What happens the day after we stop dredging? Why is dredging necessary for navigation and trade?

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Introduction

Most ports were built in locations which naturally provided the necessary maritime access. Access to these ports was not a problem for the types of ships which were present at the time. The issues which ports are facing at the moment are multiple and complex. Globalisation, trends in logistics, scale increases in vessel size and a new port hierarchy in the European port system mean that it is necessary to enlarge the fairway to these ports so that they can continue to play a role as motors of economic prosperity. For the access to most ports dredging has become a fundamental activity.

In this respect it is necessary to consider whether the social benefits of increasing the size of the fairway, or even merely the maintenance dredging, are higher than the costs incurred by this. For example, it might be more profitable for a region to move the port itself, although this is rather unlikely, in view of the enormous costs of port infrastructure.

By way of example, I would specifically like to look at the case of Antwerp.

Scheldt Estuary

It is important to make a distinction between maintenance dredging and capital dredging. Capital dredging for navigation purposes is the excavation of sediments to increase depths in an area to accommodate the draft of vessels. Maintenance dredging is concerned with maintaining the depth of the channel. Maintenance dredging in estuaries (an estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage – Pritchard, 1967) is a continuing and unrelenting expense.

Naturally, estuaries tend to silt up rather than become eroded. This is because the river flowing into it transports sediments to the estuary, while a great deal of sediment also comes in from the sea. In many places in the world this process is accelerated by human activity. This applies to dykes, polders and dredging itself.

In an estuary the ratio between what is transported away by the river and the tidal volume is important. In fact, there is an individual type of sediment management for every ratio. In the Scheldt estuary the tidal volume strongly predominates. Therefore changes in the volume at high and low tide are particularly important. These actually determine whether the estuary will become silted up or enlarged. The water and sediments are transported by the channels. When there is an increase in the volume at high tide, the channel will become broader and/or deeper. When it decreases, the channel will become smaller. If it becomes silted up with river and sea sediment, the volume at high tide will become smaller, creating smaller channels. Flooding results in a larger volume at high tide and therefore in larger channels. Therefore dykes and polders result in smaller channels. Dredging enlarges the channels, while the tidal volume does not increase proportionately. This leads to more rapid silting up of areas at the side, so that the volume at high tide decreases again. As a result, it then becomes necessary to dredge more downstream.

The dredging work in the maritime access channel to the port of Antwerp concentrates mainly on the places where the river is naturally shallowest, and particularly on the sills. (These are the straight part of the river situated between two successive bends.) Without dredging work the natural depth at the various sills in the Scheldt would vary between five and nine metres at low tide.

Few people are probably aware of the fact that Zeebrugge also has its natural access via an arm of the Scheldt estuary, and in this sense it is not a 'true sea port'. For the development of Zeebrugge it was necessary to dredge an artificial channel (Pas van't Zand) straight through a sandbank. The tidal flows run straight across this, which therefore does not remain at the necessary depth naturally. Dredging is necessary for the Flemish sea ports to remain accessible to the current generation of ships.

For the enlargement of the Scheldt to 13.1 m for shipping irrespective of the tides, the costs of the work taken into account can go up to 100 million euros. In 2007, 94 million euros were provided in the Flemish budget for the maintenance dredging in the Scheldt, and in addition, another 69 million euros was provided for the maintenance dredging in the North Sea and Zeebrugge, and five million euros for the dredging work on the Ghent- Terneuzen canal. In addition to this maintenance dredging in the maritime access channels, there is also the dredging in inland waters and in the (sea) ports. In 2006 the share of the maritime access accounted for 54 per cent of all the Flemish government expenditure in the Flemish sea ports.

MKBA (analysis of social costs and benefits)

The maritime access channels to the Flemish sea ports are public space. Bringing these channels up to standard and maintaining them is of general social importance. In the context of the market this is not dedicated in any respect. It is becoming increasingly socially important to gain a clearer insight into the usefulness and necessity, and into the effects of the efforts made by governments to make and keep maritime access channels more accessible.

Expanding and maintaining the maritime access channels to the sea ports is expensive, but the government also gets money back for this, for example, in the form of employment and added value. If the external effects of the project are deducted, and this results in a positive balance, it can be decided to carry out the project from the economic and welfare point of view.

This can be examined in an MKBA. This systematically estimates all the internal and external effects of an investment project and provides a financial evaluation. In other words, this is a conversion in monetary units, because it is necessary to make comparisons. The aim is to find out the net effect of a project (in this case, dredging) by looking at the difference between the costs and benefits.

In an MKBA the development with the execution of the project is compared to the zero alternative, i.e., the development without the execution of the project. This specific case concerns

the access to the port of Antwerp without further deepening of the fairway of the Scheldt. This means that ships with a draft of 11.85 m can continue to enter the port of Antwerp, irrespective of the tide. Larger ships will have to enter and leave during a particular tidal window, depending on the size of the ship.

