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Efficiency of multi-modal Hinterland Terminals

Herbert V. Ruile[a]*

[a]*University of Applied Science Northwestern Switzerland,*
Institute for business Informatics, Peter Merian Str. 86, 4052 Basel, Switzerland

Abstract

Economic growth and the related international trade trigger a steady increase of container flow on supply chains between the economic areas. Hence, operating competitive supply chains demands for cost efficient and high performing intermodal transport system. Hinterland terminals (HLT) are identified as key resources of inter-modality. However, between the sea port and Hinterland, there is an emerging complex infrastructure coined by heavily discontinuities and a broad range of services. This explorative, multi-case study investigates the information flow within the socio-technical system of HLTs. The research shows, that the freight transport system is a highly fragmented multi-actor network and the efficiency of HLTs are strongly depending on both the vertical collaboration for preparatory information flow within the order and execution system, and the horizontal collaboration for defining standards in services and procedures.
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Keywords: Socio-technical system, Hinterland terminal, information flow, case study

* Corresponding author. Tel.: +41 61 279 18 32.
E-mail address: herbert.ruile@fhnw.ch

1. Introduction

The Rastatt construction site accident in August 2017 hits the Rhine valley line, which is the main freight line for intermodal transport in Europe. About 50% of the trade between Northern Europe and Italy is performed on this intermodal axis. The accident on the railway has severe consequences on transported volume on freight railways (-75%), lead time extension caused by re-routing, capacity overrun on road, waterways and transshipment terminals (Hinterland terminals). It increases unpredictable transportation cost, supply shortages for retail and production stops for industry on both sides of the Alps. The European freight system was close to collapse und resulting in financial damages in high magnitudes. The accident demonstrates the criticality of a complex, less coordinated and inflexible intermodal infrastructure behind seaports. It became obvious, that the management of the Hinterland freight logistics is an international task (force) involving numerous stakeholders like shippers, transport and infrastructure operators, logistic service providers, terminal and port operators as well as regional and international politics. The accident pushes the need for a better, holistic understanding of the intermodal hinterland logistics to create and operate a resilient and sustainable freight transport system supporting European economic health. Beyond the accident, the ever-growing international trade leads simultaneously to mounting freight volume and container shipments between the economic regions. There is an increasing demand for efficient handling capacities at both port site and Hinterland. Within a circular container transport chain the Hinterland terminals has become an important place as a buffer, service station and as an intermodal node managing the transition between water, rail and road transport systems. "Inland terminals are taking up a more active role in supply chains by increasingly confronting market players with operational considerations such as imposing berthing windows, dwell time charges, truck slots, all this to increase throughput, optimize terminal capacity and make the best use of available land" (Rodrigue & Noteboom, 2009).

The efficiency of the Hinterland terminals has been seen increasingly in the light of an integrated and cost efficient logistic system (Notteboom, 2008). From seaport to the local distribution channels a complex infrastructure emerges containing multimodal transport chains, terminals and depots, which are coined by discontinuities and services, displaced from the seaport, and forced to increased competitive pressure. All trends indicate that in foreseeable future the containerized freight transport will further increase. In the mid- and long-term plan of terminal development there are fields of actions identified to overcome the prospected terminal bottleneck: innovative freight transport concepts, regional transport connections, extensions of infrastructure and uprating of existing capacity by process optimization, automation and planning (Geweke, Busse, 2011). The research project put light into the latest field of action.

Seaport terminals have achieved high efficiency by high investment into port standardization and automation. This is not valid for Hinterland terminals, which require more flexibility and their services induce more complexity. The design of the terminal operating concept is defined by the desired flexibility and the available investment capital. A full automated concept requires quite higher investment and delivers less flexibility than a terminal with digital supported manual controlled equipment. Therefore, the development of Hinterland terminals fall back due to less automation capability and missing usage of the economy of scale.

