Multi-functional use of port areas

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Abstract. The core business of a port is handling vessels and cargo. In addition a landlord Port Authority invests in development of port areas. However, in view of the new trends such as stakeholders interests related to environment and sustainability, it is can be wise to reexamine the business portfolio periodically. This applies especially if an opportunity presents itself as in the case of the Maasvlakte 2 project, which is an expansion of the existing Port of Rotterdam into the North Sea. The phased construction of the port areas results in a large water area (the inner lake or the Binnenmeer) that is temporarily not used. A unique opportunity for the Port Authority to carry out pilot projects related to other activities than cargo handling. The conclusion of our research is that both cargo related and non-cargo related activities or even a combination of the two is feasible in the Binnenmeer. Flexibility, in the form of multi-functional use of space, contributes to sustainability.

Keywords. Flexibility, multi-functional use, Maasvlakte 2, balanced score card.

1 Introduction

Port activities are more and more affected by the economic situation and by its direct environment. Businesses prefer to specialise on their core activities and outsource side-line activities. Port’s environments are increasingly intertwined with the port and pose stringent requirements (PoRA, 2011c). These requirements do not necessarily have to conflict with the mission of the port authority and its clients. A decent portfolio analysis gives insights into mutual interests and future growth opportunities that avoid idle areas.

Many organisations choose to focus on their day to day business and tend to forget their changing environment around them. They might miss business opportunities or even endanger their long term existence (Bishop, 2004). Therefore it is important that port authorities ask themselves, especially if an opportunity such as the large water area on Maasvlakte 2 (MV2), presents itself: How to analyse potential activities and how to set up an evaluation that takes stakeholders’ perspectives over time into account.
This study makes an inventory, through a brainstorming session, several cargo and non-cargo handling activities for the temporary inner lake on MV2 and evaluates their advantages and disadvantages from different perspectives with a balanced score card for a short, medium and long term period (Ros, 2011). In this way, Port of Rotterdam Authority (PoRA) can verify its business portfolio for MV2 and implement sustainable solutions.

MV2 is carried out in phases. The first ship will be received in 2013. The construction for the next phase will begin in response to client demand, and it is only in 2033 that MV2 will be fully operational. This means that, in between the phases (time uncertain), a large area of water of about 500 hectares, protected by an expensive sea-defence, is not in use (Figure 1).

![Fig. 1. Maasvlakte 2 in 2013 (left) and Maasvlakte 2 in 2033 (right)]

2 Activities

A brainstorming session was carried out with people from Delft University of Technology, PoRA and Public Works of Rotterdam to extend the existing inventory of activities, collected in earlier sessions, and to separate potential from promising activities by their overall viability as single criterion (PoRA, 2011a). A division of the activities by cargo and non-cargo activities ensures a balanced portfolio. Literature and expert opinions were used to work out promising activities (PoRA, 2011b).

![Fig. 2. Overview of cargo (left) and non-cargo handling activities (right)]
Six promising cargo handling activities were investigated: Transhipment of liquid bulk from ship to ship (saves intermediate storage, requires few facilities, suitable for small and fast growing markets), storage of granite blocks (benefits from Rotterdam’s good hinterland connections), offshore wind turbine assembling facility (European Union’s renewable energy targets 2 units per day until 2030, benefits from Rotterdam’s offshore cluster), mooring spaces for inland vessels and feeders (until the traffic management system, that synchronizes arrival times with quay occupancies, is operational), common barge terminal (more capacity at deep sea quay, inland vessels pick up their cargo at one location, so that terminal operators and Port of Rotterdam Authority can postpone investments).

Eight promising non-cargo handling activities were investigated: Wind turbine farms (windy North Sea coast, payback period of 10 years is longer than expected availability of the inner lake of 7 years), mussel farming (pilot floating harvesting method to avoid revoking permits), algae farming (pilot to render algae feasible as low quality supplement, i.e. fuel and food), hotel at work (houses workers of construction projects), fast ferry (line service from Hoek van Holland to Maasvlakte 1, low occupancy rate so far), temporary nature reserve (acclimatization, spawning area or food stock), sports (events, i.e. wind driven boat races, or leisure, i.e. kite and wind surfers), dolphinarium (number of visitors going down and operational costs going up, due to stricter living conditions rules).

Whereas some activities can be allocated on the inner lake without any facilities, others require structures. Functional requirements are used to couple activities with structures to alternatives (Ros, 2011). Alternatives are evaluated by their monetary and non-monetary value up next.

3 Evaluation

The advantages and disadvantages of the alternatives are evaluated with a balanced score card (Balanced Scorecard Organization, 2011). Different stakeholders’ perspectives enable PoRA to determine the effects of each alternative on the short, intermediate and long term. Ten criteria are derived from the port vision (2011c), annual report (2010) and internal documents: financial viability (net present value & costs over 10 years & discount rate of 8.5%), sustainability (consequences & image), synergy (collaboration), safety (distances & nautical) and innovation (product & process).

