# Economic Feasibility of New Generation Terminals Emerging Perspectives

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*This paper addresses the methodology of assessing the economic feasibility of new generation (NG) terminals. After a sketch of recent developments the paper presents a systematic framework for estimating the economic performance of such terminals by means of a proper decision support framework.*

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## Introduction

This paper aims to offer new insights into performance evaluation of so-called new generation freight terminals (or NG-terminals). Due to the need to cope with increasing pollution and traffic congestion, intermodal transport has become an important policy issue in the European Union (EU), its member states and elsewhere.

Active support for intermodal transport leads to a shift from road transport to environmentally-benign modalities such as rail and inland waterway transport. As intermodal transport requires a different type of freight terminals, both the technical and economic feasibility of such NG-terminals need to be investigated thoroughly.

However, the emphasis tends to be put primarily on the technical feasibility, while more or less neglecting the economic aspects. Therefore, in the present paper we focus on the economic aspects of NG-terminals: how can the economic performance and feasibility of a NG-terminal be determined? How can the decision process concerning the start and continuation of NG-terminals be structured? Due insight into the economic performance of NG-terminals is a sine qua non for investment decisions of both the private sector and governments.

## 1. New Generation Terminals: Why?

In the past few decades, we have witnessed an increase in both personal mobility and freight movement, which has placed a great strain on the capacity use of transport infrastructure (Hoyle and Hilling, 1984). The traditional response of public authorities (expansion of infrastructure) is increasingly being questioned due to sustainability concerns. Consequently, a smarter and more rational use of infrastructure capacity based on scientific principles is necessary. Recent research in the transportation sector has indeed widened its scope and focused on the efficient logistic organisation of physical movement, e.g. intermodal transport (see Keijer and Rietveld (1999) and McCann, 1998).

Transport systems have traditionally been built and organised from the perspective of a unimodal approach, without due recognition of synergy and integration of different transport modes. This approach was mainly based on the assumption of competition between modes rather than complementarity; see Nijkamp et al. (1995). In recent years, researchers have extensively studied the spatial-technical feasibility of NG-terminals for intermodal transport (see Bruinsma et al, 2000). New logistic concepts for consolidating freight flows allow relatively small commodity flows and associated terminals to participate in the advantages of larger –often global - networks. These advantages comprise inter alia lower costs per load unit, higher transport frequencies and a larger number of destinations (cf. Cariou, 2001).

A key activity in intermodal terminal operations is consolidation, the process of transporting and combining cargo belonging to different flows in shared transport and/or load units on common parts of their route. The complex consolidation concept offers three main advantages:

a) a higher load factor of loading units (leading to cost reduction);

b) a higher transport frequency (leading to better quality of services and increasing economies of scale);

c) a larger number of destinations from each starting terminal (also serving to improve the quality of services).

This kind of complex consolidation networks will have positive effects on the results of new generation terminals, which we call network profits throughout the remainder of our discussion (cf. Benacchio et al., 2000).

The development of new generation terminals as part of broader networks does not only require a profound technical analysis, but also a clear economic analysis (Liu and McDonald, 1999). From this perspective, the need arises for a toolkit for assessing the economic performance of a new generation terminal by means of a proper decision support system. This paper will offer a new perspective against the above background.

## 2. New Generation Terminals: Practice

Multimodal transport requires the design of appropriate terminals, and in various EU countries huge investments are nowadays made. For example, NG-terminals are located, designed or planned in Venlo (the Netherlands), Busto

(Northern Italy), Metz (France) and Valburg (the Netherlands). The existing terminal at Venlo was founded in the eighties as part of the strategy to strengthen the hinterland transport routes and services of Rotterdam. The NG-terminal for Venlo will be able to attract new business and to extend its network. The Busto project (located in Northern Italy) focuses on the realisation of a new generation terminal next to the existing railroad. The major advantage here is the opportunity to set up new services and/or to improve regional services. With the NG-terminal it is possible to handle services faster and more efficiently than conventional terminals do.

