Seaport strategies for pre-emptive defence of market share under changing hinterland transport system performance

Arne Jensen and Rickard Bergqvist*

Logistics and Transport Research Group,
Department of Business Administration,
School of Business, Economics and Law,
Gothenburg University,
P.O. Box 610, SE 405 30 Gothenburg, Sweden
E-mail: arne.jensen@handels.gu.se
E-mail: rickard.bergqvist@handels.gu.se
*Corresponding author

Abstract: Main deep sea ports that are market leaders in their regions will continuously defend their market shares. The most constructive way of defending market shares is to predict changes of important competitive factors in the markets and to react to factors representing threats by developing preemptive defence strategies. Two main competitive factors in the hinterland of main deep sea ports have been identified: the improving performance of road-rail intermodal transport systems and the development of new dedicated port hinterland transport systems, e.g., systems based on dry ports and direct rail shuttles. This paper analyses whether these two competitive factors in the focal port's hinterland will represent future threats to the port's market share of intercontinental container flows and derives effective pre-emptive strategies for the focal port's defence of its market share in competition with other main deep sea ports.

Keywords: significant sustainable; competitive advantage; market entry ability; hinterland transport; hinterland strategies.

Reference to this paper should be made as follows: Jensen, A. and Bergqvist, R. (2013) 'Seaport strategies for pre-emptive defence of market share under changing hinterland transport system performance', *Int. J. Shipping and Transport Logistics*, Vol. 5, Nos. 4/5, pp.432–448.

Biographical notes: Arne Jensen is Research Fellow and Professor of Transport Economics and Logistics at the University of Gothenburg since 1996. Prior to that, he served as Acting Professor of Marketing Logistics at the University of Gothenburg. He has conducted research within logistics, supply chain management, marketing channels, and transport economics. His key research areas are land and sea based intermodal transport and competition and efficiency in transportation. He has been responsible for several research groups and guided more than 14 doctoral candidates to their PhD dissertations as a tutor and examiner. His publication list includes more than 45 titles.

Rickard Bergqvist is Associate Professor in Logistics and Transport Management. He is Program Coordinator for the MSc programme in Logistic and Transport Economics. His key research areas are maritime logistics, regional logistics, intermodal transportation, dry ports and public-private collaboration. His major works include over 20 refereed journal articles, conference papers and book chapters related to intermodal transport, dry ports, economic modelling, maritime economics and public-private collaboration.

This paper is a revised and expanded version of a paper entitled 'Port strategies for pre-emptive defence of market share under changing hinterland transport system performance' presented at Annual IAME Conference 2011, Santiago de Chile, 25th to 28th October 2011.

1 Introduction

For major deep-sea ports the creation and maintenance of efficient, effective and stable transport opportunities for their end customers in the supply chains, the industrial shippers, are vital strategic goals. Ports that are market leaders in their regions will continuously defend their market shares. This can be explained by both efficiency and effectiveness considerations and by their ambitions to maintain stable transport access for the industrial customers they serve. Port cost structures are characterised by both economies of scale and potential sunk costs. Therefore, loss of market shares of freight in spatial hinterland market segments will lead to less cost efficient container flows, and it may also decrease transport quality and stability. The most constructive way of defending market shares is to predict changes of important competitive factors in the markets and to react to factors representing threats by developing pre-emptive defence strategies before competitors utilise such factors as opportunities for market attacks. This calls for early and adequate strategic market analysis and strategy development. That proactivity can lead to more effective and efficient strategies for market share defence than reactivity has been observed in the general management literature by Kotler and Singh (1981). They describe a number of possible ways of defending market shares.

In this paper, our main interest lies in peripheral regions of continents, and our empirical focus is on the region of Northern Europe and the deep sea port of Gothenburg, the focal port of our study. We observe two competitive factors in the hinterlands of main deep sea ports which seem to change the competitive landscape for ports on the European continent:

- The improving performance of road-rail intermodal transport systems, particularly their cost efficiency, but also their environmental impact and service quality
- The development of new dedicated port hinterland transport systems, e.g., systems based on terminals with extended functions, such as dry ports

The purpose of our paper is to analyse whether these two competitive factors in the focal port's hinterland will represent future threats to the port's market share of intercontinental container flows and, if so, to derive effective pre-emptive strategies that seem to be available for the focal port's defence of its market share in competition with other main European ports. Our contribution in this paper will lie both in the development of a general scenario based method for predicting competitive threats to port hinterland market share and in using the method for deriving empirical results and conclusions on port strategies.

Since other ports are influenced by the development of the same or similar competitive factors, this case study of the port of Gothenburg can be expected to deliver knowledge of general interest.

2 Evolving strategies of peripheral main deep sea ports

2.1 Direct call strategy

In a region in a peripheral part of a continent, the leading deep sea port will try to attract direct calls from intercontinental container lines allowing direct transport of containers to/from transoceanic ports instead of being connected to them by feeder transport and transhipment through centrally located transhipment ports acting as hubs for the region. Implementing direct calls can be seen as a sub-strategy in an overall port strategy for market stabilisation and growth since, given sufficient volumes, it has potential to offer shippers improved service and lower transport cost from door to door. The Scandinavian countries belong to the most export dependent countries in the world, and reliable and stable transport flows to export markets are high on the agenda of major Scandinavian firms. Therefore, the introduction of direct calls represents added value for the Scandinavian industry.

