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Longevity in regional specialization: the Dutch dredging industry

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Writing about industrial districts and regional clusters in the *Handbook of Business History*, Jonathan Zeitlin calls for more historical research into the sustainability of industrial districts. After they had been created, how did industrial districts or local productive systems survive for an extended period of time? How did they respond to periodic shifts in markets and technologies and to the usual ups and downs of the economic cycle? [1]

In this paper about the Dutch dredging industry we will to explore these questions about long term continuity.[2] First we will analyze why one region in the Netherlands developed into the most important dredging centre in the country during the nineteenth century, and how the people from this relative backward region succeeded in acquiring international commissions, ranging from Russia, China, the Dutch East and South America. Second, we are going to discuss how the relatively small scale dredging firms developed into leaders in large-scale production during the 20th century. While the initial advantages seem to have been located in networks and close family relationships, during the second half of the 20th century the dredging sector became more and more concentrated in a few large diversified companies, working increasingly outside their home country. We will discuss which competitive advantages enabled these companies to create such a dominant position on the international dredging market, and to what extent regional characteristics played an important part in their success story. In looking for explanation we will explore the whole dredging cluster and the position of that cluster

[1] Zeitlin, 'Industrial districts', 234-236.
[2] This paper is based on the research we did for the study on the Dutch dredging company Boskalis: Bouwens and Sluyterman, *Verdiept verleden*.

within the Dutch industry. The key to success were the huge infrastructural projects launched by the government as well as the link between the Dutch dredging companies and other Dutch multinational companies, in particular in the oil industry, the offshore industry and the shipping industry.

Rise of the dredging industry in the Netherlands during the 19th century

The Netherlands is a country that historically is associated with water management. The traditional coexistence of low-lying areas, rivers and sea in combination with an economy largely related to transport, navigation and ports, made The Netherlands into a natural environment for developing for dredging and reclamation techniques. Dredging took place in many areas in the Netherlands. Yet, Sliedrecht and Werkendam, relatively small towns on the river Merwede, about 30 kilometers east of Rotterdam, stood out. From the 16th century men from Sliedrecht had a strong reputation in using spades and wheelbarrows to dig channels, deepen harbours, keep waterways navigable and to protect the fragile banks of drainage channels. In the 19th century most men in the Sliedrecht area worked in this industry, and combined this heavy manual labour with small-scale agricultural activities. Table 1 gives an indication of the importance of the small town Sliedrecht during the 19th century.[3]

Table 1: Home town of dredging firms working on improvements of the river Waal, 1830-1912

Home town	Number of firms	Percentage of total
Sliedrecht	83	21
Hardinxveld	35	9
Pannerden	34	9
Nijmegen	21	5
Giessendam	14	4
Zaltbommel	11	3
Werkendam	8	2
Elsewhere	186	47
Total number of firms	392	100

[3] Calculations based on: Van Heiningen, *Diepers en delvers*, annex 3, 384-390.

It is a fascinating question why this region became the core of the Dutch dredging industry. Several factors can be mentioned. The geographical conditions of the area promoted excavation, reclamation and other maritime construction activities. The location, close to the river and the important harbours of Rotterdam, was a natural breeding ground for these activities. The fact that the occupational substitutes were limited encouraged men to travel to distant parts of the Netherlands to dredge, drain and reclaim. In terms of discipline, every man that was able to handle a spade and could persevere long working hours, was suited for the job. This profession fitted the Calvinistic hard working sober type of people that dominated this area.[4] The techniques of the industry were rather simple and 'on the job training' was common practice.

The government played a crucial role in the development of the dredging industry by initiating huge infrastructural projects. During the 19th century many canals were constructed, important rivers deepened and new land created. The organisation was very clear. The engineers of the Ministry took the lead and were responsible for design, planning, organisation and management of the projects. Initially, the contractors didn't have any say in the projects. The engineers not only defined the technical specifications, but also the working hours, the housing of the personnel and the other labour conditions.[5] Over the 19th century this unilateral relation gradually changed, because of the governmental decision *not* to invest in dredging equipment.

