

Leader Firms in the Dutch Maritime Cluster

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ABSTRACT

The cluster-concept is frequently used to analyse the competitive advantage of countries. Countries are specialised in a few clusters of economic activities. The competitiveness of a cluster depends on the behaviour of firms in the cluster and the interaction between these firms.

This paper discusses the presence and impact of 'leader-firms' in the Dutch Maritime Cluster. Leader firms are firms with the ability and incentive to make investments with benefits for other companies in the cluster. Benefits are created in three ways: by encouraging innovation, by enabling internationalisation and by enhancing labour pool quality.

In this paper, the Dutch Maritime Cluster is briefly described, the leader firm concept is discussed and results of an empirical study of leader firm behaviour in the Dutch Maritime Cluster are presented. Conclusions and implications for government policy finalise the paper.

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INTRODUCTION

The cluster concept is often used to analyse the economic specialisation of a country. A cluster is a geographically concentrated set of firms related to a common product or process. This set of firms is homogenous: some firms play a more significant role in the development of the cluster than others. One specific set of firms, termed leader firms in this paper, are important drivers of the development of economic clusters. In this paper a ‘theory’ of leader firm behaviour is developed, leader firms in the Dutch Maritime Cluster are identified and the ways in which they contribute to the performance of the cluster are analysed.

This paper is structured as follows. In the first section, a short overview of the Dutch Maritime Cluster is provided. In section two ‘leader firm behaviour’ is discussed. In section three a method to identify leader firms is presented. In section four, empirical findings of leader firm behaviour are discussed. A concluding section finalises the paper.

THE DUTCH MARITIME CLUSTER

The total added value produced by maritime industry in the European Union is €70 billion. 10 % of the European value added is generated in the Dutch Maritime Cluster (DMC). The share of maritime activities in the national product in the Netherlands is twice as high as the European Union average (Policy Research, 2001). This shows the Netherlands is specialised in maritime activities.

The Dutch Maritime Cluster (DMC) is extensively documented by studies commissioned by the ‘Dutch Maritime Network’. Peeters et al (1999) identify eleven maritime sectors that make up the Dutch Maritime Cluster. Figure 1 shows the sectors that form the DMC.

Figure 1: Sectors included in the Dutch Maritime Cluster

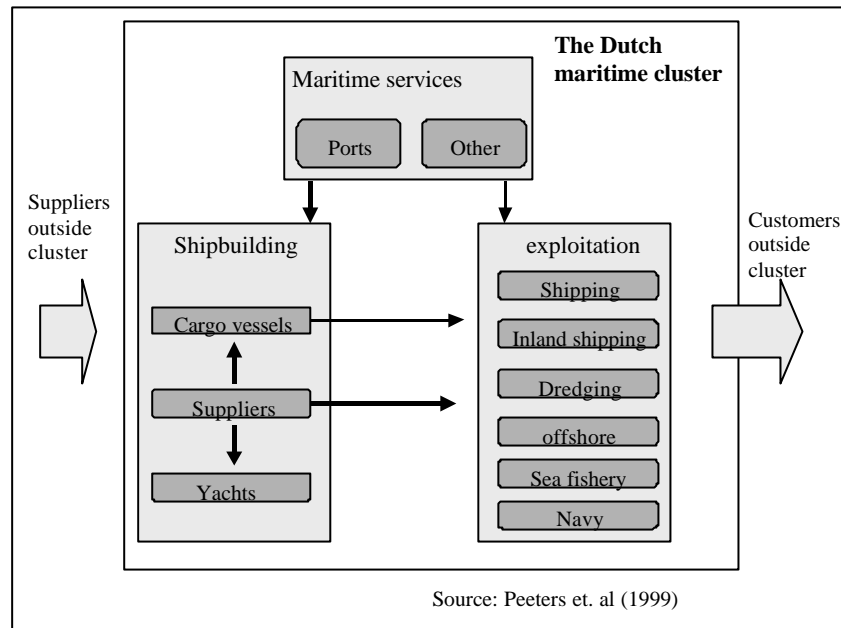


Table 1 shows the number of firms of the eleven sectors that make up the DMC and shows the relative importance of these eleven sectors, in terms of value added and employment.

