An Analysis of Multimodal Transport Routes for Construction Equipment in Vietnam

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Type of Paper: Research:

Purpose of this paper: The purpose of this paper is to analyse intermodal systems in Vietnam in respect of the movement of large units of construction equipment to building projects in northern Vietnam.

Design/methodology/approach: The basis of analysis is the application of a time-cost-distance model which allows different routes to be compared directly. The paper is case-study based, using data supplied by logistics companies and their transport sub-contractors. Data were collected through interviews and questionnaires. Routeing options for the movement of oversized construction equipment from southern to northern Vietnam are compared, and strengths and weaknesses within the respective supply chains identified.

Findings: The main contribution of the paper is to identify the most suitable route for the cargo taking account of operational constraints. In Vietnam, domestic transport is shown to be complex, and under-developed because of infrastructure weaknesses and a regulatory framework which is incomplete. The cargo characteristics lead to specific requirements which elevate security, safety and avoidance of damage to high priority considerations. There are shown to be four main routes which can fulfil the overall needs of shippers but each route is shown to be sub-optimum in terms of one or other consideration.

Value: The paper provides an analysis of multimodal transport routes for 'over-sized cargoes not previously undertaken in this form for Vietnam.

R*esearch limitations/implications*: As often occurs with studies of this type the acquisition of data is difficult and the number of routes studied limited. Future research could be undertaken to explore a wider range of multimodal transport corridors and solutions.

Introduction

The shipment of over-sized construction equipment from southern Vietnam to northern Vietnam by Nhu Han Transport Service Co Ltd (Nhu Han Transport) forms the core of a case study analysing the issues faced in the movement of over-sized cargoes. Moreover, this paper explores the problems and issues facing the different transport modes used for this transport. The main contribution of this study is to identify the most suitable route and mode combination for shippers of over-sized cargo. In Vietnam, domestic transport is both complicated and under-developed because of two principal factors; obsolete infrastructure and incomplete regulation. Despite increasing Vietnamese prosperity, transport infrastructure is still under-developed, furthermore, the disadvantages of geography create some negative effects for transport operators. The complex and turbulent political situation have also impacted many of the traditional transport systems. However, over the last two decades, the government of Vietnam has

been making fundamental regulatory and institutional changes in order to ensure a more market-oriented economy (Ruddle, 1998).

In Vietnam, there are numerous developments taking place. Large corporations transport used construction equipment between developments using obsolete transport infrastructure. This study is focused on the transport of over-sized machines and equipment that are owned by Nhu Han Transport, which is the third biggest construction company in Vietnam. The paper is based on the intermodal concept and it uses an established Cost Model to analyse and explain the current issues (Beresford, 1999). Before Nhu Han Transport began to supply transport services for this equipment, the shipper specified some special requirements in order to protect the shipment and ensure delivery to schedule. Practically, there are four main routes that could fulfil the requirements of this project, however; many restrictions and inconvenient regulations cause some difficulties. This research explores all four routes in order to highlight both the benefits and drawbacks.

In order to find the most efficient alternative solution for Vietnamese domestic transportation of large unit load cargo, 3 main research questions were asked:

1. What are the critical factors which can influence intermodal transport operators in their choice of solution in order to eliminate barriers and enhance operational effectiveness?
2. What are the main elements which can influence shippers, consignees and carriers using intermodal transport operation in Vietnam?, and;
3. Can intermodal transport solutions eliminate some transport cost for over-sized construction Machinery, tools and equipment?

Intermodality is very suited for ASEAN countries, because of the geography (Fontaine and Workman, 1998). However, in Vietnam, the barrier of developing intermodal transport is the under-developed transport infrastructure and this is likely to be quite a significant problem facing Vietnamese transport in the future. Currently, with Vietnamese transport and investment policy being more transparent, there are many foreign investors trying to establish intermodal transport infrastructure in order to develop the domestic market. Intermodal transport in Vietnam hinges on the effectiveness of road, rail, and coastal shipping. For North – South transport, distances are sufficiently long for combinations of these three to be commercially viable. However, the transport modes have specific problems.

