director
Peterson's Havenbedrijf	J. P. Peterson	Managing director
European Bulk Services EBS B.V.	J. Kuiper	Managing director
Gevelco Terminals B.V.	F. van den Gevel	Managing director
Dirkzwager BV Kon.Scheepsagentuur	F. van Hoorn	Managing director
P&O Nedlloyd B.V.	Lodder	Port operations
Geest North Sea Line BV	W. Pronk	Managing director
Haniel Transport Maatschappij	W. Sijthoff	Managing director
Jo Tankers B.V.	R. van Westebrugge	Managing director
Shortlines B.V.	R. Spierings	Managing director
Transforwarding	P. W. Vogelaar	Managing director
Matrans Marine Services B.V.	H. Vervat	Managing director
Over de Tjonger	J. de Ruiter	Managing director
Rabobank	H. A. van Klink	Port analist
Vopak Terminal Botlek	R.J. Wester	Managing director
Broekman Beheer b.v.	R. Riemen	Managing director
Interforest Terminal Rotterdam B.V.	B. de Lange	Managing director
Ebrex B.V. Int. Expeditiebedrijf	J Ebus	Managing director
Hudig & Veder	L. Bracco Gartner	Advisor
Schenker Int. Nederland B.V.	Damen	Managing director
Geodis Vitesse Holding B.V.	S. Weima	Managing director
Shell Pernis	F. Snuif	Managing director
Lyondell Chemical Nederland B.V.	R. P. Verhagen	Managing director
Caldic Nederland B.V.	Van Caldenborgh	Managing director
Huntsman Holland B.V.	Barents E.	Managing director
Köpcke International	W.F. van Noordwijk	Managing director
Cornelder Holding	Van Dam	Managing director
Kamer van Koophandel	R. de Boer	Chairman
Scheepvaart- en transportcollege	E. Hietbrink	Chairman
Vopak	P. Govaart	Managing director
Port support	A. Seltenreich	Managing director
Smit Internationale	B. Vree	Managing director

Table A3: Port experts in Durban

Organization	Expert name	Job position
Portnet South African Port Operations (SAPO)	R. Holthausen	Commercial Manager
South african association of freight forwarders	S. Frederic	Director
Durban Metro Economic Development	G. Robbins	Economic and Investment advisor
Mediterranean Shipping Company	A. Rolfe	Operations Manager
Portnet Training Academy, NPA	D. Cele	Port Academy Manager
DTB Cartage Company Ltd	P. Rayner	Managing Director (Chairman HCA)
University of Natal	T. Jones	Professor
P&I Associates	Capt. A. Reid	Managing Director
Rennies terminals	A. Dawe	(Senior manager) Ops. Director
Mediterranean Shipping Company (MSC)	Capt. S. Sarno	Chairman
Portnet, NPA	R. Chetty	Planning & Development
South African Stevedores	J. Roux	General Manager
(Maersk) Safmarine Container Lines	C. Lambourne	Area Executive
Unicorn Lines	D. Rennie	Chief Executive Unicorn Lines
Spoornet	D. Naidu	Ops. Manager (Durban Harbour)
Ladit Associates	D. Lawrance	Managing director
Self-employed	T. Hutson	port/shipping editor
South African Sugar Association Terminal	G. Ebdon	operations manager
Rennies Ships Agency (Pty) Ltd	T. Kee	Marketing Director
Union Transport (UTI)	H. Fisher	International Forwarding
Fresh Fruit export terminal	T. Bestenbreur	General Manager: Durban
South African Bulk Terminals Ltd (SABT)	K. Smith	Managing Director Bulk Division
Bidfreigth Terminals (Pty) Ltd	A. Dawe	Operations Director
Union Transport (UTI)	K. Marsh	General Manager - KwaZulu Natal
Chandling International	M. Yunnie	Managing director
CSAV	A. Sibbald	Line Executive
John T Rennie & Sons	N. Reddy	Operations Manager
King & Sons (Pty) Ltd. Ship's Agents	N. Sargent	General Manager
Outlook Maritime Project Managers	N. Cronje	Managing director
Mondi Paper	A. Ryan	Distribution Manager
ISS - Voigt Shipping	P. Voigt	Managing Director
Seaboard Overseas Management Company Ltd.	C. Sutton	Manager Operations
Rennies Ships Agency (Pty) Ltd	C. D. Glen	General Manager
Vopak Terminal Durban (Pty) Ltd.	R. Okker	Managing Director
Elgin	R. Deane	Ship Repair Managing Director
Southern African Shipyards (Pty) Ltd	J. Cobarg	General Manager
Paperlink / Mondi Paper	D. McAslan	Logistics Manager
Engen Refinery	J. F. Stolz	Production Superintendent
Brink & Associates, Marine Consultants	Capt. A. R Brink	Managing Director
Toyota SA Manufacturing	K. M. Beck	General Manager Logistics Division

APPENDIX 3: BIK CODES OF PORT CLUSTER ACTIVITIES

Component	Description based on BIK code
Cargo handling	Loading, unloading and transhipment activities (6311) Pilotage (6322.02) Terminal suppliers, Port engineering (No code)
Transport	Shipping services (6110) Pipeline transportation (6030) Rail transport (6010) Inland water transport (6120) Trucking services (6024.21) Other freight transport by road (6024.23) Shipbuilding and repair (351)
Logistics	Transport intermediaries (6340) Storage (6312) Logistics consulting services (no code)
Manu-facturing[4]	Oil refineries (2320) Cokes manufacturing (2310) basic chemical manufacturing (241) Flour milling (1561) Production of iron and steel (271) Automobile manufacturing (34) Other chemical manufacturing (246) Specialized suppliers of port manufacturing firms (No code)
Trade[5]	Fuel wholesalers (51512) Metal and ores wholesalers (5152) Gain wholesalers (51211) Mineral oils wholesalers (51513) Traders oil and fuels (511201) Traders in metals and ores (511202) Traders in chemical products (511203) Traders in raw products for food industry (511105)

The Performance of Seaport Clusters

A Framework to Analyze Cluster Performance and an Application to the Seaport Clusters of Durban, Rotterdam and the Lower Mississippi

Summary

Economists frequently use the cluster concept to analyze the economic development of regions. Because of increasing interaction and competition between regions, the specialization of regions increases. This leads to the development of clusters: spatial concentrations of interrelated firms. Competitive clusters can contribute substantially to the economic development of regions. Therefore, the question 'what determines the performance of clusters' is relevant.

In this thesis, a framework to analyze the performance of clusters is developed. This framework is applied to three case studies: the port clusters of Rotterdam, Durban and the Lower Mississippi. The cluster concept is frequently applied, but hardly to seaports, in spite of the fact that seaports are clear examples of clustering. Virtually all ports attract firms related to the arrival of goods and ships. The results of the case studies are relevant both for economists dealing with clusters in general and scholars specializing in port studies.

The thesis consists of three parts. In the first part the theoretical framework is developed (chapters 1 to 6), the second part (chapters 7 to 12) deals with the application to seaports and the third part (chapters 13 to 15) presents conclusions.