Table 1: Economic size of the 11 sectors in the Dutch Maritime Cluster

Sector	Number of firms	Added value (% of cluster total)	Employment (% of cluster total)
Ports	639	29%	19%
Offshore	343	12%	14%
Navy	1	9%	13%
Maritime suppliers	622	9%	9%
Inland waterways	4,110	8%	10%
Shipping	364	7%	4%
Maritime services	728	7%	7%
Shipbuilding	101	6%	8%
Dredging	296	5%	4%
Yacht industries	3,851	5%	8%
Fishery	795	3%	4%
Total	11,850	100% About €7,000 million	100% 137,400 persons

Source: based on Peeters (1999)

The port sector is the largest sector in the maritime cluster. 29% of the value added and 19% of the employment is generated in the port industry¹. The fishery sector is the smallest sector in the DMC.

Data from Peeters et al. (1999) allows an analysis of the relations between the sectors. Table 2 shows –per sector- the percentage of output supplied to

other sectors in the cluster, the percentage of input sourced from other firms in the cluster and the number of sectors with which commercial relations exist.

Table 2: Economic relations in the DMC

Sector	Output to DMC, as % of turnover	Input from DMC in % of turnover	Number of connected sectors ⁱⁱ	Export as % turnover
Maritime services	18.0	0.3	8	60%
Maritime suppliers	50.0	0.2	9	42%
Shipbuilding	48.2	22.1	10	46%
Waterworks (dredging)	5.3	24.1	8	57%
Ports	5.3	2.6	9	65%
Shipping	1.2	23.3	8	89%
Offshore	0.0	6.7	7	49%
Inland shipping	0.9	24.5	9	50%
Yacht industry	0.5	2.5	4	45%
Royal Navy	0.0	10.9	7	0%
Fishery	0.0	19.4	3	84%
Average	12.0	12.0	7	55%

Source: based on Peeters (1999)

Table 2 shows the central position of shipbuilding in the DMC. Shipbuilding is directly related to all ten other sectors of the DMC. Almost 50% of its output is supplied to other firms in the cluster, and more than 20% of its input is sourced from firms in the cluster. The sectors Royal Navy, offshore and fishery do not supply to other sectors in the cluster, they only *use* suppliers in the cluster. The relatively small percentage of output supplied to firms in the DMC in the sectors ports, shipping and waterworks shows that the majority of customers are located outside the cluster.

The water sport industry and fishery are the sectors that are least embedded in the cluster. Both have relations with only a few other sectors and do not supply to other sectors in the cluster.

Table 3 shows some characteristics of firms in each of the eleven sectors that make up the Dutch Maritime Cluster. Table 3 shows each sector has specific characteristics. Furthermore, the number of large firms per sector is given.

Table 3: characteristics of sectors of the Dutch Maritime Cluster

Sector	Number of firms	Average annual turnover in 1,000 €	Average number of employees	Average turnover per employee in 1,000 €	Number of large firms ⁱⁱⁱ
Yacht industry	3,851	227	3	76	1
Inland shipping	4,110	286	3	95	4
Fishery	795	540	7	77	2
Maritime services	728	1,148	13	88	6
Maritime suppliers	622	2,568	20	128	7
Waterworks (dredging)	296	3,649	19	192	7
Ports	639	4,992	41	122	27
Shipping	364	7,379	15	492	37
Offshore	343	7,824	56	140	9
Shipbuilding	101	16,931	109	155	37
Royal Navy	1	1,256,000	17,862	70	1

Source: Peeters 1999, Bureau van Dijk, 2000

The Royal Navy is by far the largest (public) company in the cluster. Other large companies include Vopak, P&O-Nedlloyd, Boskalis, IHC-Caland, Fugro, Smit-Internationale and ECT.

Apart from the Royal Navy, the ship building industry is the sector with the largest average company size. Both the turnover and number of employees are twice as high as in any other sector. This stems from the capital-intensive nature of the industry and the relatively large 'minimum efficient scale'.

The shipping industry is a capital-intensive sector: it has the highest turnover per employee. Inland shipping and the yacht-industry are characterised by a large number of small firms. The number of large firms in both industries is very small.