During this century the technology of dredging changed fundamentally. Steam powered dredgers replaced human power and horse- and wind-driven engines. Steam power enabled other inventions such as the centrifugal pump and the rotating cutter head. The innovations increased the productivity of the dredgers enormously.[6] The government pushed the industry to invest in the new technology. Initially, when the state engineers required that steam engines should be used in their projects, foreign dredging companies took the place of the national firms. In reaction, several Dutch dredging companies joined forces to be able to compete with the foreigners. From the 1860s they organized themselves in – rather unstable - associations that brought together enough capital to enable them to investment in steam technology and related innovations. The associations

[4] Bos, *Sliedrecht*, 58-58; Vandersmissen, *Ophogen en uitdiepen*, 56.
[5] Bouwens and Sluyterman, *Verdiept verleden*, 30-37.
[6] Van Heiningen, *Diepers en delvers*, 123-203; Bos, *Van baggerbeugel tot sleepzuiger*, 27-31.

that were built around existing local and regional networks and family ties greatly contributed to the professionalism of the sector and can be seen as an institutional prerequisite for the transformation of the industry. The central position of the government was not called into question, but the modernization of the industry had a long term impact on the relations between government and industry.

The relation between the authorities and the contractors also changed because of the entrance of engineers as company directors. Many entrepreneurs now decided to send their sons to the Technical University of Delft. As the new generation of directors entered the industry during the late 19th century, the firms did not only have more technological knowledge, but also important connections with the engineers of the government. The dredging companies were able to discuss and negotiate with the government on a more equal footing.

The personal links among the Dutch engineers helped the Dutch dredging companies in acquiring international commissions. The Dutch state employed engineers had a strong international reputation and were often consulted by foreign governments in matters of land reclamation, drainage and hydrology, the construction of canals, harbours and the creation of sluice gates.[7] In the slipstream of the state engineers the dredging companies obtained many foreign commissions. Moreover, the activities in colonial Indonesia offered the contractors a stepping stone to other areas in Asia. Again, networks were crucial. The Dutch contractor J.A. Kalis travelled to Yodo to instruct Japanese labourers, after he was recommended by engineers of the Dutch government.[8] Businessmen, politicians and diplomats were active in promoting the abilities of the Dutch dredging industry and their comparative advantage in knowledge and efficiency. In the late 19th century, the banker E.D. van Welree and the director of the Holland-China-Trading Company, F.B. s'Jacob, successfully lobbied with the Chinese authorities. The East Asiatic Dredging Company, in which several Dutch contractors were associated, got the commission to participate in dredging the Huangpu river. Through their networks the Dutch dredging firms acquired many commissions in all parts of the world, from Asia to Latin-America. Sometimes it was evident that dredging companies from small had

[7] Van der Ven, *Leefbaar laagland*, 181; Fockema Andreae, 'Waterschapsorganisatie', 319-320.
[8] De Neve, 'Hollandse methode', 197-198.

advantages in acquiring foreign state commissions, because they were not seen as threatening to the power of those states.[9]

The First World War interrupted the international expansion of the industry, but new opportunities opened in the Netherlands soon afterward. Again, huge public projects stimulated the expansion and consolidation of the industry. The construction of an enclosing dam in the Zuiderzee, a sea arm that covered about 5000 km^2, made the reclamation of large areas possible. Dikes were constructed within the new freshwater lake and water was pumped out.[10] The scale of the projects required close cooperation between the leading dredging companies. Most businessmen knew each other and occasionally they were even related. The larger dredging companies established a joint venture to engage in the huge projects related to the Zuiderzee land reclamation. Soon, the smaller companies joint forces to compete with the first association. Obviously, the state was happy to have two competing groups of contractors.

During the 1930s overcapacity and fierce competition caused serious problems for most dredging companies. The government reduced the number of commissions, while the contracts related to the huge Zuiderzee-project came to an end. Most dredging companies had to survive through maintenance-work. Profitability deteriorated. The dredging companies set up a business interest organisation, and reached a cartel agreement, but all that was not enough in the face of the huge overcapacity in the industry. The alternatives were limited. A few dredging companies from the Sliedrecht region succeeded in setting up foreign subsidiaries. Boskalis, that established the Westminster Dredging Company in the UK, was one of them. A commission from the Anglo-Dutch company Unilever to dredge the Bromborough Docks was the starting point of a successful extension of their activities on the other side of the North Sea.[11]

The creation of a dominant position in the international dredging industry during the second half of the twentieth century

[9] Bouwens and Sluyterman, *Verdiept verleden*, 54-62.
[10] Van der Ham, *Verover mij dat land*, 211-300; Van der Ven, *Leefbaar* Laagland, 237-286
[11] Bouwens en Sluyterman, *Verdiept Verleden*, 133-139.

