Sustainable Regional Intermodal Freight Transport: Lessons from Dry Ports Development in Asia

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Abstract: The volume of international trade and freight transport has been growing very fast during the last decades in Asia. To facilitate this trade development of efficient intermodal transport is essential. Dry port, an extension of ports in hinterland inland locations, is an important component of intermodal transport. It can play important role in facilitating transshipment and distribution of goods in wider inland areas including Asia’s 12 landlocked countries. The paper presents selected case studies of dry port and intermodal transport development in Asia. Barriers, lessons and policy options to promote intermodal freight transport as well the role of dry ports in reducing CO2 emissions are presented. It is hoped that lessons from the case studies and would help decision makers to initiate policies and plans to further develop sustainable intermodal freight transport in Asia.

Key words: Sustainable freight, Intermodal transport, Dry ports, Asia

1. INTRODUCTION

Container trade between Asia and Europe has reached 27.2 million TEU in 2008 of which Asia to Europe accounts for 16.7 million TEU and Europe to Asia is 10.5 million TEU. Despite the efforts to improve inland transport between Asia and Europe, share of land transport is only 1% and most of the trade is through maritime transport (UNCTAD, 2009).

Further, the merchandise export and import in various subregion of Asia which is growing positively at different rates. About half of the trade is intraregional with other countries in the region. The proportion for exports rose from 41.2 to 49.2%, and proportion for imports from 48.9 to 57.7% during 1998 to 2008 (ESCAP, 2009).

The growth of intraregional trade and negligent land transport share of Asia-Europe trade clearly demonstrates the need to improve inland freight transport in Asia. Earlier model for transport development was taking unimodal approach where road and rail were planned and constructed separately without much consideration of integration. Intermodal/multimodal transport uses more than one mode of transport to deliver goods and various policy initiatives are being taken by transport planners to promote intermodal/ and multimodal transport concept.

Three attributes to be considered for intermodalism are transport network, transport nodes and provision of efficient services. While there have been efforts in Asia in developing regional
transport networks (ESACP, 2003 and ESCAP, 2006b) and sea ports. Development of inland dry ports- one of important transport node is at early stage. As Asia is house to 12 of world’s landlocked countries development of dry ports could play a major role in promoting and facilitating intermodal transport as well as transshipment and distribution of goods in wider inland areas and also to improving operational efficiency.

Various studies have focused on development of dry ports, inland terminals, and intermodal transport in Europe and developed countries (Rodrique et al, 2010 and Caris et al, 2008). There are not many researches focusing on intermodal transport and development of dry ports in Asia.

In this context, this study aims to review the current state of intermodal transport and dry ports development in Asia. The research takes case study approach by presenting some selected cases of intermodal transport and dry port development in Asia. Key messages, policy lessons and constraints/barriers to promote intermodal transport are revealed.

2. INTERMODAL TRANSPORT AND DRY PORTS

Intermodal transport refers to the movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes (ECE, 2001). An international intermodal transport involves at least one border crossing from one country to another that can expedite the movements of goods and people across international borders by connecting key points in different countries.

In order to promote intermodal transport development of transport links and nodes that include ports, airports, river ports and inland dry ports as well as improvement of efficiency of transport services is essential. Intermodal transport nodes provide opportunities for change of mode as envisaged in its definition. Following sections outlines development of transport network, nodes, and service in Asia and also review environmental benefits of intermodal transport system.

2.1 Transport links

Improvement of transport links such as highway and railway network and inland waterways need to be stressed (Kopicki, 2009). In case of Asia –the development of transport networks such as Asian Highway and Trans-Asian Railway have progressed well (ESCAP, 2003 and ESCAP, 2006b). Regional initiatives such as Asian Highway Trans-Asian Railway, Singapore-Kunming Rail, ASEAN Highway, transport corridors in Central Asia provides ample example.

Although, Asia includes major countries like China, India and Russian Federation having extensive railway and highway network, further improvement is necessary to provide uninterrupted connectivity (ESCAP, 2010c and ESCAP, 2006a). In addition, there are certain routes which lack capacity and maintenance- therefore considerable investment has to be made for regular and periodic maintenance.