The theoretical part

The question 'how can cluster activities be identified' has received limited serious attention. In virtually all cluster studies, clusters are defined loosely. A precise delimitation is a step forward, since it provides a basis for a precise analysis of the evolution of a cluster in time, it enables a detailed comparison between clusters, and it allows for a precise analysis of the influence of certain characteristics of a cluster, such as degree of foreign ownership, diversity in the cluster and entry and exit in the cluster, on its performance.

In this thesis a method to delimit clusters is developed, based on two 'boundaries' of the cluster: the economic and spatial boundary. The method of delimitation consists of four iterative steps:

1. Selection of a loosely defined specialization of the cluster and spatial scope of the cluster analysis, for instance 'shipbuilding in the North of the Netherlands'.

2. Identification of the set of 'cluster activities' based on an analysis of relations between activities with the use of input/output data, an analysis of the spatial concentration of activities, an analysis of the structure and membership of business associations and an analysis of the composition of value chains.

3. Identification of the relevant cluster region, based on a concentration analysis. Municipalities with a percentage of cluster firms above a certain minimum are included in the relevant region.

4. Identification of the 'cluster population', consisting of firms involved in cluster activities *and* located in the relevant cluster region.

Variables of cluster performance

In this thesis it is argued that the value added created in the cluster is the best performance indicator. A growth of the added value over time shows a cluster is performing well. The value added in a cluster changes as a result of two effects: an 'incumbent performance' effect (changes of the value added generated by established firms) and a 'population effect' (changes in the value added caused by a changing cluster population because of start-up, entry, exit, and bankruptcy).

A widely accepted theory on relevant variables of cluster performance is lacking. In this thesis, four relevant schools are identified and insights from these schools are used to develop a sound analytical framework for analyzing cluster performance. The first school is termed 'the Diamond School' because the diamond framework (Porter, 1990) is center stage in this school. This framework encompasses a variety of insights relevant for the performance of clusters, but is not precise on variables that influence the performance of a cluster. The second school is 'New Economic Geography', with Krugman (1991) and Fujita et al (1999) as leading scholars. This school focuses on explaining the spatial concentration of economic activities.

The third school is the 'industrial district' school, developed to explain the success of clusters of small and medium sized firms in Italy. Nowadays, this school not only analyzes these 'Italianate industrial districts' but all kinds of clusters. The fourth school is 'Population Ecology'. This school analyzes the evolution of populations of firms in an industry. This school is relevant, since a cluster is also a population of firms that changes over time.

The variables for the performance of clusters are derived from these four schools. A distinction is made between 'governance variables' and 'structure variables'. The first group includes all variables that are directly related to the behavior of organizations in the cluster, the second group includes all variables for which this is not the case. Four 'structure variables' - agglomeration and dispersion forces, internal competition, cluster barriers and cluster heterogeneity - and four governance variables - trust, leader firms, intermediaries and collective action regimes - are identified. The effects of all these variables on the performance of clusters are summarized in the tables S1 and S2.

Table S1: The effects of cluster structure on cluster performance

Element of cluster structure	Effect on cluster performance
Agglomeration economies	A shared labor pool attracts firms to the cluster.
	The presence of customers and suppliers attracts firms to the cluster.
	The presence of knowledge (spillovers) attracts firms to the cluster.
	Land scarcity and high land prices 'disperse' firms from the cluster.
	Congestion disperses firms from the cluster.
Internal competition	Internal competition prevents monopoly pricing.
	Internal competition leads to specialization.
	Internal competition promotes innovation.
Cluster barriers	Entry barriers (such as inaccessible networks) and start-up barriers (such as non-availability of local venture capital) reduce competitive pressure and prevent the inflow of (human) capital.
	Exit barriers (such as 'sticky labor' and cluster specific investments) reduce uncertainty for firms in the cluster.
Cluster heterogeneity	Cluster heterogeneity enhances opportunities for innovation.
	Cluster heterogeneity enhances opportunities for cooperation.
	Cluster heterogeneity reduces vulnerability for external shocks.

Table S2: Variables for the quality of cluster governance

Elements of cluster governance	Effects on cluster performance
The presence of trust	Trust lowers coordination costs because costs to specify contracts decrease.
	Trust increases the scope of coordination beyond price, because the risk of free riding decreases.
The presence of intermediaries	Intermediaries lower coordination costs and increase the scope of coordination beyond price because they specialize in managing coordination.
The presence of leader firms	Leader firms generate positive external effects for firms in their network, mainly by encouraging innovation and promoting internationalization.
	Leader firms generate positive external effects for firms in the cluster, mainly by organizing investments in the training and education infrastructure, the innovation infrastructure and the infrastructure for collective action.
Quality of collective action regimes	The more resources are invested in the collective action regimes, the better the performance of a cluster. Five variables influence the amount of resources invested: the role of leader firms, the role of public organizations, the presence of an infrastructure for collective action, the presence of a community argument and the use of voice.

The empirical part

The empirical part consists of three case studies of the port clusters in Rotterdam, Durban and the Lower Mississippi. These cases have been selected because they are the largest port on their continent, they have a large gateway function and they are important clusters in the region.

The empirical results are based on desk research, interviews and a survey. In each port cluster, a list of port experts was made, and these experts were asked to participate, by making time for an interview and answering a set of survey questions. These survey questions were answered during the interview, so that questions and answers could be explained. 43 experts participated in Rotterdam, 34 in Durban and 31 in the LMPC. This is over 80% of all selected port experts, so the results from the survey and interviews are reliable. The survey questions address the validity of the variables, the importance of the variables, and the 'score' of each port cluster compared to a competing port cluster, for each variable. Rotterdam is compared with Antwerp and Hamburg; Durban with Richard's Bay and the LMPC with Houston. For all survey results, tests of the statistical significance have been made.

The cluster concept has hardly been applied to seaports. Relevant studies are those of Haezendock (2001) on the strengths and weaknesses of Antwerp's port cluster, Van Klink (1995) on the development of port networks, and Slack (1989), among others on the location behavior of the port service industries. The empirical research in this thesis contributes to port studies in a number of ways: explicit attention is given to the issue of delimiting port clusters, the application of new insights from cluster theories to ports, attention to the issue of governance in seaports, a comparison between different port clusters, and an analysis of implications of using the cluster perspective for policy and management in seaports.

The arrival of ships and cargo is central to port clusters. The arrival of goods and ships attracts different economic activities that can be classified in five components. The first component is cargo handling, comprising of all activities necessary to load and unload ships, such as terminal operators, pilots, towage and mooring. The second component is transport and includes all firms that facilitate the movement of goods, such as shipping lines, shipbrokers and trucking firms. The third component is logistics and includes all activities that add value to the transported products, such as storage, re-packing and blending. The fourth component consists of a specific set of manufacturing activities. The most important

manufacturing activities are oil refining, chemicals production and steel plants. The fifth component consists of specific trading companies. Trade activities related to commodities that are frequently stored in ports (such as oil and grain) are included in the port cluster.