2.2 Rail port strategy

For some time now, deep sea ports are developing railway based, dedicated hinterland intermodal transport systems for containers between inland terminals and seaport. The minimum requirement in each link is that dedicated container shuttle trains operate according to a fixed schedule between terminal and port. Above the minimum requirement, several logistical and administrative services may be added to the terminal's offer to shippers, carriers and forwarders. Ports have several motives for these initiatives, such as limited space for expansion of container yards in their present locations, congestion of trucks in sensitive parts of port cities, the ambition to reduce environmental impacts from road transport, the opportunities for developing locally differentiated customer services, and the improving cost/service performance of road-rail intermodality (cf. Bergqvist, 2007; Bergqvist et al., 2010; Cullinane and Wilmsmeier, 2011). Regardless of the width of the terminal's service mix between the minimum requirement, as described above, and some possible upper level, we will use the term 'rail port' in this paper for such terminals. By definition, the term 'dry port' could be applied (cf. Roso, 2006), however, the term 'rail port' accentuates a hinterland system based on rail transport. The development of dedicated hinterland transport systems for distribution and supply can be seen as another sub-strategy in the overall port strategy for market stabilisation and growth.

3 Research design

3.1 Derivation of operational research questions

Our main approach is strategic scenario analysis, which, in a generic sense, is an established approach for strategic and competitive analysis in industry (see Linneman and Klein, 1985; Schnaars, 1987; Schoemaker, 1992; Gilbert, 2000). We analyse possible impacts on the focal port's hinterland market share of intercontinental container flows from two main drivers of change: the improving performance of road-rail intermodal transport systems (factor *A*) and the development of new dedicated hinterland transport systems (factor *B*). In the analysis, we model two scenarios, scenario 1 and scenario 2. Scenario 1 is a reference scenario assumed to represent the present flow pattern in terms of transport links. Scenario 2 represents conceptually a structural transformation of scenario 1 in which a main continental European transhipment port, capitalising on the two competitive factors (*A* and *B*), is assumed to have entered the hinterland market of the focal port by developing a dedicated hinterland transport system to/from the continental transhipment port. The term 'market challenger' or just 'challenger' will be used as a synonym of the term 'main European transhipment port' where suitable. We analyse *N* different transformations from scenario 1 into scenario 2. Each transformation represents a hypothetical competitive entry into the focal port's hinterland market and a hypothetical share of that market. Scenario 2 will be considered true if one of the *N* transformations occurs. The transhipment port's attack in the hinterland market of the focal port may be a competitive response for regaining market shares lost, for preventing future losses of market shares, or for more offensive strategic reasons. The *N* transformations will be chosen so that their number and structures allow our analysis to fulfil the research purpose.

The core question to analyse is whether scenario 2 seems possible or likely and, if so, to derive defence strategies that may be adopted by the focal port. We analyse this by structuring the analysis in a partly integrated way around two operational research questions:

- In model terms, will it be possible for the continental European transhipment port to design an efficient and effective competitive dedicated hinterland transport system in Scandinavia based on road-rail intermodality?
- Given a realistic conceptual model of an efficient and effective competitive dedicated hinterland transport system supposed to be connected to and controlled by the European transhipment port, will it be possible for such a system to enter the market?

3.2 Conceptual framework

Our general approach and our analysis of the two operational research questions is based on the conceptual framework for the design and evaluation of intermodal transport systems developed by Jensen (1987, 1990, 2008). In order to be successful according to this framework, a proposed intermodal transport system must first of all possess a significant, sustainable competitive advantage (SSCA) and, given this, it must also have sufficient market entry ability (MEA).

SSCA refers to a unique combination of properties that allows the system to provide an output with a cost/service ratio that is preferred by customers over the closest competing alternatives. ‘Significant’ means that the difference is big enough and ‘sustainable’ that it will last for a sufficient period of time. Otherwise, transport buyers will not change transport service provider. When evaluating the SSCA of a proposed system, cost efficiency, environmental efficiency, and transport quality are decisive performance dimensions. A sufficient criterion for SSCA of a proposed system over a reference system to exist is that the proposed system shows a significant sustainable advantage in one of the performance dimensions and is at least as good in the other two. The reference system will normally be the existing system, but it can be any hypothetical system. MEA depends on two concepts, integrability and communicability. A new transport system is said to be integrable if it is designed to avoid or reduce entry barriers and competitors’ turf defence, factors that may make it difficult for a newcomer to get access to critical system components when entering the market. Infrastructure, transport and handling services, and customer contacts are examples of critical components. An intermodal transport system is considered communicable if it can be given a profile that facilitates for potential customers to compare its value to them with the value of the closest existing or realisable alternative. Creating this profile is not only a marketing issue. It is also related to intermodal system design. A transport system fulfilling the sufficiency criterion for SSCA mentioned above is also communicable, a characteristic that will not be true for all combinations of outcomes in the three performance dimensions.

4 Related research and empirical sources

Much research has addressed the issue of designing competitive liner networks. From a cost-efficiency perspective, Cullinane and Khanna (2000) analyse the economies of scale in operating large containerships for intercontinental operational scenarios. Ng and Kee (2008) penetrate optimal ship sizes of container feeder services in Southeast Asia. Regarding markets and marketing, Robinson (1998) describes the dynamics of the restructuring of the Asian hub/feeder nets. Panayides and Cullinane (2002) summarise and discuss theories of competitive advantage in liner shipping. Plomaritou (2008) develops an application of the marketing mix concept, and Notteboom (2006) points to the importance of the time factor in liner shipping services.

The role of ports has been addressed by several authors. Port and terminal selection by deep-sea container operators is the focus of Wiegmans et al. (2008). Sanchez et al. (2003) measure port efficiency as a determinant of maritime transport costs in international trade. From a northern European perspective, Ng (2006) assesses the attractiveness of ports in the North European transhipment market and, in a case study, Baird (2002) finds that transhipment can offer operating and capital cost advantages compared with multiport direct services.