Most large firms are active in shipbuilding, shipping and the ports industry. A number of large firms are active in a number of sectors included in the cluster.

THE LEADER FIRM CONCEPT

The leader firm concept originates from theories on clustering. A cluster is a population of geographically concentrated firms that are interrelated, amongst others because of buyer-supplier and knowledge-exchange relationships. Firms locate in clusters because the 'cluster environment' provides advantages, such as the proximity of customers and suppliers, a joint labour pool and the presence of knowledge and information (Krugman, 1991).

Leader firms are firms with a relatively large impact on other companies in the cluster and the cluster as a whole. Lorenzoni and Badenfuller (1995, p. 147) define leader firms as 'strategic centres with superior co-ordination skills and the ability to steer change'. They distinguish four ways in which a leader firm contributes to the competitiveness of their partners: through strategic outsourcing, the sharing of knowledge, by forming a bridge between different networks, and by focussing on competition on a value chain or network level rather than on firm level. Lazerson and Lorenzoni (1999, p. 362) identify 'focal firms', which are 'companies that occupy strategically central positions because of the greater number and intensity of relationships that they have with both customers and suppliers'. The most prominent outcome of this position is the role these focal firms play in *innovation*. Leader firms can act as *lead users* (a concept discussed in Von Hippel, 1989), firms with an advanced demand, that triggers innovation processed with suppliers. In the above-mentioned studies on leader firms, their effects on the cluster as a whole are recognised, but the effects of leader firms on other firms in the cluster are not analysed.

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 *internationalisation* of other firms in the clusters. On the basis of 'many cases', they argue that 'leader firm internationalisation can be considered the main impulse for district internationalisation' (Albino et al. 1999, p. 57). Leader firms act as 'launching customers' for the internationalisation of their suppliers or sell products from the cluster in foreign markets. Other scholars have also recognised that the development of small firms depends to some extent on the presence and behaviour of a larger firm with strong co-ordination skills (see Kaufmann, 1995 and Lazerson, 1999)^{iv}.

Leader firm investments encourage innovation, enable internationalisation of other firms in the cluster and improve the quality of the labour pool. In these ways, leader firms contribute to the competitiveness of other firms in the cluster and, as a consequence, the cluster as a whole. We define leader firms as follows:

“Leader firms are firms in a cluster that have -because of their size, market position, knowledge and entrepreneurial skills- the *ability* and *incentive* to make investments with positive externalities for other companies in the cluster.”

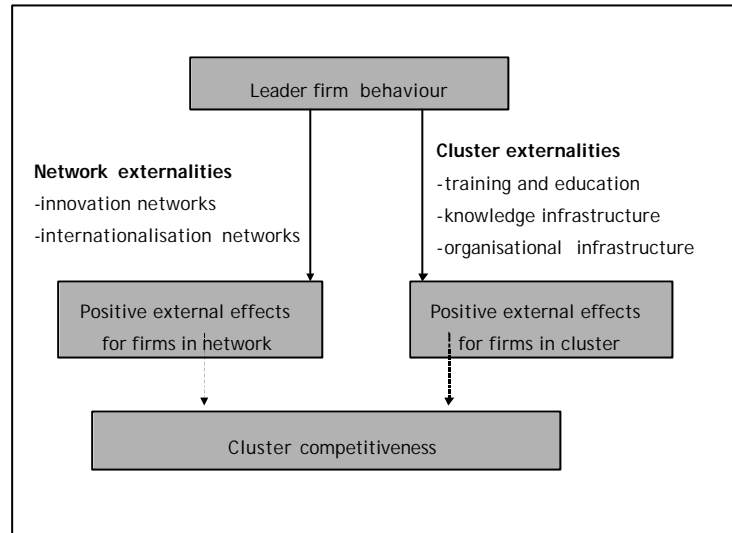
Positive externalities are central in our definition of leader firms. The concept of ‘network externalities’ is widely acknowledged (Economides, 1996). The benefits of (additional) investments in networks (interfirm, infrastructure and communication networks) amount to all network partners. Thus, in principle *all* investments that increase the competitive position of a network have positive externalities. Apart from these *network* externalities, *cluster* externalities (also termed agglomeration –or localisation- economies, see Richardson, 1978 and Krugman, 1991) exist. Cluster externalities differ from network externalities because firms in the cluster benefit from these externalities, not just firms included in a relatively closed interfirm network^v.