The size of the three port clusters is analyzed. The available firm data in Rotterdam lead to a small overestimation of the number of firms, since legal or fiscal ventures are included. Rotterdam's port clusters consists of about 3,560 firms, 36% of which is active in transport and 45% in logistics. The number of manufacturing firms is limited (about 90) but they generate a substantial part of all value added in the cluster. The relevant cluster region consists of 16 municipalities, of which Rotterdam and Dordrecht are the most important ones. In Durban, firm data are lacking, so the cluster population is identified on the basis of expert opinions and the Yellow Pages directory. This leads to a small underestimation of the size of the cluster. Durban's port cluster consists of about 680 firms, to a large extent transport firms (48%). The relevant region consists of 6 municipalities, of which Durban is by far the most important. The Lower Mississippi Port Cluster (LMPC) can be defined very precise. The cluster consists of 1,168 firms. Transport is dominant and trade relatively well represented (16%). The cluster region consists of 12 municipalities.

In the three cases, the validity of the variables is confirmed. The specific conclusions for the various variables are given below.

Agglomeration economies

- The presence of customers and suppliers is a clear force towards concentration in all three ports. Furthermore, it is regarded as the most important agglomeration force.

- The presence of knowledge is also regarded as a force towards clustering in seaports.

- The presence of labor was regarded as an agglomeration force in Rotterdam and the LMPC, but not in Durban, because of high unemployment and limited training efforts in this port. About half of the respondents in Rotterdam indicate that the high wage level is a dispersion force.

- Congestion in seaports is not regarded as a dispersion force. The same is true for high land prices.

Internal competition

The presence of internal competition (competition between firms located in the port cluster) contributes to the performance of the port cluster, because it lowers switching costs (which prevents monopoly pricing), it leads to specialization of firms in the cluster, and it leads to innovation.

The fierceness of internal competition is moderate in cargo handling and port services such as pilotage and towage. Only in the LMPC internal competition is fierce, for handling breakbulk and dry bulk. This is partly explained by the competition between port authorities in the LMPC.

Cluster barriers

The presence of barriers to entry or barriers to exit limit the performance of port clusters. The most relevant entry barrier is the inaccessibility of knowledge and networks. The unavailability of 'local capital' is an entry barrier in Durban and the LMPC, but not in Rotterdam. The only exit barrier is unrecoverable 'port specific investments'. This finding suggests a strategy to 'tie' firms to the cluster does not contribute to performance; rather, exit barriers should be reduced, for instance by leasing assets to firms in the port cluster.

Heterogeneity of the cluster

Heterogeneity contributes to performance, because it creates opportunities for innovation and cooperation. Furthermore, it reduces vulnerability for external shocks. A diverse mix of local firms, foreign owned firms and cluster based multinationals (diversity of international scope) and a diverse mix of economic activities are important in this respect. The LMPC is less diverse than Rotterdam and Durban.

Trust

Trust in the cluster contributes to performance. It is the most important 'governance variable'. Both the LMPC and Rotterdam are not high trust clusters, compared to their competitors. The level of trust in the port cluster in Durban is higher than in Richard's Bay.

Intermediaries

The presence of intermediaries contributes to the performance of the port cluster, but is relatively unimportant compared to the other governance variables. The forwarder is regarded as the most important intermediary. Rotterdam is endowed with a large number of intermediaries. In the LMPC and Durban, intermediaries are not well represented.

Leader firms

Leader firms are firms with both the ability and the incentive to make investments with benefits for other firms in the cluster. Leader firms generally have a good market position, an international scope and innovative capabilities. The presence of such firms in a cluster contributes to its performance. Rotterdam is endowed with relatively many leader firms, but the same is true for Antwerp and Hamburg. Durban has more leader firms than Richard's Bay, the LMPC lags behind Houston in this respect.

Collective action regimes

Collective action regimes are required when the problem of collective action leads to underinvestment in projects with collective benefits, because individual firms 'free ride'. This problem is relevant for investments in training and education, marketing, innovation, and hinterland access. All these regimes are important for the performance of port clusters. The following conclusions with regard to the quality of these regimes can be drawn:

- The hinterland access regime in Rotterdam is better than this regime in the LMPC and Durban. This is explained by the involvement of public organizations (especially the port authority) and leader firms in this regime.

- The marketing and promotion regime in Durban is not effective, both governments and private firms are not willing to contribute to the quality of the regime. In the LMPC, this regime depends largely on public actors, whereas in Rotterdam a good public-private arrangement has been created.

- The training and education regime is especially bad in the LMPC, leader firm involvement is lacking in this cluster. The regime is good in Rotterdam, because of the role of leader firms and the effective organizational infrastructure.

- The innovation regime is modest in all three ports, in Rotterdam because there is no 'community spirit'. The internationalization regime is also modest in all three cases.

- Leader firm involvement is an advantage for Rotterdam 'across the board'.

- All fifteen regimes that have been analyzed have shortcomings. Experts have indicated opportunities for improving all regimes. In most cases, this requires joint efforts to collect relevant 'market intelligence'.

The comparison of competing port clusters

Rotterdam has three weaknesses compared to Antwerp: the level of land prices, the supply of labor and the quality of collective action regimes. Compared to Hamburg, only the level of land prices is a weakness. A strength of Rotterdam compared to both competitors is the presence of knowledge. Compared to Hamburg, Rotterdam is also more diverse and endowed with more customers and suppliers in the cluster. The added value in Rotterdam increased more in Rotterdam's port cluster than in Antwerp, while cargo volumes were lost to Antwerp. This can be explained with the strengths and weaknesses: especially cargo handling is sensitive to land prices and labor costs and quality.

Durban's port cluster is competitive compared to Richard's Bay: the cluster is more diverse, the knowledge base is better, there is more leader firm involvement and the number of suppliers and customers in the cluster is higher. Furthermore, Durban is a 'high trust cluster'. Disadvantages are the high land prices and congestion. The cargo throughput statistics are in line with these strengths and weaknesses: Durban remains South Africa's leading port and does not lose cargo to other ports.

The LMPC is a cluster in decline: Houston has advantages in terms of collective action regimes, trust, presence of customers, suppliers and intermediaries and diversity of the cluster. The LMPC's only advantage is less congestion. The throughput figures support this conclusion; the LMPC has lost considerable market share. Furthermore, the cluster does not attract highly skilled economic activities.

De performance van havenclusters

Een raamwerk om cluster performance te analyseren en een toepassing op de havenclusters in Durban, Rotterdam en de beneden-Mississippi

Nederlandse samenvatting

Steeds meer economen gebruiken het clusterconcept om de economische ontwikkeling van regio's te onderzoeken. Door de toenemende economische interactie en concurrentie tussen regio's neemt de specialisatie van regio's toe. Deze specialisatie blijkt uit de vorming van clusters: ruimtelijke concentraties van aan elkaar gerelateerde bedrijvigheid. Sterke clusters kunnen een grote bijdrage leveren aan de economische ontwikkeling van regio's. Daarom is de vraag 'wat bepaalt de performance van clusters' relevant.