After the Second World War Dutch dredging companies were in high demand because of the need to repair the war damage. Harbours and bridges were destroyed and land inundated. This was in particular true for the island of Walcheren, after the dikes had been bombed in 1944 by the Allied Forces to drive out the German troops. Repairing the dikes in Walcheren was challenging, because it took nearly a year before the work could be started and all that time the sea had moved in and out through the gaps, making them larger and deeper. It was impossible to close the gaps in the traditional way by simply protecting the sea bottom with fascine mattresses and dumping boulder clay in the gap. Desperate measures were needed, and these included the sinking of old ships and the use of caissons left over from the D-Day invasion. The use of caissons had been considered when the Zuiderzee dike was built in the late1920s, but at that point in time the traditional methods had been preferred, and with success. In 1945, however, the caissons proved their usefulness and from then on became part of the arsenal for building sea protection.[12]

In 1953, a combination of high spring tides and a storm surge broke many dikes in the provinces of Zealand, North Brabant and South Holland. Over 1800 people lost their lives, 800 kilometres of dikes were damaged and 2000 square kilometres of land were flooded, mostly with salt water. The extent of the damage called for drastic measures. After the repair work had been done, the government presented an extensive plan for a new flood protection system called The Delta Plan. The plan involved damming the tidal estuaries to create a stronger barrier at the coast. It included the construction of many dams, several storm surge barriers, locks that separated salt and fresh water, and higher sea dikes.[13] Initially, the dredging companies were hardly involved in the designing process, but gradually the importance of their expertise was acknowledged.

The plan as a whole was huge, but most of the individual projects were large as well, and often moved into new territory. For that reason the government was not prepared to commission individual contractors, not even the larger ones, but insisted on contractors forming alliances. Thus the larger Dutch dredging companies had to share the work between them, and they were all involved in the learning process. Other sectors also

[12] Van der Ham, *Heersen en beheersen*, 176; Den Doolaard, *Het verjaagde water, geannoteerde uitgave*, 30, appendix 4, 540-560, appendix 5, 561-772, appendix 6, 573-581.
[13]Van der Ven, *Leefbaar laagland*, 400-401.

profited. Dutch shipbuilders responded to the demand for dredging equipment and the government commissioned some special purpose vehicles for the more experimental parts of the Delta Project. The Delta Project started in 1954 with the Storm Surge Barrier on the Hollandse IJssel and formally came to an end with the completion of the Oosterschelde Barrier in 1988, though work on dikes and new dams continued after that date.[14]

The Delta Project meant a huge boost for Dutch dredging companies. To illustrate the expansion of the six leading Dutch dredging companies, chart 1 shows the increase in the value of their dredging equipment between 1941 and 1971.[15]