In general, enterprise resource planning (ERP) systems are recognized as effective instrument to optimize operational processes (Framinan, u.a., 2004). A successful implementation of ERP systems may reduce inventories, cost of production, transport, and workload. In consequence, ERP systems have been recognized as critical resource in both large and small & mid-size enterprises (Shaul, Tauber, 2013). In recent years, there were some developments to extend the ERP market for smaller companies and for service business. Consequently, there are some low-cost applications available now: but simplified with few functionalities. They do not fit to the requirements of a service oriented Hinterland container terminal. Neither they optimize the flow of goods nor they manage the combination of a bundle of services (Botta-Genoulaz & Millet, 2006). The research work of Choi & Kim (2003) investigated an ERP approach for container terminals. For their study, container terminal operating systems (CTOS) are necessary information systems, which ensure an efficient operation with the objective to improve the terminal performance and reduce costs. According to their study the pre-dominant functions of a CTOS are:

- Design an efficient container flow within the terminal by optimizing storage and handling
- Plan and control of loading and de-loading, as well as terminal traffic
- Plan and control of the information flow between internal and external actors.
- Performing of services (repair, customs, storage)

The objective of our research work was to investigate efficiency potentials of HLTs. The concept of Supply Chain management promises high rationalization potentials by integration of activities at internal and network oriented interfaces. We follow Goepfert (2016), who distinguishes between logistics management and supply chain management. She scopes Logistics management as the internal logistics, managing material movement, storage and necessary information flow. Supply Chain management considers design and operation of cooperation and relationship of the involved actors. We assume, that both perspectives will influence each other. Therefore, our research propositions are:

- The efficiency of the Hinterland terminal operation influences the efficiency of the overall intermodal transport chain.
- Horizontal and vertical cooperation will reduce information uncertainty and information asymmetry between the actors of the intermodal chain. This enables and supports terminal resource planning and optimization
- The efficiency and effectiveness of a Hinterland terminal itself relies on efficient internal information flows, enabled by an integrated and flexible terminal operating system.
- Hinterland terminal processes have high specificities in the transport chain, but they have also sufficient isomorphism to enable harmonization of terminal activities and standardization of terminal operating systems.

2. Theoretical Background

2.1. Basic Theories

The influence of uncertainty on transaction between actors is formulated and widely proven in the theory of Transaction Cost Economics (TCE) by Williamson (2010). Transaction costs are defined as cost for the exchange of goods and services between separated organizational units. They consider initiation, contracting and enforcement cost of the transaction. Hence, the performance of a value chain, established by adding more than two institution in a sequence, is mainly depending on the performance of these transactions, which itself are depending on frequency of transactions, specificity, uncertainty, limited rationality, and opportunistic behavior. Our research applies the TCE principle for both the micro-economic view, which covers the terminal organization with different functions, and the macro-economic view, which involves the actors of the intermodal transport system. From macro-economic point of view, we assume high and still growing transport volume and therefore higher frequency of transactions. Due to growing environmental, political and economic risk we expect also increasing uncertainty. And due to the complex structure of stakeholder involved, and growing competitive forces we presume limited rationality and opportunistic behavior. All indicators point at high transactions cost and therefore high efficiency potentials. In this situation, the TCE theory would propose a more hierarchical governance, which means the organization of the value chain is moving forward to more integration (e.g. long term contract, joint ventures, insourcing).

But TCE is not sufficient to explain institutional performance. We follow also the theory of resource based view from Barney (1991), who defined: “firm resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness”. A firm can utilize these resources to achieve competitive advantage, if they are rare, non-substitutable, hard to imitate and are able to contribute to customer value: cost, quality, efficiency and effectiveness. Without doubt, in the view of the intermodal transport system, the terminal resources (i.e. location, yard and handling equipment) are specific. From a horizontal point of view all terminals are similar and may have a certain level of isomorphism. However, the investigations of Franc & van der Horst (2008) showed that TCE and RBV are still not enough to describe decisions made in the intermodal transport system. They argue, that these theories do not consider sufficiently the geographic and institutional influencing parameter. Because Hinterland terminals are not in focus of research (Wiegmans, Witte, 2017), we cannot explain in which extend these parameters influence the transport-system’s efficiency.

2.2. Cooperation

The aspect of cooperation within the value chain has multiple been investigated. Their success factors are well identified: trust, leadership, structure, competence. In contrast, the horizontal cooperation between the logistics actors is quite unexplored (Schmolzi, Wallenberg, 2011). Their research work is indicating, that logisticians are attracted by horizontal cooperation, when the economic environment becomes more complex and shows increasing cost pressure. One can suppose, that this behavior is driven by market oriented motives (as market size, market share, market development, market coverage) as well as cost oriented motives (as learning, embedded knowledge, more skilled labor forces). These well-known approaches of cooperation may be categorized as sharing information, best practice, or activities. In order to achieve higher levels of effectiveness, we assume a higher level of horizontal cooperation which allows the harmonization and standardization of internal processes and (IT-) tools cross enterprises. Therefore, we support the thesis, that the capability of growing horizontal cooperation influences positively the potential of operational excellence.