Not dredging is not the same as a zero alternative. If no maintenance dredging is carried out, the depth of the Scheldt will be reduced and navigation to Antwerp would be impossible with modern maritime ships. For nontidal shipping, dredging is also important in the channels on the North Sea for access to the ports of Ghent and Zeebrugge. For Zeebrugge this also applies for tidal shipping. Dredging in the maritime access is even important for Ostend, although this ratio is marginal.

This analysis can show whether deepening is desirable or undesirable. It can also show that deepening is desirable, but only up to a particular depth, after which the costs are higher than the benefits.

Market dynamics

As indicated earlier, there are a number of important trends which have an impact on the development of the European ports. The historical increase in world trade is a remarkable phenomenon. Normally, an elasticity of 1.5 to 2 between the development of GDP and international trade is recorded. During the 1990s, the relationship between the development of GDP and international trade increased to a level of 2.5 to 3. This means that international trade was growing much faster than the evolution of GDP. The European Union is dependent on the sea for 90 per cent of its trade with the rest of the world. The increasing openness of the Belgian economy also makes it more and more dependent on its sea ports.

In 2005, imports and exports accounted for respectively 83 per cent and 86 per cent of Belgian GDP.

Seaports are also confronted with powerful port users, who play off one port or group of ports against another. Many distribution functions used to be performed by different entities ranging from maritime shipping lines, shipping and custom agents to freight forwarders and rail and trucking companies. Nowadays many intermediate steps in the transport chain have been removed. Large logistics operators control many segments of the supply chain. The ability of ports to fully exploit synergies with other transport hubs and other players within the logistics networks will increasingly determine its success.

A number of terminal operators have opted for an increase in scale and have established a global presence. Smaller terminal operators have not been successful in neutralising the power of these giants and try to avoid direct competition by concentrating on market niches. The port industry is now increasingly in the hands of those TNCs (transnational corporations). TNCs operate container terminals across various regions, countries and continents. It is difficult to find an industry which has grown as fast as the container terminal industry.

Previously non-competing ports are forced into direct competition by new liner service networks and larger ships. Ports are confronted with fewer but bigger shipping lines demanding more for less. Having container facilities available in the port is an absolute prerequisite for further development. Larger ships have a lower cost per TEU-mile than smaller units with the same load factor.

Important economies of scale were achieved by concentrating the production of commodities in countries and continents with specific comparative advantages. Next, components are transported to the final destination to be assembled or distributed to the most important consumer areas.

Enlargement of scale is an important factor which can give rise to savings. There has been significant growth in container transport in Antwerp and Zeebrugge, which was possible only because of the dredging work that was carried out. However, this enlargement of scale will not go on for ever. There is a limit to the size that ships can grow to. In addition to aspects of safety and nautical navigation, there are also economic effects, such as congestion.

The business strategies of the container companies show that larger navigation windows are absolutely vital. This time effect is an economic advantage that cannot be underestimated in attracting shipping companies to a port. For the first deepening of the fairway of the Scheldt, the Antwerp market share consisted mainly of ships with a capacity of 3,000 TEU. Subsequently the market share moved to the range of 3,000 to 5,000 TEU and over.

Scheldt MKBA

The CPB drew up an analysis of the social costs and benefits for the deepening of the Scheldt in 2004. In accordance with the Second Memorandum of Vlissingen, project alternatives that were analysed include deepening the Scheldt to 12.5 m, 12.8 m and 13.1 m, irrespective of the tide. The MKBA that was carried out earlier will be updated for the OTB (Draft Route Decision in the Netherlands). For this purpose, updating the maritime traffic prognoses was considered to be necessary as the first step. After all, the transshipment of containers appears to have increased significantly more in recent years than was initially predicted.

The MKBA showed that deepening the channel of the Scheldt up to Antwerp will have significant positive effects on welfare. From a European perspective, deepening the channel is socially possible for all the scenarios and versions that were examined. For Flanders and the Netherlands deepening the channel is also advantageous as a result of the lower transport costs for Flemish and Dutch shippers.

From a European perspective the project shows a positive balance of 1.0 to 2.3 billion euros. From a bi-national point of view (Flanders plus the Netherlands), deepening the channel up to 13.1 metres is socially profitable. In that case the project would yield a positive balance of 0.6 to 1.6 billion euros.

For the Netherlands, the costs and benefits are between 0.4 and 0.7 billion euros. For Flanders, deepening the Scheldt up to 13.1 metres irrespective of the tide yields benefits of between 0.6 and 1.2 billion euros. In the short term this will lead to a market share gain for Antwerp of 21 per cent in 2001 in the HH-range (Hamburg/Le Havre range) to 25 per cent in 2010. In the long term, the market share of Antwerp will fall back to approximately its present level because of the constantly increasing size of ships.