Het clusterconcept wordt veelvuldig toegepast, maar is vrijwel niet gebruikt om havens te analyseren, ondanks het feit dat havens duidelijke voorbeelden zijn van clusters. In en rond havens vestigen zich immers vrijwel altijd bedrijven die direct of indirect gerelateerd zijn aan de aankomst van schepen of lading. In dit proefschrift wordt een theoretisch raamwerk ontwikkeld om de performance van clusters te analyseren. Dit raamwerk wordt getest met drie casestudies, van de havenclusters in Rotterdam, Durban en de 'beneden Mississippi'. De resultaten van de studie zijn zowel relevant voor economen die zich met clusters bezighouden als voor economen gespecialiseerd in havens.

Het onderzoek bestaat uit drie delen. In het eerste deel van het proefschrift (de hoofdstukken 1 tot en met 6) wordt het analytische raamwerk ontwikkeld, in het tweede deel (de hoofdstukken 7 tot en met 12) volgt de toepassing op zeehavens en het derde deel (hoofdstukken 13 tot en met 15) bevat de conclusies.

Het theoretische deel

De vraag 'hoe kan worden bepaald welke activiteiten een onderdeel uitmaken van een cluster' heeft tot dusver weinig aandacht gekregen in de economische literatuur. Meestal wordt volstaan met een grove afbakening van de cluster. Een nauwkeurige afbakening is om drie redenen relevant: ten eerste biedt het de basis voor een precieze analyse van de ontwikkeling van een cluster door de tijd, ten tweede maakt het een gedetailleerde vergelijking tussen clusters mogelijk en ten derde kan de invloed van specifieke

karakteristieken van een cluster, zoals de mate van internationalisatie van bedrijven in de cluster, de aantallen toe- en uittreders in een cluster en de heterogeniteit van de cluster beter worden onderzocht.

In dit proefschrift is een methode ontwikkeld om clusters af te bakenen aan de hand van twee 'grenzen' van de cluster: de functionele en de geografische grens van een cluster. Het afbakenen van een cluster vind plaats in vier iteratieve stappen:

1. Keuze van een breed gedefinieerde 'kernspecialisatie' en geografische schaal van de clusteranalyse. Zo kan bijvoorbeeld een clusteranalyse gemaakt worden voor 'de scheepsbouwcluster in Noord-Nederland' of 'de tuinbouwcluster in het Westland'. Pas nadat deze keuze is gemaakt kan een cluster afgebakend worden.

2. Identificatie van de set met cluster activiteiten, op basis van een analyse van relaties tussen economische activiteiten, met behulp van input-output analyse, een analyse van de ruimtelijke concentratie van verschillende economische activiteiten, een analyse van de structuur en het ledenbestand van collectieve belangenorganisaties en een analyse van relaties in waardeketens. Deze set geldt voor alle clusters met dezelfde kernspecialisatie.

3. Het vaststellen van de relevante clusterregio, op basis van een analyse van de mate waarin clusteractiviteiten geconcentreerd zijn in gemeenten (of provincies). Gemeenten met een concentratie boven een bepaalde grens vormen een onderdeel van de relevante clusterregio.

4. Identificatie van de bedrijven die gezamenlijk een cluster vormen. Deze bedrijven zijn zowel gevestigd in de relevante clusterregio als actief in één van de clusteractiviteiten.

Variabelen voor de performance van clusters

In dit proefschrift wordt beargumenteerd dat de toegevoegde waarde (TW) die gecreëerd wordt in een cluster de beste maatstaf is voor de cluster performance. Een voorspoedige ontwikkeling van de TW op de lange termijn geeft aan dat de cluster een goede performance kent. De TW van een cluster verandert door twee verschillende effecten: door veranderende toegevoegde waarde gecreëerd door de al aanwezige bedrijven in de cluster, en het 'populatie effect'. Dit effect omvat de toegevoegde waarde die ontstaat door de komst

van nieuwe bedrijven en de toegevoegde waarde die verdwijnt doordat bedrijvigheid failliet gaat of zich verplaatst naar een locatie buiten de cluster.

Er is geen breed geaccepteerde theorie over de variabelen die de performance van clusters bepalen. In dit proefschrift worden vier scholen onderscheiden waaruit relevante inzichten af te leiden zijn. De eerste school wordt de 'Diamand School' genoemd, vanwege de centrale plaats van Porter's diamant raamwerk. Het raamwerk omvat veel relevante inzichten over de performance van clusters, maar is niet erg precies over welke variabelen de concurrentiekracht beïnvloeden en op welke manier. De tweede school is 'New Economic Geography'. Belangrijke economen in deze school zijn Krugman en Fujita. De school houdt zich bezig met de vraag hoe concentratie van industrieën in bepaalde regio's ontstaat.

De derde school is de 'Industrial District' school, die is ontstaan uit onderzoek naar Italiaanse clusters die goed bleken te kunnen concurreren met multinationale conglomeraten. Deze school analyseert de voordelen van deze clusters. De vierde school is 'Population Ecology'. Deze school analyseert de ontwikkeling van populaties van bedrijven door de tijd. Deze school is relevant voor clusters omdat een cluster opgevat kan worden als een populatie van bedrijven. Deze populatie verandert in de loop van de tijd, door fusies, overnames, faillissementen en starters. Uit deze school komen relevante inzichten over factoren die de ontwikkeling van populaties beïnvloeden.

Uit de bovenstaande scholen kunnen variabelen voor de cluster performance worden afgeleid. Daarbij wordt een onderscheid gemaakt tussen 'structuur variabelen' en 'governance variabelen'. Alle aan het gedrag van organisaties gerelateerde variabelen worden als 'governance variabelen' gekenmerkt, de variabelen waarvoor dat niet het geval is zijn de 'structuur variabelen'. De volgende vier structuur variabelen worden onderscheiden: agglomeratie-effecten, interne concurrentie, clusterdrempels en cluster heterogeniteit. Daarnaast worden er vier governance variabelen onderscheiden: vertrouwen, 'leader firm gedrag', tussenpersonen en 'collectieve actie regimes'. Onderstaande tabellen vatten de effecten van de variabelen op de performance van clusters samen.

Tabel S1: Het effect van de vier structuurvariabelen op clusterperformance

Structuur variabelen	Effecten op cluster performance
Agglomeratie effecten	De aanwezigheid van arbeidskrachten trekt bedrijvigheid aan.
	De aanwezigheid van klanten en leveranciers trekt bedrijvigheid aan.
	De aanwezigheid van kennis trekt bedrijvigheid aan.
	Ruimteschaarste en hoge land/huurprijzen leidt tot het verdwijnen van bedrijvigheid uit de cluster.
	Congestie leidt tot het verdwijnen van bedrijvigheid uit de cluster.
Interne concurrentie	Interne concurrentie voorkomt (misbruik van) marktmacht.
	Interne concurrentie geeft prikkels voor specialisatie.
	Interne concurrentie geeft prikkels voor innovatie.
Cluster drempels	Toetredingsdrempels en startersdrempels verkleinen de concurrentie-intensiteit en belemmeren de instroom van (menselijk) kapitaal.
	Uittredingsdrempels reduceren de onzekerheid voor bedrijven in de cluster.
Cluster heterogeniteit	Cluster heterogeniteit creëert kansen voor innovatie.
	Cluster heterogeniteit creëert kansen voor samenwerking.
	Cluster heterogeniteit reduceert de kwetsbaarheid voor 'externe schokken'.