Road: Road transport usually provides the simplest transport solution, moreover, road transport is often used as both the starting and finishing mode in transport systems (Beresford, 1999). Door to door service is the most advantageous aspect of this mode; however, there are still some disadvantages which can impact on road transport as the mode of choice. High driver turnover can cause problems for carriers, because the cost of road haulage in comparison to other transport modes is much higher (De croon, et al, 2004; Morrow, 2005). Also, with the increasing use of container transport, congestion problems are becoming more severe, not only in the vicinity of seaports but also in some central cities (Stopher,2OO4). In Vietnam both recurrent and non-recurrent congestion occurs; recurring congestion because of under-developed infrastructure and the rapid development of Vietnamese economy; non-recurring because of wider problems with the infrastructure and inappropriate road development (Caramia and Guerriero, 2009).

Rail: For developing countries, infrastructure establishment is critical for economic development. Railway building is a critical part of increasing a country's prosperity. Beneficial rail facilities can enhance capital transport and reduce cargo delivery costs. Moreover, rail transport can facilitate other transport modes, for instance rail is more competitive for the hinterland transport of containers than semi-trailers, and the

integration of rail transport and inland waterway can increase the efficiency of each other (Woxenius and Bergqvist, 2010). As result, compared to road transport, rail has advantages such as reducing environmental impact and decreasing transport distance costs (Roso, et al., 2009). In Vietnam, the mountainous geography confines rail mainly to the eastern coast. Recently the Vietnamese government has completed some railway construction in order to shorten the development gap between southern and northern Vietnam. Nevertheless, insufficient financial support and the special construction technology limits rail infrastructure development.

Sea: Port terminal facilities cause significant barriers for short-sea shipping. Many ports still use human power to load and unload ship cargoes; moreover, many seaports have serious draught restrictions. While Vietnam has a long coast line and should be able to develop a strong maritime transport sector, the Vietnamese seaport system has not been able to compete with neighbouring countries ports such as the ports of Singapore, Bangkok and Port Klang (Do, et al, 2011). Hence, Vietnam has no hub port in this region. Recently, with the growth of world trade carried in containers, shipping liners, port users and port service providers are beginning to develop.

Case study

This case study considers the shipment of over-sized construction equipment from southern Vietnam (Ho-Chi-Minh) to northern Vietnam (Bac Giang). Many construction contractors consider transporting both new and second-hand over-sized construction equipment from southern construction sites in Ho-chi-Minh to northern construction sites. The Full Power Joint Stock Company (FPJSC) is one of the largest Taiwanese and Vietnamese joint ventures and has various construction sites in Bac Giang. The company needed the over-sized equipment moved on their behalf by Nhu Han Transport. This type of equipment is usually difficult to transport due to poor transport services and infrastructure. However, the Vietnamese government has already reformed some customs clearance procedures and inspection processes, as well as expanded IT systems in order to improve transport facilities and infrastructure. Table 1 identifies the key aspects of the shipments as identified by the shipper, consignee and carrier.

Table 1 Interview Results for Shipment Characteristics

Opinions of:	**Shipment Value**	**Shipment Volume**	**Shipment Weight**	**Time Limitation**
Shipper	Rare equipment in Vietnam – High value	Very large but not the biggest	Normal weight for construction tools	At most l0 days for transport
Consignee	Same as shipper	Same as shipper	Same as shipper	As soon as possible
Carrier	High value	Large construction equipment	Heavy construction equipment	Must deliver the shipment within 7 working days

There were four routes that could be used by FPJSC involving:

Route 1. All Road — No intermodal transfer
Route 2. Road – Rail – Road — Two intermodal transfer points
Route 3. Road – Rail – Road - Rail – Road — Three intermodal transfer points
Route 4. Road - Sea (Coastal Shipping) – Road: Two intermodal transfer points

