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Differentiation of access management services at seaport terminals: Facilitating potential improvements for road hauliers

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ABSTRACT

Plagued by congestion and long turnaround times, road hauliers' access to seaport terminals suffers from inefficient seaport terminal and haulier operations, poor information flows between hauliers and seaport terminals and a lack of high-quality, real-time data. To address hauliers' poor access management at seaport terminals, five access management services provided by different seaport terminals worldwide were identified as part of an ongoing conversation about such services. This paper offers new insights to both scholars and practitioners by differentiating the services according to the elements of turnaround time, access reliability, access precision and access flexibility, characteristics of which were identified during a review of relevant literature. The potential impacts of the elements for each access management service were investigated during empirical studies involving six semi-structured interviews and two workshops with participants (i.e. two hauliers and a seaport terminal). The chief finding is that access management services able to exchange information in real time have greater potential to improve access management for road hauliers.

1. Introduction

Congested physical environments such as seaport terminals (named as terminals in this paper) are characterised by inaccessibility (Hesse and Rodrigue, 2004) that can prompt inefficiency and bottlenecks (Islam et al., 2013). Worldwide, bottlenecks are a problem at terminals (Dekker et al., 2013), where increased congestion prolongs turnaround times for trucks receiving containers (Konings et al., 2013). Such congestion can arise due to the local regional environments of the terminals (Monios et al., 2018) and from inefficient terminal and haulier operations (Sternberg et al., 2012b), which can stem from poor information flows among the actors,[1] meaning hauliers and terminals (Buijs and Wortmann, 2014; Styhre, 2013; Zhang and Pel, 2016), who have noted that such flows between hauliers and terminals are critical for their efficient operations. Such information flows can suffer from a lack of high-quality, real-time data, which forces haulier operators to make decisions based on prior experience or outdated or incomplete data (Steadieseifi et al., 2014). Ultimately, deficient decision making negatively affects accessibility for trucks receiving containers at terminals (Ballantyne et al., 2013).

To improve accessibility for trucks receiving containers, studies have underscored that reliable interaction and collaboration between hauliers and terminals are pivotal (Bisogno et al., 2015; Sternberg et al., 2012a). Reliable interaction and collaboration are possible by enabling better real-time information exchange among actors (Boile and Sdoukopoulos, 2014; Styhre, 2013), largely because improved information flows can afford improved *access management*, defined as the management of the process of actors accessing resources[2] for specific activities[3] in transport systems Jacobsson et al. (2017). Improved access management is critical when differentiating services and products according to customers' requirements in efforts to improve the competitiveness of terminals (Clott and Hartman, 2016). Improved access management can additionally improve efficiency in terms of time-savings at terminals (Goetz and Rodrigue, 1999) and is important not only for the terminal to stay competitive (Horst and Langen, 2008) but also for the entire transport chain (Konings et al., 2013).

For road hauliers, access management can be improved by adopting various access management services. Currently, five such services have been identified that focus on improving the access management for road hauliers at terminals: information access services (Heilig and Voß, 2014), automated gate services (Dekker et al., 2013), pre-notification and appointment services (Wasesa et al., 2017), real-time information

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[1] *Actors* refers to people or organisations within a network (Håkansson, 1987).
[2] *Resources* refers to immaterial or material resources, whether mutually dependent, human, physical or heterogeneous, that are owned by actors (Håkansson and Snehota, 2006).
[3] *Activities* refers to actions conducted by actors based on specific resources (Gadde et al., 2003).

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exchange platform services (Carlan et al., 2016; Huynh et al., 2016) and dedicated access services (Boile and Sdoukopoulos, 2014; Zhao and Goodchild, 2013). Those services reveal various levels of access management with different degrees of efficiency, meaning that access management can be differentiated to meet the specific demands of customers—that is, groups of people or individuals who obtain and often pay for a service (Johnston and Clark, 2008). However, little research has been conducted on categorising and differentiating those services. According to Heilig and Voß (2017), only one study has addressed the topic; nevertheless, it categorised different information systems while excluding existing and potential services that do or could be based upon them at terminals without differentiating the systems and the services.

According to Looy (1998) the differentiation of services can be an important competitive advantage for service providers such as terminals (Robinson, 2002), for terminals that offer the best services at the best price are likeliest to attract the most customers. Services offered to customers are called *customer services* (Jonsson, 2008; Lumsden, 2006), which in the study reported here represent the five access management services provided by terminals and offered to hauliers. According to the model depicting how customer services are expressed in different customer service elements (Christopher, 2011; Oskarsson et al., 2013), the performance of access management services can be articulated in terms of four elements: turnaround time, from the moment that hauliers initiate truck drivers to begin driving to a terminal to retrieve containers until the drivers leave the terminal area; access reliability (i.e. correctly handling of access); access precision (i.e. on-time access); and access flexibility (i.e. ability to adapt to changes during the transport process).