The six promising cargo handling activities have a cumulative net present value of about 20 M€:
- Liquid bulk transhipment has a net present value of about 7.5 M€, is more costly for shipping companies, but safer due to port facilities (mild wave conditions, patrol vessels).
- Dry bulk storage has a net present value of about 2 M€ and is carried out at an existing quay wall at small scale, i.e. hindrance (additional number of encounters) is negligible.
• A wind turbine assembling facility has a net present value of about 2.2 M€, is carried out at an existing quay wall, brings additional green cargo, but requires a focus on safety (lifting vessels).
• Mooring spaces inland vessels and feeders have a negative net present value, but they are required to ensure safety, if vessels have to wait at a quay.
• Common barge terminal has a net present value of 8.0 M€, reduces the turnaround time, saves costs for PoRA and terminal operators and serves as pilot project for flexible structures.

The eight non-cargo handling activities have a cumulative net present value of about 2 M€:
• Wind energy has a net present value of about 1.5 M€, but may disturb communication of fish (noise), may form an obstacle to birds and require safety distances to shipping (wing breakoff).
• Mussel and algae farming cultivate products for humans, food and shelter for other species. Pilot projects can be carried out at the inner lake and applied later on a larger scale elsewhere.
• Hotel at work houses workers of construction projects, requires safety distances to other activities and reduces commuter traffic (less CO2 emissions, allocation issues and travel time).
• Fast ferry can reduce the usage of private transport, increase safety, avoid a grid lock, but is only useful if activities generate enough passengers.
• Nature reserve gives species the opportunity to develop and does not lead to hindrance of port development (new regulations enable to relocate protected species).
• Water sports can take place at a certain safety distance from port activities, regulate nature by producing noise, can attract large crowds and require safety measurements.
• Dolphinarium aims for high number of visitors, but requires safety measures.
### Balanced Score Card

<table>
<thead>
<tr>
<th>Alternatives for the inner lake</th>
<th>Criteria</th>
<th>Short term</th>
<th>Intermediate term</th>
<th>Long term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo handling</td>
<td>Financial viability [M€]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Liquid bulk</td>
<td>Net present value [M€]</td>
<td>7.5</td>
<td>0</td>
<td>-4</td>
</tr>
<tr>
<td>- Dry bulk</td>
<td>Net present costs [M€]</td>
<td>-0.3</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>- Wind turbine assembly</td>
<td>Consequences [RCI, BA]</td>
<td>2.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>- Mooring inland</td>
<td>Image [branding]</td>
<td>2.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>- Mooring feeder</td>
<td>Synergy</td>
<td>-0.3</td>
<td>0</td>
<td>+3</td>
</tr>
<tr>
<td>- Common barge</td>
<td>Inner lake [cooperation]</td>
<td>-0.2</td>
<td>0</td>
<td>+3</td>
</tr>
<tr>
<td>- Common barge</td>
<td>MV2 [cooperation]</td>
<td>8.0</td>
<td>0</td>
<td>+3</td>
</tr>
</tbody>
</table>

| Non-cargo handling            | Safety                                         | -0.3       | 0                 | -2        | 0         | 0          |
| - Wind energy                 | External distances [Nautical]                 | 0.4        | 0                 | 0         | 0         | 0          |
| - Mussel farming              | Nautical [crossing]                            | -0.2       | 0                 | -3        | 0         | 0          |
| - Algae farming               | Innovation                                     | 0.0        | 0                 | 0         | 0         | 0          |
| - Hotel at work               | Product phasing [phase]                        | 0.1        | 0                 | 0         | 0         | 0          |
| - Fast ferry                  | Process phasing [phase]                        | 0.0        | 0                 | 0         | 0         | 0          |
| - Nature reserve              |                                               | 0.0        | 0                 | -2        | 0         | 0          |
| - Water sports                |                                               | -0.5       | 0                 | +3        | 0         | 0          |
| - Dolphinarium                |                                               | -1.1       | 0                 | -4        | 0         | 0          |

**Fig. 3.** Evaluation of alternatives (financial viability over 10 years with discount rate 8.5%)

### 4 Conclusions

This paper analysed and evaluated cargo and non-cargo handling alternatives for the temporary inner lake on Maasvlakte 2. Several cargo, non-cargo handling alternatives or a combination of them are feasible. The following conclusions can be drawn from this study:

- A balanced score card is an appropriate tool to point out the advantages and disadvantages of several alternatives from different perspectives for a short, intermediate and long term planning horizon. Decision-makers can deliberate with a balanced score card the importance of their (long term) vision versus their (short term) profits and make a well-considered choice.

- Cargo handling alternatives generate a larger net present value than non-cargo handling alternatives. Nevertheless, non-cargo handling alternatives generate
considerable non-monetary benefits for PoRA and its stakeholders in the intermediate and long term.

- Most alternatives have an overall positive net present value. The profits generated from cargo handling alternatives can be used to overcome starting problems (low net present value, implementation risks) of non-cargo handling alternatives and to generate long term benefits (working with restrictions and resources of the port environment instead of against them).
- Multi-functional use of port areas makes a port development project more sustainable. However, flexible use of space is only possible through implementation of flexible port infrastructure and flexible governance. More research on these issues, and a promotion of flexible port infrastructure is required.

Acknowledgements

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