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Inland terminals: Competitive advantage as a need for new entrants

Sonja Maria Russo[1,*] and Manfred Gronalt[1]

[1]University of Natural Resources and Life Sciences Vienna, Feistmantelstraße 4, Vienna, 1180, Austria

[*]Corresponding author. Email address: sonja.russo@boku.ac.at

Abstract

The present paper revolves around the question, how a sound expansion and development strategy can support new terminals entering the market. It lists potential favourable competitive conditions of a new player and contrasts them with the drawbacks of competing against a well-established terminal with a strong customer base. It sheds light on the relevance of market penetration of established terminals to ensure their long-term success. A novel contribution of the research is the combination of different methodological analyses, including the phenomena of path dependence and insights gained in innovation diffusion models. We develop a generic stock and flow (system dynamics) model of the competition between two rival terminals and use a terminal's price sensitivity to reflect its competitive conditions. The results of the sensitivity analysis demonstrated that the higher the initial market share of an existing terminal, the more new entrants are forced to win customers through their innovative demand. Switching costs may additionally drive them out of the market, even if they offer a perfect substitute. The system behaviour shows the system archetype success to the successful, while the attractiveness of the new offer can serve as a leverage point.

Keywords: Inland terminal; competition; system dynamics; price sensitivity; success to the successful;

1. Introduction

Within the last decade, logistics terminals faced increasing competition for customers due to significant spare transhipment capacities alongside strategic partnerships, acquisitions and mergers of terminal operators. This is especially evident in the maritime sector (De Souza et al., 2003), which shapes not only inter-port competition but also intra-port competition having several terminals at one port (Kavirathna et al., 2019). Although the competition among inland terminals is characterized by greater geographical spread, they too strongly compete for partly overlapping customer markets. Unequal competitive conditions of rival terminals are of great importance.

The system archetype success to the successful addresses the topic, in which two rivals compete for a limited amount of resources. The more resources a competitor receives, the more successful he becomes, which again increases the level of his resources (Senge, 1990). In connection with this, the importance of the initial market shares and the number of regular customers of competing terminals can be linked to the phenomena of path dependence. Thus, success in the past causes success in the future (Mandl, 2019). The theoretical observation reinforces the empirical fact that new players need to struggle to win a considerable market share. At the same time, however, favourable competitive conditions may alleviate the competitive edge of a firmly established organization. At present, the intermodal sector lacks tools, which allow to assess and evaluate changes in the terminal network.

The present paper revolves around the question, how a sound expansion and development strategy can support new terminals entering the market. It aims to answer which are potential favourable competitive conditions of a new player and contrasts them with the drawbacks of competing against a well-established terminal with a strong customer base. Furthermore, the paper sheds light on the question, which relevance has the current market position of an established terminal to ensure its long-term success.

2. State of the art

Several authors used game theory applications to analyze cooperation and competition among container terminals. Some focused on the impact of the terminal's geographical location, its service level, and shipping distance (Wang and Sun, 2017), others on the benefit of being a first-mover (Zhuang et al., 2014). Pujats et al. (2020) provide a literature review of game theory applications for the cooperation and competition of seaports. Luo et al. (2012) use a two-stage pricing and capacity expansion game to investigate the strategy of two ports, which serve the same hinterland. The authors describe the impact of unequal competitive conditions on the market transition from monopoly to the duopoly and reflect its findings in a case study. They conclude that a high initial market share, large congestion in access roads, low investment costs and high price sensitivity of the competitor increase the likelihood to expand a port's capacity. Other two-stage games focus on traffic volumes for container and bulk cargo operations (Zhuang et al., 2014), cargo transhipment under a vertical integration or separation of the port (Van Reeven, 2010) or port charges (Yip et al., 2014).

Duopoly competition for quality between two consumer products forms a centrepiece of an analysis of Sice et al. (2000). The authors used system dynamics to model the behaviour of duopoly competition and observe an oscillatory behaviour, characterized by a potential change of roles of the leader and the follower. Research and investment costs, timely responses, and recognition lag mainly influence behaviour. In general, the authors underline that the behaviour of the system is highly path-dependent. In system dynamics, path dependence is a known phenomenon of the system archetype success to the successful. Mandl (2019) investigates potential leverage points to this behaviour, i.e. the initial number of adopters, a potential head start of one of the competitors and a different level of technology attractiveness. He underlines that events are especially decisive at the beginning of the competitive process, while later on, the closer a competitor's market share gets to 0 or 100%, the less noticeable is the impact of the leveraging points.

