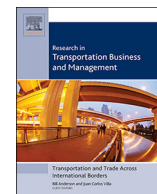




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Competition and cooperation for intermodal container transshipment: A network optimization approach

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ABSTRACT

This study presents an analysis of cross-border competition and cooperation between ports in Bangladesh and India. Nepal and Bhutan are countries without access to seaports — two landlocked countries in South Asia, depending solely on the Indian port of Kolkata for their international seaborne trade. Alternatives do exist in the Bangladeshi ports of Chittagong and Mongla but these are not exploited, in spite of trade agreements that allow access to a third country's port, and/or crossing the land of a third, intermediate, country. We formulate a mixed integer linear programming optimization model to find the optimum economic benefit of port users (serving Bhutan, Nepal and Northeast India) and port authorities (Chittagong, Kolkata, Mongla), were Indian and Bangladeshi ports to cooperate in serving intermodal transshipment traffic. Our results show that port users would benefit greatly from such a cooperation, in terms of reduced transportation costs, although Kolkata Port Authority (KPA) would suffer a revenue loss for which it ought to be somehow compensated. Sensitivity analyses considering equal terminal handling charges (THC) for transshipment container at the three ports, as well as different capacity and demand volatilities are also carried out, to establish the robustness of any strategic decisions that might be made on the basis of our findings. Finally, we show that inland transportation costs determine container transshipment demand to distant hinterlands, rather than THC at ports.

1. Introduction

Landlocked countries, i.e. countries without direct access to the sea, rely on their neighbours for access to the international markets of their imports and exports. Article V of the General Agreement on Tariffs and Trade (GATT, 1994) provides freedom of transit to landlocked countries through the most convenient routes of accessing World Trade Organization (WTO) member countries (Sen, Mukhopadhyay, & Gupta, 2011). Article VIII of the South Asian Free Trade Agreement (SAFTA) also emphasizes the importance of simple customs procedures, regional transit facilities, efficient communication systems, and development of transport infrastructure (Kharel, 2009).

Landlocked countries often face significant challenges including higher transportation costs, escalating import prices and poor international competitiveness of their exports (Frankel & Romer, 1999; Limao & Venables, 2001; Srinivasan, 1986). As a result of their often precarious socio-economic situation, landlocked countries are also weak negotiators of bilateral transit agreements, even with the help of international organizations such as the United Nations (Nayak, 2016).

Among the 31 landlocked countries in the world, 16 are least developed, and three of them are in South Asia; namely Afghanistan, Bhutan and Nepal. With regard to Bhutan and Nepal, which are the subject of our analysis, bilateral transit agreements with India do exist, but political tensions have not so far allowed their effective use (Kharel, 2009).

More specifically, although Bhutan and Nepal could easily use the Bangladeshi ports of Chittagong and Mongla as an alternative to Kolkata, this would imply the crossing of Indian territory, for Bangladesh is surrounded by India in all of its inland borders (Islam, 2008; Kharel, 2009; Nayak, 2016; Rahmatullah, 2009). Indian transit distances are admittedly short (only about 50 km), but protectionism and geopolitical disputes¹ between Bangladesh and India have been key inhibitors of the use of this alternative. Transit agreements between Bangladesh and Nepal and Bangladesh and Bhutan exist since 1976 and 1980 respectively. In 1997, India and Nepal concluded an agreement, allowing Nepal road transit for its bilateral trade with Bangladesh (Kharel, 2009). On June 15, 2015, India, Bangladesh, Bhutan, and Nepal signed a sub-regional *Motor Vehicles Agreement* to facilitate easy cargo movement across their borders (Banerjee, 2015, p.2). Despite

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¹ For instance, sea-borders and sharing of waters of the Teesta and Feni rivers.

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such initiatives, there has been minimum progress on the transit issue, for both Nepal and Bhutan, due to political tensions and lack of co-operation among the countries. Moreover, accessibility of Bhutan and Nepal to the facilities of the port of Kolkata has been decreasing from 2013 to 2016.² Import and export costs have increased in the case of Nepal, although stable for Bhutan (see World Bank Development Indicators at: data.worldbank.org). The difficulties of Nepal in availing itself transit through the port of Kolkata are highlighted in many studies, including Kharel (2009); Nayak (2016); and Saha (2017).

Apart from Nepal and Bhutan, there are regions in India's northeast which are economically landlocked due to their distance from Indian ports and (poor) transport infrastructure to the mainland, as well as due to the physical presence of Bangladesh between them and the port of Kolkata. These pseudo-landlocked regions of India are known as Seven Sister States (SSS). Although Article V of WTO does not cover transit issues of pseudo-landlocked regions, the SSS region of India shares a long border — along with history and culture — with the Northeast of Bangladesh. Before the Indo-Pak war of 1965, the region was connected to the Chittagong Port via inland waterways transport (IWT), and its trade with rest of the world was facilitated by this port. As IWT is no longer available (since the 1965 war), the SSS region suffers significantly in terms of economic growth, compared to the rest of the country.