Route 1. All Road: It takes at least five days to travel to Ho-Chi-Minh from Bac Giang by road. One of the primary issues is that trucking companies avoid daytime driving to evade a surcharge by traffic police. In Vietnam carriers call this surcharge a 'Coffee Fee'. This situation is similar to that highlighted in Banomyong (2001) who named the surcharge in Thailand as a 'Tea Fee'. In order to reduce these unpredictable costs, many carriers demand that drivers pay half of this fee. Many drivers detest this regulation, thus they choose to drive during the night and use remote routes to avoid traffic police road inspection. This situation not only increases the transport time but also increases the risk within the transport process and ultimately the total transport cost is more expensive than the other three routes.

Route 2. Road – Rail - Road: This route includes both road and rail modes. The biggest problem with this route is that there are only a few flexible schedules available. In 2008, there was only one railroad service that could accommodate such shipments but the appropriate train only runs every two days. Geographically, the mountainous territory is the severest problem in developing a railway service in Vietnam. In this case, the shipment is over-sized, and halfway to the destination the rail route encounters a tunnel height restriction. Furthermore, the transport cost of this freight train service was almost the same as the uni-modal transport road service. Although it may be safer than only using road transport, the freight cost and long transport time are big issues for both shippers and consignees.

Route 3. Road – Rail – Road - Rail – Road: The third route still integrates the road and rail service but on this route there are two transfers at two different rail terminals to change to different rail tracks in order to avoid the tunnel height limitation. This meant that the transport time has to be extended and the risk is thus higher. The other noticeable issue was that the shipment was difficult to load and unload. In 2008 the basic loading and discharging superstructure at the Vinh rail terminal was not adequate. However, in order to avoid travelling along the 'tunnel' route, the shipment had to be transferred from the largest central rail terminal - Da Nang to the second largest rail station - Vinh. Over this 472 km route, Nhu Han Transport Service had to hire other heavy cranes and hoists to lift the cargoes at the Vinh transfer. The road transport fees were also expensive because there are fewer trucks available in this remote and under-developed region. Mostly, in this region, carriers had to hire specific truck companies. All of these extra costs were higher and more complicated. In addition, the transport time had to be extended for more than three days. In Vietnam, the weather can also be unstable and there are many rain affected days after May. These problematic factors also cause some unpredictable operational risk when using this route selection.

Route 4. Road - Sea (Coastal Shipping) – Road: The last route uses coastal shipping. According to Lowe (2005), this transport mode is the most efficient and most cost effective. In Vietnam, coastal shipping is a very common and convenient method of transport. This mode can be employed between Ho-Chi-Minh new port (coastal shipping port) to the northern main feeder and barge port of Hai-Phong. The vessels used are essentially Roll on/ Roll off (Ro/Ro) ships and therefore the transfer facilities do not need specific and complex superstructure. This can not only save a significant amount of transport time but also reduces risk. Further, the competitive freight costs of coastal shipping also contribute to the low overall transport costs compared to the other three routes. Nevertheless, this service still has cost and time disadvantages. The door to door service depends on road transport. Adverse maritime conditions can lead to service delays or cancellations. The port terminal equipment and superstructure also could not entirely accommodate loading and unloading of this type of cargo. The Ho Chi Minh new port facilities were not sufficiently robust enough to handle such over-sized cargoes. Further, Ho Chi Minh new port only opens four hours per day on average for bulk and RO/RO services, thus ships and trucks have to queue, increasing lead times and adding delay possibilities.