Also, diffusion models of innovation allow understanding the dynamic behaviour of potential adopters and interventions to reach the tipping point of new adopters (Mandl, 2019). Maier (1998) applies system dynamics to innovation diffusion models and underlines the mixed influence of innovative demand and imitative demand on sales. He extends the model to a competitive structure.

To sum up, although different studies focused on describing competitive behaviour and market penetration, none of them paid attention to unequal competitive conditions of rival terminals against unequal initial market shares. Of importance are; moreover, potential time lags known from system dynamics models, the use of leverage points to understand an observed path dependence and insights gained in innovation diffusion models regarding imitative and innovative demand, including the possibility that customers switch to the competitor. A novel contribution of the present research is the combination of learnings from different angles and analyses to understand the dynamics of systems. It examines first, which factors may lead to a favourable competitive condition of a new terminal and how strong his competitive advantage needs to be in order to conquer a considerable market share.

3. Materials and Methods

The present research uses a generic system dynamics model of the competition between two rival terminals. The model is implemented in the software Vensim 7.2., applies monthly time steps and has a simulation horizon of 5 years. The model was checked for dimensional consistency and under extreme conditions. Figure 1 gives an overview of the quantitative stock and flow model structure. It consists of three stocks (represented by rectangles), i.e. accumulations, which characterize the state of the system and accumulate the difference between inflows and outflows. These flows (represented by pipes) are called rates and are controlled by valves (Sterman, 2010).

The model reflects the acquisition of new customers caused by the rates of innovative demand and imitative demand. Innovative demand derives of a percentage of the potential customers and the assumed time to win a new customer. Imitative demand is linked to the number of already acquired customers by a terminal, including the expected time it takes to imitate. The customers, which have been acquired by the two terminals (stock Customers Terminal A/B) add up to the total market of acquired customers. Imitative demand increases with an increasing market share, thus, governs a self-reinforcing process known of the system archetype success to the successful. Furthermore, the model allows for a terminal to lose customers (rate leaving A/B), which decreases the number of acquired customers (stock Customers Terminal A/B) and increases the stock of potential customers that the two terminals compete for. The model consists of eight exogenous variables, which set the model boundary. Namely, the overall number of potential (thus, not yet acquired) customers, which the terminals compete for (total market), the initial number of customers of Terminal A and Terminal B, the price sensitivity of

Terminal A and B, the time it needs to become a new customer (time to imitate, time to acquire), and the time to lose customers.