Chart 1: Fleet size of six leading Dutch dredging companies, 1941-1971

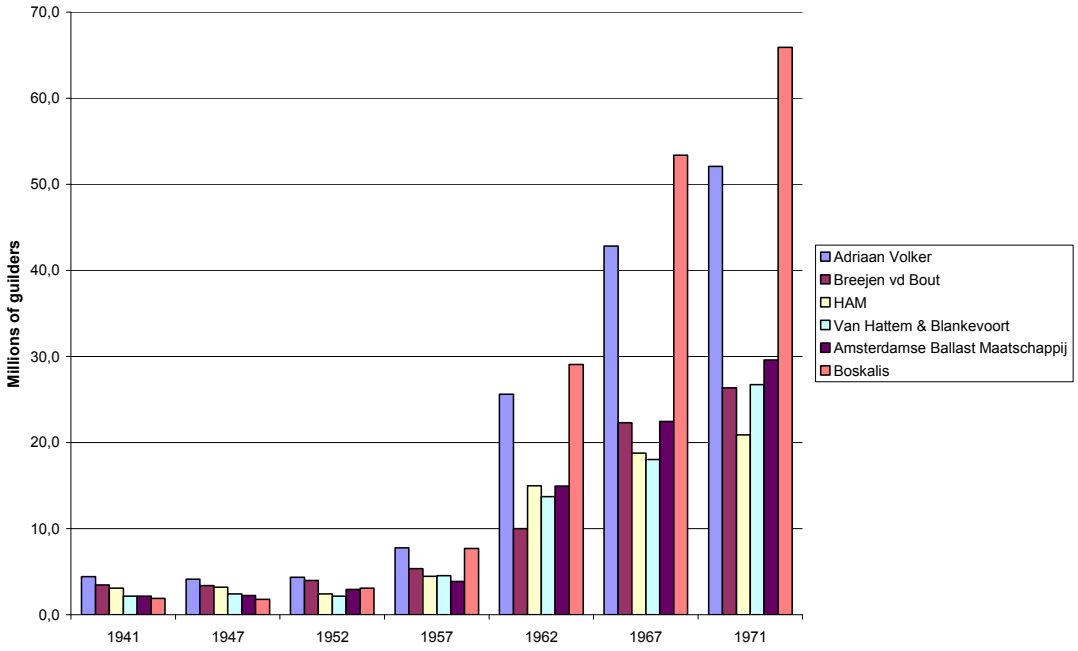


Chart 1 also shows how the smallest dredging company in 1941, Boskalis, became the largest by 1971.

Developments in the home market offered the Dutch dredging companies interesting work with innovative elements that added to their competitive strength, apart from the

[14] Van der Ven, *Leefbaar laagland*, 401-406; Van Heezik and Toussaint, *Van spelbepaler tot medespeler*, 67-72; Van der Ham, *Heersen en beheersen*, 227-228, 239-243.
[15] Source: Nationaal Baggermuseum Sliedrecht (NBS), Archive Centrale Baggerbedrijf: Measured is the size of the fleet in age value. The age value is the construction value minus depreciation with 1.5% point per year.

traditional work in building and extending harbours and creating urban spaces. But the Delta Project was not the only learning curve. The fast post-war economic growth stimulated the expansion of the oil industry. The exploration and production of oil demanded a lot of dredging work, and the same was true for the transport of oil that took place in increasingly larger tankers. Most of these activities took place abroad, but that formed no hindrance for the Dutch dredging companies. They benefited from the fact that one of the big international oil companies, Royal Dutch Shell, happened to be located in the Netherlands and Britain.[16]

To illustrate the links between the dredging and oil companies, we will focus on the dredging company Boskalis. Since the 1930s Boskalis had a British subsidiary, the Westminster Dredging Company. Via this subsidiary the first forays in the oil business took place. In 1953 Boskalis became on of the four partners in the Overseas Dredging Company (ODC), existing of two Dutch and two English partners. The ODC worked in Kuweit, Iran and Doha for oil related projects. With the latter two projects there was also a link with Shell. In Pakistan and India ODC was involved with shipping related projects. Because the financial results were disappointing, the ODC was dissolved. The partners went their own way. Boskalis continued in the Middle East, and through Shell subsidiaries in the area found a new niche in operating oil terminals. This work included maintenance of offshore mooring buoys and the provision of tugs for the birthing and un-birthing of vessels. From the Middle East Boskalis moved to Africa where the operation of oil terminals was taken in hand in Nigeria and South Africa. Apart from this specialized activity, Boskalis found plenty of work in Nigeria for the oil operations of Shell. This included the construction of canals to bring the drilling equipment to the drilling site and land reclamation to build up the drilling rigs. The Dutch dredging companies were also contracted by the Nigerian government for extending harbours and preparing building sites.[17]

Before the Second World War the colony Indonesia had been a focal point for Dutch companies working abroad. This ended when in 1957 the Republic of Indonesia nationalized all Dutch companies. Instead new clusters of Dutch companies developed in

[16] Sluyterman, *Concurreren in turbulente markten*.
[17] Sluyterman, 'Boskalis in het kielzog'.

other parts of the world. One such cluster was around the Lake of Maracaibo, where Shell rapidly extended its oil production and set up a refinery in the 1950s. The Dutch bank HBU opened an office in Maracaibo, Van Leer, producer of oil barrels, established a factory and the dredging company HAM constructed a canal. A similar cluster arose in Nigeria. Unilever, through its subsidiary UAC, was already active in this country. Van Leer opened a factory in 1939. In the 1950 followed the Dutch trading Hagemeyer and the oil company Shell. The oil production brought the dredging companies HAM and Boskalis, followed by the shipping company Damen, who set up a joint venture for the maintenance of the dredging vessels. Thus the presence of one Dutch company stimulated the arrival of others. In the European communities abroad they regularly met at receptions and parties, no doubt also discussing future projects and commissions.[18]