In global business environment and modern supply chains enterprises need to react flexible on the ever-changing influencing parameters. Much of these enterprises assume that "collaboration and creativity in supply chain (SC) relationships are critical to future competitiveness" (Fawcett, 2008). Fawcett defines supply chain cooperation as the capability to design and manage the value chain with the business partners in such a way, that they can fulfill the ultimate customer expectations better than competitors. This is due to the management of the interfaces and the better planning (Koppers, Klumpp, 2010). But claim and reality are drifting apart. There shows additional need for models and methods to close the gap between requirements and capabilities. Among others, there were proposals to establish and test advisory councils (Fawcett, 2008). Furthermore, integration is increasingly recognized as a socio-technical system (Kull, Ellis, & Narasimhan, 2013). In this approach, the technical elements and social elements are progressively integrated equally. Unfortunately, there is only very limited research on cooperation between buyer, seller and logistics service providers (Stefansson, 2006). It looks quite worse for investigations into the cooperation of a multi actor Hinterland freight system.

2.3. Process management for Hinterland Container Terminal

The business process reengineering goes back to the fundamental work of Hammer & Champy (1990) and Davenport (1993), where business processes were linked to information technology capabilities. Their definition of business process still counts: business process is "a set of logically-related tasks to achieve a defined business outcome" and "a set of processes forms a business, the way in which a business unit carries out its business". They mentioned two main characteristics: processes have customers and business processes crosses organizational boundaries. A stream of researchers (e.g. Goksoy 2012, Sentanin, e.a., 2008) arguments that the concept of BPR enables companies to improve their productivity and relationships with customers which is required to survive highly competitive environment. At least, up to now there is no universal approach nor a guarantee for success (Habib, Shah, 2013). Nevertheless, it provides valuable structured approaches to understand how business activities are organized and performed. With introducing the concepts of SCM, the internal logistics concepts were extended. To achieve the next level of performance the focus moved from internal process integration to external (customer-) integration (Kia, Shayan, & Ghotb, 2000, Bergsmann, 2012). A consistent, validated and developable process organization should be suited as basis for a modern process management of container terminals. For this, the complexity of Hinterland terminal processes need to be reduced to allow stepwise process optimizations (Vis & de Koster, 2003).
In the research community, different approaches were applied to optimize greater and interlinked terminal processes. On one hand side, there are operation research and simulation tools, to validate consequences of alternative handling equipment (Lau H., Zhao Y., 2008), storage layout (Kemme, 2012) or vehicle types (Vis I., Harika I., 2004) on the overall terminal performance. On the other side, there are almost none investigation on optimizing terminals as a socio-technical system, which considers organizational structure, processes, people and technology.

2.4. Information and Communication Technology (ICT)

The problematic of integrated information flows in Hinterland terminals will be explained on 4 different levels according Kia, e.a. (2000):

- Level 1: the e-Business concept which allows to manage the relationship and the communication between public administration, company and customer (European Union, 2011)
- Level 2: the ERP approach for integrated planning, optimization and control of terminal processes. (Choi e.a., 2003). In an early phase, the focus was on particular process optimization (crane, transshipment, yard). Recently, integrated optimization systems consider mutual dependencies of sub-systems (Vacca, Salami, & Bierlaire, 2010)
- Level 3: Smart terminal solution, which uses automated identification and guidance of vehicles and intelligent container (e.g. RFID tagged) (Shi & Voss, 2011, Böse, Piotrowski, Scholz-Reiter, 2009)
- Level 4: Software technology architecture, which considers the data modelling, the data flows as well as the object and model oriented programming (Bielli u.a., 2006).

Close related to automation is the issue of information flow integration. Awareness about available information has strongly risen over recent years. Beside achieving cost savings, the integrated information flow (accurate, timely, complete, correct) promises the next level of efficiency (Marchet, Perotti und Riccardo 2012).