Railway was first invented as a freight carrier and now can run in clean form of energy (Smith, 2003). The energy intensity and long life cycle of rail cars, new speed innovation- can take major
share of growing transport demand for freight and passenger. Relative cost, relative time and relative comfort are the common factors likely to influence modal choice (Chaudhury, 2005). Policies and efforts railway operators are necessary to maintain its environmental superiority.

2.2. Transport Nodes

Transport nodes such as airports, seaports, dry ports and logistics intermodal terminals need to be developed in order to develop intermodal transport. Among these, seaports have developed rapidly and many large seaports have emerged in the Asian region as evidenced by 19 of the top 30 container ports in the world are located in Asia (CI, 2010).

Inland dry ports are important transport nodes for landlocked countries. There are various terms used interchangeably to refer dry ports such as inland ports, inland container depots (ICD), freight terminals etc. A dry port is an inland terminal which is directly linked to a maritime port (ECE, 2001). Various definitions relating to inland transfer points/dry ports, inland terminal can be found in Notteboom and Rodrigue (2009). Economic and Social Commission for Asia and the Pacific (ESCAP) has proposed the following working definition for dry ports during a regional meeting of dry ports in Asia (ESCAP, 2010b): Discussions are still going on to develop an agreeable definition of dry ports in the Asian context.

*A dry port provides services for the handling and temporary storage of containers, and general and/or bulk cargoes that enter or leave the dry port by any mode of transport, including roads, railways, inland waterways or airports. Full customs-related services and other related services, such as essential inspections for cargo export and import, should be put in place in a dry port whenever possible.*

Dry ports/freight stations are one of the key components of the intermodal transport. Existing government policies and regulations relating to dry ports influence its development. ESCAP is working to develop and intergovernmental agreement on dry ports to promote its coordinated development. Figure 2 shows linkage between dry port and various sectoral policies that may be relevant to dry port development (ESCAP, 2010c).

2.2.1 Policies and institutions

The various policies depicted in the figure 1 relate to various sector and ministries. Also there would be different policies of different level of government such as central, provincial; and local government. Therefore, coordination among various sector as well as different level of government is essential.

![Figure 1: Policies and regulations relevant to dry ports (Source: ESCAP, 2010c)](image)
Designation of lead or coordinating agency and provision of “one stop” services under one roof to offer services and advice to potential developer of a dry port project to provide all necessary government approval during planning as well as operation. Further, special economic zones and free trade areas that provide special tax incentives are also being designated adjacent to dry port locations to provide economic stimulus.

2.2.2 Dry port location

As outlined in section 2.2.1 there are also many actors and issues that need to be considered while planning and developing dry ports. Lack of clear policies and institutional arrangements, conflicting interest of actors pose greater problem in selecting location of an inland dry port.

Some of the common factors that affect the location of dry ports are its proximity to ports, markets and manufacturing area, connections to other modes of transport, costs of development, operation and transport, potential of encouraging mode shift, environmental concerns, security, and existing government policies. While some of established cost benefit analysis (CBA), environmental impact assessment (EIA) can look at economic, financial and environmentally feasibility- that can compare potential alternatives. However, as many of the above factors are subjective and cannot be quantified- thus makes the location problem a complex. The dry ports location problem can be analyzed by using multi-criteria decision analysis (MCDA). Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP) are well recognized methodologies to analyze multi-criteria decision problem. The methodology consists of defining a problem with a set of evaluation criteria and sub criteria, assigning relative weight for each criteria and evaluating alternatives location. This method can compare and rank possible alternatives. The AHP/ANP model could help decision makers to evaluate various alternatives and make decision based on their preferences. Lee (1998) has used AHP for appraisal of transport projects in Korea. AHP and ANP were applied for environmental impacts assessment and evaluation of transport policies (Islam and Saaty, 2010, Berrittella and Certa, et al., 2007 and Brozova and Žika, 2010).

2.3 Transport services

Intermodal transport requires improving efficiency of transport services. The logistic performance index (LPI) that captures quality of trade and transports and services varies widely among Asian countries. For example Asian courtiers with high LPI in 2010 are Singapore (4.09), Japan (3.97) and Republic of Korea (3.64) while Mongolia (2.25), Afghanistan (2.24) and Nepal (2.2) most land locked countries have low LPI (Arvis et. all, 2010).