Tabel S2: Het effect van de vier governance variabelen op clusterperformance

Governance variabelen	Effecten op cluster performance
Vertrouwen	Vertrouwen leidt tot lagere contract kosten en dus lagere transactiekosten.
	Vertrouwen leidt tot meer samenwerking, omdat het risico van 'opportunistisch gedrag' afneemt.
Tussenpersonen	Tussenpersonen zijn gespecialiseerd in 'afstemmen': ze reduceren transactiekosten en vergroten de mate van afstemming.
Leader firms	Leader firms genereren positieve effecten voor bedrijven in hun netwerk, met name omdat ze innovatie en internationalisering bevorderen.
	Leader firms genereren positieve externe effecten voor andere bedrijven in de cluster omdat ze investeren (en middelen organiseren voor investeringen) in de onderwijs- en innovatie-infrastructuur en in de organisatorische infrastructuur in de cluster.
Collectieve actie regimes	Betere collectieve actie regimes verhogen de cluster performance. Deze regimes zijn beter naarmate er meer in geïnvesteerd wordt. Relevante factoren in dit opzicht zijn: vertrouwen, de organisatorische infrastructuur, de opstelling van leader firms, het gebruik van een 'community argument' en een actieve inbreng van bedrijven.

Het empirische deel

Het empirische deel bestaat uit drie case studies van de havenclusters in Rotterdam, Durban en de beneden-Mississippi. Voor deze drie cases is gekozen omdat ze alledrie de grootste van hun continent zijn, een belangrijke doorvoerfunctie hebben en de regio gespecialiseerd is in havengerelateerde activiteiten.

De empirische resultaten zijn gebaseerd op desk research en informatie verkregen van havenexperts die een vragenlijst hebben ingevuld en open vragen beantwoord. De vragenlijst is ingevuld tijdens de interviews, met waar nodig uitleg van de vragen. Daarom zijn de uitkomsten van de vragenlijst relatief betrouwbaar. In Rotterdam zijn 43 interviews gehouden en vragenlijst afgenomen, in Durban 34 en in de LMPC 31. Voor alle resultaten is geanalyseerd in hoeverre ze statistisch significant zijn en of er significante verschillen bestaan tussen de cases.

In de vragenlijst staan de vier structuur en de vier governance variabelen centraal. De experts is gevraagd of zij de argumentatie voor de effecten van de variabelen onderschrijven, hoe belangrijk de variabelen zijn voor de performance en hoe elk van de drie clusters scoort ten opzichte van concurrerende havenclusters in de omgeving. In Rotterdam is een vergelijking gemaakt met Antwerpen en Hamburg, in Durban met Richard's Bay en in de LMPC met Houston.

Het clusterperspectief is nauwelijks toegepast op zeehavens. De belangrijkste studies zijn die van Haezendonck (2001) naar de sterkten en zwakten van de Antwerpse havencluster, een studie van Van Klink (1995) over de ontwikkeling van havennetwerken en vestigingscondities in zeehavens en studies van Slack (1989), onder meer naar de binding van de maritieme 'service industrie' aan havens. Het empirische onderzoek in dit proefschrift verrijkt de bestaande literatuur onder meer op de volgende punten: expliciet aandacht voor de vraag welke activiteiten onderdeel uitmaken van havenclusters, toepassing van nieuwe clusterinzichten op de haven, aandacht voor 'governance' vraagstukken in zeehavens, vergelijking tussen drie havenclusters met één uniforme methode en een analyse van implicaties van het 'clusterdenken' voor beleid en management in havenclusters.

De kernspecialisatie van havenclusters is de aankomst van zowel lading als schepen. Dit trekt verschillende economische activiteiten aan, die kunnen worden onderverdeeld in 5 componenten. De eerste component is de overslag en omvat alle bedrijven die noodzakelijk zijn om overslag te laten plaatsvinden, zoals terminal operators, sleepdiensten en

loodsdiensten. De tweede component omvat alle goederentransportactiviteiten, zoals transporteurs, scheepvaartagenten, en transportondersteunende bedrijven. De derde component omvat alle logistieke bedrijven in een haven, zoals opslagbedrijven en logistieke consultants. De vierde component bestaat uit een aantal specifieke productieactiviteiten, waarvoor zeehavens aantrekkelijke locaties zijn. De vijfde component bestaat uit een specifieke set handelsbedrijven, namelijk bedrijven die handelen in de goederen die veelvuldig in de haven worden op- en overgeslagen. De havencluster omvat alle bedrijven die actief zijn in de bovenstaande componenten en die gevestigd zijn in de relevante havenregio.

De Rotterdamse havencluster bestaat uit ongeveer 3.560 bedrijven, het merendeel is actief in transport (36%) en logistiek (45%). Dit is een lichte overschatting van de clusterpopulatie, omdat ook 'lege BV's' geregistreerd worden in het gebruikte databestand. De ongeveer 90 productiebedrijven die onderdeel uitmaken van de havencluster zijn wel veel groter en genereren wel een fors deel van de toegevoegde waarde in de cluster. De relevante clusterregio bestaat uit 16 gemeenten, waarvan Rotterdam en Dordrecht de meeste clusterbedrijven huisvesten.

In Durban ontbreken precieze gegevens, waardoor de afbakening moet plaatsvinden op basis van expertgegevens en het Gouden Gids register. Daarom is er sprake van een lichte onderschatting van de bedrijven in de cluster. In Durban bestaat de havencluster uit ongeveer 680 bedrijven. In deze cluster zijn transportbedrijven (48%) dominant. De relevante regio in Durban bestaat uit 6 gemeenten, waarvan Durban verreweg de belangrijkste is.

In de 'Beneden Mississippi port cluster'(LMPC) zijn de beste cijfers voorhanden. De cluster bestaat uit 1.168 bedrijven. Transport is dominant en handel relatief sterk vertegenwoordigd (16%). De cluster bestaat uit 12 gemeenten.

Uit de cases kan worden geconcludeerd dat het clusterconcept zinvol toegepast kan worden op zeehavens. Het theoretische raamwerk ontwikkeld in het theoretische deel wordt grotendeels gevalideerd in de cases. Uit de cases komen de onderstaande resultaten aangaande de acht variabelen voor clusterperformance.

Agglomeratie effecten

- De aanwezigheid van klanten en toeleveranciers is in alledrie de havens een duidelijke concentratie-versterkende factor. Deze factor wordt ook in alle clusters als belangrijkste factor voor de performance van de cluster aangemerkt.

- Ook de aanwezigheid van kennis en informatie werkt in alledrie de cases clusterversterkend.

- De aanwezigheid van een arbeidsreservoir is in Rotterdam en de LMPC een clusterversterkende factor, maar in Durban niet. In Rotterdam geeft ongeveer de helft van de experts aan dat het hoge loonniveau in het nadeel van de Rotterdamse cluster werkt.