2.5. Theoretical model

Based on the literature review on transaction cost economics, resource based view, horizontal cooperation and vertical integration, as well as in discussion and in line with terminal operator, we propose the following theoretical framework:

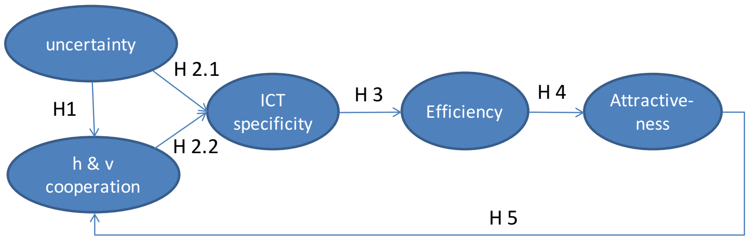

Fig. 1 theoretical framework of Hinterland terminals

Increasing uncertainty and competitive pressure drives horizontal and vertical cooperation (H1). Both are also driving the development of specific ICT solutions appropriate to the specific situation of the Hinterland terminals (H2.1 and H2.2). They will achieve higher efficiency in their operations, which represent a customer value (H3). Better performing Hinterland terminals will be more attractive to their customer (H4), which induces stronger vertical collaboration (H5)

3. Research Methodology

3.1. Explorative research approach multiple case study

Because of the almost unexplored and complex situation of Hinterland terminals we propose an explorative research design intending a better understanding and determining the nature of the problem. Our multi case study approach results in qualitative observations at three intermodal Hinterland terminals located in Austria, Germany and Switzerland. The purpose of the case study is to develop descriptive models to represent the observed phenomena in different terminals in a structured and comparable way (Yin, 2003). Using three cases gives us the opportunity to identify uniqueness and isomorphism cross the cases. Although all cases were Hinterland terminals, they operate in different business environment and have established distinguishing organizational procedures, technologies and structures.

3.2. Unit of analysis

The unit of analysis is the Hinterland terminal as a semi-permeable organization embedded in the intermodal containerized freight transport system and being part of the information flow between involved actors.
The decomposition of the research unit distinguishes between:

- Closed loop intermodal container flow: we observed and tracked the individual container life cycle as moving asset in a closed loop between seaport and Hinterland shippers. At least our focus was at the interface where the physical container flow hits the Hinterland terminal system and triggers terminal activities
- Actors involved and their horizontal and vertical information sharing: we investigated the order processing and information sharing between the involved actors of the intermodal transport chain for a better understanding of the necessary information flow for planning and optimizing of the actors' operations.
- Terminal operating system. Our study on terminal operating system investigated the product characterization, services offered, and their related process management
- Organizational implementation of the processes as a socio-technical system.

The Hinterland terminals investigated are summarized in table 1.

Table 1. Unit of analysis.

Terminal	Functions	TEUs/a	mode
A	Depot, Terminal	475’000	road, rail, water
G	Depot	190’000	road, rail, water
S	Depot, Terminal	300’000	road, rail, water

3.3. Data gathering and validation

The qualitative research design of our case study focuses on interpretation and understanding the context and behavior of the organization. Operations of Hinterland terminals are characterized as socio-technical systems (STS) which is well proven and comprehensive approach for work design (Blok e.a. ,2016). STS considers people, technology, organization and context. Social research however is limited to observe only human artefacts and people’s and organizational behavior (Atteslander, 2008). To capture the socio-technical reality, we used content analysis, observation and interviews. Therefore, we applied a mixed method which relies on secondary data research, informal qualitative approaches and formal qualitative approaches.

4. Result

4.1. Intermodal container flow

The container life cycle flow is similar as many other equipment life cycle models: a container is built, used, stored, maintained, rebuilt/upgraded, has a 2nd life and will be disposed at the end of life. During lifetime owner, user and tenant may change. The containers are in an almost steady flow between the economic areas and are being used by different stakeholder. Most of the container stakeholders take serious interest on actual container location and his condition in order to optimize their operations. In general, this requires an intensive information exchange between the stakeholders to fulfill the requirement for tracking and tracing container movements. During life time the container condition changes by damage, change of use, external and internal contamination, defects, corrosion, additional equipment and configuration. This personalizes each individual container. Hinterland terminals are one of the major service providers during the life time of a container.

For Hinterland terminal, we identified eight distinguishing system interfaces where the container flow may enter or leave the terminal. We named it terminal transfer points. At each of the transfer points we identified distinguishing customers, order processes and order specifications (quantity, time, trip assignment, …). For Hinterland terminals inbound and outbound is multi-modal. Between inbound and outbound the stakeholders of the container expect and request a series of services, which were described later. Depending on the transfer point Hinterland terminals are forced with different uncertainties.