During the 1960s oil production took off in the North Sea, bringing the oil-related activities much closer to home. The larger Dutch dredging companies became involved with the exploration of oil through a joint venture, Netherlands Offshore Company (NOC), in which five companies participated. NOC was involved in the construction of seagoing drilling rigs. and They did not intend to take on the actual drilling, but left that to the company Sedneth, a joint venture between NOC and the American company Sedco. The costs for the first rig were for 80% covered by the contact from Shell and built to the design of the rig Stafflo that Shell engineers had developed. In addition, NOC decided to play a role in the offshore industry by building its own crane barges. Tankers were converted to special vessels for the offshore laying of pipelines and performing heavy duty lifting. Finding sufficient work for these vessels after the building boom of the early 1970s turned out to be the bottleneck. In 1979 NOC sold their ships. Shell was a particular interesting client for Boskalis, and a source of information for future developments. When Boskalis became a listed company in 1969 it invited a just retired board member of Shell to become its first chairman of the supervisory board. When he stepped down, another retired board member of Shell took over until 1985.

[18] Sluyterman and Wubs, *Over grenzen*, 167.

The Dutch organisation of dredging companies made a world ranking of dredging companies in 1979, measured in investment in their fleets. Table 2 shows that the top-ten companies included four from the Netherlands, and one from Belgium.[19]

Table 2: World's largest dredging companies in 1979			
ranking	company	country	Value of the dredging fleet, in millions of guilders
1	Boskalis	Netherlands	467
2	State company	China	448
3	Volker Stevin	Netherlands	408
4	State company	Soviet Union	234
5	HAM	Netherlands	218
6	Dredging International	Belgium	193
7	Penta Ocean Construction	Japan	171
8	US Army Corps of Engineers	US	163
9	BAM	Nederland	155
10	State organisation of Iraqi Ports	Irak	154

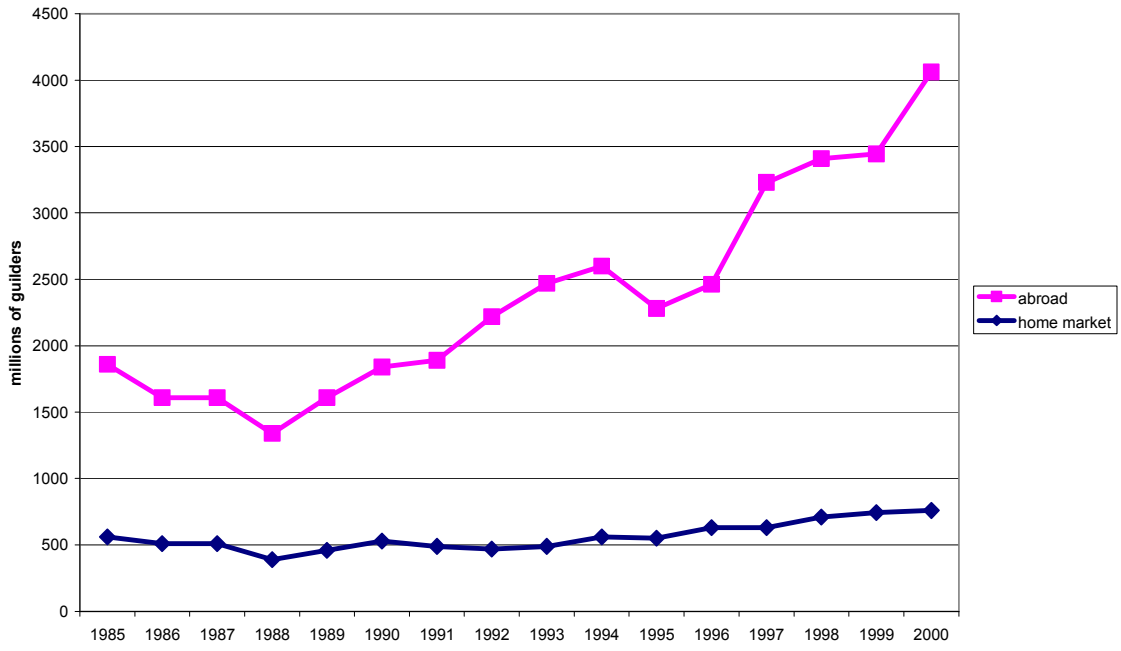
The recession of the 1970s did not hit immediately the dredging companies, because of the oil boom in the Middle East. Dutch dredging companies and building companies signed huge contracts for constructing harbours, roads and industrial sites. The recession did hit the ship building industry, though one of the few companies that survived and later grew into prominence was IHC, specialized in the building of dredging vessels such as the trailing suction hopper dredgers and the cutter suction dredgers. When the oil prices started to go down in the early 1980s, the dredging industry felt the impact heavily. This was particularly true for Boskalis, because it had diversified in the 1970s and found many of the new activities loss making. The Dutch dredging companies were discussing a new round of consolidation and expected Boskalis to disappear from the market.[20] However, Boskalis succeeded in convincing the banks that a reconstruction and a return