The issue of dry ports and hinterland transportation has been addressed by many authors. Some argue that the challenge of liner shipping have moved from the sea, first to the ports and then to the hinterland (cf. Notteboom, 2002; Guthed, 2005). In 1982, the UN first used the term dry port underlining the integration of services with different traffic modes under one contract (Beresford and Dubey, 1990). Research on hinterland transport in connection to principal ports is also comprehensive. Examples with their main geographical context are: Notteboom and Rodrigue (2005) USA, Rodrigue (2008) USA, IBI Group (2006) Canada, Beavis et al. (2007) Australia, Wang and Cullinane (2006) Asia, Woodburn (2006, 2007) UK, Pettit and Beresford (2007) UK, Debrie (2004) south-west Europe, Gouvernal and Daydou (2005) north-west Europe, van Klink and van den Berg (1998) Rotterdam with hinterland, Bundesamt für Güterverkehr (2005) Germany, (Bergqvist, 2007, 2010 – Sweden/Scandinavia) and Roso (2006) Sweden/Scandinavia.

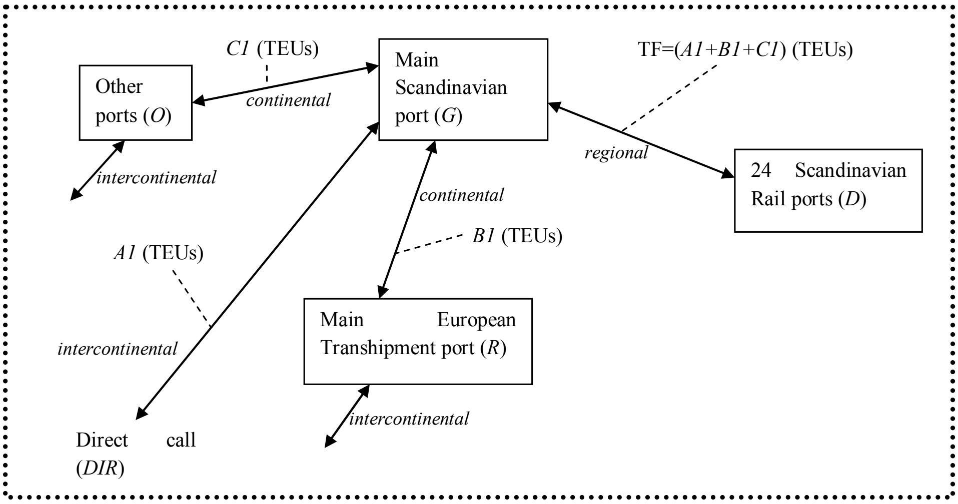
However, little research has been done in assessing future seaport strategies for pre-emptive defence of market share against other seaports' attacks in the intercontinental container flow market, attacks which are becoming increasingly possible in the evolving competitive landscape driven by shifts in relative performance advantage between feeder modes and by the emergence of dry ports/rail ports.

For identification and estimations of cost related data, a number of scientific sources have been used. Besides above mentioned sources related to sea operations, Flodén (2007), Bergqvist (2007, 2008) have been key references related to intermodal transport. The research conducted by Bark et al. (2008) and Woxenius (2003) on road-rail intermodality and terminals have further contributed to cost estimations in the context of Scandinavian conditions. Enarsson (1998) has been the platform for road transport cost data. The environmental estimations and data input are based on Flodén (2007) and Banverket (2005).

5 Two scenarios

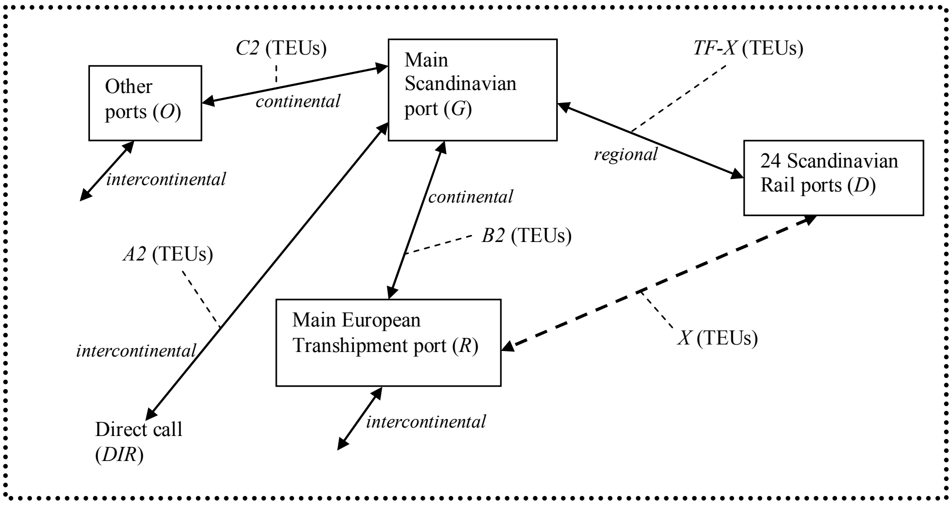
Scenario 1, modelled in Figure 1, is assumed to represent a successful, however not necessarily optimal, implementation of the direct call strategy by the focal Scandinavian port *G*. Figure 1 is a generalised representation of the present situation in terms of flow structure and flow size and materialises the 'reference system' of our conceptual framework. It contains three container flows with volumes *A1*, *B1*, and *C1* passing *G*. *D* can be regarded as an average rail port representing a set of 24 rail ports in Scandinavia. *A1* represents the sum of flows in both directions between *G* and intercontinental ports by direct calling container vessels, the flow *B*1 is carried in the link between *G* and the transhipment port *R* by smaller feeder vessels, and shipped between *R* and other European or intercontinental destinations after handling in and out. *R* is an important analytical concept in this study. It can be perceived as representing a generalised port somewhere along the coast between the Hamburg and Antwerp areas. *R* is assumed to be connected by intercontinental container lines to all transoceanic ports needed for maintaining important freight flows in both directions between Scandinavia and its transoceanic markets. The third flow, (*C*1), is moved by ship between *G* and other European ports. It may consist of both containers that are transhipped to/from intercontinental ports and intra-European flows. In the case of *B*1 and *C*1, intra-European flows in relation to the intercontinental flows are marginal and hence, not highlighted in Figure 1 and Figure 2. All flows with notations *A1*, *B1* etc. are sums of flows in both directions of a link and flows are assumed balanced. The size of flow volumes *A1*, *B1*, and *C1* has no other analytical relevance than being able to absorb any of the *N* transformations that carry scenario 1 into scenario 2. At present, the approximate yearly flows of the focal port Gothenburg are *A1* = 150,000, *B1* = 75,000, and *C1* = 575,000 giving a total flow *TF* = 800,000 TEUs. Flow *TF* is moved by train between *D* and *G*.