The shunting yard Metz-Sablon terminal is located in France, near the towns Metz and Montigny-les-Metz. The main objectives of this NG-terminal are to offer faster services and an increase of throughput capacity. It should lead to economic advantages in terms of shorter transport times, cost reductions, synergy effects and environmental benefits.

The Valburg terminal will be constructed in the Netherlands, north of the river Waal, near the future Dutch-German Betuwe railway, between the cities of Arnhem and Nijmegen. The main objective is the bundling of small continental flows from different parts of the Netherlands with large maritime flows, in order to increase the transport volume in an efficient way. The main advantage of this particular terminal is that management is able to offer fast integration of continental flows into maritime flows.

The terminal design field appears to exhibit fast dynamics in recent years and therefore there is a need for both a technological evaluation and an economic performance evaluation. Recently, more attention has been paid to performance evaluation (See Itmi et al, 2002).

### 3. Economic Environment

NG-terminals are not isolated phenomena, but operate in an environment of different spatial, logistic, technological and regulatory dimensions. The environment of each new generation terminal consists thus of various decisive factors. Besides the economic dimension, there are e.g the technological dimension and the political or legal dimension. The technological dimension is related to the introduction of new products and new processes, influencing the current relationship between prices and services, e.g robotisation. Governmental support may result in financial support for NG-terminals, e.g. because of positive environmental effects, thus lowering their prices in order to reach a desired economic performance. Although many other dimensions can exert a specific influence on the economic performance of a NG-terminal, we focus here on the economic dimension.

First, the economic characteristics of the transport sector are of importance. For example, within the framework of industry growth, slow sales developments mean harder fights for market shares than fast developments. Furthermore, higher investment costs force the competitors to concentrate more on capacity building.

The Porter (1980) model is very suitable to demonstrate the role stakeholders play in the direct economic environment of an individual terminal. There are five stakeholders: competitors, clients, suppliers, new entrants to the market and substitutes. They all influence the economic power of a NG-terminal, and thus its economic performance; see also Wiegmans et al (1999). In the traditional Porter (1980) model, the explicit role of the government is missing.

Competition, or rivalry among existing competitors, is one factor of influence for the economic performance of a NG-terminal. The competitive intensity among the industry competitors depends on a number of factors, such as the market organisation, the degree of regulation, the access to information systems, the use of advanced logistic and other services etc. All these factors can exert an influence on prices and volumes. More dogs fighting for the same bone in general means less volume for each terminal and lower prices in order to attract other terminal's clients. Switching costs and creating client loyalty can make clients less open for attractive and relatively lower prices by competitors.

Clients, called buyers in the Porter model, are here defined as those actors or institutions that make use of NG-terminal services. Terminal clients in principle wish to get prices down or quality up. Their ability to do so depends on their individual and collective market power, how much they buy, how well informed they are, the number of buyers and their willingness to experiment with alternatives (Mintzberg et al, 1998). These factors influence the development of prices and volumes of loading units. Clients can put pressure on the terminals' profits, e.g. by demanding more or better services for the same or even lower prices. The fact that a terminal service saves money gives buyers less bargaining power. The economic power of the clients, in regard to the NG-terminals, depends on their number, on their market share and on the importance of capacity utilisation, amongst others. Greater numbers and smaller market shares diminish their individual bargaining power and hence their individual economic power, and thus the possibilities of the terminal to increase prices. The importance of capacity utilisation puts pressure on increasing volumes, sometimes at the cost of price decreases.

Suppliers take the opposite position of clients. Again their number, market share and capacity structure is of importance. Examples of suppliers to NG-terminals are component and equipment suppliers. Equipment for a terminal can consist of software and hardware for computers and identification systems, complete goods transshipment cranes and accompanying components, operating systems and terminal vehicles.

