A challenge in port planning and design

Towards an Area Planning Studio for the Port of Rotterdam

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"Plans are nothing. Planning is everything" (Dwight D. Eisenhower 1890-1969; American general and president).

Abstract

In order to plan and design the Rotterdam port industrial complex, professional area planning is required. Basically, area planning can be defined as the process of balancing the mutual relations between spatial planning, business development and environmental constraints and opportunities. In other words area planning deals with conflicting interests of long term development and short term gains. For years the Port of Rotterdam (PoR) experiences increased environmental turbulence, which is characterized by an increase in dynamics, complexity and unpredictability. Because of this turbulence the PoR is facing a continuous challenge to manage the balance of these mutual relations. As a result area planning has become increasingly important as a field of knowledge for the PoR. In this context it has been recognized that the current area planning process at the PoR, which is primarily conducted in a manual fashion, has not sufficiently evolved to cope with the increased environmental turbulence. Based on experiences regarding the current area planning process, a number of bottlenecks have been identified such as: (1) keeping area plans up to date (e.g. datasets are not always complete or up to date), (2) difficulties taking all relevant aspects into account and considering them integrally (e.g. key data is mainly accessible through specialized departments), and (3) insufficient learning capability (e.g. limited coherent overview of future situations (scenarios) and little understanding of long term effects of short term decisions). In association with the Delft University of Technology the PoR is currently developing an Area Planning Studio (APS) for the port of Rotterdam. This studio provides a means to support different parts of the area planning process in order to resolve these bottlenecks.

1. Introduction: port planning processes

The Port of Rotterdam (PoR) is responsible for developing and exploiting some 10.000 acres of the Rotterdam port and industrial complex. Intelligent and conscious development of this complex is in the best interest of the PoR and its customers. To be able to continuously control the

development of the port, port planning processes are of increasing importance.

Port planning as a concept comprises the element of process as well as the element of content and can be considered as a set of problems to be solved, resulting in spatial plans for development.

1.1 Why port planning?

In the search for growth opportunities the PoR continuously faces the scarcity of resources. For instance the amount of available land within the port industrial complex has substantially decreased over the past few years. Nowadays there are hardly any large and unused areas left. Available land is mainly found in small sizes and widespread and is not always accessible from the waterside.
Another example of a scarce resource is the available noise emission quota in some areas. The total noise emission of all company activities during the day and the night is restricted by setting noise quota for the port industrial complex. The administration of the total allowed emission is done by the PoR.

In order to plan and design the port industrial complex taking into account the scarcity of resources, professional port planning is required. Basically, port planning can be defined as the process of balancing the mutual relations between spatial planning, business development and environmental constraints and opportunities.

Spatial planning is the whole of decision processes required to make a systematic preparation of activities to develop an area in such a way that it optimises the:

- availability of area
- accessibility
- liveability
- sustainability
- commercial attractiveness

The aspects related to area availability are shape and size of a lot, present (infra) structures, activities nearby and destination in the municipalities' development plan. For instance a deep-sea container terminal requires a rectangular lot with a surface of at least 45 tot 120 ha and a lot-depth of 400 to 600 metres.
The accessibility of a lot is among other aspects determined by sufficient draught and manoeuvring space for vessels, rail access, road capacity, and available space for connecting the area to the cable and pipeline network.
The aspects related to liveability are noise, (fine) dust, stench, external safety, soil pollution, scenery view and protection of endangered species in the flora and fauna. The spatial development has to be in harmony with its external environment.
In general sustainability entails environmental aspects and cluster advantages. For instance one of the by-products of a chemical plant is heat. The heat is for instance used by residential areas (Hoogvliet) to heat houses.
Aspects related to commercial attractiveness are either financial, like economies of scale on investments, revenues from harbour dues, transhipment and lot rent, and efficient exploitation of scarce areas. Or it can be strategic, like stimulating the competitive position of the PoR with respect to other ports. In other words the right company at the right location (Weustenenk, 2004).