Road transport is most flexible transport modes and are operated and managed by the private sector. Most of railway routes operation in Asia is still handled by public sector railway companies having overall government control. Quality of operation is the single most significant problem in railways freight operation. Therefore, in order to attract more freight share the quality of service and reliability has to be improved and punctuality of freight service train has to be maintained. This requires reform on existing railway operation system and new approaches to railway marketing. Ballis and Golias (2002) have looked at ways of improving efficiency of rail-road terminals. If private-sector freight forwarders can provide quality services railway sector
should also be able to improve their services. Service quality and price are important aspects to change modal shift (Buehler et al., 2005).

In order provide door-to-door service railway has to be integrated with existing logistical networks. Interfaces between railways and other transport modes are essential to encourage modal shift. Amos (2009) suggests that government can improve rail freight by developing rail freight as a business, encouraging level playing field, private sector’s involvement and competition, removing barriers of borders.

3. ENVIRONMENTAL BENEFITS OF INTERMODAL TRANSPORT/DRY PORTS

Intermodal transport offers opportunities to encourage modal shift from one mode to another. In order to have net environmental benefits of intermodal transport, we need to explore ways and measures that will enhance modal shift from which is more environmental friendly.

Planning and development of freight terminals, freight villages, dry ports, ICDs can extend the reach of the rail mode through intermodal services. Rail-based intermodal freight transport is more environmental friendly than truck-only freight systems, particularly for long-distance haulage and in terms of CO2 emissions (Kim and Wee, 2009). Rail is considered as ideal connection from port to the dry port (Roso, 2009).

Construction of consolidation centers/dry ports near urban and strategic location can also help reduce number of freight trips. One such example is the Freight Construction Consolidation Centre in London which was established to consolidation construction freights and was able to minimize construction traffic for building and development resulting in fewer freight trucks and 75% of CO2 emission reduction (TfL, 2007). IEA (2009) argues that modal shift is attractive options for CO2 reduction and suggests investment in railways and intermodal transport.

Thus location of dry port and freight hubs becomes important consideration and many studies have considered potential environmental impacts as one of important criteria/factor for analysis. Other studies have evaluated alternative options and solutions for environmentally sustainable transport system. Implementation of a dry port concept that considered replacement of freight transported by trucks from port to dry port by railway in Sweden led to potential 25% CO2 emission reduction in addition to reducing port congestion (Roso, 2007).

Activity-based emissions modeling made comparison of intermodal transfer point in Taiwan and utilizing coastal shipping and trucks rather than distributing by only trucks showed 60% less emissions due to efficiency of coastal shipping (Liao et al, 2009) and impact of emerging port on CO2 (Liao et al, 2010). A study of freight emissions in London revealed that consolidation and distribution centres have combined 25.7% emissions reduction (Zanni and Bristow, 2009).

The freight and consolidation centers/dry ports have also potential to reduce the empty truck. For example empty truck running account for 12-30% in Pakistan and 43% in China (London-Kent, 2009). While a British study indicated a load factor of 72% for ports and rail freight operators (ECE, 2010). Improved logistics organization, coordination, and route planning can reduce up to
10-20% emissions (OECD, 2010). Railway privatization has worked in United Kingdom (UK), through promotion of rails for certain leg in their chain (Woodburn et al, 2008). Top-down policy direction has worked for Indian Railway which was making loss was turned to second best public company in India (Raghuram, 2007). The Indian Railways XI five-year plan places priorities to freight sector including development of dedicated freight corridors and villages.

Another issue that needs to be addressed is to attract freight to railway and give equal priority to freight trains. In railway operation usually the passenger rail get priority over freight. To ensure reliability of freight delivery scheduling is important. Once the schedules are reliable railway will get more share of freight.

The promotion and development of intermodal transport can help to reduce CO₂ emissions if we can encourage mode shift to rail transport which is more environmentally friendly. For this to materialize dry ports need to be developed in inland areas and connected with railway. It is assumed that collection and distribution of cargoes from a dry port will be mainly by road and transport to and from the port to a dry port is by railway.