New entrants to the market (here newly constructed NG-terminals) and substitutes (e.g., unimodal transport operators) have predictable influences: they have lowering effects on NG-terminal prices, in order to make the market less attractive for new parties and services. New entrants are those who are willing to set up NG-terminals in the same market, thus introducing new capacity into the market and lower volumes for the current NG-terminals. To prevent this from happening, the current NG-terminals can put up entry barriers (such as long-term contracts with buyers and developing client loyalty). The introduction of substitutes (e.g., unimodal transport facilities) limits the volume of any NG-terminal to a certain extent, through the alternatives they offer (e.g., by making use of other transport forms; see also NEA, 1997). In general, it can be stated that higher margins of NG-terminals will attract more entrants and substitutes, because the market is more attractive.

## 4. Economic Analysis

After we have scouted the economic environment of NG-terminals, we will now focus our attention on the economic performance of the NG-terminal. It should be noted that the economic performance is inextricably bound up with the economic environment, but also with other environmental dimensions, such as technological and political factors.

First, the earning capacity will be analysed, followed by an exploration of the cost side. This section concludes with an assessment of the economic performance.

### *4.1 Earning Capacity*

The sales of the NG-terminals are dealt with here in terms of earning capacity. In our model, earning capacity consists of two components: the price per loading unit (PLU) and the volume of loading units (VLU). The components of the earning capacity also have dynamic characteristics, as they develop over time. It has been stated before that both the prices and the volumes depend on the economic environment of the terminal.

### *4.2 Costs*

The cost structure of a NG-terminal consists of two components: capital costs and operational costs.

The initial investments for setting up a NG-terminal is built up from four major components: technology, infrastructure, land and rail tracks. Other investments (identification systems, terminal vehicles, investments in mechanics and investment in the foundations of cranes) are of minor importance here and are hence neglected. The capital costs associated with the investment costs consist of yearly depreciation plus interest on the initial investment, and are to be calculated for all investments. The deprecation costs are a multiple product of externally determined depreciation periods: for example cranes last for about 30 years while software and hardware last for only three years.

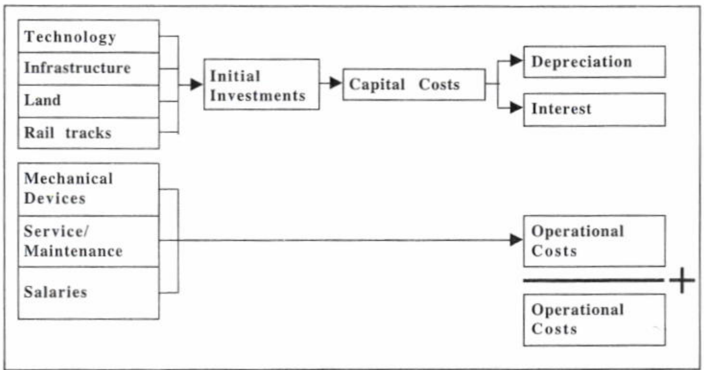


**Figure 1: cost structure**

The operational costs consist of three categories. The first one concerns operating costs: operating costs of mechanical devices, operating costs of infrastructure and operating costs of train handling (normally, these costs are determined by the number of trains per day). The second cost category is service & maintenance. Based on expert opinion we chose to use a percentage of the total investment sum. The third cost category comprises salaries (number of personnel times wage level).

### *4.3 Economic Performance: Proviso*

At the outset, we should point at one more important issue, viz. network profits, or the concept of complex consolidation networks. Bundling is the process of transporting cargo, which belongs to different cargo flows in common transport and/or load units on common parts of their route (Vleugel and Kreutzberger, 2000). The complex consolidation concept offers three main advantages: a higher load factor for loading units, a higher transport frequency and more destinations from each starting terminal.

This kind of network will have positive effects on the economic results of the NG-terminal in a broader sense, which we call network profits. These network profits will affect the costs per unit, and hence the economic performance of the NG-terminal.

Furthermore, it should be noted that the analysis is different for scenarios under a regime of public investment or private investment. Reasons for a third party, like the government or private institutions, to invest in such a project are likely favourable returns, environmental effects and macro-economic effects.