In general issuing an area often tends to be characterised by quick wins on the short term. Gains on the long term are uncertain, because future developments in the economic situation (*business development*) are hard to predict. E.g. suppose that for a certain area the most suitable type of business has been established. However, untill now there are no customers for this type of business, while for other – less suitable - types of business there are. The dilemma is now: keep the area reserved or issue the area to the less suitable type of business?

In other words port planning deals with conflicting interests of long term development and short term gains.
The earlier mentioned noise emission quota is an example of an *environmental constraint*, whereas nature compensation can be mentioned as an environmental *opportunity*. Loss of nature on one side of an area can sometimes be compensated on the other side, which increases the possibilities of developing an area. In short "port and environment have to be in harmony".

In addition, port planning is also crucial for obtaining financial resources and all legal permits in time in order to execute port plans.

1.2 Different types of plans

In current port planning processes at the PoR, different types of spatial plans can be defined. They can be distinguished on the basis of three different aspects (table 1):

1. scale: this is related to the size of the area considered
2. scope: this refers to the level of detail of a spatial plan
3. time range: this refers to the period of time which is considered

Type of spatial plan	Scale	Scope (detail level)	Time range
Port plan	Large	Low	15 years
Labelling plan	Medium	Low	approximately 10 years
Area plan	Medium	High	5 – 10 years
Development plan	Small	High	up to approximately 4 years

Table 1: Examples of spatial plans

All spatial plans made by the PoR should be drafted in such a way that they meet the requirements of all national and European rules and regulations. E.g. they should meet the requirements of the municipal zoning plan (a plan indicating the permitted types of land uses of the area).

The ambitions for development of the total port industrial complex are described in the *port plan*. The latest port plan, 'Port Vision 2020' (dated 2004), presents the targets for the coming 15 years. Implementing these targets comprises both economic policy and spatial planning. Since the level of uncertainty of the information involved is high, it is not a detailed plan.

A labelling plan and an area plan are two ways to work out the port plan: the main difference is the detail level. The objective of a *labelling plan* is to show the logical (im)possibilities of the area considered, by labelling the available areas in terms of e.g. 'suitable for clustering distribution companies'. An *area plan* gives directions to the further development and can be used to verify business development and investment decisions with regard to (public) infrastructure.

A *development plan* is the next step towards realisation: what actions have to be taken and in which order?

The focus of this paper is on area planning, since an area plan is more or less a deduction or translation of the port plan.

1.3 The ideal area planning process

The ideal area planning process is an area planning system, comprising of a number of distinct steps, procedures, mechanisms and roles (the *process* of area planning) , resulting in a vision on the spatial development to optimise the availability, accessibility, liveability, sustainability and commercial attractiveness of the area (the *content* of area planning). A resulting vision consists of a feasible and most promising adjustments or actions to develop the area, by evaluating and comparing lots and land-uses on the basis of multiple aspects (the process of 'matching').

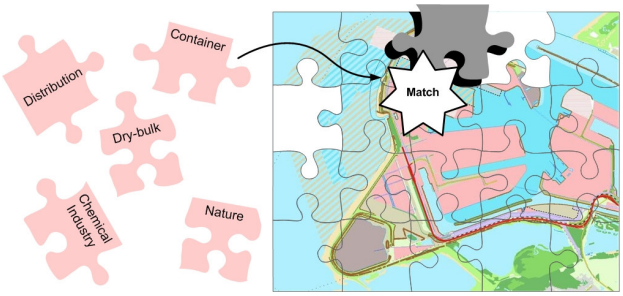

Figure 1: Area planning is like a jigsaw puzzle – matching lots and land-uses

1.4 Outline of this paper

In order to validate the current area planning process at the PoR, we have started an investigation into the actual need to reconsider the current area planning process. In section 2 we describe the motives why the area planning process could be improved. Section 3 provides insight into the potential for improvement of both process and content of area planning, by introduction of an Area Planning Studio (APS). Section 4 gives an outline of the Functional requirements of an APS. The conclusions are described in section 5.

2. The need to reconsider the area planning process at the Port of Rotterdam: a conceptual framework

Which approaches towards area planning are possible?
In our view 2 extremes in area planning can be distinguished. We could call these extremes the *static* and the *dynamic* approach.