The importance of ‘externalities in clusters’ has been widely addressed, both in a school analysing clusters and industrial districts (see Harrison, 1992) as in the ‘New Economic Geography School’ (see Fujita et al, 1997). However, in these studies, the role of individual firms in *creating* these externalities is not widely addressed. Business scholars address the issue of firm networks (see Haakanson, 1999 and Boari, 1999), since networks are relevant for understanding how firms (aim to) create competitive advantage. These scholars do not focus on firm behaviour related to creating positive externalities either.

Investments of (leader) firms with substantial *network* externalities include investments in innovation and internationalisation. The benefits of both innovation and internationalisation spread to all ‘members’ of the network. Three investments with substantial *cluster* externalities are identified: investments in training and education, knowledge and information infrastructure, and an infrastructure for collective action. These investments improve the competitiveness of the cluster. Figure 2 illustrates these effects

and the resulting positive effect of leader firm behaviour on the competitiveness of clusters.

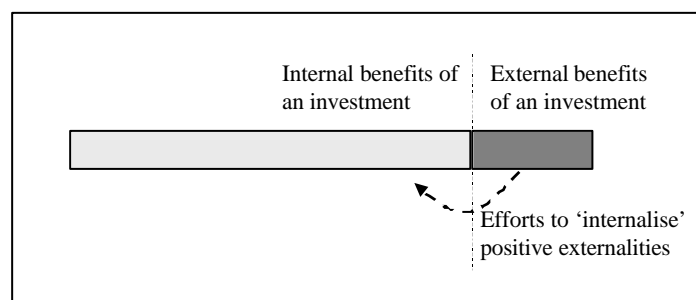
Figure 2: Network and cluster externalities of leader firm investments



The positive external effects can simply be ‘side effects’ of investments of large firms that are not relevant for the investment decision of these large firms. Especially large firms make investments with substantial ‘incidental’ positive externalities. Creating externalities can also be a part of a *strategy* of large firms. In this case leader firms can take the externalities into account in their decision process. Leader firms can have such a strong market position that a large part of the benefits of a more competitive network/cluster end up ‘in their pockets’. In general, leader firms have incentives to create positive external effects^{vi}.

Two kinds of investments can be distinguished, investment where the internal benefits are sufficient for the leader firm to justify investments. For these investments, leader firms may aim to create arrangements to ‘internalise the external effects’, but their investment decision does not depend on it.

Figure 3: Internal and external effects of an investment



Leader firms can also have an incentive to make investments with shared benefits, but not a sufficient incentive to invest by themselves. Such investment projects, provided that shared benefits exceed shared costs, face a ‘collective action problem’ (Olson, 1971). For such investments, a financial arrangement to share costs is necessary. Given their position as prime beneficiary, leader firms have the incentive to play a leading role in devising such arrangements.

Leader firms are a specific set of firms. Most leader firms are ‘in between’ ordinary small and medium sized firms and multinationals. Compared to multinationals, leader firms are much more embedded in their ‘home nation’ (in this case the Dutch Maritime Cluster). The number of local partners in their innovation and production networks is relatively large.

LEADER FIRMS IN THE DUTCH MARITIME CLUSTER

The identification of leader firms is based on two methods. First, experts were asked to identify leader firms. Second, firm data was analysed. Firms that are identified as leader firms by *both* methods are ‘classified’ as leader firm set.

Expert identification

Executives of trade associations that are part of the Dutch Maritime Network, such as the dredging association and the port association were asked to identify leader firms. These experts have knowledge about the market-conditions, the member-companies and the relations between these companies. After explaining the leader firm concept, they were asked to identify the leader firms in their industry. The ten experts that were interviewed represent all maritime sectors^{vii}.

Firm characteristics

The second method to identify leader firms is on the basis of firm characteristics. There is no single indicator of the ability and incentive of firms to make investments with positive externalities. Four characteristics of firms are relevant in this respect. For each of those characteristics, a criterion is required.