Table 2. Uncertainty at terminal transfer points

Transfer Point	description	uncertainty
1	IN: import forward flow, full container, freight decomposition	Arrival time, loading list, import services, container condition
2	OUT Import forward flow, full container, decomposed badges	Carrier availability, loading list, departure time
3	IN: Return flow, cleared from shipper, checked to store, single container	Arrival time, container condition
4	OUT: Displacement or change terminal location, single container, feed run, from store	Pick up time, container condition requirements
5	IN: feed run, from store, full, from shipper, single/few container	Arrival time, export services, condition
6	OUT: full, export forward to seaport, single container	Carrier arrival and departure
7	OUT: empty, positions shipment, to export port, freight packaging	Departure time, container condition
8	IN: empty, position shipment, to Hinterland	Arrival time, container condition

4.2. Cooperation and information flow in the network of the intermodal container transport system

To describe the macro-economic freight transport in Hinterland, Flitsch and Brümerstedt (2015) investigated 14 descriptive models using the following relevant criteria: geographic area, number of geographical zones, modes (road, rail, water, air), number of commodities, trip modelling steps (generation, distribution, modal split, logistics, assignment), and perspective (aggregated, disaggregated). These models were developed to calculate a "realistic, flexible and behaviorally acceptable demand" (Safwat, e.a., 1988) used for optimizing mode traffic, carrier and handling capacities as well as operations. Decisions making is considered on choice of port, choice of carrier and choice of mode. Decision makers were identified in the transport network as shipper, shipper agents' carrier, carrier and freight forwarder, carrier-shipper, carrier shipper port or as simply as actors (Flitsch, 2015). It displays the complexity and uncertainty of structure, interactions and decision-making procedures considering probabilities, decision criteria and their weights, environmental risks and possible scenarios.

Hence, the container flow is linked to the specific information flow exchanged between the actors involved. In normative or rational decision making theory, this information is needed to minimize cost and maximize profits. However, it does not explain the behavioral decision making considering beliefs and preferences (Tversky, 1986) With each additional actor, the information content increases by adding new data, interactions and interfaces, which requires serious information handling between the parties. Each of the party may require different information to optimize his own operation. Chibba, A. and Rundquist, J. (2004) have differentiated the type of information: direct and indirect information. Direct information considers all data necessary to execute orders: (product/service, time, quantity, quality requirements) and is related to the rational decision making. Indirect information cover information about the market situation, business, future investment/divestments plans and other intentions and objectives of the actors.

Due to the many actors, interactions and relationships between, we applied social network concepts to describe the freight transport system. In phase 1 we identified the actors using both snowball principle and "walk the order line". In the snowball-principle we started at the Hinterland terminal identifying their business partners and went on asking them for their business partners. By "walk the order line" we can follow the order placements starting at importer/exporter to their supplier to the sub suppliers. Semi-structured questionnaires considered direct information (planning, ordering, order tracking, order completion) and indirect information flow (strategic planning, learning, sharing, …). The qualifying criteria were: level of coordination, synchronization and frequency. In general, the results show a quite insufficient information sharing practice: average satisfaction level is at 2 on a 5 level Likert scale.

4.3. Hinterland terminal operation

Companies who are acting in similar business environment, delivering similar products and having similar equipment are showing similar organizational behavior. They show a certain level of isomorphism (DiMaggio, P., Powell, W., 1983). Tan e.a. (2013) differentiate between intuition and competition induced isomorphism with clusters. Both forces drive the potentials for standardization and improved effectiveness. In order to identify areas of isomorphism, we applied a business operating model structuring the Hinterland terminal activities. The business operating model defines four building blocks: order intake, resources, order execution and optimization. "Order intake" represents products and services offered to the market, the customer interface, as well as the sales process. "Resources" comprises yard layout, equipment, organization as well as financial and personal resources. "Order Execution" covers all necessary activities (processes) to fulfill the customer order. At least, "Optimization" describes the planning and control systems of the terminal. We used functional parameters to qualify the inter-organizational isomorphism of Hinterland terminal services: purpose and object of service, location of service, phase of the overall service, frequency of service, decision making within service as well as quality, quantity and time of execution (see also: Hill, e.a., 1994).