Freight carried by rail emits much less CO₂ compared to freight being transported by heavy good vehicle (HGV). For example, an average 28.3 g of CO₂ emission per tonne-km of rail freight, 118.6 g for HGV and 400 g for light good vehicle are in use UK (DECC, 2009).

Table 1 shows resulting CO₂ emissions savings from development of rail based dry port in Birgunj, Nepal. The detail case study is presented in section 3.3. The freight handled in year 2008/09 was 16,928 TEU (equivalent to 406,272 MT) and 237,104 MT of cargoes. It is assumed that if there was no dry port all freight from Kolkata would be transported by HGV to the dry port. Using the emissions factors outlined in above paragraph, the resulting CO2 savings would have been 57,687 MT for the year 2008/9 which is about 82% of the road emissions.

We have to be clear that we cannot make the inland intermodal freight transport sustainable (emissions free) but our efforts should be directed towards making intermodal transport more sustainable. The next chapter presents experiences of selected Asian countries in developing intermodal transport and dry ports/logistics centers.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Length Km</th>
<th>Freight</th>
<th>Eq. Freight, MT</th>
<th>T-km</th>
<th>CO2 Emissions, MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail</td>
<td>704</td>
<td>16,928</td>
<td>237,104</td>
<td>643,376</td>
<td>452,936,704</td>
</tr>
<tr>
<td>Road</td>
<td>924</td>
<td>16,928</td>
<td>237,104</td>
<td>643,376</td>
<td>594,479,424</td>
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<tr>
<td>Saving in CO₂ Emissions (B-A)</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

4. CASE STUDIES OF DRY PORTS DEVELOPMENT IN ASIA

Countries in Asia are at different stages in developing their dry ports. They are both road and rail based and intermodal dry ports, near production or industrial centres with the aim of effectively

1 Using maximum allowed weight, 1TEU=24 MT
consolidate and distribute cargoes. Some countries have established well-functioning dry ports while others are still in an early stage of development. The following sections present selected case studies of development and operation of dry ports in Asia covering financing, operational aspects, regulatory and institutional aspects.

4.1 Navoi International Logistics Centre, Uzbekistan

Uzbekistan has established an international intermodal logistics centre at Navoi, situated about 350 km of south-west of Tashkent with the aim of becoming a regional transshipment hub in Central Asia. Currently, it is a predominantly air-based logistics centre serving as a consolidation hub for transport of high-value goods from Asia to Europe and vice versa. Freight service is on operation from Navoi to major destinations including Inchon, Milan, Brussels, Delhi, Mumbai, Bangkok, Frankfurt, Shanghai, Moscow and Dhaka. There are plan to extend cargo service to Istanbul, Almaty, Dubai, and Tel Aviv.

Korean Air has been engaged to manage and operate the logistics center and develop and market a business plan up to 2018. Uzbekistan Air and Korean Air operate 40 cargo flights per week. Even though sufficient cargo and freight is not generated in Navoi, it is being used as consolidating and distribution hub for transporting air cargos to Central Asia and Europe. The Navoi airport operates 24 hour and can cater for 10 heavy aircraft such as Boeing-747 per day and parking for five heavy aircraft. It has a 4,000 m × 45m runway with instrument landing system and has a plan to develop another runway. It has capacity to process 300 tons of cargo per day (100,000 tons per year). It is capable of receiving all types of aircraft.

The new cargo terminal with capacity of storing 1,000 tons of cargo was opened in August 2010. It includes facilities like refrigeration and freezer, heating chamber, the storage area of dangerous goods, perishable foodstuffs and animals. Other facilities required for international logistic terminals are being developed such as hotel, expansion of capacity, parking areas for trucks. Administration building houses all essential services.

In 2009 it handled 26.7 thousand tons of cargo and it was estimated that the volume handled will reach to 60 thousand tons in 2010. Outside of Inchon, Navoi is the 2nd largest air fright hub in terms of cargo frequency. Navoi is aiming to be number one cargo service provider. Its central location is interesting as major cities such as Moscow, Istanbul, Tel Aviv, Dubai, Mumbai, New Delhi and Almaty are within radius of 6 hours flight time while Milan, Frankfurt, Brussels, Bangkok, Shanghai and Inchon are within 8 hours flight radius.