2.1 The static approach of area planning: 'figuring out'

Characteristic for the static approach[1] to produce area plans is that the entire process can be disassembled into a number of distinct steps that need to be carried out in a sequential and orderly manner. Premise is that by going through these steps in a conscious and structured / analytical manner will yield the best result. One of the main advantages of a static approach is that it helps to achieve optimisation by explicitly considering and evaluating all alternative land uses for lots (options of land) i.e. the allocation of scarce resources. It is the intention of the static approach to predict, to analyse, to optimise, to program, to deliberate fine-tune and control the port's future development. We could call this the process of 'figuring out'. This requires a highly stable environment.

2.2 The dynamic approach of area planning: 'finding out'

In the dynamic approach[2] the area planning process is not about comprehensively *figuring out* an area plan in advance, but about *finding out* by doing and gradually blending various future options together. It is about working with flexible scenarios instead of static area plans. This approach is suitable in a highly turbulent environment.

2.3 Analysing environmental turbulence at the port of Rotterdam

There is a strong relation between the degree of environmental turbulence and the choice between a static and dynamic approach. The intensified competition demands quick responsiveness to initiatives of other European ports. Therefore flexibility is of outmost importance for the PoR. The same goes for the customers of the PoR. They too experience intensified competition and

[1] Planning perspective (Wit, 1998): organisations strive to make strategy in a highly deliberate manner, by first explicitly formulating comprehensive plans, and only then executing them.

[2] This dynamic approach is related to 'logical incrementalism' (Quin, 1978; Wit, 1998). Important to mention is that 'logical incrementalism' is distinguished from 'muddling through' in this respect that 'logical incrementalism' is proactive in nature whereas 'muddling through', although also incremental, is rather reactive in an ad-hoc fashion. By 'logical' we mean reasonable and well-considered.
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therefore the PoR has to react fast on requests of customers..

We will take a closer look at the environmental turbulence as one of the important drivers of the way of acting by the PoR. For years the PoR experiences increased environmental turbulence, which is characterized by an increase in dynamics, complexity and unpredictability (Voberda, 1997).

2.3.1 Dynamics

Dynamics indicates the degree to which competitive forces between ports remain basically static over time or are in a continuous process of dynamic change. Nowadays both the intensity (impact) and frequency of 'events' are high in comparison with 10 years ago.
E.g. container shipping companies all over the world have proven to become very 'footloose'.

2.3.2 Complexity

The complexity of the environment depends on the number of factors within a competitive force and their relatedness. Accessibility by road for example, is related to the intensity of traffic during the day. But it is also related to the EU standards for emissions of NO_x and fine dust.
These issues tend to be highly interrelated. Consequently the solution to one problem requires a solution to (all the) other problems.

The complexity of the environment is reflected in the organisation of the PoR. To cope with the complex environment the input of various specialised departments is crucial. Incorporation of the various fields of expertise requires a well defined and organised area planning process in order to achieve the understanding, acceptance and commitment needed to execute the area plans effectively.

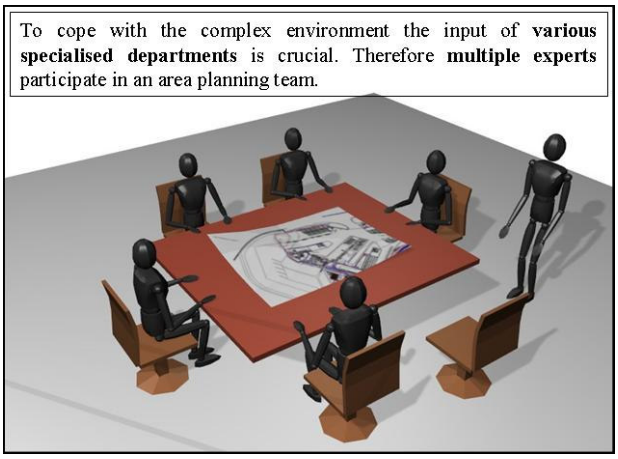

Figure 2: The setting of a meeting in the current area planning process

It can be questioned whether the turbulence is really high in case all required data is available, since the availability of data determines to a high extent the predictability of future events. So we think it is the unpredictability itself which contributes even more to turbulence than complexity does.