More than 30 different services of Hinterland terminals offered to the customer were identified. They may be categorized into logistics services (depot, transshipment, transportation, …), container trade (rent, sell, buy), container service (repair, stuffing, customs, …). The terminal service offerings overlap by 66%. This means 2/3 of the services identified are identical, at least similar to all Hinterland terminals. The object of service is the container. The correct and optimal handling of the container depends however on: ownership, quality, condition, content, form, and fixtures. At least, the ISO 668 differentiate 9 types and 30 sub types, not including tank container and special forms (office, sanitary, water, trailer, …). Therefore, at each transfer point the Hinterland terminal delivers container and service specific output and performance. To generate this output, we identified a set of similar process modules consisting of several activity blocks. For the investigated terminals we summed up 39 differentiated process modules to deliver logistics and container services. Transfer point 3 was chosen as common reference for all investigated terminals/depots to evaluate isomorphism in detail. At transfer point 3 there are 5 common process modules: pre-notification, identification, pre-check, processing and unloading. The level of isomorphism on level activity is given in table below. Although, there is a high level of isomorphism, there is still the wide range of services provoking terminal specific processes.

Table 3. Isomorphism at Hinterland-terminal Transfer point 3

Process module	isomorph	common bilateral	Terminal specific
Pre- notification	63%	11%	26%
Identification	90%	0%	10%
Check	52%	40%	8%
Processing	52%	4%	44%
unload	100%	0%	0%

4.4. Hinterland terminal operation

Hinterland terminal operation were investigated as social-technical system considering people, organization and technology. The aspect of people is considered herein by their competence profiles. In detail, our interest was focused on decision making competence. In small terminals, we recognized a one-person-decision-making situation. Hereby, it is a necessary precondition for correct and good decisions, that these experts have correct, timely and complete information. In uncertain situations with growing business impact the decision-making process becomes a cooperative with other business functions and customers. The information need to be shared real-time between different internal and external stakeholders. At least, the quality of decisions depends on available expertise and methodologies. The aspect of organization is considered by the level of formalization and structural embeddedness of procedures. The more organizational functions are involved in the process module, the more formalized exchange of information between the involved parties is necessary. Technology was categorized into 4 types: tools supporting the activity (e.g. lamp), people to people communication (e.g. phone), people to object communication (ID reader), and people to system communication (e.g. tablets). We see strong opportunities and progresses in digital supported internal communications.

Planning and control of activities and resources are strongly depending on early information availability. Uncertainties in the information flow lead to inefficient operations. We have identified major drivers of uncertainties in the container freight system and summarized in table below. The rising complexity of the freight system involves more and more actors and indicates enforcing uncertainties.

Table 4: Uncertainty in freight transport system

process	Uncertainty	driver
Order	delivery time, dispatch time, order cancelation	mode, transfer points
	incorrect loading list, unknown usage	No of shiploads
	unknown container conditions wrong assessment of container condition	No of Containers, Checker experience
Customer	Requirements, Decisions, e.g. Services – offers Retention, cooperation Market development	No of Customers, services Competitive forces Macroeconomic parameter
Technology	Technology development (e.g. smart terminal) Technology acceptance	Market size, power, value
Context	Regulatory terms and conditions License, permission Reporting, documentation	No of authorities No of customer

5. Conclusion

At a first glance the operation of Hinterland terminals seems to be simple, because, from a bird's view, their primary activities are load, unload, move and store containers. Complexity rises to get the answer to: what, where, when, who and how to coordinate available resources of people, equipment and working space to achieve high customer satisfaction. Most of the involved actors are unsatisfied with the existing quality of information flow resulting in inefficient operations. This gives pressure to the whole system and requires a major change in the overall information flow in the freight system. According TCE we expect and observe early structural changes: increased integration and take overs. Hinterland terminals operate in similar economic environments within the intermodal freight transport chain. Therefore, they show a high level of isomorphism on services and processes. Unfortunately, they do not explore it as a competitive advantage. Most of the relationships are established in short term contracts, geographical distance and differing regional interests of authorities hinder major steps in standardization and process optimization. The high fragmentation of market and the missing coordinative governance limits further necessary improvements. Increasing competitive pressure gives opportunity to new forms of horizontal and vertical cooperation which are not yet formal established.

Since the introduction of business process engineering (with ICT), the objective was to develop highly integrated processes. Unfortunately, integrated processes are not flexible enough. Hinterland terminals offers a wide range of services, which requires both flexible resources and planning & control systems. The modularization of processes, the availability of smart communication technologies and the capability of module configuration offers opportunities for future process designs and related terminal operating systems. By identifying isomorphism and process modularization, the potential of Hinterland terminal optimization may be achieved by two steps. First: reducing complexity and improving flexibility by process modularization. Second: establishing horizontal cooperation and developing common process building blocks, which can be integrated easily into the overall modular process framework. The managerial consequence will be: collaborate or die!

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