- Congestie in en om zeehavens wordt niet beschouwd als 'concentratie-verzwakkend'. Datzelfde geldt voor hoge landprijzen.

Interne concurrentie

Uit deze studie blijkt duidelijk dat de aanwezigheid van interne concurrentie (concurrentie tussen bedrijven in dezelfde havencluster) bijdraagt aan de performance van havenclusters, omdat het overstappen naar concurrenten eenvoudiger wordt (en machtsposities dus niet ontstaan) en omdat er prikkels ontstaan voor specialisatie en innovatie.

In de overslag en de havendiensten, zoals sleepdiensten en loodsdiensten, is de interne concurrentie zeer beperkt. Dit is te verklaren vanuit de hoge vaste investeringen en de relatief beperkte marktomvang. Toch is het voor havens gunstig om te streven naar een arrangement dat concurrentie mogelijk maakt, bijvoorbeeld door de havenbeheerder relatief veel vaste investeringen te laten doen.

Cluster drempels

Uit de empirische resultaten blijkt duidelijk dat 'toetredingsbarrières' de performance van de cluster negatief beïnvloeden. Als relevante toetredingsbarrière wordt met name de ontoegankelijk van netwerken en kennis in havenclusters genoemd. De afwezigheid van 'lokaal kapitaal' wordt in Rotterdam niet als een significante toetredingsdrempel gezien, in Durban en de LMPC wel.

Ook uittredingsdrempels, met name 'onverplaatsbare investeringen', hebben volgens de experts een negatief effect op de performance van de cluster. Daarmee wordt de hypothese dat deze barrières juist gunstige effecten zouden hebben verworpen. Het is dus onverstandig te proberen bedrijven te 'binden' aan de haven.

Heterogeniteit van de cluster

De hypothese dat heterogeniteit van de cluster bijdraagt aan de performance ervan wordt bevestigd: heterogeniteit schept kansen voor samenwerking, het stimuleert innovatie en reduceert de kwetsbaarheid van de cluster voor externe schokken. Een heterogene mix van vestigingen van buitenlandse multinationals, hoofdkantoren van internationaal opererende bedrijven en lokaal opererende bedrijven en een mix van verschillende soorten economische activiteiten blijken van belang voor de performance. De LMPC blijkt in alle opzichten minder heterogeen dan beide andere clusters.

Vertrouwen

De bijdrage van vertrouwen aan de performance wordt breed onderkend. Vertrouwen wordt ook aangemerkt als belangrijkste 'governance-variabele'. Zowel in Rotterdam als de LMPC geven de experts aan dat de havencluster minder goed scoort dan de omliggende haven(s). De experts in Durban geven juist aan dat Durban een relatief sterke cultuur van vertrouwen heeft ten opzichte van Richard's Bay.

Intermediairs

De experts onderschrijven de hypothese dat de aanwezigheid van intermediairs bijdraagt aan de performance van havenclusters. Het belang van intermediairs is relatief gering: het is de minst belangrijke van de vier governance variabelen. De experts die werken bij grote bedrijven twijfelen relatief vaak aan het nut van intermediairs. De expediteur komt als belangrijkste intermediair naar voren. In Rotterdam geven de experts aan dat Rotterdam goed scoort op het gebied van intermediairs, Durban en de LMPC scoren slecht op dit gebied.

Leader firms

Leader firms zijn bedrijven die zowel de prikkels als het vermogen hebben om investeringen te doen die positieve gevolgen hebben voor andere bedrijven in de cluster. Leader firms hebben in het algemeen een vooraanstaande marktpositie, zijn redelijk groot en bovengemiddeld innovatief. De aanwezigheid van deze bedrijven in een havencluster draagt sterk bij aan de performance ervan. De aanwezigheid van leader firms wordt na vertrouwen beschouwd als de belangrijkste governance variabele. In Rotterdam zijn relatief veel voorbeelden van leader firm gedrag te vinden, maar dat geldt ook voor de havenclusters van Antwerpen en Hamburg. Durban scoort beter dan Richard's Bay, terwijl de LMPC juist veel minder leader firms heeft dan Houston.

Collectieve actie regimes

Collectieve actie regimes zijn nodig als er sprake is van een 'collectief actie probleem', het probleem dat gezamenlijke investeringen niet tot stand komen, doordat elk afzonderlijk bedrijf kan besluiten niet mee te investeren, zonder uitgesloten te kunnen worden van de voordelen van de investeringen. Een collectief actie regime omvat alle arrangementen om gezamenlijke investeringen te laten plaatsvinden.

De experts geven aan dat dergelijke regimes in havenclusters nodig zijn op vijf gebieden: achterlandbereikbaarheid, innovatie, training en onderwijs, marketing en promotie van de haven, en internationalisering van het havenbedrijfsleven. Al deze regimes zijn belangrijk voor de performance van havenclusters. Over de kwaliteit van de regimes kunnen de volgende conclusies getrokken worden:

- Het achterlandregime van Rotterdam is beter dan in Durban en de LMPC, met name vanwege de grote inbreng van leader firms en de rol van overheden (met name het gemeentelijk havenbedrijf).

- Het marketing en promotie regime is in Durban slecht, met name vanwege de geringe inbreng van overheden en het bedrijfsleven. In Rotterdam is de organisatorische infrastructuur goed, terwijl in de LMPC juist publieke actoren een goede inbreng hebben.

- Het onderwijs- en trainingsregime is in Rotterdam het beste en in de LMPC het slechtst. In de LMPC zijn er geen leader firms, in Rotterdam juist wel. Daarnaast is de organisatorische infrastructuur in Rotterdam goed.

- Het innovatie regime is in alle drie de havens matig. In Rotterdam is er vooral onvoldoende samenwerkingsgezindheid.

- Het internationaliseringsregime is ook voor alledrie de havens matig.

- Voor alle vijf regimes scoort Rotterdam bovengemiddeld op het gebied van leader firm betrokkenheid.

- Alle vijftien regimes zijn relatief matig, overal zijn er duidelijke zwakten te onderkennen en is er ruimte om de kwaliteit van regimes te verbeteren. Eén cruciale kans die relevant is voor alle regimes is het vergaren van goede marktinformatie (market intelligence). Deze informatie is in veel gevallen onvoldoende aanwezig, maar cruciaal om kansen te identificeren om ladingpakketten en economische activiteiten aan te trekken.

De vergelijking van de havens met de concurrenten

Rotterdam heeft ten opzichte van Antwerpen drie zwaktes: de hoogte van grondprijzen, de kwaliteit van het arbeidsreservoir en de kwaliteit van collectieve actie regimes. Hamburg scoort alleen beter op het gebied van grondprijzen. Op het gebied van kennis scoort Rotterdam beter dan Antwerpen en Hamburg. Vergeleken met Hamburg is Rotterdam ook meer heterogeen en heeft het meer klanten en leveranciers in de cluster.

