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Route Selection: Applying a Logistics Viewpoint

The choice of routes for trade flows is made based on four factors: the total logistics costs, time required for door-to-door movement, reliability of delivery, and condition of the delivered goods.¹ Chapter 2 analyzed components of the logistics chain for major trades and routes currently in use in order to explain their impacts on cost and time. This chapter will expand the analysis by comparing the time and costs for these existing routes with those of alternative routes that are not currently in operation, either because of protocol restrictions or infrastructure gaps. The comparative analysis demonstrates how the components of the logistics chain contribute to the competitive advantages of one route over another. The analysis provides a framework for evaluating proposed improvements in a specific route. The impact of these improvements depends on the change in logistics time and cost, as well as the potential for cargo damage, for the route relative to competing alternatives. Similarly, comparative analysis provides a basis for identifying and evaluating new routes by considering their advantage in terms of time, cost, or condition relative to currently used routes. The Bank study team, in collaboration with private sector stakeholders from the subregion, developed the logistics cost model used for the comparative analysis (see Map 6 at the end of this report).

The framework provides a tractable and easy-to-use tool for stakeholders that will help in two types of decisionmaking: (a) to determine which of the routes available is less inefficient and (b) to determine which of the components of the transport logistics chain on a particular route are problematic, where improvements in the

1. The exports and imports analyzed in Chapter 2 are sold either cost-insurance freight (cif) or ex-factory/farm gate. The imports of polypropylene and wool are bought on a cif basis. The intraregional shipments are sold either cif or ex factory/farm gate. In all cases, the responsibility for the logistics rests with either the shipper or the consignee, not both. Therefore the selection of a route will be based on the complete logistics time and cost. The alternative would be to sell exports at the port on a free on board (fob) basis and to purchase imports cif at the port. When the logistics stop at the port, the selection of a route is decided by both the shipper and the consignee.

short term can bring significant returns in terms of efficiency improvements. Shippers and consignees can use this analytic framework to select routes. Governments and other stakeholders can use it to evaluate policies and investments intended to improve performance on one or more routes.

The objective here is not to recommend any one particular route over others or to suggest that any one of the routes analyzed here is the most efficient. The routes analyzed all have inefficiencies, some more than others. Rather, the focus is on trying to encourage further probing and informed dialogue among stakeholders on the routes where efficiency gains can be achieved in the short term, and where more long-term interventions would be required. The focus is on the information that stakeholders have available when selecting routes for shipping cargo. The objective is to identify those improvements in infrastructure, services, and trade facilitation that allow shippers to offer their goods to selected markets at a lower delivered cost with a delivery time and reliability that is acceptable to that market.

It is important that shippers have options. The choice of route will vary with the type of commodity being shipped and the market for that commodity. Reductions in cost, time, and damage on one route will cause some of the cargo to be diverted from alternative routes. These diversions are not instantaneous, but they can occur rapidly if cargoes are traded in competitive markets. Lower logistics costs allow shippers to compete on delivered price. Faster travel times allow shippers to compete for markets that require shorter delivery times. Less damage allows shippers to compete where the quality of the product is a major concern or where restocking times are long. The following analysis suggests that relatively small changes in the logistics chain can have a big impact on route selection.

This same technique can be used to assess future requirements for logistics services. Already, liberalization of trade and the restructuring of international and domestic transport industries have raised expectations regarding the quality of logistics. Future changes in trade and the transport network will raise not only expectations but also requirements for new routes with lower logistics cost and time, and with greater reliability. These trends are discussed briefly at the end of the chapter. They are important to anticipate since the logistics industry in the region has largely been in a catch-up mode and has acted as a constraint rather than as a catalyst for growth in trade and economic development.

The planned improvements in the regional transport network will raise expectations and lead to a diversion of freight movements to the more efficient routes. The end of this chapter discusses the impact of these improvements on route selection. The type of commodities being shipped are expected to change from predominantly raw and semiprocessed materials to semifinished and finished manufactured goods. The trend toward the production of high-value goods must be complemented by better logistics if producers are to compete in international markets.

