ICD concept: An overview of the development from an original purpose to a global viewpoint

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Abstract. The shortage of space, congestions in seaports and inland connectivity have primarily resulted in establishment of original ICDs as nodes in a multimodal transport. Progressively, the concept of ICD has been required to develop through new generations due to international logistics and global supply chain. This article focuses on analysing the development of ICD from its initial purpose to broader perspectives via numerous studies in literature. Moreover, the classification of ICDs based on relative distance from a seaport including near ICD (below 150 km), middle ICD (from 150 to 500 km) and distant ICD (above 500 km) to be appropriate for intermodal transports as an outcome of this research Finally, a combination of these types of ICDs could be an alternative solution for their distributions in logistics transport

Introduction

Development of connection between seaports and their inland areas has been more important for supply chain in many parts of the world. In order to develop the market, seaports have attempted to increase their capacities. The inlands of seaports are able to significantly enlarge due to factors acknowledged such as : containerisation, door to door services, globalisation and multimodal transports [1, 2]. Nevertheless, the obstacle of seaport development is the increasing containerised transport and urbanisation. It leads to congestion on the access routes serving terminals, seaport gates and developing area shortage of seaports. Consequently, this factor had sparked to create an Inland Container Depot (ICD) concept, where many functions of seaports are outsourced at the reasonable hinterland locations [2]. The idea of ICD as a multimodal transport node with connecting rails/roads/ waterways and seaports, is certainly not new. Actually, ICD concept can cover more functions than its original purpose. Therefore, numerous definitions have been generated [3-6]. As

a result, there was a consensus on the higher importance of ICD. It means that an ICD must be global perspectives with improving cost-efficiency, environmental issues, global logistics and supply chains [4, 7]. The main objective of the article is to analyse the expanding ICD concept from an original idea to the global perspectives and classify ICDs according to distance from seaport as a solution to redistribution of container cargo.

Methodology of research

A methodology of this research is an analysis the ICD concepts from the literature with about 109 scientific articles and international proceeding reports regarding keyword: "ICD, dry port", as an essential input part of the research mission. An extensive literature review is to provide good insight into the development of ICD concept. The literature methodology contains three-steps including: (1) definition of original ICD concept; (2) the development of ICD generations through global cases studies; (3) relatively classify ICDs following a viewpoint of distance from seaport.

Overview of conventional ICD concepts

In the literature, there are several different definitions of ICDs used for either the same hinterland terminal facilities or different facilities:

ICD is Inland Clearance Depot that is a common concept of hinterland infrastructure. It is preferred to associate with seaports or airports, with public authority status, equipped with fixed installation, and offering services for handling and temporary storage of any kind of goods [2].

ICD is Inland Container Depot that is focused on facilities for handling and temporary storage of import/export stuffed and empty containers [9]. India firstly introduced Inland Container Depots (ICDs) in 1983. Fundamentally, an ICD is a consolidation node for containers where are generally located outside the seaports.

ICD is Intermodal Freight Centre that is a concentration of economic independent companies working in freight transport and supplementing services on a designated area where a change of transport units between traffic modes can take place [3]. This concept is normally used in Euro.

ICD is Inland Freight Terminal that was defined by Eurocode [10]. Accordingly, ICD is often located inland, generally far from seaport terminals. ICD is an intermodal terminal where value-added services is given or a merging point for different traffic modes involved in distributing goods that comes from ports and is directly linked to seaports.

ICD is Dry Port that is a facility connecting between seaports or airports and hinterland in local and international trade. A dry port usually provides both local

and international logistics and distribution services, including freight forwarding, customs brokerages, integrated logistics, and information systems [11].

Basically, most seaports are placed in cities or the gateway of economic areas, where requests the effective and safe goods transport. Simultaneously, space and facilities for loading, unloading, storage, terminals are also demanded to guarantee the development of the seaports. The conventional ICD concepts above cover all not enough aspects of hub's functions due to only common feature linking to seaports. Therefore, a more precise definition and category of the ICD concept is necessary to come up with broader perspectives.

Discussion about the global viewpoint of ICD development

The global perspective of ICD concept has been developing from the application for many parts of the world such as Europe, North America, Africa and Asia. Generally, an ICD is planned in the proximity of an existing or potential production or economic centre. The number of ICDs depends on locations and economic activities. About 150 ICDs were established in North America, 130 in Europe and about 200 ICDs in the Asia-Pacific region by 2015 [12]. Many factors involved such as material flows, infrastructure, logistics and stakeholders were also indicated in the ICD development [12]. In which, logistics services are a key aspect providing on the planning, location and utilisation of ICDs. Thus, new ICD is much more than original one and should cover additional services to give support to maritime container logistics such as customs services, inspection services, empty container depot services and other added value logistic services such as stuffing and stripping or warehousing could be also integrated in ICDs. The other researchers revealed that the dynamics of price, cost and quality services are primary facets of improving ICDs. For example, the development of ICD in India was focused on providing better quality services and policy rather than offering low cost [13]. The development of ICDs in China has shown another aspect that ICD was known as a node in global supply chain. The ICD concept has only used in China since 2002. However, due to the economic strategies focusing on the extremely large hinterland with remarkable resources enhancing for ICD structures [15]. According to the concept of new ICD in China, it is only node in the global supply chain and has close relations with seaports; it can collect and distribute cargoes for seaports. Thus, the efficiency of ICD has vital importance for a seamless global supply chain. The concept of ICDs has been developing from simple to complicated services through their new generations [16, 17]. Discussions among policy makers on ICD concepts primarily handled the step by step to improve from basic ICD to ICD with more services. As a result, there are numerous ICDs that were built to explore both domestic and global market for multimodal transport. It has led to an increasing attraction for interconnection between nodes and improving logistics transport system. Clearly, the new generation of ICD concept has provided more benefits such as logistics

efficiency, low environmental impact and improvement of quality services. However, there is no common formula for developing ICDs in general due to the significant difference in regional and local transport policies, as well as infrastructural logistics plans in specific countries. Thus, it is generally admitted that the development of ICDs is a global phenomenon with local characteristics [17].