Figure 1 Container flows (arrows) in different links under scenario 1 (system model *S*1)



Note: Total flow *TF* = 800,000 TEUs. Flows are assumed balanced in all links (half of the shown quantities move in each direction).

Figure 2 Container flows in scenario 2 (system model *S*2)



Scenario 2 represented by the system model in Figure 2 assumes a situation where the main European port *R* has developed and implemented a competitive strategy in an attempt to win all or part of volume *A1* and *C1* in scenario 1 due to defensive or offensive reasons. The concrete response consists of the establishment of dedicated transport links from rail ports to the transhipment port *R*. The only difference between scenarios 1 and 2 in terms of transport links is the addition of link *D*-*R* in scenario 2 and a possible shift of freight volumes between links. The total container volume *TF* to and from *D* is assumed to be the same in both scenarios, but in scenario 2 the flow will be shared between link *D-R* with *X* TEUs and link *D-G* with (*TF-X*) TEUs. This means that the flows passing *G* and *R* will change accordingly.

Other designs of the link *D-R* in scenario 2 were considered such as links consisting of smaller Scandinavian ports in combination with road or rail connections and small feeder vessels from ports to *R*. However, they were found less realisable for the main European transhipment port due to problems of efficiency, effectiveness, and organisation. They were not analysed further since analysis of the most likely solution was sufficient to answer the research questions.

6 Calculation of performance differences between scenario 1 and 2

According to our framework, a potential dedicated hinterland transport system of the European transhipment port *R* must have SSCA as well as MEA in order to be realisable. In this section we make some strategic calculations of performance differences in terms of unit costs, environmental impact and transport quality that will occur if the door to door container flow *X* is transferred from link *D-G* to link *D-R*. This is one step in our attempt to throw light on the question whether it is possible for a main European transhipment port (*R*) to design a dedicated hinterland transport system that will have a SSCA.

6.1 Strategic cost calculations

Following principles and motivations for strategic cost calculation outlined in full detail in Jensen and Bergqvist (2010), we calculated differential costs per container from door to door for container flows that are shifted when scenario 1 represented by system model *S1* is assumed to be transformed into scenario 2 represented by system model *S2*. For hinterland transport cost in *S1*, calculations are made on 24 individual rail ports and the Scandinavian rail port system including terminal handling costs. Due to the difficulty to determine from which rail ports volume *X* will be moved, the cost of hinterland transport in *S2* is based on three homogenous groups of rail ports based on the distance to the transhipment port *R*. This has been done for a set of alternatives where each alternative specifies a certain change of container flows when the container volume *X* is moved from link *D-G* to link *D-R*. We thus calculate the differential cost (pos. or neg.) per container flow moved to *D-R*. The cost calculations are based on the following assumptions and methods:

- We compare two systems, *S1* and *S2*, each under stationary conditions, in order to calculate the difference between them regarding total resource consumption measured in cost terms per container shifted.
- In the transport links *G-O* and *G-R* as well as in the terminals *G* and *R* we assume that resources have alternative use and can be moved in to or out from the system at market prices.
- In the link with direct call, a proportionate reduction of volume will only lead to a less than proportionate reduction of total costs since scale advantages will be lost or

capacity unused. It is assumed that some adaptation to demand is possible by changing frequency of call or type of vessel. When calculating costs that consider the possible adaptation to demand, we have used 'dynamic value functions' determined in Jensen and Bergqvist (2010). These are dynamic cost curves where costs are expressed as functions of ship types and roundtrip frequencies. However, we assume that at volumes below a certain break-even point between the dynamic cost curve and the cost curve of feeder shipping, feeder shipping will be used between G and R together with transhipment at R as a substitute for direct shipping.

- The railway shuttle between a rail port and the focal Scandinavian port will normally run a fixed number of trains per week according to a fixed schedule in a yearly train plan. The number of trains per week will be determined from the average expected demand per week. We adopt the following notations:

  expected demand per year (TEUs) per rail port = Y

  average train utilisation factor = U*100%

  number of trains per week = T

  maximum number of TEUs per train = H

  number of production weeks per year = W

With these parameters the scheduled number of trains per week in the yearly train plan is determined as T = integer part of $\frac{(Y/W)}{(U*H)}$

- The container flow in and out demanded at a rail port will vary from week to week depending on a lot of factors. The container flow per week is assumed to be a random variable (z) following the normal probability distribution with mean M and standard deviation S. If demand a certain week exceeds train capacity, the overflow will be moved on road by lorry between rail port and sea port. The number of containers moved on road per week is equal to $(z - T*H)$ for $(z > T*H)$, and equal to 0 for $(z \leq T*H)$. The expected number of containers in need of road transport per week in a given rail port link can be shown (for a derivation, see Jensen, 1990, pp.401–403) to be equal to $(S*[p(k) - k*(1 - F(k))])$. In this expression, $p(z)$ is the density function of the standard normal probability distribution, $F(z)$ its distribution function, and $k = \frac{(T*H - M)}{S}$, a standardised normal variate. Given estimates of the coefficient of variation of rail port container flow, CV, we calculate $(S = CV*M)$.