A free economic industrial zone (FIEZ) in Navoi was established in 2008 to attract foreign direct investment from manufacturer that will generate high value cargos. The initial lease within the FIEZ is 30 years. It is an extensive 584 hectares development, which is still under construction that includes a logistics centre with an area of 40 hectares. International joint ventures with companies from Japan, the Republic of Korea and Singapore have established manufacturing factories within the zone. FIEZ provides one stop licensing and registration service including tax incentives for investment and customs incentives on equipment imports.
Navoi provides a very useful example of development of logistics centre/dry port on policy initiatives of the government and commitment of various organizations from the beginning. Examples of policies include provision of infrastructure, land lease, tax incentives for bringing FDI to the free economic zone to generate cargo and one stop service to grant business and manufacturing license, customs incentives to import equipments.

4.2 Uiwang ICD, Republic of Korea

Rapid growth of export and import volume has led to expansion of Korean ports. The pace of port expansion could not catch up with growth of trade that led to congestion of gateway ports like Busan, Gwangyang and Inchon handling the majority of the Republic of Korea’s foreign trade. The government initiated policy to develop inland logistics centres in 1980.

The Uiwang ICD was developed by a public-private partnership in 1993. The Korean Railroad Company and Private Transportation companies have invested in the Uiwang ICD. It has capacity of 1.3 million TEU/year with an area of 417,000 square meters. Customs, food inspection, plant quarantine and railway operation are located in with ICD in addition to private sectors facilities and operating companies. Shippers send goods by road to the ICD and ICD consolidates and send to ports by railway- thus utilizing both modes and helping to ease road congestion and serves as a clearance depot. The railway has capacity of 36 trains/day.

Figure 2 shows the containers handled at Uiwang ICD which has crossed 2 million TEU in 2006. We could note some decrease in volume of containers handled after 2008 due to economic recession. Also, the road mode share has hovered around 75% except some drop in year 2008.

The Ministry of Land, Transport and Maritime Affairs (MLTM) is the regulatory authority in responsible for planning, construction and management of dry ports in the Republic of Korea. MLTM encourages private sector investment in development of dry ports and logistics centres. Large scale infrastructure project proposals from the private sector are reviewed by the Public and Private Infrastructure Investment Management Centre (PIMAC) to check whether proposals correspond with the government’s long term plan and investment priority. The Government provides some support for development of dry ports in form of land acquisition cost and part of project costs. Infrastructure projects under public private partnerships are either selected by government or proposed by the private sector.

Uiwang ICD presents an interesting case of market driven dry port development with PPP- for financing as well as to improve efficiency of operation. Government logistics policy and role of
PIMAC has played a supportive role in the development.

4.3 Birgunj Inland Container Depot, Nepal

Birgunj Inland Container Depot (ICD) was developed by the Government of Nepal with the support of the World Bank. It has 12 km rail link to ICD from railhead in India and connects further to Kolkata/Haldia ports in India. The length of road from Kolkata is 924 Km and that of railway is 704 km. The ICD facilities include broad gauge railway yard with 6 full length lines, a container stacking yard, a covered container freight station, goods shed, and parking space. It is fitted with the Automated SYstem for CUstoms DAta (ASYCUDA). It took some time to conclude the Rail Service Agreement with India for operation of dry ports- as majority of rail link is in India. The Birgunj ICD which was commissioned in July 2004 is leased to private sector for operation. It now handles container, tank wagons for liquid cargo and flat wagons for bilateral break-bulk cargo after amended of the service agreement.

Nepal Intermodal Transport Development Board (NITDB) which has representative from public as well as private sector is a regulatory body for all dry ports in Nepal. As envisaged in Trade Policy 2009 -Nepal Intermodal Transport Development Authority (NITDA) is planned to establish to regulate operational issues including issuance of license for development and management of dry ports, container freight stations and integrated custom points in the country. Policies relevant to transport and trade facilitation, transit and logistics and investment on development of dry ports had been put in place but lacks effective implementation. Acts and regulations related to multimodal transportation, land and environment also played important roles in the operation and establishment of dry ports in Nepal. Dry ports has played a significant role in reducing transit and transport costs including a mode shift to rail from road in land locked Nepal- which have clear environmental benefits. Around 15-16 freights train unit trains were received on average in a month. The volume of cargo handled at the ICD is shown in figure 3 the figure shows growth of container cargo arriving at Birgunj dry port.