2.3.3 Unpredictability

Past developments can be extrapolated to 'predict' future developments. Unfortunately this can not always be done with great certainty. When data concerning future developments are unclear (trend breaks or discontinuities), or when management ignores certain relevant data because of limitations of scope, the environmental turbulence is relatively unpredictable. When data are simply unavailable, the result will be the highest level of environmental unpredictability.
E.g. the event of '9/11' seemed unpredictable. Within a few years time the maritime world responded by implementing ISPS rules and regulations for ports.

2.3 A different approach to area planning

Which approach of area planning is followed at the PoR?

At present the area planning process follows an orderly step-by-step plan, based on a static approach

However, it has been recognised that the current way of working has not been sufficiently evolved to cope with the increase in environmental turbulence. Although the present area planning process at the PoR is not unsuitable, it is less favourable in high turbulent environments.

In order to cope with environmental turbulence – resulting from the dynamics, complexity and unpredictability of the environment– the *process* and *contents* of area planning should be reconsidered.
There is a need to shift from a *static approach* towards a more *dynamic approach* and to develop a new way of working. In other words taking best of both worlds, without ruling out the static approach.

Shifting the area planning process from a static towards a more dynamic approach, will lead to:

- area plans that are gradually shaped – continuously updated - instead of intentionally designed once and for all;
- a process that is characterised by 'finding out' instead of 'figuring out';
- scenario analysis of future developments (since they are partially unknown and unpredictable) instead of trying to forecast and anticipate on them;
- implementation focussed on learning (development) instead of programming (efficiency).

In addition to improving the way of coping with environmental turbulence, there is another important aspect which requires improvement and that is the cognitive limitation of all the professionals involved in the process of area planning[3].
Ways to cope with this cognitive limitation are e.g. the visualisation of information and the use of scenario analysis to decrease the amount of considerations that has to be done in the heads of individuals and therefore enhances the decision making process.

3. Potential for improving area planning

The potential for improving area planning – both process and content - in view of the environmental turbulence and the cognitive limitations of professionals is distinguished in three elements (figure 3):

- Up to date area plans
- Increased learning capability
- Integral analysis of all relevant aspects

3.1 Up to date area plans

The responsiveness of the PoR to initiatives and requests from the environment can be accelerated by having up to data area plans available. Updating area plans requires quick accessibility of the data involved. Also the present datasets available at the PoR are not always totally complete or up to date. By supporting the actualisation and accessibility of existing datasets, the area planning process can be improved.

3.2 Increased learning capability

The current use of 'static' area plans does not substantially stimulate the learning process of experts and/ of decision makers at the PoR. By assuming only one possible situation of an area, no insight into long term effects of short term decisions is provided. What if a business or infrastructural development is realised differently

[3] Concerning the cognitive limitations we refer to Simon (1957) and his notion of bounded rationality – 'people act intentionally rational, but only limitedly so.' The area planner must sometimes improvise to make up, for example, for a lack of information, but will try to do this as logically as possible. The amount of aspects that can be overlooked simultaneously by an individual is limited.

from the ones suggested in the applicable area plan? Or what if the assumptions that are made in the area plan meanwhile have changed? The use of various scenarios gives a coherent overview of possible future situations and therefore enables a quick response to intermediate modifications within the area.

Another aspect of the learning process is the possibility to use a 'corporate memory'. The risk of making the same area planning decision twice or more can be prevented by recalling existing analysis and visions by making them easily accessible.

To improve the area planning process, support of both scenario analysis and consulting already existing analysis are needed.

3.3 Integral analysis of all relevant aspects

Since key data is mainly accessible through specialized departments, all information has to be gathered and discussed centrally. The existence of cognitive limitations makes it even harder for individuals to consider all relevant aspects at the same time and make well-considered decisions. A (more) integral approach (managing of interaction between experts/ decision makers), can improve the area planning process in order to achieve commitment to the execution of area plans.

A (more) integral approach in area planning is also needed to monitor the translation from strategy into the realisation of an area layout, since an area plan is more or less a deduction or translation of the port plan.