A more precise indicator of logistics performance is the variance, rather than the average value, of the times and costs of transportation. It is difficult to obtain data on this variable. This chapter also includes a brief discussion of the impact of variance on the costs to the user. It then looks at the relative importance of the condition of the cargo following shipment and the impact of losses and damage on route choice. Losses and damage not only increase the delivered cost but also add to reorder time and increase inventory cost to cover potential shortfalls in the delivery of acceptable goods. The number of intermediate transfers is important for cargoes that are sus-

ceptible to loss of damage. The form of shipment is important because it affects both time and damage. Containers and bulk cargoes can be moved more quickly with less damage if handled with appropriate equipment. Several of the selected routes involved container movements, but part of the transport was in break bulk because of physical or regulatory constraints. Bulk cargo is often bagged at a port or transfer point between rail and truck transport, thereby increasing losses and delivery times.

This chapter begins with a comparative analysis of five of the routes that the previous chapter discussed. The analysis is based on current charges and performance. Comparisons are made with alternative routes that have been suggested by users and other stakeholders, or are in the process of being made available because of ongoing bilateral or multilateral negotiations, upgrades to the physical infrastructure, or both factors. These alternatives have specific advantages that may or may not be significant when placed in the context of the total costs for movement of the cargo. Using the same context, the chapter reviews various proposals for improving the efficiency of the logistics for the existing and proposed routes. Based on the result, a series of initiatives are proposed for improving the selection of routes available by building on the recommendations of the previous chapter.

COMMODITIES, MODES, AND ROUTES: SELECTED CASE STUDIES

The five cargo flows selected for comparative analysis were presented in the previous chapter. Three are extraregional trade in carpets, tea, and general cargo (or FAK), and two are intraregional trades in cement and fruits. The comparisons also consider routes through other countries, especially Bangladesh and India, which are shorter and may offer potential savings in cost and time

for the landlocked regions of Nepal, Bhutan, and Northeastern India.

Case 1: Exporting High-Value Goods from a Landlocked Country to an International Market

Carpet is exported from Nepal to European markets via Calcutta port. The carpets are containerized at Birganj, which is 165 kilometers from Kathmandu. The container trucks are cleared by Nepalese customs and, after an overnight wait at the Nepal-India border, enter Raxaul for clearance on the Indian side. The entire trip by road from Kathmandu to Calcutta port, plus the time in port, averages eight days. This includes a two-day wait to enter the port. It takes an additional four days for clearing customs and loading the cargo on the vessel. The cargo is then shipped east to Singapore for transshipment to a larger ocean vessel heading west to Europe.

The freight forwarders in Nepal are proposing the use of the port at Nhava Sheva (Jawaharlal Nehru Port Trust, or JNPT) on the western coast of India as an alternative to Calcutta once the Bhairawa ICD becomes operational (Map 8 at the end of this report).² This would allow direct shipments to Europe instead of feeding through Singapore. The new route would be by truck from Kathmandu through Bhairawa to Nautanwa, India, where the cargo would be packed into containers. The containers would be transported to the ICD at Moradabad and placed on rail cars for shipment to Mumbai and the JNPT container terminal. Although the land transport distance is three to four times as far as the distance to Calcutta port, the ocean portion offers considerable savings in freight rates and shipping times.

2. Nepalese cargo has access through the ports at Kandla and Nhava Sheva on the western coast of India in addition to Calcutta port.