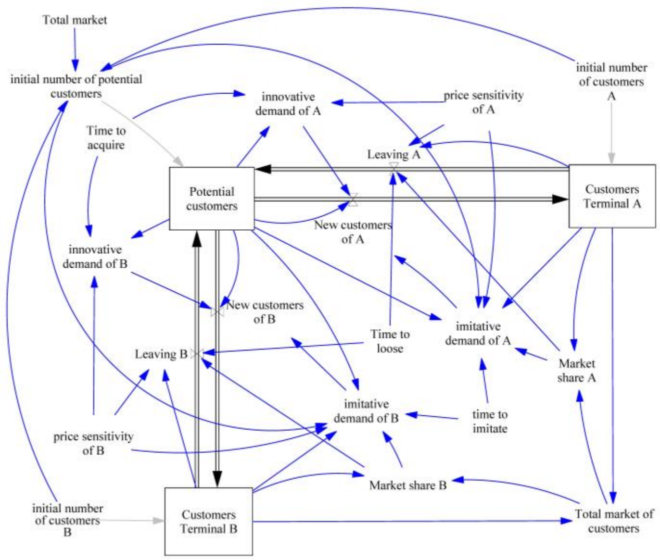

Figure 1. Overview of the stock and flow model

The potential competitive conditions of a new terminal entering the market may be, e.g. the location, thus, its proximity to customers and major transportation routes or its gateway role; furthermore, the number of modes offered by the terminal, the operating and investment costs, the affiliation to a terminal network, or the service offer and the efficiency of terminal processes, which result in reputational gains, price advantages or lower lead times (Protic et al., 2020). Some of the conditions may be influenced actively, e.g. investment can decrease lead times, while others are non-influenceable, e.g. the geographic location. In the system dynamics model, we use a terminal's price sensitivity to reflect the sum of favourable conditions. The price sensitivity is a predefined constant, which accounts to 1 for the well-established terminal and ≤1 for the new entrant. The lower the price sensitivity, the greater the competitive advantages. Therefore, while the price sensitivity of the established terminal is unit elastic and any change in price is matched by an equal change in demand quantity, the price sensitivity of the new entrant is assumed to be relatively inelastic where the competitive advantage of the offer is strong, so even when prices increase, demand doesn't change a lot. In the stock and flow model, the price sensitivity influences all three rates, namely, innovative demand, imitative demand and leaving customers. It is linked to a fictive transhipment price of 1 for both terminals and kept constant during the entire simulation horizon.

The data of the model is based on a fictional case study. The total market is set to a fictive number of 1000 terminal customers. This amount splits into the number of already acquired customers by the well-established terminal (Terminal A), those acquired by the new entrant (Terminal B) and the remaining number of potential customers; thus those, who are neither regular customers of Terminal A nor Terminal B. The initial number of customers of Terminal B accounts to 50, thus 5% of the overall market, which seems to be an appropriate share of customers if only taking into regard the ones located in the immediate proximity to the new terminal. The sum of totally acquired customers is used to calculate a terminal's market share. Therefore, if the initial market share of Terminal A accounts to 50%, the terminal has only as many customers acquired as Terminal B, i.e. 50. Figure 2 provides an example of the behaviour of two variables innovative demand and imitative demand, Figure 3 of the stocks potential customers and acquired customers.

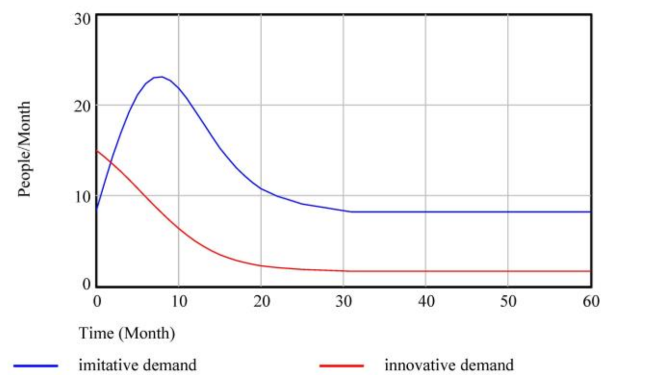

Figure 2. Example of the imitative demand and innovative demand of a terminal (market share of both terminals: 50%, price sensitivity of both terminals: 1).

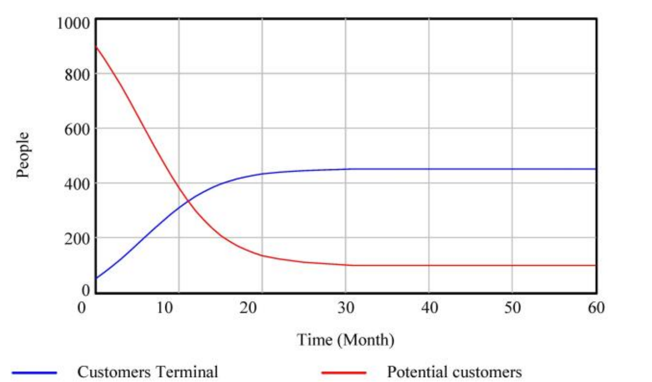

Figure 3. Example of the acquired customers and the potential customers of a terminal (market share of both terminals: 50%, price sensitivity of both terminals: 1).

To understand how strong, the competitive advantage of a new entrant needs to be to have success, we conduct a sensitivity analysis, varying the initial number of acquired customers of Terminal A, thus, its initial market share, and the price sensitivity of Terminal B. Table 1 gives an overview of changing parameters with other input parameters held constant, which results in 153 scenarios.

Table 1. Scenarios of the sensitivity analysis.

	min	max	increment
Price sensitivity of Terminal B	0.2	1	0.05
Initial market share of Terminal A	50%	90%	5%

4. Results and Discussion

Table 2 presents the results of the sensitivity analysis. They show the percentage increase (+) or decrease (-) of the market share of Terminal A, comparing the final time period of the simulation (t60) with the initial time period (t1). The results demonstrate that the higher the initial market share of an existing terminal, the more favourable the offer of the new entrant needs to be. If the existing terminal has a market share of 70% (about 2.5 times as much as our new entrant), the new terminal needs a service offer approximately 1.5 times as competitive as his rival. The results indicate that an approximately linear relation between the initial market share of Terminal A and the competitive advantage of Terminal B assures equal market shares of the two rivals at the end of the simulation period.