Cost Model Analysis of the case study routes

Route 1: According to the cost model concept, the most important factors are cost, lead-time and risk. For this route, only road transport is used. Commonly, road transport is the most expensive method (Beresford, 2001) and this is confirmed here as this is the most expensive routeing option of the four routes examined here. On the other hand road transport is more dependable and offers lower risk under normal circumstances. However, the special inspection fee ('Coffee Fee') and the inferior quality of road infrastructure in Vietnam leads to some risk of damage and delay. The data for this route are presented in Table 2. The total cost is $US 2953.33 and the total transport time is 122 hour, but unpredictable traffic police inspections increases the risk of delay. In addition, poor weather also degardes the road conditions and the delivery time becomes more unpredictable.

Table 2. All Road: Cost, Distance and Time

Flat Rack Unit	$US	Kilometres	Hours
Loading Operation	117.64		2
District 9 to Bac Giang	2835.69	1197	120
Total	**2953.33**	**1197**	**122**

Route 2: For this route the main transport mode is rail. The geographical limitations present immense difficulty and the tunnel heights lead train schedules being less frequent. Thus the transport time is too long and the costs are high. In terms of the risk, this route has lower risk because it only requires a small level of road transport, but the long transport time creates other unexpected risks such as construction project delays. The data for this route are presented in Table 3. The total cost is $US 2364.64 and total transport time is 116.5 hours. The risk is lower than the Route 1 and time, cost and distance are all lower.

Table 3 - Road – Rail – Road: Cost, Distance and Time

Flat Rack Unit	$US	Kilometres	Hours
Loading operation	117.64		2
Road - (District 9 - Song Than rail station)	184.66	12	1
First intermodal transfer	90		1.5
Waiting time			82.5
Rail. (Song Than rail station – Hanoi rail station)	1647.05	877	26
Second intermodal transfer	90		1.5
Road (Hanoi rail station - Bac Giang)	235.29	52	2
Total	**2364.64**	**941**	**116.5**

Route 3: For the third route option, the main transport mode is also rail. In order to avoid rail restrictions due to the difficult geography, there are two transfer points. Time, cost and risk are increased due to transfer processes. Especially, in central Vietnam, the loading and discharging equipment is difficult to acquire, thus the transfer cost is much higher than in normal circumstances. The data for this route are presented in Table 4. For this route the total cost is $US 2563.61and the total transport time is 129 hours. This route therefore takes the longest and the risk is also higher than the previous two routes. In this case study, it was apparent that the complicated transport processes lead to the transport cost being more expensive and of higher risk of delay.

Table 4 - Road – Rail – Road – Rail - Road: Cost, Distance and Time

Flat Rack Unit	$US	Kilometres	Hours
Loading Operation	117.64		2
Road (Dist 9 - Song Than rail station)	184.66	12	1
First intermodal transfer	90		1.5
Waiting time			20
Rail (Song Than rail station – Da Nang rail station)	705.88	882	36
Second intermodal transfer	90		1.5
Waiting time			17.5
Road (Da Nang rail station - Vinh rail station)	470.58	322	28
Third intermodal transfer	325.45		8
Road (Vinh rail station – Hanoi Rail station)	254.11	295	10
Fourth intermodal transfer	90		1.5
Road (Hanoi rail station - Bac Giang)	235.29	52	2
Total	**2563.61**	**1563**	**129**

Route 4: Coastal shipping is the cheapest of the three transport modes. The transport time is also the shortest. The risk of using this route is lower, although the port facilities are an issue for carriers. There are the possibilities of delays which could add up to 48 hours to the transport time during rainy seasons. For shippers and consignees the unpredictable shipping schedules are also an issue. As a result, coastal shipping has advantages of cost and time and even risk, but improved port infrastructure would make this mode transportation more stable and attractive. The data for this route are presented in Table 5. The total cost of this route is the lowest at $US 1288.21 and the transport time is only three days (72 hours). While this route offers the most suitable transport method for this shipment, nonetheless some risks remain. However, this route is still more stable in comparison to the others.