- We assume, as in practice, that road transport is used in case of insufficient train capacity as a method for reducing costs. This method allows running trains with high load factor and accepting a minor additional cost of road transport in infrequent cases of overflow leading to lack of train capacity. The cost of the extra road transport is set equal to the average cost per TEU of road transport between rail port and sea port multiplied by the expected number of containers carried by lorry.

The results of our calculations are shown in Table 1.

6.2 Differences in environmental impact and transport quality

Similar to the strategic cost calculations we calculate the environmental performance of CO_2 per container from door to door for container flows that are affected when scenario 1 represented by system model *S1* is assumed to be transformed into scenario 2 represented by system model *S2*. This has been done for the same set of alternatives as described in Section 5.1. The results are also shown in Table 1. In comparison to the assumptions and methods described in Section 5.1, the following additional assumptions and methods apply:

- We assume electric power supply to locomotives. Since the rail service is of such great scale we assume that there is the possibility for the electric locomotives to directly connect to the rail handling terminals without any need for diesel powered marshalling locomotives.
- The source of electricity is based on Sweden's electrical power mix since the principal part of the transport route is located in Sweden.
- To simplify calculations, environmental performance is based on three categories of LoLo ships, > 8,000 dwt, 2,000–8,000 dwt and < 2,000 dwt.

The environmental performance is measured in CO_2. Besides differences in carbon dioxide, there are other well-known and significant environmental improvements when shifting goods from sea to rail for other emissions, e.g., NOx and SO_2. These emissions, however, are outside the scope of this research.

7 Significant sustainable competitive advantage of dedicated transport system

7.1 Criteria

In a strategic analysis of the Scandinavian hinterland market, we assume that a potential entrant will first estimate whether a new dedicated hinterland transport system between Scandinavian rail ports and the entrant's port will be able to offer a competitive advantage for the container flows. The estimate will be based on differential outcomes in three dimensions: cost efficiency, environmental efficiency and output quality. If the new system is found significantly superior in one dimension and at least as good in the remaining two, it fulfils the sufficiency criterion for SSCA.

From Table 1 it can be seen that CO_2 emissions and transit times representing environmental impact and transport quality respectively are only marginally better for flows shifted to the dedicated hinterland transport chain *D-R* instead of following chain *D-G*. This implies that if the cost advantage is perceived to be significantly higher for chain *D-R*, the *D-R* chain will by definition have a SSCA over the existing chain for the same flow. This is perceived as a favourable condition for market entry into the Scandinavian rail port market by the European transhipment port *R*. It deserves mentioning that the environmental advantage of *S2* is slightly underestimated since only CO_2, and not NOx and SO_2, is considered, and shipping has higher emissions in these dimensions than freight trains.

7.2 Cost advantage

Following the principles outlined in Section 5.1 above, we have calculated the increase in cost per TEU for different combinations of flows (*A1, A2, ...*) assumed to be shifted from the focal port *G* (flow *D-G-*) to the potential dedicated hinterland transport system of the transhipment port *R* (flow *D-R-*). The results are shown in Table 1. In terms of our notations, this is expressed as shifts of flows *A1, A2,…* etc. occurring when scenario 1 (*S1*) is transformed to scenario 2 (*S2*). In this hypothetical shift of container flows, the volume given for each alternative in the column for direct flows, 'from G-DIR', is assumed to be the entire direct flow, whereas the volumes in columns 'from *G-R*' and 'from *G-O*' may be only parts of larger flows. The results are shown in Table 1, where impacts on performance are expressed as reduction per TEU of costs, emissions and transit times. In Table 1, a negative reduction of costs per TEU represents a cost increase by the absolute value of the negative reduction.

A very interesting observation that can be made in Table 1 is the fundamental importance of direct calls to the focal Scandinavian port and its system of rail ports. This importance is represented by the series *A1, A2, A5, A8, A11* and *A14*, where there is a cost reduction per TEU for flows in the competing link *D-R-* according to the series 5, 7, –7, –12, –26, –33. This means that for growing volumes, there is a growing cost advantage for direct calls compared with the flow via the European transhipment port using rail. Direct calls can be seen as a protective weapon in port competition. If the direct flow is above a certain volume, it is unlikely that a competing port will try to enter the market with a dedicated hinterland transport system in Scandinavia since the cost advantage of flows passing the main Scandinavian port may be perceived as too difficult to match. The cost advantage of strategies aiming at winning market shares in the flow from the Scandinavian port to other ports (the flow *G-O*) is shown in alternatives *A21, A22* and *A23*, which indicate cost reductions from 7 to 29 EUR per TEU depending on volume. A shift of this flow to the chain *D-R-* would mean a loss of business for the Scandinavian port *G* and a gain for the transhipment port *R*.

Alternatives *A24* and *A25* show a cost advantage of seven and five EUR respectively for a shift of flows from the chain *D-G-R* to a railway shuttle between the European transhipment port *R* and Scandinavian rail ports. However, this shift is deemed less likely to be perceived as attractive by *R*, since *R* already owns this market for transhipment between transoceanic trunk lines and feeder lines to the Scandinavian port. Besides that, port *R* would start competing with its own customers, the feeder vessel operators. Only in situations where the feeder operators and the transoceanic operators are identical, do we consider this to be an option in a market strategy for the port.

There are several alternatives among *A1–A25* in Table 1 that can be regarded as representing a significant cost advantage. Since they at the same time perform better regarding environmental impact and transport quality, they represent a significant, competitive advantage. The competitive advantage of these alternatives can also be regarded as sustainable since it depends on differences in transport distances, use of different and stable modes of transport, and different and stable handling technologies. Therefore, we conclude that a wide set of alternatives among *A1–A25* represents a significant sustainable competitive advantage (SSCA) to the European transhipment port *R*.