Lessons from Nepal reveal that it is relatively easier to develop dry port infrastructure - it requires more efforts to bring in operation. Even though the case was unique in sense that it is located near border and main railway connection is from Kolkata port in India- most of the freight route is in India. After initial operation – extension of railway service agreement to include open, break bulk and freight wagons- took much time. It is worthwhile to consider operational issues while developing infrastructure. Nepal presents the importance of operational and facilitation issues, provision in reviewing and amending agreement.

Other dry ports in the country are Biratnagar, Bhairahawa, and Kakarbhitta near border with India and at Kodari near Chinese border. Recent

![Figure 3: Cargo handled at Birgunj ICD](image-url)
initiatives to promote intermodal transport rail included feasibility study of east-west rail and 60-km long Kathmandu-Birgunj railways and connections to the four railheads in India. Furthermore, talks are underway to extend the railway line from Lhasa, China to the dry port at Kodari and further south to Kathmandu.

4.4 Lat Krabang ICD, Thailand

The Lat Krabang ICD developed by the State Railway of Thailand (SRT) started operation in 1996. It is located about 27 km east of Bangkok and 118 km north of Laem Chabang Port and cargoes are carried by both railway and road between Lat Krabang ICD and Laem Chabang sea port. The terminal operation is managed by six private sector concessionaire and provides cargo consolidation, distribution, warehousing, customs clearing, and empty container storage services.

Thailand is giving priority for developing dry ports to help shift of freight from road-based transport to multimodal transport. The existing Lat Krabang has full EDI link and handled around 1.7 million TEUs in 2008 which is far more than its initial design capacity of 500,000 TEU. Because of this congestion many container are now by-passing ICD and are being stuffed and de-stuffed outside the facility. Also many containers from Laem Chabang are now by-passing Lat Krabang altogether and proceeding direct to external locations for stuffing and destuffing. Laem Chabang Port and Bangkok Port on the Chao Phraya River handle almost all of Thailand’s container trade. In 2007 the two ports handled 4.65 million and 1.56 million TEU, respectively.

The figure 4 shows the growth of container handled in Lat Krabang which has reached peak in 2008 and declined in 2009 was due to economic recession.

The figure 5 shows the mode share of container handled by trucks and rail. It is worth noting that rail share has been decreasing and owning to its flexibility the road share is increasing. We could note some gain in rail share during 2002-2005.

Thai authorities are planning the future expansion of the Lat Krabang facility as well as construction of new dry ports. Thailand is also working to
enhance the country’s logistics capabilities through the development of intermodal facilities to encourage a modal shift from road to rail and water transport which are more environmentally-friendly than road. Thailand is also considering developing Hub-and-spoke system aiming to integrate transport infrastructure and facilities to transform the country into a regional transport hub.

4.5 Dry ports development in China

China is developing 18 large inland container rail transfer and logistics distribution centres (Wu, 2009) as part of the “Go West” strategy promoted to encourage investment in and the industrialization of the interior of the country. The China Railway Container Transport Centre (CRCTC) was established by the Ministry of Railways as a container rail operator that can bring foreign investment. In addition, CRCTC has attracted other companies to invest in a number of specific ventures. These facilities will be operated by China United International Rail Container Co., Ltd, a special-purpose entity set up by the Ministry of Railways in 2007.

In order to promote intermodal transport China has initiated five fix policies namely: (i) ‘fix’ location for cargo loading and discharging; (ii) ‘fix’ route; (iii) ‘fix’ trains; (iv) ‘fix’ departure and arrive times, and finally (v) ‘fix’ prices for cargo transport (Tanlai, 2009).

Dry ports have important role in stimulating economic development and facilitating international trade and transport in central and western inland areas in China. In this respect role of national government in promotion and coordination, dry ports infrastructure development including whole transport infrastructure linking with dry ports and the streamlining of institutional and regulatory framework are three aspects that need careful consideration.