Classifying ICD according to distance

Currently, there are three different types of ICD linking to seaports [18]. In which, a single ICD servicing one seaport, a single ICD servicing multi-seaport and multi-ICDs servicing the same seaport. Based on the location of an ICD in comparison to distance from seaports, they might be classified including distant, middle and near. Accordingly, a distant ICD has the longest distance of three ones.
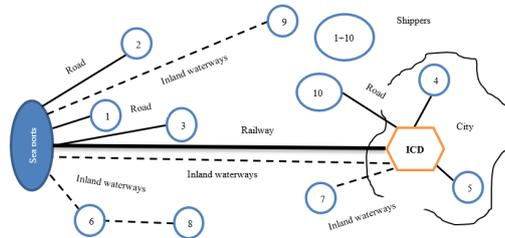
Fig. 1. Seaport with a distant ICD

Fig. 1. indicated that a seaport linked to its ICD with a long distance. The advantages of distant ICD in relation to road and rail that caused reduction of congestion at the seaports and its surroundings. Moreover, the distant ICD is promoted in a broad hinterland due to low cost and high-quality services. Particularly, it might make more services even though seaports are reluctant to transport in containers unconnected to shipping. Nevertheless, road transport does not directly benefit by transporting containers from road to rail, but they are still in relation to the intermodal transport chains.
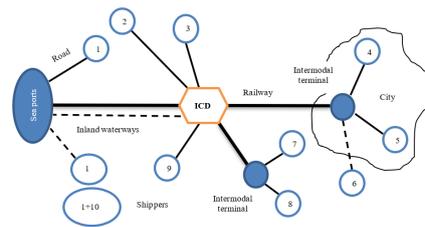

Fig. 2. A middle ICD in linking to the seaport

Moreover, geographical and demographical conditions primarily influence on the competitiveness of road and rail transport. The rail transport is generally competitive at distances above 500 km [19]. Mid-distance (from 150 km to 500 km) is appropriate for road transport in hinterland as shown in Fig. 2. In this case study, it

is necessary to establish mid-distant dry port in term of a middle ICD to connection seaports with conventional intermodel terminals or cities.

A near ICD is to describe an ICD placed at the edge of the seaport city. It supports for road transport from shippers outside the city area as shown in Fig. 3. Compared to the other types of ICDs, larger possibilities for buffering containers can be provided by a near ICD. Clearly, the risk of container vessels waiting is decreased significantly due to highly reliable rail service. A radius of less than 50 km from the seaport is relatively appropriate for setting up a close ICD [4].
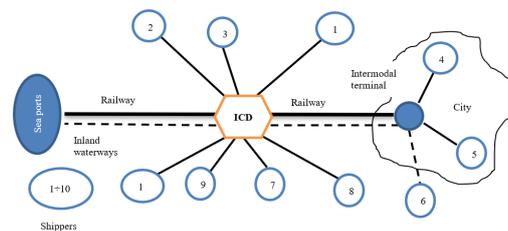
Fig. 3. An ICD in proximity with connection to the seaport

A combination of the three types of ICDs could be alleviated drawbacks of road transport connecting between a seaport and its city area as shown in Fig. 4. In the case, the shippers closest to the seaport (1, 2, 9 and 10) connecting to a near ICD, shippers (7 and 8) linking to middle ICD through another intermodal terminal and the shippers (3,4,5 and 6) transporting to the distant ICD are used either railways or inland waterways to seaport. Consequently, gate congestion in the seaport is unavoidable. Therefore, the intermodel connections between seaports and shippers with ICDs is an answer this problem.
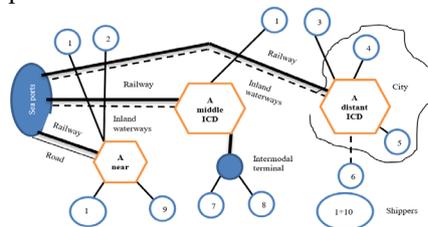
Fig. 4. A combination of intermodel connections with ICDs

Conclusions

A conventional ICD concept is an initiative as a transport node to deal with a lack of capacity, efficiency issues and congestion in the seaports. Progressively, ICDs have confronted the high density of freight distribution, the augmented focus on multimodal transport infrastructures and capacity problems due to globalisation, containerisation, global logistics and supply chain. Thus, it is essential for ICDs to expand their functions to solve such problems. The development of ICDs is different

from other countries due to local characteristics, but the global perspectives of ICD generations is the same way. This article proposes a combination of ICD's distributions based on their categories according to distance from seaports as one of solutions for dealing with the improvement of ICDs. For further research, other solutions will be considered such as the operational and tactical level to provide more studies in different regions.

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