First, *firm size*, measured by turnover and number of employees is relevant. In general, larger firms have both more incentives and are more able to make leader firm investments. Firms with over 200 employees *and* firms with over €5 million match this criterion.

Second, the number of *foreign subsidiaries* is relevant. It indicates the ability to enable the internationalisation of other firms in the cluster. Firms with at least one foreign subsidiary match this criterion.

Third, the *number of patents* indicates the role of firms in knowledge networks and their ability to innovative. Firms with at least one patent registered in the last ten years match this criterion.

Fourth, The *number of association memberships* is relevant. This indicates the involvement of a firm in the governance of the cluster. Firms that are members of at least two associations match this criterion.

Thus, five criteria are identified. The more criteria a firm matches, the more likely it is this firm behaves as a leader firm. Table 4 shows the number of firms in the DMC that meets one of these criteria.

Table 4: Number of firms that meet a criterion

Criteria	Number of firms
Foreign subsidiaries	92
Patents	27
Employees >200	91
Turnover > €5M	115
Membership	140

Firms that meet at least two of these criteria are regarded as leader firms on the basis of the second method (firm characteristics).

Firms are regarded as leader firms when they are identified on the basis of both methods: firms have to be identified by the experts *and* on the basis of firm characteristics. The set of leader firms, and the distribution of leader firms across the sectors are shown in Table 5.

Table 5: The leader firm set

Sector	Firm characteristics	Expert identification	Included in leader firm set
Maritime suppliers	15	9	8
Inland shipping	8	5	5
Shipbuilding	11	5	5
Maritime services	20	3	3
Offshore	9	10	8
Dredging	14	3	3
Shipping	29	6	6
Ports	48	4	4
Yacht industries	2	3	2
Fishery	2	2	2
Royal Navy	1	1	1
Total	159	51	47

Table 6 shows the relation between the number of criteria that firms match and the identification of firms by the experts. The figures show that the firm characteristics are consistent with the expert identification.

Table 6: Number of firms that meet multiple criteria compared to the expert opinion

Firm characteristics	Number of firms	Of which: Identified by experts
5 criteria	7	7
4 criteria	9	9
3 criteria	19	12
2 criteria	124	19

The identification on the basis of expert opinions is more selective: the majority of firms that match only two criteria are not regarded as leader firms by the experts. This is plausible: for instance, large firms with over 200 employees and a turnover of over €5 million are not necessarily leader firms. All firms that match four or five characteristics are identified by the experts as well. This shows both methods are complementary and increases the validity of the expert opinion: they did not ‘miss’ a firm whose characteristics strongly indicate it is a leader firm.