The purpose of the study is to explore how the five identified access management services can be differentiated in terms of four service elements: turnaround time, access reliability, access precision and access flexibility. The customer service elements were investigated via participant observations, six semi-structured interviews and two workshops with participants (i.e. two road hauliers and a terminal).

The study's chief finding is that the more efficiently an access management service can exchange information in real time (e.g. with dedicated access and real-time information exchange platform services), the better able it is to improve access service elements. Moreover, differentiation can also improve visibility for terminals' decision makers as they plan to implement other access management services in efforts to improve access service elements (e.g. decreased turnaround time and increased access reliability, access precision and access flexibility).

2. Review of relevant literature

In this section, the relevant literature is reviewed in terms of what access management services are contemporary existing, and how these services can be differentiated in terms of various service elements.

2.1. Access management services

To improve access management for hauliers at terminals, five different access management services have been identified. The following paragraphs detail their chief functions and characteristics in terms of whether they (1) offer information sharing (i.e. uni-directional information flows) or information exchange (i.e. bi-directional information flows) between hauliers and terminals according to the definitions of Jacobsson et al. (2017); Mohr and Nevin (1990), and (2) are able to manage truck traffic to terminals in off-peak hours (Bentolila et al., 2016; Maguire et al., 2010).

First, using software systems, information access services include services constructed via a web interface or browser (Baumgrass et al., 2015) and can advance only the sharing of information from a terminal to road hauliers. For example, terminals can provide information to hauliers via webcams (Huynh et al., 2011), or via information technology (IT) systems or webpages (Heilig and Voß, 2017), which can include the cloud-based Smart Port Logistics project in Hamburg, Germany. Smart Port Logistics provides traffic information about accidents, congestions and updated closure times of moveable bridges (Heilig and Voß, 2014). With such information, the truck arrivals to terminals can be utilised if the hauliers are willing to use the information and send the trucks to the terminals when less congestions are present during off-peak hours.

Second, automated gate services use automated gate systems that minimise unnecessary stops for trucks at terminals due to automated container inspections (Dekker et al., 2013). Such systems can allow information sharing via port community systems (Heilig and Voß, 2017), without which some terminals have introduced self-service stations located externally. With those stations, truck drivers can inform terminals of their arrival, which can accelerate processing at gates (Heilig and Voß, 2017). Regarding processing at gates, truck arrivals cannot be managed to off-peak hours with automated gate services.

Third, pre-notification and appointment services use timeslot allocation systems (Giuliano and O'Brien, 2007), including truck appointment systems (Chen et al., 2013b; Phan and Kim, 2015), vehicle booking systems (Islam and Olsen, 2014; Islam et al., 2013) and truck scheduling (Hall, 2001). Such services enable trucks to notify terminals of delays along routes and of arrival times at terminals (Wasesa et al., 2017). With such information, terminals can begin readying access for hauliers in advance. The hauliers´ resulting truck traffic to terminals can be equalised by using the pre-notification and appointment services since they can manage the trucks to arrive in off-peak hours (Giuliano and O'Brien, 2008).

Fourth, real-time information exchange platform services use decision support systems, real-time systems and transaction processing systems (Buijs and Wortmann, 2014). An example of those systems is port community systems, which can enable real-time information exchange among actors via the exchange of extensible mark-up language messages (Heilig and Voß, 2017) that include physical variables such as audio, video, text and numbers via sensors. By using real-time information exchange platform services, both terminals and hauliers can improve visibility and achieve more accurate, effective transactions (Carlan et al., 2016; Huynh et al., 2016). For example, by exchanging real-time gate congestion information, the truck arrivals can be managed (e.g. to spread the truck arrivals to off-peak hours) and in turn minimise the congestions at terminal (Sharif et al., 2011).

Fifth, based on the same information systems as pre-notification and appointment services and real-time information exchange platform services with corresponding characteristics of information flows, dedicated access services allow more efficient access for hauliers with appointments to terminals to certain priority lanes (e.g. green lanes) or specific timeslots based on price, urgency or liability (Zhao and Goodchild, 2013). By exchanging such information, terminals can more easily handle truck traffic at terminals and in turn be able to spread out the arrivals to off-peak hours (Boile and Sdoukopoulos, 2014; Heilig and Voß, 2017).

2.2. Differentiation, customer services and access service elements

Differentiation means to develop and market distinct products or services to meet customers' demands (Clemons and Weber, 1994; Magrath, 1988). Differentiating products and services involves establishing differences according to characteristics (Dickson and Ginter, 1987) such as complexity and features that make products or services unique (Magrath, 1988). Although both products and services are necessary for access management, the latter can most improve access management. Therefore, this paper considers only the differentiation of services.

Services offered to customers are called *customer services*, and they are influenced by information flow, logistics services and delivery services (Jonsson, 2008; Lumsden, 2006). Information flow is a