[19] Source: Dredging Museum Sliedrecht, Archive Centrale Baggermaatschappij, 3.03, figures about the world dredging market.
[20] Bouwens and Sluyterman, *Verdiept verleden*, 294-299.

to the core dredging activities would be preferable. The Dutch AMRO bank, later to form part of ABN AMRO, was instrumental in saving the company from bankruptcy, underlining the importance of the Dutch network of international operating companies. The company did not disappoint its bankers. In 1988 a small version of Boskalis was able to regain the trust of the market and then start on a new course of expansion.[21] The consolidation of the industry took place, but Boskalis was not one of its victims.

Chart 2 illustrates the expansion of Dutch dredging companies in foreign markets after 1985.[22] Not until 1988 did they succeed in increasing their turnover. The increase after 1988 was overwhelmingly achieved in foreign markets. The Dutch market remained sluggish and only picked up modestly after 1995.

Chart 2: National and international dredging production of Dutch companies, 1985-2000



The new growth area of the 1990s was Asia. One of the largest projects for the world dredging industry was the construction of an airport off the coast of Hong Kong. Two islands were merged into one to create Chek Lap Kok airport. 14 trailing suction hopper dredgers, 4 cutter suction dredgers, 3 booster pump stations, 7 grab

[21] Bouwens and Sluyterman, *Verdiept verleden*, 281-286, 294-299.
[22] Source: Annual Report Centrale Baggermaatschappij, 1985-2000.

dredgers and some 20 hopper barges were deployed from all over the world. Dutch and Belgian dredging companies participated in the consortia that were formed to execute the work. Contracts were signed in 1992 and the airport was ready in 1998. During the project so many Dutch employees were present in Hong Kong that a Dutch primary school was opened.[23] Other large land reclamation project in Asia followed. But the economic growth in Asia also led to the demand for newer and larger harbour facilities. In the meantime, maintaining harbours and canals remained core business for the dredging companies.

The large land reclamation project pushed the dredging companies to increase the size of their vessels. In 1968 Boskalis introduced the then largest trailing suction hopper dredger in the world with a hopper capacity of 9000 cubic metres. In 1997 it launched the jumbo trailer W.D. Fairway with a capacity of 23,000 cubic metres, again the largest trailer in the world at the moment of its launching. But size was not the only relevant aspect of the new trailers, and in fact, smaller trailers were also added to the fleet. The modern ships contained far more computer aided instruments to make the dredging process more accurate. The innovation of the dredging fleet took place in close collaboration between the dredging and shipbuilding companies. The Dutch shipbuilder IHC was much in demand and established a prominent position in this field.[24]

In the 1990s new competitors appeared from close by. Two Belgian dredging companies, DEME and De Nul showed rapid growth in the new markets that developed during the 1990s.[25] Sustaining competitive advantage was clearly difficult. How were those Belgian competitors able to become such serious competitors? In this case, one could argue that the Flemish dredging companies were in fact part of the same cluster. One of the two main companies had its roots in the Netherlands. In 1993, inspired by the publications of Michael Porter[26], the Dutch study centre for technology and policy TNO analysed the economic strength of the Dutch and Belgian dredging sectors as part of one cluster. How could the strength be explained? First:

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[23] *Cohesie (company magazine Boskalis)*, June 1994; *Terra et Aqua*, no. 100, September 2005: Forty years of maritime solutions that changed the world; interview authors with B. van der Zwaan, 13 Aug. 2009.
[24] Vandersmissen and Stam, '50 jaar IHC'.
[25] Vanderostyne, *Waterbouwers*, 10-26, 131.
[26] Porter, *Competitive strategy*; Porter, *Competitive advantage*; Porter, *Competitive advantage of nations*.

modern dredging companies required expensive ships and other expensive equipment that made it difficult for newcomers to enter the sector. Moreover, the network of personal links between clients and contractors as well as between contractors, subcontractors and suppliers was dense. As far as dredging activities were concerned, substitution was practically non-existent. The power of the dredging companies towards their suppliers of dredging equipment was not particularly strong, because of the dominant position of IHC. However, dredging companies tried to avoid complete dependence on one source of supply. The power of dredging companies towards the clients was limited, because clients were mostly governments. On the other hand, governments didn't have too much choice if the work was highly specialized. In short, the TNO study concluded that power relations were fairly balanced. The competitive strength of the Dutch dredging companies was the demanding and innovative home market.[27]

In 2001, Boskalis estimated the annual turnover of the world dredging market at around 7 billion euros, half of which, approximately 3.5 billion euros, was achieved on free markets. The free markets have been dominated by the large West-European dredging companies. Their share accounted for an estimated 60 per cent. With a share of 20 per cent of the free market, Boskalis considered itself market leader.[28] Competing for prime position were one other Dutch company, Van Oord, and two Belgian companies, DEME and Jan de Nul. Together these four dredging companies can lay claim to a very competitive position on the world market.

Conclusion

After more than hunderd years, Sliedrecht and its neighbouring town Papendrecht are still the prime location for dredging companies, if only because Papendrecht is the home to the largest Dutch dredging company Boskalis, and the dominant shipbuilder of dredging vessels, IHC Merwede, has its headquarters in Sliedrecht. The other large

[27] Jacobs *et al*, *De economische kracht van de baggerindustrie.*.80-81.
[28] Annual Report Boskalis, 2001.

Dutch dredging company has its headquarters in Rotterdam, less than thirty kilometers from Sliedrecht. At the same time, it is fair to say that the sustaining cluster of dredging and supporting companies has become wider and includes Dutch companies in other regions as well as part of Belgium. Still, on a world market one could easily define the Netherlands and Belgium as one region.

The Dutch dredging companies have profited from the fact that the natural location of the country required extensive protection against rivers and sea. At the same time, the water was put to good use by constructing and maintaining harbours and canals. For that reason, there was continuous dredging work to do. For the sector it was of vital importance that the 19th century government decided that dredging companies had to purchase their own equipment. That enabled the more entrepreneurial companies among them to grow in size and capital investment and made the government dependent on their capabilities.

Huge infrastructural projects in the 20th century, such as the Zuiderzee project and the Delta project added to the size and capabilities of the Dutch dredging companies. On the international market, the Dutch dredging companies undeniably had an advantage due to the fact that one of the largest oil companies, Royal Dutch Shell, was established in the Netherlands (and England). They could therefore already in the Netherlands (and England) negotiate their foreign contracts. Boskalis encouraged access to the personal network deliberately by inviting retired Shell executives to sit on their supervisory board. Boskalis received contracts from Shell. That is not to say Boskalis only worked for Shell. Other oil companies as well as governments entrusted Boskalis with their projects. It is clear that the Dutch dredging companies thanked their strong international competitiveness not just to their location by the sea and the technically challenging Zuiderzee and Delta Project. The fact that the Netherlands was home to one of the world's largest oil companies stimulated the dredging companies to explore new paths, both geographically and technologically.

Once established as the leading international companies with an impressive fleet of expensive state of the art ships, it was difficult for newcomers to enter the market. The Belgium dredging companies succeeded in challenging them, but it could be argued that they had formed part of the same cluster and had easy access to the same

group of supportive suppliers. A more recent threat comes from the Chinese state-owned companies, who may have enough access to funding to overcome the entrance barrier. So far, Dutch companies have responded to this challenge by extending their services to the early stages of the design process and by investing in the newest technology.

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