Zhengzhou east dry port located in central China started its operation in 1997 and can be accessed by railway. Customs, inspection and quarantine can be conducted in dry port. Shijiazhuang dry port with a designed capacity of 205,000 TEUs per annum is one of the largest dry ports in China. The dry port has both railway and road accesses. Customs, inspection and quarantine are available at the dry ports. The dry port has direct link with Tianjin sea port and mainly serves as feeder port for Tianjin port.

There is a road-based dry port in Urumqi. Some small scale dry ports facilities are under construction near Urumqi Railway station. All these dry ports in Urumqi mainly serve the market in Xinjiang rather than international trade. International cargoes to/from Lianyungang Alashankou normally bypass Urumqi.

In terms of cargo volume, Alashankou is the second largest border station in China connecting to Dostyk station in Kazakhstan. It can handle all types of cargoes, containers, break-bulk as well as oil. On average it handles about 20 freight trains daily. Figure 6 shows volume of containers handled at Alashankou dry port which show a growth of 22.5% from 2007 to 2008. Erenhot dry port near border Zammin-Uud in Mongolia also handles containerized and bulk cargoes.

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International free trade economic zone (FTEZ) with aim of attracting manufacturing factories is being constructed in Horgos near the border between China and Kazakhstan. A logistics centre is also planned within FTEZ. Currently border crossing and transport at Horgos are conducted by road. The average waiting time for the trucks to cross the border is normally 2-3 days. Around 75-100 trucks travel cross the border each day from China to Kazakhstan and similar number of trucks travel from Kazakhstan to China. Trucks from Kazakhstan with special permission are allowed to operate in specified areas in China. The equal number of permissions is also issued to Chinese trucks which are allowed to operate in Kazakhstan. Railway linking Jinghe, Yining and Horgos has recently completed. A railway connection in Kazakhstan from border Khorgos to Almaty is also planned.

In order to improve efficiency of rail freight China has been running double stack container train services to and from the main coastal ports on selected routes using new specialized wagons and powerful locomotives. In 2007, Chinese Railways operated 680 double-stack trains, up from 454 trains in 2006, which carried 53,161 TEU, up from 39,437 TEU in 2006.

4.6 Dry ports development in India

India has extensive network of 59 inland container depots, of which 49 can handle export-import. These inland dry ports provide custom clearance, warehousing, container parking, repair facilities and office facilities. The terminals are linked by rail and road. The operation is handled by the Container Corporation of India, Ltd. (CONCOR) a subsidiary of Indian Railways. Figure 7 shows volume of container handled by CONCOR which shows share of international container is growing gradually from 60% in 1996/97 to 81% in 2007/08. The decrease in container volume from 2007/08 could be due to economic recession. CONCOR is investing in modernization of facilities and improving efficiency through improving fleet, developing dedicated container platforms and advance ICT system and e-Business.

Tughlakabad ICD located 17 km south west of Delhi with an area of 55 hectares is the biggest rail linked ICD in Northern India. It has handling capacity of 400,000 TEUs per year. It has good link to Mumbai and Jawaharlal Nehru Ports through Delhi-
Mumbai arterial trunk corridor and National Highways. The ICD is equipped with all modern facilities including Electronic Data Exchange, export and import warehouses, RFID container tracking and customs clearance. During 2009/10 it handled 413,384 TEUs.

India is also implementing a project to develop dedicated freight corridors costing around US$ 10 billion. One of them is the Mumbai-Delhi corridor which is being assisted by the Government of Japan. The freight corridor will segregate freight from passenger and will be a state of art system with high axle load and capacity (Parhi, 2010).

4.7 Comparison of selected issues relating to dry ports development

Table 2 summarizes some characteristics of dry ports relating to their development and operation. All dry ports included in the case studies are evaluated with respect to mode served, environmental benefits/concerns, potential of mode-shift opportunities, ownership, operation arrangement, government policies and incentives for development of dry ports and barriers and lessons to promote intermodal transport.