In Rotterdam groeide de toegevoegde waarde over de afgelopen vijf jaar sneller dan in Antwerpen, terwijl de haven juist volume verloor aan Antwerpen. Deze ontwikkeling sluit aan bij de bovengenoemde sterktes en zwaktes: Rotterdam raakt lading kwijt omdat daar de grondprijzen en arbeidskosten dominant zijn. In de logistiek en industrie zijn deze minder doorslaggevend, met als gevolg dat Rotterdam daar wel meer toegevoegde waarde genereert. Het ladingverlies leidt daarom (nog) niet tot een evenredig verlies aan toegevoegde waarde.

Durban's havencluster scoort goed ten opzichte van Richard's Bay: er is meer interne concurrentie, meer kennis, er heerst meer een cultuur van vertrouwen, er zijn meer klanten en toeleveranciers gevestigd en er is meer leader firm betrokkenheid. Nadelen zijn de hoge grondprijzen, de congestie en de geringe aanwezigheid van tussenpersonen. Deze sterktes en zwaktes maken duidelijk dat Durban een sterk cluster is, waar de agglomeratievoordelen dominant zijn. Deze conclusie sluit aan bij de overslaggegevens over Durban: op de kolenexport na blijft Durban de dominante haven, zonder marktaandeel te verliezen.

Het beeld van de LMPC is dat van een havencluster onder druk: alleen op het gebied van congestie scoort de haven beter dan Houston. De LMPC scoort slechter ten aanzien van de kwaliteit van collectieve actie regimes, de aanwezigheid van klanten, toeleveranciers en intermediairs, de cultuur van vertrouwen en de diversiteit van de cluster.

De overslagcijfers ondersteunen deze conclusie: de LMPC verliest eigenlijk op alle markten marktaandeel. Juist de hoogwaardige bedrijven (zoals logistieke dienstverleners en olie traders) zijn maar zeer beperkt geconcentreerd in de havencluster.

Vervolgonderzoek

Uit de cases blijkt de havenbeheerder goed gepositioneerd te zijn om zich op te stellen als cluster manager. In Rotterdam gedraagt de havenbeheerder zich deels ook als cluster manager. Dit maakt de rol van de havenbeheerder interessant vanuit theoretisch oogpunt: in andere clusters bestaat er geen vergelijkbare actor die zich zo zal inzetten voor de performance van de cluster. Op dit punt biedt het huidige onderzoek een goede basis voor meer onderzoek. Uit het onderzoek blijkt bijvoorbeeld dat het maken van havenspecifieke investeringen een toetredingsdrempel is. Omdat de clustermanager een blijvende betrokkenheid heeft bij de havencluster is het voor deze partij geen probleem om clusterspecifieke investeringen te doen. Daarom kan een arrangement waarbij de havenbeheerder (eventueel in een joint venture met een bank of leasemaatschappij) investeringen doet in onverplaatsbare assets en deze marktconform least aan bedrijven bijdragen aan de performance van de havencluster.

Curriculum vitae

Peter de Langen has worked for over six years as a transport, port and regional economist at Erasmus University Rotterdam. His is active in teaching, contract research and academic research. He specializes in port economics and has studied various aspects of ports, such as trade forecasting, entrepreneurship and innovation in ports, labor relations in seaports, long range planning in seaports, economic clustering in seaports, and port competition. With regard to contract research, he has participated in studies on change processes in the port of Rotterdam, international policies related to seaports, clustering in maritime industries, governance in port clusters, entrepreneurship in seaports, and innovation in ship design. He has gained project management experience in a substantial number of projects over the last three years. He has published a number of articles on the performance of (seaport) clusters and other port and regional economic issues.

ERASMUS RESEARCH INSTITUTE OF MANAGEMENT (ERIM)

ERIM PH.D. SERIES

RESEARCH IN MANAGEMENT

ERIM Electronic Series Portal: http://hdl.handle.net/1765/1

Berghe, D.A.F., *Working Across Borders: Multinational Enterprises and the Internationalization of Employment.* (co) Promotor(es): Prof.dr. R.J.M. van Tulder & Prof.dr. E.J.J. Schenk, EPS-2003-029-ORG, 90-5892-05-34, http://hdl.handle.net/1041

Bijman, W.J.J., *Essays on Agricultural Co-operatives; Governance Structure in Fruit and Vegetable Chains*, (co-) Promotor(es): Prof.dr. G.W.J. Hendrikse, EPS-2002-015-ORG, ISBN: 90-5892-024-0, http://hdl.handle.net/1765/867

Campbell, R.A.J*., Rethinking Risk in International Financial Markets*, (co-) Promotor(es): Prof.dr. C.G. Koedijk, EPS-2001-005-F&A, ISBN: 90-5892-008-9, http://hdl.handle.net/1765/306

Chen, Y., *Labour flexibility in China's companies: an empirical study*, (co-) Promotor(es): Prof.dr. A. Buitendam & Prof.dr. B. Krug, EPS-2001-006-ORG, ISBN: 90-5892-012-7, http://hdl.handle.net/1765/307

Delporte-Vermeiren, D.J.E., *Improving the flexibility and profitability of ICT-enabled business networks: an assessment method and tool*, (co-) Promotor(es): Prof.mr.dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2003-021-LIS, ISBN: 90-5892-040-2, http://hdl.handle.net/1765/359

Dijksterhuis, M., *Organizational dynamics of cognition and action in the changing Dutch and U.S. banking industries*, (co-) Promotor(es): Prof.dr. F.A.J. van den Bosch & Prof.dr. H.W. Volberda, EPS-2003-026-STR, ISBN: 90-5892-048-8, http://hdl.handle.net/1037

Fenema, P.C. van, *Coordination and Control of Globally Distributed Software Projects*, (co-) Promotor(es): Prof.dr. K. Kumar, EPS-2002-019-LIS, ISBN: 90-5892-030-5, http://hdl.handle.net/1765/360

Fleischmann, M., *Quantitative Models for Reverse Logistics*, (co-) Promoter(es): Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. R. Dekker, EPS-2000-002-LIS, ISBN: 3540 417 117, http://hdl.handle.net/1044

Fok, D., *Advanced Econometric Marketing Models*, (co-) Promotor(es): Prof.dr. P.H.B.F. Franses, EPS-2003-027-MKT, ISBN: 90-5892-049-6, http://hdl.handle.net/1035

Ganzaroli, A., *Creating Trust between Local and Global Systems*, (co-) Promotor(es): Prof.dr. K. Kumar & Prof.dr. R.M. Lee, EPS-2002-018-LIS, ISBN: 90-5892-031-3, http://hdl.handle.net/1765/361

Gilsing, V.A*., Exploration, Exploitation and Co-evolution in Innovation Networks*. (co) Promotor(es): Prof.dr. B. Nooteboom & Prof.dr. J.P.M. Groenewegen, EPS-2003-032-ORG, ISBN 90-5892-05-42, http://hdl.handle.net/1040

Graaf, G. de, *Tractable Morality. Customer discourses of bankers, veterinarians and charity workers.* (co-) Promotor(es): Prof.dr. F. Leijnse & Prof.dr. T. van Willigenburg. EPS-2003-031-ORG, ISBN 90–5892–051–8, http://hdl.handle.net/1038