Table 2. Results of the sensitivity analysis, changing the initial market share of Terminal A and the price sensitivity of Terminal B. Percentage increase (+) / decrease (-) of the market share of Terminal A, comparing the final time period of the simulation (t60) with the initial time period (t1).

Price sensitivity of Terminal B	Initial market share of Terminal A								
	50%	55%	60%	65%	70%	75%	80%	85%	90%
0.20	-47,6%	-52,6%	-57,5%	-61,9%	-66,3%	-70,3%	-72,9%	-70,5%	-17,9%
0.25	-47,6%	-52,6%	-57,3%	-61,6%	-65,9%	-69,6%	-71,1%	-62,0%	-5,8%
0.30	-47,6%	-52,5%	-56,9%	-61,2%	-65,5%	-68,5%	-68,2%	-43,9%	1,2%
0.35	-47,6%	-52,2%	-56,6%	-60,8%	-64,8%	-67,2%	-62,7%	-18,7%	2,6%
0.40	-47,3%	-51,8%	-56,3%	-60,5%	-63,7%	-64,5%	-50,0%	-7,0%	3,6%
0.45	-47,0%	-51,4%	-55,9%	-59,9%	-62,3%	-59,2%	-23,8%	1,4%	4,4%
0.50	-46,7%	-51,0%	-55,4%	-58,9%	-59,9%	-50,2%	-7,2%	5,5%	5,0%
0.55	-46,4%	-50,7%	-54,8%	-57,5%	-55,9%	-25,5%	4,1%	7,6%	5,5%
0.60	-45,9%	-50,3%	-53,7%	-54,9%	-46,1%	-3,3%	8,7%	8,9%	5,9%
0.65	-45,6%	-49,6%	-52,2%	-50,5%	-24,1%	8,2%	12,1%	9,8%	6,2%
0.70	-45,1%	-48,4%	-49,8%	-40,5%	3,9%	13,9%	13,5%	10,6%	6,5%
0.75	-44,3%	-46,8%	-45,6%	-12,6%	14,4%	17,0%	14,6%	11,3%	6,7%
0.80	-42,9%	-43,9%	-31,0%	11,2%	19,4%	18,7%	15,3%	11,8%	7,0%
0.85	-40,8%	-37,1%	-1,5%	20,0%	22,1%	19,7%	16,0%	12,1%	7,1%
0.90	-36,1%	-21,0%	18,2%	25,4%	24,2%	20,6%	16,6%	12,3%	7,3%
0.95	-27,2%	10,7%	26,6%	27,6%	25,2%	21,2%	17,1%	12,5%	7,5%
1	0,0%	25,6%	31,5%	29,5%	25,8%	21,8%	17,6%	12,6%	7,6%

Figure 4 shows the results in customers of Terminal A and Terminal B when varying the price sensitivity of Terminal B. Three scenario runs, i.e. Terminal B with a price sensitivity of 0.3 (PSb03), with a price sensitivity of 0.5 (PSb05) and with a price sensitivity of 0.7 (PSb07), are compared to the basic scenario with a price sensitivity of 1 for both terminals (Basic). The results indicate that the lower the price sensitivity of the new entrant, thus, the stronger its competitive advantage, the more customers he wins compared to Terminal A. Figure 5 shows the results in customers of Terminal A and Terminal B when varying the initial market share of Terminal A. Three scenario runs, i.e. Terminal A with an initial market share of 80% (MSa80), with an initial market share of 70% (MSa70) and with an initial market share of 60% (MSa60), are compared to the basic scenario, in which both terminals have an initial market share of 50% (Basic). The results clearly demonstrate that a higher initial market share of Terminal A prevents the new entrant of winning customers.