TABLE 3.1 CASE 1—HIGH-VALUE EXPORTS FROM A LANDLOCKED COUNTRY TO EUROPE**CONSIGNMENT ATTRIBUTES**

Commodity type	Carpet
Shipment size	1 TEU
Origin	Kathmandu, Nepal
Destination	Munich, Germany
Via	Bremen Port, Germany
Shipment value	\$90,000

	ROUTE 3-1 ATTRIBUTES		ROUTE 3-2 ATTRIBUTES	
	Kathmandu-Birgunj/ Raxaul-Calcutta Port-Bremen		Kathmandu-Bhairawa-Nautanwa- Moradabad-Mumbai (JNPT)-Bremen	
	Cost (US\$)	Time (hours)	Cost (US\$)	Time (hours)
<i>Transport & handling</i>				
Inland transport	480.00	117	740.00	88
Cargo handling	260.00	74	463.00	155
Ocean freight	1,200.00	528	750.00	336
<i>Cross-border processing</i>				
Cargo transfer	261.00	164	125.00	37
Customs inspection	405.00	20	202.33	7
<i>Trade-related logistics</i>				
Time cost of goods	1,252.45		864.09	
Insurance or pilferage & damage	675.00		675.00	
Documentation & forwarding	450.00		450.00	
Bank processing for letter of credit	360.00		360.00	

KEY RESULTS

Transport logistics cost (US\$)	5,343	4,629
Transport logistics time (hours)	903	623

Source: Logistics cost study, World Bank.

It has the additional advantage of better productivity and fewer delays at Nhava Sheva than at Calcutta port. Table 3.1 shows the cost and time comparison of the two routes.

Although there is about a 14 percent reduction in cost for the route via the JNPT, the more substantial benefit is a 30 percent reduction in travel time from nearly 38 days to 26 days. The land

route to the JNPT is more costly because of the longer distance, but the travel time is reduced by more than one day because of the higher speed on the rail connection between Moradabad and the JNPT. The three-day time for transferring cargo from truck to rail at the Moradabad ICD and 1.5 days in Nhava Sheva port is comparable to the six days spent at Calcutta port. The reduction in ocean transport time is substantial because the route from Calcutta is assumed to include a three-day voyage to Singapore and a five-day wait at Singapore for connection to the mother ship. The JNPT route time could be reduced by one day through tighter coordination in the packing of containers and loading on the rail cars. Further efficiencies could be obtained if the transshipment from road to rail could be avoided altogether at Moradabad. With the operationalization of the rail ICD at Birganj, it would be feasible to ship containerized carpets all the way by rail from Birganj across India to the JNPT.

Although the new route through Nhava Sheva offers substantial savings in time and cost for cargoes shipped to Europe, the same does not apply for shipments to Asia. The latter would require shipping the cargo from Nhava Sheva back through Singapore. Surprisingly, the difference in costs and time with this doubling back would not be that much greater than the route through Calcutta.

Carpets are high-value commodities, and shippers are interested in minimizing the number of handlings. This is better accomplished by shipping containers through Nhava Sheva. Although carpets do not have short order times, they do have a high carrying cost so that a one-month reduction in delivery time will produce a saving to the shipper of about \$1000 per container shipment. More importantly, the faster route allows Nepal to compete in markets that require tighter logistics and shorter order times.

This case also suggests that efficient train operations can play a role in the movement of high-value cargoes over long distances. More importantly, it shows that inefficient ports can have a major impact on route selection. Even if the time in Calcutta could be reduced to four days and the cross-border movement could be reduced to one day (especially once the Birganj ICD is operational), the route through the JNPT would still be nine days shorter for shipments to Europe.

Case 2: Exporting Medium-Value Goods From a Landlocked Region To a Third Country

The second case concerns tea shipped from Assam to Europe. Tea produced in Assam is exported to foreign markets through an all-India route, either by rail from an ICD at Gauhati to Haldia port or by road from Assam to Calcutta port. Let us consider the latter case. The tea is crated at the exporter's premise and trucked to Calcutta port. The 1,380-kilometer trip via Shiliguri requires about seven days. In Calcutta, the cargo is checked by customs and loaded into containers at the port's container freight station. It is drayed to the container terminal and subsequently loaded onto an oceangoing vessel. The total processing time on average is 6.75 days. The ocean route involves transshipment via Colombo or Singapore before continuing on to Europe, taking a total of 23.5 days. The major avoidable delays occur at the port of Calcutta.