Table 5 - Road – coastal shipping - Road: Cost, Distance and Time

Flat Rack Unit	$US	Kilometres	Hours
Loading Operation	117.64		2
Road (Dist 9 – New Port)	73.52	2	0.50
First intermodal transfer	55		2
Coastal Shipping (New Port – Hai Phong)	840	1628	72
Second intermodal transfer	55		2
Road (Hai Phong – Bac Giang)	147.05	75	1.50
Total	**1288.21**	**1705**	**80**

Interpretation and Conclusions

The four routes utilise different transport modes, paths and terminals. The cost and time are the most vital factors for shippers, consignees and carriers. However; the specific circumstances and weather conditions can also play significant roles. For the first route, poor road conditions have impacted on the transport operators' confidence. Traffic police practices also indirectly increase the risk of this route with drivers responding by choosing to operate at night to avoid additional charges and delays. The second and

third routes combine road and rail services. In theory, this is standard intermodal transport. Unfortunately, the obsolete rail terminals, disadvantages of railroad geography and inflexible train schedules diminish the merits of intermodal transport. Vietnam's mountainous geography and out-of-date equipment mean such services are less than satisfactory. The final route has cost and time advantages. The greatest weakness of the coastal shipping service in Vietnam is the poor quality of port infrastructure and insufficient number of ports. For the quality element, the craneage and port congestion issues are important. The Vietnamese government has some projects to improve port productivity, and in those plans the most important concept is to increase the port cargo volumes and cooperate with foreign companies to develop more modern port facilities.

In this case study the shipment features are critical, and as a result some fundamental elements of transport such as cost, lead time and distance are, perhaps, not so obvious. Risk and safety evaluation have greater emphasis in this analysis. Certainly, for under-developed and developing countries, all of them have greater restrictions in developing intermodal transport. Regulation, operation and infrastructure are negative factors in developing intermodalism. The Vietnamese freight rail services still require more foreign investment, especially to expand the rail network and to increase performance and therefore to improve rail competitiveness in the future.

The coastal shipping service offers the lowest costs and the most convenient transport mode for certain intermodal operations. The risk of unstable weather conditions, however, has a negative effect. Inflexible shipping schedules also decrease the opportunities for this transport mode to shippers and carriers. The most advantageous feature of coastal shipping, in Vietnam, is that there are many natural harbours which can be developed as transfer nodes to improve intermodal operations.

An interesting aspect of this study is the interplay of trade-offs between cost, speed and risk which can be highlighted as in Table 6.

Table 6. Cost, Distance, Time and Risk by Route

Route	Cost $US	Cost / Km $US	Distance (km)	Time (hrs)	I-modal transfer	Speed / Cost/ Risk
1	2953	2.46	1197	122	0	2nd quickest, most expensive but least risk
2	2364	2.51	941	116.5	2	Med. speed, Med. cost, Med. risk
3	2563	1.64	1563	129	3	Slowest, Med. cost, highest risk
4	1288	0.76	1705	80	2	Quickest, cheapest, Med. risk

Three of the four routes are rather similar in terms of total cost, whereas route four (coastal shipping option) is clearly the cheapest. Measured by time, however, routes one, two and three are similar with route two offering slightly the quickest service. These are all slower than route four which is comfortably quickest and cheapest. Therefore, there appears to be no clear cut reasons for preferring routes one, two or three over route four as several also have inherent risk of loss, damage or delay at intermodal transfer points. However, the coastal shipping option suffers from significant and unpredictable delays during the rainy season. These delays, both at sea and in the ports, have the effect of substantially reducing the reliability of the price competitive coastal shipping option.

To conclude, the Vietnam case-study shows clear trade-offs between cost and time which suggest that the quickest option is generally also the cheapest but there is substantial risk of delay at certain times of year. On the other hand, rail-road intermodal solutions are rather expensive with some risk attached mostly to the

intermodal transfer activities. The all road alternative is probably the most reliable (built on the traditional advantage of door-to-door service) but is expensive and not particularly quick.

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