Therefore from a long-term perspective, deepening the channel of the Scheldt is necessary to maintain Antwerp's market share. The total transshipment in the Hamburg-Le Havre range was already approximately as high in 2005 as the CPB had predicted for 2010 with a scenario of average economic growth. A study of Oceans Shipping Consultants dating from 2006 also contains new prognoses in the HLH range showing that container storage is growing more rapidly than was first expected. Like the traffic in the total range, the traffic in the ports of Antwerp and Zeebrugge has grown more than expected by the CPB. Both Antwerp and Zeebrugge are currently already above the storage figures predicted by the CPB for 2010.

If the fairway of the Scheldt is not deepened, the market share of Antwerp in the container sector will fall by about one third in the long term, compared with its current market share. This will be taken over almost entirely by Rotterdam.

Greater depths were not examined in this MKBA, but at 13.1 m, there is a kink in the costs. At this point, significant non-linear effects of scale come into play. This can be explained by the fact that the number of places where dredging is necessary is increasing significantly. In the end, it will even be necessary

to dredge the whole approach route in the sea across the entire surface area. Below 13.1 m, it is only the fairway in the West Scheldt that are concerned, viz., the sills.

If there were to be no more dredging in the Scheldt, it would reverse to a natural depth, which would mean that Antwerp could no longer serve as a sea port. In fact, without maintenance dredging, every port will eventually become inaccessible for the current generation of maritime ships.

The economic importance of the Flemish sea ports

The importance of the Flemish sea ports can be demonstrated by a number of important economic variables. Figures of the NBB (National Bank of Belgium) for 2005 show that the direct added value which was generated by the activities of the companies established in the Flemish ports represented 14.1 billion euros. viz., 8.2 per cent of the GDP of the Flemish Region or 4.7 per cent of the Belgian GDP. Direct employment represented almost 106,700 FTE, i.e., 4.9 per cent of the employment of the Flemish Region or 2.8 per cent of the Belgian employment. Taking indirect employment into account, this amounts to 247,200 FTE.

With over 167 million tonnes of cargo handled last year and facilities to accommodate a wide range of commodities, the port of Antwerp is the second European port and the fifth port worldwide, after Rotterdam, Singapore, Hong Kong and Shanghai.

In 2006, over 81 million tonnes of containers or an equivalent of seven million TEU were handled in Antwerp. Over the last 15 years Antwerp achieved growth figures of 10.8 per cent on average, which is above the range's average of 7.9 per cent per year.

In the first quarter of 2007 the maritime traffic in the Flemish sea ports increased significantly, compared to the first quarter of 2006: on average, +11.1 per cent (total traffic). The growth was greatest in Ostend (+25 per cent), but there was also significant growth in the other three ports, Antwerp, Ghent and Zeebrugge, of respectively 11.8 per cent, 7 per cent and 7.6 per cent.

As regards containers, the total increase amounted to +20.4 per cent in the first quarter of 2007, compared to the first quarter of 2006. At the level of containers (expressed in TEU), there was an increase of +17.4 per cent in the port of Antwerp and in Zeebrugge the container traffic increased by +33.6 per cent in the first quarter of 2007. For Ghent and Ostend the growth figures were even bigger, respectively +75.9 per cent and +35.1 per cent. These high (positive) growth figures can be explained by the fact that container traffic is relatively small in these two ports.

The most respected consultants worldwide expect an internationally sustained growth in container traffic as a result of the continued globalisation of the world economy. It is expected that the high growth rate will continue for at least five or even 10 years, globally as well as in the Hamburg-Le Havre range. For the port of Antwerp, estimates indicate that the port will achieve 300 million tonnes in 2030 of which 206 million tonnes (or almost 70 per cent) will be containers.

Conclusion

Containers have permitted large cost reductions in cargo handling, increasing cargo transhipment and therefore national and international cabotage. In turn, this increase in cabotage has led to the creation of hub ports that permit countries or regions to take advantage of an increasing return to scale. When the depth is not great enough for the latest generation of ships to enter the port, the chances are that the port will no longer serve as a hub. In view of the enormous economic importance of the port of Antwerp for the region, keeping ahead of developments in container trade and container shipping is therefore not an option but a necessity.

Deep sea ports, such as Rotterdam, will always have an advantage over ports where the natural access is more restricted. However, the depth is not the be all and end all – the geographical position, services, flexibility, productivity, modern infrastructure and multimodal hinterland access are also important success factors for a port.

If dredging activities are to be carried out, it is always necessary to see whether the social benefits are higher than the costs.

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ABOUT THE ORGANISATION

The Flemish Region (Ministry of the Flemish Community – Maritime Access Division) is responsible for the dredging activities in the Belgian coastal zone.

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