Table 1 Impact of competition on cost, emission and transit time per TEU for alternative transformations of scenario 1 into scenario 2

Alternative	*Shift of container flow (TEU/year) to link D-R from other links when S1 is transformed into S2*			*Impact of transformation from S1 to S2 on shifted container flow's door-to-door competitive advantage*		
	From G-DIR	*From G-R*	*From G-O*	*Reduction of costs[1] (EUR/TEU)*	*Reduction of emissions kg (CO2/TEU)*	*Reduction of transit time (Days)*
A1	37,500	0	0	5	14	0 - 1
A2	75,000	0	0	7	12	1–2
A3	75,000	0	143,750	24	14	2–3
A4	75,000	0	287,500	31	14	2–3
A5	112,500	0	0	–7	12	2–3
A6	112,500	0	143,750	13	14	2–3
A7	112,500	0	287,500	31	14	2–3
A8	150,000	0	0	–12	12	2–3
A9	150,000	0	143,750	9	14	2–3
A10	150,000	0	287,500	18	13	3–4
A11	187,500	0	0	–26	12	3–4
A12	187,500	0	143,750	–2	13	2–3
A13	187,500	0	287,500	11	14	3–4
A14	225,000	0	0	–33	11	2–3
A15	225,000	0	143,750	–5	13	2–3
A16	225,000	0	287,500	5	13	3–4
A18	150,000	37,500	0	–1	13	2–3
A17	150,000	75,000	0	3	14	2–3
A19	150,000	37,500	287,500	21	13	3–4
A20	150,000	75,000	575,000	32	12	3–4
A23	0	0	71,875	7	17	1–2
A22	0	0	143,750	23	16	2–3
A21	0	0	287,500	29	15	2–3
A25	0	37,500	0	5	19	0–1
A24	0	75,000	0	7	17	2–3

Note: [1]A negative reduction of costs represents an increase of costs by the absolute value of the negative reduction

Table 1 also shows that alternatives with low and medium sized volumes for the direct flow *G-DIR* plus addition of some volumes from the *G-O* flow may be perceived by an entrant to have a cost advantage.

8 Market entry ability

Table 1 show that it would be possible for the European transhipment port *R* to design a competing dedicated transport system possessing a significant, competitive advantage (SSCA) in the hinterland of port of Gothenburg. However, in order to actually enter the market it must possess market entry ability, MEA, as well. This means, according to our framework, that the competing entrant's system must be integrable in the existing hinterland transport network consisting of rail ports and rail shuttles. It must also be communicable to key decision makers.

In order for a promising transport system to be integrable, it must gain access to critical system components. The two most critical physical resources in this context are intermodal road-rail terminals (including handling) and trains. The Swedish railway network is an open market for freight train operators, and several operators compete in the market. So access to train services will not be a barrier to market entry.

Access to the necessary terminal services is more complicated to analyse. The rail shuttle system of the main Scandinavian port, Gothenburg, has 24 terminals/rail ports. They are located strategically in demand centres and owned or controlled by local interests. Terminal location is influenced by demand factors, but also by restrictions such as rail and road access, legislation and others. The consequence of these demand factors and restrictions is that the terminal function of an entering competitor from an efficiency point of view will have to choose the same locations as the existing 24 terminals/rail ports, at least so to a very high extent. Duopoly in each location with two separate terminals will not be economically feasible. It will also be questionable from a community planning perspective. Therefore, integrability implies sharing terminal functions with the existing terminal users except in the rare cases where there is a market for a new investment. The only existing user in the majority of cases is the focal port, Gothenburg. Unless port of Gothenburg (*G*) can use its market power to prevent entry, a dedicated hinterland transport system developed by the European transhipment port *R* appears to be integrable. At present the market power of the port of Gothenburg is rather weak since it does not control the terminals of the rail ports by ownership or long term contracts giving the port a prioritised position.

A dedicated transport system of the transhipment port *R* will not have any communicability problems. For the subset of alternative shifts of volumes where it has a SSCA, the system will also be communicable since it has a significant cost advantage and also marginal advantages in environmental impact and transport quality. There are no other aspects indicating that communicability should not be present since we are considering services that are well known by all actors involved.

Our conclusion is that if the European transhipment port *R* designs a competing dedicated transport system possessing a significant, competitive advantage (SSCA) in the hinterland of port of Gothenburg, such a system will possess MEA as well.

9 Conclusions and discussions about port strategies for pre-emptive defence of market share

9.1 Strategic risks in the present market development

At present, several peripheral deep-sea ports have focused on developing value-added collaboration and capabilities with inland terminals and rail ports. The sea ports have invested creativity, know-how and capital in these rail ports and their connected transport links, possibly in the belief that they are operating in a protected market. However, associated formal commitments are rare and loose. There is a risk that rail ports and inland terminals will use their developed competences and capabilities to form alliances and collaboration with other seaports. The absence of formal commitments combined with the rationale for the independent inland terminal or rail port to increase its market penetration and expand its catchment area forms strong incentives for not forming exclusive alliances with any specific sea port as long as it is not evidently the principal and natural sea port for the large majority of demand in the catchment area. Hence, it is a high risk strategy for the main sea port to rely on loyalty based on informal commitments and a mutual understanding of the importance and value of the collaborative benefits.

In the present case study, given the present policy of only having weak control over competitors' access to the terminals in its dedicated hinterland transport system, the port of Gothenburg, is exposed to certain strategic risks. One risk is that the opportunity of winning a substantial market share from intercontinental flows between the port of Gothenburg and other transhipment ports than its main European transhipment port *R* may lead the latter to enter the hinterland market of the Scandinavian port. However, our calculations show that this risk can be assumed to be inversely proportional to the direct intercontinental container flow's share of the total intercontinental flow from Gothenburg.