Recently, things appear to be changing. In return for using the ports of Chittagong and Mongla, as well as the road, rail and inland waterway transport network of Bangladesh, to transport goods to its north-eastern region, the Indian government has agreed to allow Bangladesh to use the Indian transportation network to provide transshipment facilities to Bhutan and Nepal (Parvez, 2015). Bangladesh has been reluctant in responding to Indian interests, for a long time, trying to negotiate all bilateral issues in one package (Islam, 2008). Recently, however, Bangladesh has realized the considerable economic gains that could be achieved from providing transshipment facility to third countries (Nepal and Bhutan). At the same time, India has approached Myanmar, exploring transshipment possibilities to its pseudo-landlocked region. In spite of its strong ties with China (India's competitor in the region), Myanmar has shown a certain interest in strengthening bonding between the two countries. However, the Myanmar route would be far more expensive for India, due to travel distance, time, capital investment in infrastructure and bureaucratic procedures.

In this background, we design a transshipment facility problem of a system serving Nepal, Bhutan and the SSS region of India, using the ports of Kolkata, Chittagong and Mongla. The model is designed as an intermodal container transportation network optimization problem, in view of the required change of transport mode to final destination. As in Haralambides, Veldman, Van Drunen, and Liu (2011), our objective here is to establish empirically, whether it could make economic sense to port users and port authorities to 'somehow' cooperate in serving the landlocked countries and regions.

Such a cooperation could be seen as a *port alliance* serving partially overlapping hinterlands; perhaps something of a movement towards the development of a regional port cluster (Wang, Ng, Lam, & Fu, 2012). Port clusters are not new, and examples can be found, among others, in the ports of Pearl River Delta in South China, as well as in the recent grouping and aggregation of Italian ports. Naturally, alliances among ports located in different countries are bound to be much more difficult, both in the short-run (e.g. harmonized transshipment pricing) and in the long-run (investment planning and port development).

2. Literature review

Multimodal transport refers to an integrated system of moving goods quickly and seamlessly, from shipper to consignee, by at least two

different transport modes, under a single contract of carriage (UNCTAD, 2001). *Intermodal* transportation, instead, is a type of multimodal transportation, from origin to destination, without handling of the goods themselves or changing the type of their unitization (e.g. container) (UNCTAD, 2001). The existence of intermodal transportation facilities is essential for the integration of ports into global supply chain networks (Song & Panayides, 2008). Hayut (1981, p.160) describes the importance of intermodal transportation for ports as follows: [...] *intermodal transportation systems have a profound effect on port structure and operations, they have modified some of the traditional port functions, and have introduced new dimensions to port competition, port hierarchy, and hinterland delineations.*

A well-researched concept, relevant to our work here, is that of *port regionalisation*. Notteboom and Rodrigue (2005) define port regionalisation as that phase of port development where ports expand their hinterlands [...] *through a number of market strategies and policies that link them more closely to inland distribution centres.* Obviously, intermodal transportation facilities are again essential to port regionalization (Monios & Wilmsmeier, 2013) which, understandably, intensifies competition among neighbouring ports serving often distant albeit overlapping hinterlands (Haralambides, 2017, 2002). The result of the above trend is the emergence of several multi-port gateway systems (see Hamburg-Le Havre range of ports in northern Europe), offering shippers a wide choice of alternatives for the routing of their cargo.³

The active involvement of port authorities in the development of their hinterlands (and related logistics facilities) has a significant impact on the port's capability to attract container volumes from distant hinterlands (Rodrigue & Notteboom, 2006; Van den Berg & De Langen, 2011). This requires the active cooperation and coordination of all port stakeholders, with intermodal transport operators, inland terminals and logistics providers playing the core part in the regionalization phase of a port (Monios & Wilmsmeier, 2013). A good example of hinterland strategies, as reported by Van den Berg, De Langen, and Costa (2012), is the initiative of the Port Authority of Barcelona to invest in a rail shuttle between Barcelona and Lyon, thus capturing market share from a distant hinterland. The same authors report similar success stories, through intermodal transshipment network developments, at the ports of Rotterdam, Antwerp, Gothenburg and Zeebrugge. In general, the development of intermodal transshipment networks, to serve distant hinterlands, is evident in Europe (e.g. port authorities of Rotterdam, Le Havre, Barcelona, Marseille, Lisbon, Antwerp and Copenhagen) (Donselaar & Kolkman, 2010; Monios & Wilmsmeier, 2013; Notteboom, 2010; Van den Berg et al., 2012) and East-Asia (e.g. port authorities Shenzhen, Guangzhou) (Liu, Wang, & Yip, 2013).

However, as already mentioned above, the situation is in general quite different in South Asia. On top of this, being landlocked countries, Bhutan and Nepal are in need of a better intermodal transport network to connect them with the ports of their neighbouring countries. Interestingly, while Nepal is actively looking forward to an alternative to the port of Kolkata (Islam, 2008; Nayak, 2016), Bhutan seems to be rather content with its existing transit arrangements with that Indian port, receiving better treatment than Nepal due to the friendly relationship of the two countries (Kharel, 2009). At the same time, India also wants access to Bangladeshi ports, to tranship containers to their landlocked regions in the northeast (Islam, 2008; Sen et al., 2011). Rahmatullah (2009) has proposed some potential routes, involving rail, road and inland waterways, to develop an intermodal transportation network serving the hinterlands of Bangladesh, Bhutan, India and Nepal. However, while road routes already exist, rail and inland waterways transport is yet to be developed. Hence, assuming a horizontal

³ As noted in Haralambides (2017), there are 147 different ways to ship a bicycle manufactured in Wuhan, China, to Paris, France, and it makes little difference if it will be imported via Hamburg, Rotterdam or Antwerp.

² See <https://data.worldbank.org/indicator/IQ.WEF.PORT.XQ> for more detail.

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