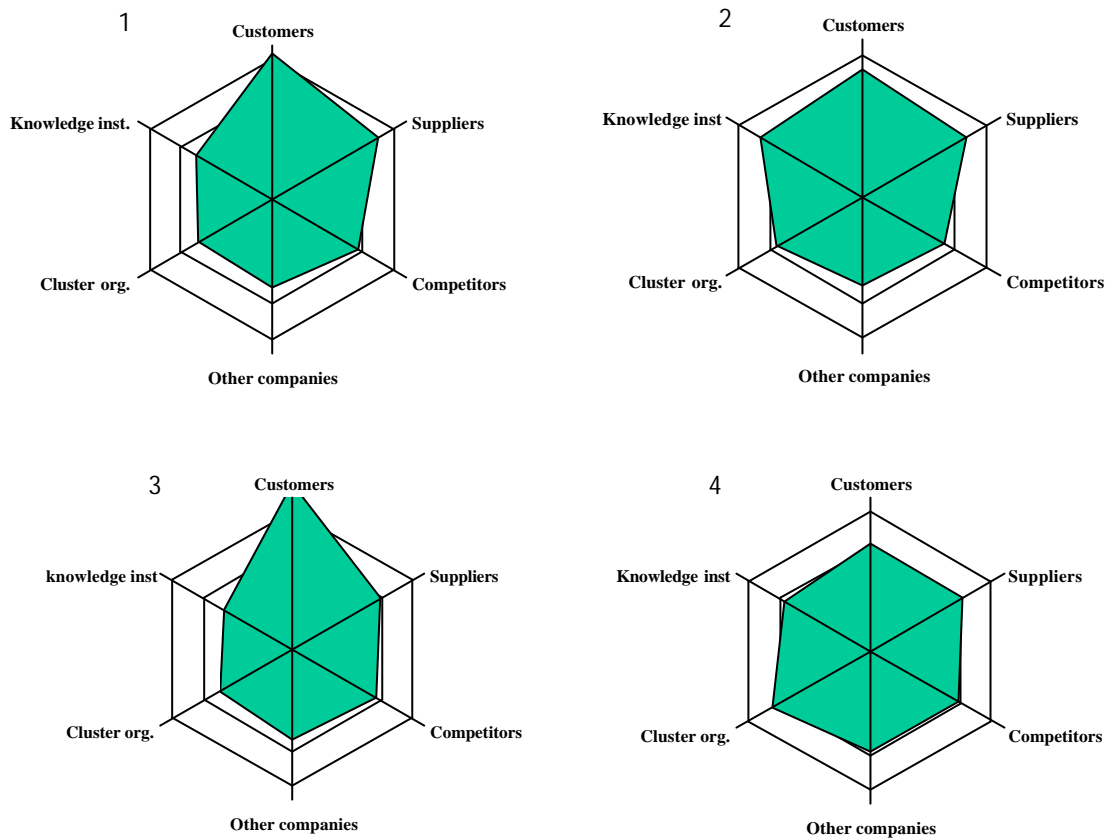
LEADER FIRM BEHAVIOUR IN THE DUTCH MARITIME CLUSTER; SURVEY RESULTS

The senior managers of the 26 leader firms that participated in this research were asked to answer a small set of survey questions. 18 of the 26 senior managers filled out the survey.

The networks of the leader firms are the starting point for the analysis of their role in the cluster and their impact on other firms. In general, the more a leader firm's networks are embedded in the DMC, the higher the impact of its investments. We distinguished four relevant networks: the production network, the innovation network, the internationalisation network and the labour market network^{viii}.

In these networks the partners are categorized in six groups: competitors, suppliers, customers, other companies, knowledge institutions and associations. The importance of these actors differs between the networks. Figure 4 shows the relative importance of actors in the different networks, according to the leader firms.

Figure 4: Relative importance of different actors in 1 production, 2 innovation, 3 internationalisation and 4 labour market networks



Customers and suppliers are the most important partners in the production and internationalisation networks. It is to be expected that these are the actors with whom the most interaction exists. Some remarkable differences can be seen between the networks. For example the role ‘other companies’ play in the networks. While the forming of new combinations, for which these companies are important, is a known source of innovations, the relative importance of these companies is the least in the innovation networks.

Cluster organisations are relatively the least important parties in most networks, except for the labour market network, where they contribute to education and promotion activities.

Not all these networks have the same geographical setting; some are more internationally orientated than others. The main difference was found between the production and innovation network. 50% of the surveyed companies indicate that their international production networks are equally important or more important than their local production network. The

innovation networks are more locally embedded: 55% of the respondents said their innovation network is strongly embedded in the cluster, 40% indicate local embeddedness is moderate and 5% indicate this network is not embedded in the cluster.

The survey results show that the majority of the leader firms contribute to the innovative capabilities of other firms in the cluster. Table 7 shows how various leader firms encourage innovation.

Table 7: Ways of stimulating innovations

Act as 'lead user'	17 of the 18 LF's play this role
Share knowledge and innovation	17 of the 18 LF's play this role
Involve suppliers in innovation projects in an early stage	14 of the 18 LF's play this role
Providing finance for innovation projects	12 of the 18 LF's play this role
Management of innovation networks	11 of the 18 LF's play this role

Acting as a lead user and sharing information and knowledge are the two most common ways to stimulate the innovativeness of other firms. These are the least costly in terms of money and effort. The least used methods, financing joint innovation projects and managing these projects, are still used by more than 50% of the leader firms.

Suppliers benefit the most from innovative behaviour of the leader firms. For the leader firms, innovative suppliers are important to maintain a high standard in the products and production.

The leader firms also encourage internationalisation of other firms, again predominantly suppliers. Table 8 shows ways in which leader firms support internationalisation of suppliers.