5. CONCLUSIONS

The paper reviews the emergence of intermodal transport system in Asia and highlights role of transport links, nodes and services. The Asian case studies reveal roles of government, market and private sector in developing successful dry ports/logistics centres. It further emphasizes various factors that have influenced development and operation of dry ports and intermodal transport – some of them are strong policy commitment of the government, bringing all facilities and services including customs clearance, inspection, consolidation together, market driven development through public-private partnerships. It also highlights the potential role of dry ports in reducing CO2 emission. In addition to focusing on development of infrastructure, it also reveals the need to timely consider operational issues including conclusion of service or transit agreements and facilitate international and transit transport as discussion and conclusion of agreements take considerable time. One of the policy issues that need to be addressed is coordination among various government agencies involved in development of dry ports such as licensing, investment, promotion of private sector initiatives, etc. designation of lead agency would be required or “one stop” services to provide all necessary government approval. During operation works needs to be initiated for wider recognition of bill of lading issued from dry ports. It is hoped that government and private sector would work together to develop integrated intermodal transport in Asia that not only provide access to inland and landlocked areas also promotes environmental friendly and sustainable intermodal freight transport system.

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## Table 2: Comparison of key features of selected dry ports

<table>
<thead>
<tr>
<th></th>
<th>Navoi, Uzbekistan</th>
<th>Uiwang, ROK</th>
<th>Birgunj, Nepal</th>
<th>Lat Krabang, Thailand</th>
<th>Alashankou, China</th>
<th>Tughlakabad, India</th>
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</thead>
<tbody>
<tr>
<td><strong>Modes served</strong></td>
<td>Air, road and rail</td>
<td>Rail, road</td>
<td>Rail, road</td>
<td>Rail, road</td>
<td>Rail, road</td>
<td>Rail, road</td>
</tr>
<tr>
<td><strong>Environmental benefits/concerns, potential of mode-shift</strong></td>
<td>Mode shift possible but not currently, not enough freight volume for railway, reduction of air freight time</td>
<td>Contribution to reduce road congestion and vehicle emissions, railway is used to transport freight to/from ports to ICD,</td>
<td>Contribution to emissions reduction due to mode shift to rail for transportation between port and dry port, collection and distribution of cargo by truck</td>
<td>Contribution to reduce road congestion and vehicle emission, but share of rail freight is decreasing due to congestion at ICD and capacity of railway,</td>
<td>Mainly rail is used for long haul freight</td>
<td>Mainly rail is used for transporting to/from ports, road used for collection and distribution</td>
</tr>
<tr>
<td><strong>Ownership</strong></td>
<td>Government</td>
<td>Public-private partnership</td>
<td>Government</td>
<td>Public-private partnership</td>
<td>Chinese Railway, CRCTC</td>
<td>CONCOR, Subsidiary of Indian Railway</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td>Private (management contractor)</td>
<td>Private</td>
<td>Private (leased)</td>
<td>Private (Concession)</td>
<td>Public-private CRCTC</td>
<td>Public undertaking</td>
</tr>
<tr>
<td><strong>Government policies and incentives</strong></td>
<td>Tax incentives and one stop service for licensing and Free Economic Zone established nearby</td>
<td>Promotion of PPP projects through PIMAC</td>
<td>Government investing in facility, have developed other dry ports as well</td>
<td>Concessions to private sector for development and operation, considering capacity enhancement</td>
<td>CRCTC, a public-private venture entrusted for operation,</td>
<td>CONCOR investing in modernization of facilities and improving efficiency through improving fleet, dedicated platforms, use of ICT for container tracking.</td>
</tr>
<tr>
<td><strong>Barrier and lessons to promote intermodal transport</strong></td>
<td>Government policies and tax incentives were conducive, limited volume of local freight,</td>
<td>Good example of PPP, and role of PIMAC, connecting port and ICD with high capacity railway can reduce road congestion</td>
<td>Operation delayed due to delay in concluding rail service agreement with Indian Railways</td>
<td>Congestion at ICD and limited capacity of railway connecting to port</td>
<td>Government policy in development of railways and dry ports and attract more share of freight to railways, Capacity enhancement ongoing, starting double stack freight trains</td>
<td>Good network of ICDs and railway network, dedicated freight corridors to enhance efficiency</td>
</tr>
</tbody>
</table>
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