In the next chapter the type of support for area planning is described.

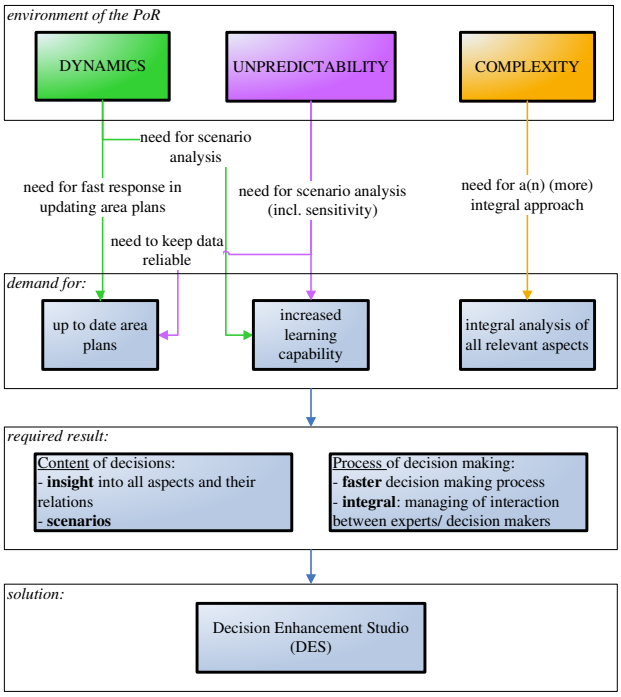

Figure 3: Potential for improving area planning

4. Towards an Area Planning Studio.

In association with the Delft University of Technology the PoR has developed an Area Planning Studio (APS) for the port of Rotterdam. This studio provides a means to support different parts (aspects with regard to process as well as to content) of the area planning process.

The APS should use existing sources of data, such as a Geographical Information System, and existing models present at the PoR.

In the following subsections we provide a number of Functional Requirements for the APS.

4.1 Support both process and content

The APS should aim to support both process and content of the area planning process. The support of the process focuses on the way to 'manage' the interaction between the experts/decision makers during the planning

process.
From the content perspective the support aims to give decision makers insight into all relevant aspects and their relations.

4.2 Process support requirements

4.2.1 Support multiple users with different backgrounds to enhance Integral Approach

Multiple users who look at the problems from their own perspective go through the area planning process.
The presentation of the expert information from the various different backgrounds should be combined and integrated in such a way that a clear and overall judgement is possible for all participating decision makers, taking into account their cognitive limitations.

4.2.2 Accelerate the decision making process

Acceleration of the decision making process is of vital importance from a business point of view, without loosing quality in the decision making process.

4.2.3 Provide a corporate memory on area planning decisions

To prevent 're-inventing the wheel' the APS should provide (at the 'right' level of detail) a 'corporate memory function' for storing experience in the area planning process.

4.3 Content support requirements

4.3.1 Insight into all relevant aspects through support by a suite of software tools

The concept of a APS should include a suite of existing and new software tools to support decision makers. These software tools are e.g. : traffic models, noise emission models etc.
In the context of area planning in the PoR there are relative static and dynamic properties. Dynamic properties have the tendency to change more rapidly compared to static properties. In the end the APS should be able to cope with both properties.

4.3.2 Rehearsing scenarios

The APS should be able to pay attention to past, present and future by enabling the analysis of various scenarios since consideration of past, present and future are relevant for guiding decisions for developing areas in a sustainable way.

5. Epilogue

The process of port planning and especially area planning - as defined by the PoR - is a complex process that should be able to cope with the environmental turbulence the PoR is exposed to. To cope with this turbulence PoR strives towards developing a more dynamic approach of area planning, meanwhile looking for means to support professional decision makers who are faced by their cognitive limitations in this process.

The functional requirements have been formulated for a socalled Area Planning Studio.

Elaboration of APS will be done in the next presentation by our colleagues of the Delft University of Technology: 'An Area Planning Studio for port planning and design'

The essence of our joint endeavour on area planning can be summarised with the words of Dwight D. Eisenhower: "Plans are nothing. Planning is everything"

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