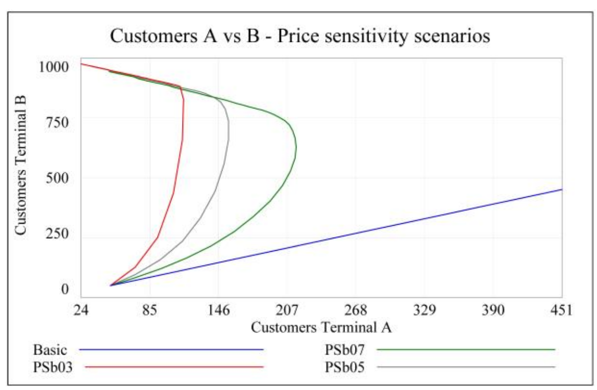

Figure 4: Comparison of the customers of Terminal A and Terminal B. Results of sensitivity runs with Terminal B having a price sensitivity of 0.3 (PSb03), of 0.5 (PSb05), of 0.7 (PSb07) and of 1 (Basic).

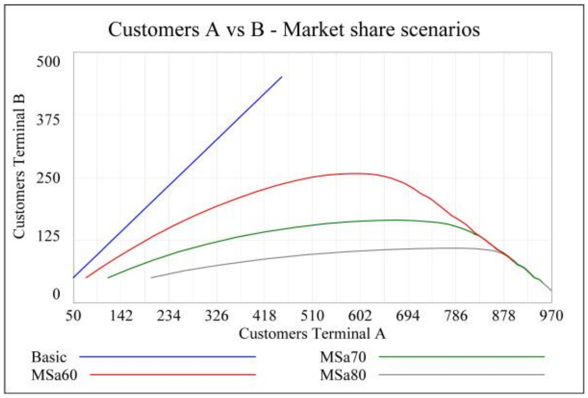

Figure 5: Comparison of the customers of Terminal A and Terminal B. Results of sensitivity runs with Terminal A having an initial market share of 80% (MSa80), of 70% (MSa70), of 60% (MSa60) and of 50% (Basic).

Figure 6 compares the innovative demand and the imitative demand of Terminal B in different scenarios of Terminal A's initial market share, i.e. 80% (MSa80), 70% (MSa70), 60% (MSa60) and 50% (Basic). The results demonstrate that the fewer customers Terminal A has compared to the new entrant, the stronger is the imitative demand of Terminal B. While, a high initial market share of Terminal A forces the new entrant to win new customers mostly through its innovative demand.

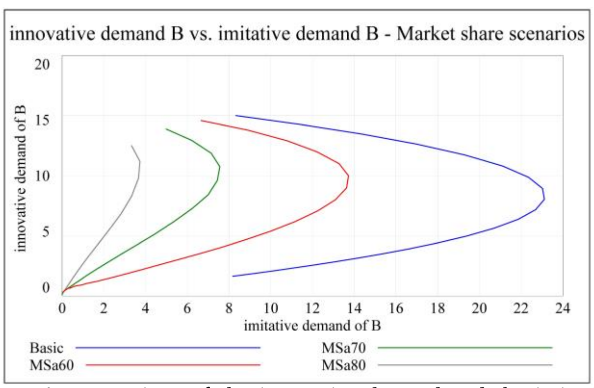

Figure 6: Comparison of the innovative demand and the imitative demand of Terminal B. Results of sensitivity runs with Terminal A having an initial market share of 80% (MSa80), of 70% (MSa70), of 60% (MSa60) and of 50% (Basic).

5. Conclusions

The present analysis shows that strong market penetration of an existing terminal requires a new entrant to have tremendous competitive advantages. Switching costs may additionally prevent customers from choosing a new offer, which brings disadvantages for the new player, even if he offers a perfect substitute. The system behaviour shows the system archetype success to the successful, while the attractiveness of the new offer can serve as a leverage point. Although part of the model's input is based on assumptions, it very well portrays the system behaviour as frequently encountered in practice. The findings make clear that the fight for customers and market penetration is particularly severe for new entrants. The key message is that a sound expansion and development strategy of a new entrant needs to focus on the terminal's competitive edge and use all the available tools for advertising them. Potential favourable competitive conditions may be, e.g. its proximity to customers and major transportation routes or its service offer and the efficiency of its terminal processes. Only a very high market penetration of established terminals ensures their long-term success.

While the present model was used to simulate a duopoly competition of two terminals, it would be interesting to extend the model in order to conduct a network analysis with several terminals in a certain region. Furthermore, in the next step, one should take a closer look at the importance of different competitive conditions.

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