The idea behind this effect is that the assets necessary to produce initially the service can be used again later for other service deliveries (Klapwijk, 1996). The third party investment is mainly used for production (e.g., terminal equipment and heavy machinery) and distribution (e.g., investments in rail tracks, land), while the own investment comprises mainly research and development (R&D), market introductions, service and maintenance.

### *4.4 Economic Performance: A Framework*

The economic performance of a NG-terminal can be calculated in four ways: net profits, break-even point, cash flow and return on investment (ROI).

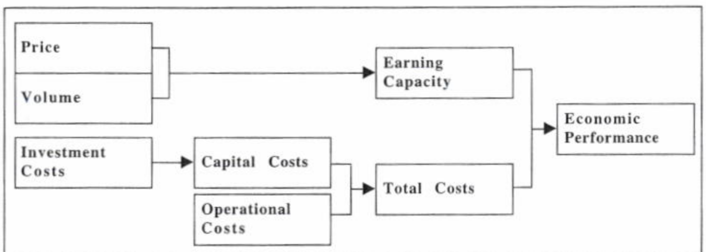


**Figure 2: economic performance**

Making losses is normal in the begin period of large investments; it is the long term which will pay back. However, the procedure stays the same. In the start-up phase of the NG-Terminal, no profits will be made due to the high investments and/or the low volume of loading units. The economic performance analysis is summarised in Figure 2, with the help of the so-called Dupont Chart-like approach.

The next way to characterise the economic performance of a NG-terminal is the break-even point analysis. The break-even point of an organisation's exploitation is reached when total revenues equal total costs, resulting in neither a profit nor a loss (Polimeni, et al, 1994). It should be noted that one could expect the costs also to rise in the case of higher numbers of loading units.

Cash flow is the net profit to be generated from a project plus the deprecations (Polimeni et al, 1994. The calculation procedure is performed as follows: using the initial investments, the terminal has to generate sales in order to earn back those initial investments. The procedure used here is the Net Present Value method (NPV; Bierman et al, 1993). Generally speaking, if NPV is negative, the investment is not attractive.

Also the payback period method can be used. The primary advantage of the payback period over the NPV is that the payback period can always be calculated exactly (Polimeni et al, 1994).

With the initial investments, the terminal hopes to generate enough sales to earn back the investments. These investments are part of the terminal's total assets. To measure the performance of the total terminal, a meaningful ratio can be calculated, viz. the return on investment (ROI). Normally, we see negative ROI's in the start-up years, mainly because of the slow development of loading units. See (Polimeni et al, 1994).

Clearly, different performance assessments can be made. They may lead to a spectrum of results, but all such calculation schemes can easily be incorporated in an estimation framework for the economic performance of NG-terminals.

## 5. Conclusion

In this paper, we have focused our attention on determining the economic performance and feasibility of innovative NG-terminals. These terminals play an important role in intermodal transport policy. When evaluating these terminals, the emphasis tends to be put primarily on the technical feasibility, while more or less neglecting the economic aspects.

Determining the earning capacity side of NG-terminals does not seem to yield many problems in general: calculating prices and volumes. It should be taken into account that network profits can have a serious influence on determining the earning capacity. These profits come from the concept of complex consolidation networks.

Determining the cost structure as such does not yield serious problems. First, capital costs and operational costs can be distinguished. The capital costs consist of both depreciation costs and interest costs. The total investment plays a crucial role here: technology, infrastructure, land and rail tracks. The operational costs consist of mechanical devices, service & maintenance and salaries

Finally we undertook the calculation of the economic performance of NG-terminals. There are four possible ratios: net profits, break-even point, cash flow and return on investment (ROI). It is natural result that a huge investment like a NG-terminal brings with it considerable losses in the beginning period.

In general, it can be concluded that building up a framework for determining the economic performance of NG-terminals does not yield many problems that cannot be solved. Therefore, our study suggests setting up an extensive system for benchmarking the economic performance and feasibility of NG-terminals

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