This study shows that there are two counter strategies against this scenario which promise to be effective for pre-emptive defence of market share: The direct call strategy and the terminal debarment strategy. These can be implemented separately or in combination. A coordination of these strategies into a joint and coherent strategy would form the strongest pre-emptive defence of market shares.

9.2 Direct call strategy

One identified port strategy for pre-emptive defence of market share is to increase the flow shipped by direct calling intercontinental container lines. If this strategy could be implemented successfully, the focal seaport would develop a high degree of strategic immunity to market attacks in its hinterland. This also has the indirect effect of reducing size of the flow carried via other transhipment ports (the *G-O* flow in Figure 1), which is vulnerable to competition as explained above. Besides being a defence strategy it may also have offensive characteristics. In generic terms it is a product/service differentiation likely to be perceived as quality improvement by Scandinavian shippers. It will promote shipper loyalty. It may also expand the hinterland market of Gothenburg since it could attract some transit flows from Baltic ports to transoceanic ports to which Gothenburg at present lacks direct connections.

The design of the direct call strategy as a pre-emptive defence measure will depend on the focal port's scenarios about the most likely spatial extent of the challenger's attack. If the attack is expected to be spatially concentrated to a certain segment of the hinterland market, the container line (lines) implementing the direct call strategy must be deemed able to capture a sufficient share of the segment in order for the strategy to be effective. If the challenger's attack is expected to be spatially dispersed over the hinterland market, the implementation of the direct call strategy must be considered potentially able to attain sufficient market penetration in most or all spatial segments of the hinterland.

9.3 Hinterland terminal debarment strategy

The other identified port strategy for pre-emptive defence of market share is to take control of the access to the terminals in the system of rail ports. The main Scandinavian port can do this either by ownership, the safest strategy, or by signing long term exclusive contracts with the terminal owners. The terminal debarment strategy can easily be adapted to different scenarios about the spatial extent of the challenger's attack, concentrated as well as dispersed. In the latter case this counter strategy should be extended to all key terminals in the system.

9.4 Concluding remarks

Generalising slightly from this Scandinavian case study, it seems as if peripherally located sea ports may be neglecting an important factor in the developing new competitive landscape, the need for market protection. The development of strategies for pre-emptive defence of market share is one aspect of market protection. Market share and volume have important functions for port management, since port cost structure is characterised by both economies of scale and potential sunk costs. Volume is also needed for the implementation of direct call strategies. These are value adding for key industrial customers in terms of transport quality and stability. Strategies for pre-emptive defence of market share will become a key issue when intermodal road-rail transport chains become more efficient and effective and terminals develop administrative and transactional aspects of the rail port concept. The strategic response by peripheral seaports will influence the range of direct intercontinental container services they will be able to offer to their key customers in the future. Can ownership of sea ports by local governments explain the absence so far of strategic response?

References

Baird, A. (2002) 'The economics of container transhipment in northern Europe', *International Journal of Maritime Economics*, Vol. 4, No. 3, pp.249–280.

Banverket, (2005) *Beräkningshandledning: hjälpmedel för samhällsekonomisk lönsamhetsbedömning av järnvägsinvesteringar*, Banverket, Handbok BVH 706, Borlänge.

Bark, P. and Jonsson, R. and Nelldal, B-L. (2008) *Intermodala komponenter – System, utrustning, metoder och miljö*, TFK – TransportForsK AB, Rapport 2008, Vol. 2, Stockholm.

Beavis, P.B.J., McGill, I., Woxenius, J. and Moore, S. (2007) 'Interface design for the coordination of container freight infrastructure with urban logistical services', *11th WCTR*, Berkeley, 24–28 June.

Beresford, A.K.C. and Dubey, R.C. (1990) *Handbook on the Management and Operation of Rail Ports*, Geneva.

Bergqvist, R. (2007) *Studies in Regional Logistics – The Context of Public-Private Collaboration and Road-Rail Intermodality*, Logistics and Transport Research Group, Department of Business Administration, BAS Publishing, Gothenburg, Sweden.

Bergqvist, R. (2008) 'Evaluating road-rail intermodal transport services – a heuristic approach', *International Journal of Logistics Research and Applications*, Vol. 11, No. 3, pp.179–199.

Bergqvist, R. (2010) *Hamnpendlars betydelse för det Skandinaviska logistiksystemet* (The significance of port shuttles for the Scandinavian logistics system), BAS Publishing, School of Business, Economics and Law at University of Gothenburg.

Bergqvist, R., Woxenius, J. and Falkemark, G. (2010) 'Establishing intermodal terminals', *World Review of Intermodal Transportation Research*, Vol. 3, No. 3, pp.285–302.

Bundesamt für Güterverkehr (2005) *Marktbeobachtung Güterverkehr – Sonderbericht zum Seehafen-Hinterlandverkehr* (Market observation freight transport – special story about seaport hinterland transport), Cologne, in German.

Cullinane, K.P.B. and Khanna, M. (2000) 'Economies of scale in large containerships: optimal size and geographical implications', *Journal of Transport Geography*, Vol. 8, No. 3, pp.181–195.

Cullinane, K.P.B. and Wilmsmeier, G. (2011) 'The contribution of the rail port concept to the extension of port life cycles', in: Boese, J. (Ed.): *Handbook of Terminal Planning*, 1st ed., Springer, New York.

Debrie, J. (2004) 'Hinterland connections of ports and Transeuropean networks' evolution – the case of south-western Europe', *The 10th WCTR*, Istanbul, 4–8 July.

Enarsson, L. (1998) *Åkerinäringens Kostnads- och Konkurrensvillkor*, (*The Cost- and Competition Conditions for the Road Hauling Industry*), University of Växjö.