Table 8: Ways to support internationalisation

Co-invest in foreign facilities	4 of the 16 LF's play this role
Offer location on-site	5 of the 16 LF's play this role
Act as 'matchmaker'	2 of the 16 LF's play this role

RESULTS OF THE CASE STUDIES; NINE FORMS OF LEADER FIRM BEHAVIOUR

In this section, the results of 26 case studies of leader firm behaviour and the results of a survey among leader firms are discussed. Case studies of 26 of the 47 identified leader firms were made, on the basis of desk research and an interview with a senior manager, mostly the CEO. The case studies were 'checked' by these senior managers. The case studies revealed nine forms of leader firm behaviour. Some of these forms of leader firm behaviour were addressed in the survey; some others were identified in the case studies. The case studies are not discussed in particular, only the general forms of leader firm behaviour.

Coordination of production networks

A first form of leader firm behaviour is the coordination of production networks. Leader firms invest in the coordination of this network. As a consequence the whole network becomes more competitive. In most industries examples of network coordination were found, ranging from building ships 'in series' at different shipyards to the formation of partners in response to specific opportunities.

Role as lead user

By expressing a 'critical demand', a more sophisticated demand than that of other firms in the market, leader firms improve the innovativeness of their suppliers. Several offshore and dredging companies in the DMC have a leading position in the world market. Their sophisticated demands motivate local suppliers to innovate. As a result several maritime suppliers in the cluster have a strong position in international markets, based on their advanced systems and technologies. The survey showed that 95% of the leader firms is conscious of this role and actively uses it to stimulate innovations.

Creating standards

Leader firms set new standards, for instance of safety and pollution prevention. Other firms, especially suppliers that are confronted with such standards in an early stage, benefit. Several cases of new standards were found. For example a more accurate dynamic position system for ships that was designed by several leader firms in a cooperative setting. Another example is found in the development of a new shock resistant hull. The hull limits the risk of spills in case of an accident to a minimum, and is now the standard for new inland gas and oil tankers.

Creating 'new combinations'

Leader firms have a central role in creating *new combinations* of previously unrelated technologies. The combination of such technologies leads to new products. Other firms in the production network benefit from this product development. The presence of a heterogeneous set of companies in the DMC often leads to the creation of new combinations. Examples can be found in offshore construction, where a company specialised in heavy lifting and a dredging company cooperatively designed a new way to install offshore windmill parks.

Improving the transfer of knowledge

A fast diffusion and transfer of knowledge adds to the competitiveness of a cluster. Because of the knowledge they possess and their central role in knowledge networks, leader firms improve the transfer of knowledge in the cluster. Several cases were found of informal networks where technicians from leader firms shared their knowledge with colleagues from other companies. Other examples are companies that have such a central position in the cluster that their large number of (commercial) contacts automatically leads to the diffusion of knowledge. These cases are mainly found in the dredging industry.

Encourage and enable internationalisation

Leader firms compete on international markets. They can start production in other countries and urge or encourage firms in the cluster to internationalise in order to supply them in these countries. Many leader firms lower the barriers to internationalise by letting suppliers use their international network or by guarantying a long-term contract for production facilities abroad. One company was found that actively managed their international sales agent network and encouraged other companies in the cluster to use the same agents.

Creating reputation

Leader firms engage in projects at the frontier of what is possible. Such projects are widely known in the industry and contribute to the reputation of the cluster as a whole. A clear case is the raising of the Russian submarine Kursk. For this job new techniques were developed to make a fast salvage operation possible. The alliance of two Dutch maritime companies that was responsible for this operation clearly enhanced the reputation of the Dutch Maritime Cluster.

Another reputation effect that occurs is that leader firms openly advertise their Dutch roots. An example is found in the yacht building industry where the largest company presents itself as a Dutch company. Other Dutch yacht builders benefit from this reputation, the addition 'Dutch built' now is a strong marketing argument.

Improving the labour market

The quality of the labour market is important for the competitiveness of the cluster. Leader firms invest to improve the quality of the labour market. Leader firms are often found among the larger firms in a cluster. Clearly these firms benefit the most from a well-trained professional labour force. This gives them the incentive to invest in education projects. Many of the interviewed leader firms invest in public education projects, resulting in better-educated employees for the leader firm, but for other maritime companies as well.