Heugens, P.M.A.R*., Strategic Issues Management: Implications for Corporate Performance*, (co-) Promotor(es): Prof.dr.ing. F.A.J. van den Bosch & Prof.dr. C.B.M. van Riel, EPS-2001-007-STR, ISBN: 90-5892-009-7, http://hdl.handle.net/1765/358

Hooghiemstra, R., *The Construction of Reality*, (co-) Promotor(es): Prof.dr. L.G. van der Tas RA & Prof.dr. A.Th.H. Pruyn, EPS-2003-025-F&A, ISBN: 90-5892-047-X, http://hdl.handle.net/1765/871

Jong, C. de, Dealing with Derivatives: Studies on the role, informational content and pricing of financial derivatives, (co-) Promotor(es): Prof.dr. C.G. Koedijk, ISBN: 90-5892-043-7, http://hdl.handle.net/1043

Koppius, O.R., *Information Architecture and Electronic Market Performance*, (co-) Promotor(es): Prof.dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2002-013-LIS, ISBN: 90-5892-023-2, http://hdl.handle.net/1765/921

Loef, J*., Incongruity between Ads and Consumer Expectations of Advertising*, (co-) Promotor(es): Prof.dr. W.F. van Raaij & prof. dr. G. Antonides, EPS-2002-017-MKT, ISBN: 90-5892-028-3, http://hdl.handle.net/1765/869

Meer, J.R. van der, *Operational Control of Internal Transport*, (co-) Promotor(es): Prof.dr. M.B.M. de Koster & Prof.dr.ir. R. Dekker, EPS-2000-001-LIS, ISBN:90-5892-004-6, http://hdl.handle.net/1765/859

Miltenburg, P.R., *Effects of modular sourcing on manufacturing flexibility in the automotive industry. A study among German OEMs.* (co) Promotor(es): Prof.dr. J. Paauwe & Prof.dr. H.R. Commandeur, EPS-2003-030-ORG, ISBN 90-5892-052-6, http://hdl.handle.net/1039

Mol, M.M., *Outsourcing, Supplier-relations and Internationalisation: Global Source Strategy as a chinese puzzle*, (co-) Promotor(es): Prof.dr. R.J.M. van Tulder, EPS-2001-010-ORG, ISBN: 90-5892- 014-3, http://hdl.handle.net/1765/355

Oosterhout, J. van., *The Quest for Legitimacy; On Authority and Responsibility in Governance*, (co-) Promotor(es): Prof.dr. T. van Willigenburg & Prof.mr. H.R. van Gunsteren, EPS-2002-012-ORG, ISBN: 90-5892-022-4, http://hdl.handle.net/1765/362

Peeters, L.W.P., *Cyclic Railway Timetable Optimization*, (co-) Promotor(es): Prof. Dr. L.G. Kroon & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2003-022-LIS, ISBN: 90-5892-042-9, http://hdl.handle.net/1765/429

Puvanasvari Ratnasingam , P*., Interorganizational Trust in Business to Business E-Commerce*, (co-) Promotor(es): Prof.dr. K. Kumar & Prof.dr. H.G. van Dissel, EPS-2001-009-LIS, ISBN: 90-5892-017-8, http://hdl.handle.net/1765/356

Romero Morales, D., *Optimization Problems in Supply Chain Management*, (co-) Promotor(es): Prof.dr.ir. J.A.E.E. van Nunen & Dr. H.E. Romeijn, EPS-2000-003-LIS, ISBN: 90-9014078-6, http://hdl.handle.net/1765/865

Roodbergen, K.J., *Layout and Routing Methods for Warehouses*, (co-) Promotor(es): Prof.dr. M.B.M. de Koster & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2001-004-LIS, ISBN: 90-5892-005-4, http://hdl.handle.net/1765/861

Speklé, R.F., *Beyond Generics; A closer look at Hybrid and Hierarchical Governance*, (co-) Promotor(es): Prof.dr. M.A. van Hoepen RA, EPS-2001-008-F&A, ISBN: 90-5892-011-9, http://hdl.handle.net/1765/357

Teunter, L.H., *Analysis of Sales Promotion Effects on Household Purchase Behavior*, (co-) Promotor(es):Prof.dr. ir. B. Wierenga & Prof.dr. T. Kloek, EPS-2002-015-ORG, ISBN: 90-5892-029-1, http://hdl.handle.net/1765/868

Vis, I.F.A., *Planning and Control Concepts for Material Handling Systems*, (co-) Promotor(es): Prof.dr. M.B.M. de Koster & Prof. dr. ir. R. Dekker, EPS-2002-014-LIS, ISBN: 90-5892-021-6, http://hdl.handle.net/1765/866

Waal, T. de, *Processing of Erroneous and Unsafe Data*, (co-) Promotor(es): Prof.dr.ir. R. Dekker, EPS-2003-024-LIS, ISBN: 90-5892-045-3, http://hdl.handle.net/1765/870

Wielemaker, M.W., *Managing Initiatives. A Synthesis of the Conditioning and Knowledge-Creating View.* (co) Promotor(es): Prof.dr. H.W. Volberda & Prof.dr. C.W.F. Baden-Fuller, EPS-2003-28-STR, ISBN 90-5892-050-X, http://hdl.handle.net/1036

Wolters, M.J.J., *The Business of Modularity and the Modularity of Business*, (co-) Promotor(es): Prof. mr.dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2002-011-LIS, ISBN: 90-5892-020-8, http://hdl.handle.net/1765/920

Wijk, R.A.J.L. van, *Organizing Knowledge in Internal Networks. A Multilevel Study*, (co-) Promotor(es): Prof.dr.ing. F.A.J. van den Bosch, EPS-2003-021-STR, ISBN: 90-5892-039-9, http://hdl.handle.net/1765/347

The Performance of Seaport Clusters; a framework to analyze cluster performance and an application to the seaport clusters in Durban, Rotterdam and the lower Mississippi.

This PhD thesis deals with the performance of clusters. Even though cluster studies are numerous, a coherent framework to analyze cluster performance is lacking. In this thesis, such a framework is developed, drawing from different schools that deal with clusters. Central in the framework is a distinction to variables of cluster performance related to the structure of a cluster and variables related to the governance of a cluster. Four structure variables – agglomeration ands disagglomeration forces, internal competition, heterogeneity of the cluster and the level of entry and exit barriers – and four governance related variables – the presence of trust, the presence of intermediaries, the presence of leader firms and the quality of collective action regimes – are identified and discussed. The validity of these variables is confirmed in the three case studies, of the port clusters of Rotterdam, Durban, and the lower Mississippi. The strengths and weaknesses of the three port clusters, the importance of the variables discussed above and opportunities for policy and management to improve the performance of clusters are discussed.

The results of this study are relevant for cluster scholars and for scholars specializing in port studies. The thesis is also relevant for (port) cluster managers and for managers of firms in (port) clusters, since implications of this study for policy and management in (port) clusters are discussed.

ERIM

ERIM

ERASMUS RESEARCH
INSTITUTE OF MANAGEMENT