Flodén, J. (2007) *Modelling Intermodal Freight Transport – The Potential of Combined Transport in Sweden*, Dissertation, Department of Business Administration, University of Gothenburg, Gothenburg.

Gilbert, L.G. (2000) 'Using multiple scenario analysis to map the competitive landscape: a practice based perspective', *Competitive Intelligence Review*, Vol. 11, No. 2, pp.12–19.

Gouvernal, E. and Daydou, J. (2005) 'Container rail freight services in north-west Europe: diversity of organizational forms in a liberalizing environment', *Transport Reviews*, Vol. 25, No. 5, pp.557–571.

Guthed, A. (2005) *Port Hinterland Connections*, Licentiate thesis, Division of Logistics and Transportation, Chalmers University of Technology, Gothenburg.

IBI Group (2006) *Inland Container Terminal Analysis – Final Report*, Vancouver.

Jensen, A. (1987) *Kombinerade transporter i Sverige*, TransPortForskningsberedningen: Rapport 9, Stockholm.

Jensen, A. (1990) *Combined Transport – Systems, Economics and Strategies*, Swedish Transport Research Board, Stockholm.

Jensen, A. (2008) 'Designing intermodal transport systems: a conceptual and methodological framework', in R. Konings et al. (Ed.): *The Future of Intermodal Freight Transport*, Edward Elgar, Cheltenham UK.

Jensen, A. and Bergqvist, R. (2010) 'The value of direct call services by container shipping lines in northern Europe – support model for strategic scenario development and case study', in K.P.B. Cullinane (Ed.): *International Handbook of Maritime Economics*, Edward Elgar Publishing, Cheltenham.

Kotler, P. and Singh, R. (1981) 'Marketing warfare in the 1980s', *Journal of Business Strategy*, Vol. 1, No. 3, pp.30–41.

Linneman, R.E. and Klein, H.E. (1985) 'Using scenarios in strategic decision making', *Business Horizons*, Vol. 28, No. 1, pp.64–74.

Ng, A. (2006) 'Assessing the attractiveness of ports in the North European container transhipment market: an agenda for future research in port competition', *Maritime Economics and Logistics*, Vol. 8, No. 3, pp.234–250.

Ng, A. and Kee, J. (2008) 'The optimal ships sizes of container liner feeder services in Southeast Asia: a ship operator's perspective', *Maritime Policy and Management*, Vol. 35, No. 4, pp.353–376.

Notteboom, T. (2002) 'The interdependence between liner shipping networks and intermodal networks', *IAME*, 13–15 November 2002, Panama City, Panama.

Notteboom, T. (2006) 'The time factor in liner shipping services', *Maritime Economics and Logistics*, Vol. 8, No. 1, pp.19–39.

Notteboom, T. and Rodrigue, J-P. (2005) 'Port regionalization: towards a new phase in port development', *Maritime Policy and Management*, Vol. 32, No. 3, pp.297–313.

Panayides, P. and Cullinane, K.P.B. (2002) 'Competitive advantage in liner shipping: a review and research agenda', *International Journal of Maritime Economics*, Vol. 4, No. 3, pp.189–209.

Pettit, S. and Beresford, A. (2007) 'An analysis of logistics distribution patterns from major container ports and proposed container port developments in Great Britain', LRN 2007, Hull, 5–7 September.

Plomaritou, E. (2008) 'A proposed application of the marketing mix concept to tramp and liner shipping companies', *Journal of Contemporary Management Issues*, Vol. 13, No. 1, pp.59–71.

Robinson, R. (1998) 'Asian hub/feeder nets: the dynamics of restructuring', *Maritime Policy and Management*, Vol. 25, No. 1, pp.21–40.

Rodrigue, J-P. (2008) 'The thruport concept and transmodal rail freight distribution in North America', *Journal of Transport Geography*, Vol. 16, No. 4, pp.198–216.

Roso, V. (2006) *Emergence and Significance of Rail Ports*, Licentiate thesis, Division of Logistics and Transportation, Chalmers University of Technology, Gothenburg.

Sanchez, R., Hoffmann, J., Micco, A., Pizzolitto, G., Sgut, M. and Wilmsmeier, G. (2003) 'Port efficiency and international trade: port efficiency as a determinant of maritime transport costs', *Maritime Economics and Logistics*, Vol. 5, No. 2, pp.199–218.

Schnaars, S.P. (1987) 'How to develop and use scenarios', *Long Range Planning*, Vol. 20, No. 1, pp.105–114.

Schoemaker, P.J.H. (1992) 'Multiple scenario development: its conceptual and behavioural foundation', *Strategic Management Journal*, Vol. 14, No. 3, pp.193–213.

van Klink, H.A. and van den Berg, G.C. (1998) 'Gateways and intermodalism', *Journal of Transport Geography*, Vol. 6, No. 1, pp.1–9.

Wang, Y. and Cullinane, K.P.B. (2006) 'Port accessibility and the impact on container logistics', *LRN 2006*, Newcastle, 6–8 September.

Wiegmans, B., Hoest, A. and Notteboom, T. (2008) 'Port and terminal selection by deep-sea container operators', *Maritime Policy and Management*, Vol. 35, No. 6, pp.517–534.

Woodburn, A. (2006) 'The non-bulk market for rail freight in Great Britain', *Journal of Transport Geography*, Vol. 14, No. 4, pp.299–308.

Woodburn, A. (2007) 'The role for rail in port-based container freight flows in Britain', *Maritime Policy and Management*, Vol. 34, No. 4, pp.311–330.

Woxenius, J. (2003) *Intermodala transporter och SJ/Green Cargos utvecklingsprojekt Lättkombi*, Institutionen för transportteknik, Chalmers tekniska högskola, Meddelande 117, Göteborg.