Organisational infrastructure

Leader firms play a role in creating and maintaining the organisational infrastructure in the cluster. Such infrastructure is an important condition for effective cluster governance (De Langen, 2002). The Dutch Maritime Cluster is an example of a strongly organised cluster. There are associations per industry and a cluster-wide organisation in which all industry-associations participate. The interviewed firms indicated that these associations are of importance to them in order to maintain a 'broad' network. They also invest in education through the cluster organisations.

Not all leader firms demonstrate all forms of leader firm behaviour. Table 9 shows the results of the case studies. For reasons of 'confidentiality', no company names are given.

Table 9: Forms of leader firm behaviour in 26 cases

Activity of leader firm	Form of leader firm behaviour								
	1	2	3	4	5	6	7	8	9
Dredging									
Firm A	*	*	*	*	*		*	*	
Firm B	*	*	*	*	*			*	
Inland shipping									
Firm C		*	*		*				
Firm D			*		*				*
Marine services									
Firm E					*		*	*	*
Marine suppliers									
Firm F		*	*	*	*	*		*	
Firm G			*		*			*	
Firm H	*				*				
Firm I			*		*				
Firm J						*			
Firm K				*	*		*	*	
Offshore									
Firm L		*	*		*				
Firm M	*	*	*	*	*		*		
Firm N	*	*		*	*		*		
Firm O	*	*	*	*	*	*	*	*	
Firm P		*			*			*	
Shipbuilding									
Firm Q			*	*	*	*			*
Firm R	*	*	*		*	*	*	*	
Firm S	*	*	*	*	*			*	
Ports									
Firm T	*								
Shipping									
Firm U		*							*
Firm V		*	*					*	
Ports and shipping									
Firm W	*	*	*	*	*	*		*	
Firm X		*	*	*	*	*		*	*
Firm Y	*	*	*		*				*
Yacht building									
Firm Z		*	*		*		*		
Total frequency	10	17	15	11	22	7	7	12	5

Table 9 shows that the vast majority of leader firms transfer knowledge to other firms in the cluster. Furthermore, the majority acts as a lead user and creates new standards. Only a limited number of leader firms invest in the organisational infrastructure, enable internationalisation of other firms in the cluster and contribute to the reputation of the DMC.

CONCLUSIONS

The results of this study are a contribution to the existing literature on clusters. Porter's theory (Porter, 1990), as well as some other theories on the development of clusters, is somewhat 'mechanic': once the conditions for cluster development are set, a cluster will develop spontaneously. This research shows that a particular set of firms play a special role in the development of the cluster. These firms are termed leader firms. Different forms of leader firm behaviour are identified. This is an addition to the existing literature.

Nine forms of leader firm behaviour can be identified. Not all leader firms demonstrate all forms of leader firm behaviour. Most leader firms transfer knowledge while only a small set of leader firms enables the internationalisation of other firms and contribute to the reputation of the DMC.

The reasons for leader firm behaviour are not addressed in this paper. An interesting avenue for further research is *leader firm strategy*. Central in such a strategy is an effort to strategically manage leader firm effects.

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ⁱ In fact, these figures underestimate the economic impact of seaports, since a number of port activities is not included in the DMC (RMPPM, 2001).

ⁱⁱ Based on direct financial relations.

ⁱⁱⁱ Firms with over 100 employees are considered large. Employment data are available for most firms in the Netherlands (Bureau Van Dijk, 2002).

^{iv} Small, high technology firms, which have a very small domestic market and thus depend on exports, are a special case. These firms frequently internationalise rapidly. Keeble et al. (1998) stress the importance of a network through which these small companies can internationalise.

^v 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.

^{vi} 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

channelled back on to the leader firm. The positive effects are at least partially external effects.

^{vii} The eleventh sector, the Royal Navy, comprises only one 'firm'. Furthermore, given the special status of this firm, it is not included in this study. The role of the Navy as a leader firm is discussed in Policy Research Corporation (2003).

^{viii} This network contains the actors that are involved in the recruitment and education of employees and in promoting the maritime industry as a work-environment.