An alternative route for Assamese tea exports could be through Bangladesh via the port of Chittagong. This route is not one that is in use because of the absence of a bilateral agreement between Bangladesh and India providing transit access to cargo from Northeastern India. If the two countries were to come to an agreement on this issue, then a possible routing could be from Assam south to Agartala (Tripura), crossing over to Bangladesh at Akhaura and on to Chittagong—

TABLE 3.2 CASE 2—MEDIUM-VALUE EXPORTS FROM A LANDLOCKED REGION TO EUROPE

CONSIGNMENT ATTRIBUTES		ROUTE 3-5 ATTRIBUTES		ROUTE 3-6 ATTRIBUTES	
Commodity type	Tea	Karimganj-Gauhati-Siliguri-Raiganj-Calcutta		Karimganj-Agartala-Chittagong-Liverpool, United Kingdom	
Shipment size	8.4 tons	Cost (US\$)	Time (hours)	Cost (US\$)	Time (hours)
Origin	Karimganj				
Destination	Liverpool, United Kingdom				
Via	Liverpool, United Kingdom				
Shipment value	\$20,000				
<i>Transport & handling</i>					
Inland transport		620.00	168	117.00	29
Cargo handling		205.00	16	328.00	37
Ocean freight		1,250.00	564	1,250.00	585
<i>Cross-border processing</i>					
Cargo transfer		265.00	150	78.00	177
Customs inspection		120.00	12	100.00	39
<i>Trade-related logistics</i>					
Time cost of goods		280.48		267.23	
Insurance or pilferage & damage		200.00		200.00	
Documentation & forwarding		100.00		100.00	
Bank processing for letter of credit		80.00		80.00	
KEY RESULTS					
Transport logistics cost (US\$)		3,120		2,520	
Transport logistics time (hours)		910		867	

Source: Logistics cost study, World Bank.

a distance of about 530 kilometers (Map 9 at the end of this report). If the current policy of prohibiting foreign vehicles into Bangladesh continues, this would mean that the cargo is trans-

ferred to Bangladeshi trucks from Indian trucks at the border. Assuming that there is no congestion, the processing time at the border would be about 19 hours and cost US\$72, or \$8.60 per

ton. At Chittagong, it would require an average of nine days for the cargo to clear customs, be loaded into a container, and wait to be loaded onto a vessel. The ocean voyage from Chittagong to Europe is similar to that from Calcutta (via Singapore). This route would save about 19 percent in total cost, as Table 3.2 shows, but the savings in time is insignificant because of the dominance of the ocean movement. The shorter road route (by over 60 percent) would save about 5.5 days, but the time for cargo transfer and customs clearance at the border would add about 3 days. Because Chittagong has less efficient handling, the time the cargo spends in port is about 2.5 days longer. Overall, the shorter route through Chittagong port produces transport time savings of less than 2 days.

The potential advantage of a shorter route through Chittagong is compromised by delays at the border and the requirement to transfer cargo to Bangladeshi trucks. Since the cargo is not containerized, the contents are sensitive to damage, even though tea exporters limit the potential for damage by packing tea in relatively sturdy crates. The choice of route is also affected by the delays at port, which in turn are a function of port performance and frequency in sailings. It is likely that a choice would be made based on the availability of sailings to Europe. The delays on both routes could be significantly reduced with improved port performance. The time in Calcutta could be reduced to four to five days, while the time in Chittagong for packing and waiting for the vessel could be reduced by two to three days. With these improvements the route through Chittagong would be faster and less costly, and the delivery time would be reduced to about 40 days.

Additional time savings could be achieved if Indian trucks were allowed to carry the cargo to Chittagong and if the tea could be transported in containers through Bangladesh.³ The elimination

of the transshipment requirement at the India-Bangladesh border would provide savings in time and cost, but more importantly would reduce the cargo damage. This alone would lower the logistics cost by about 0.25 percent of the value of the cargo.

With the changes in the long-term road and rail transport network envisioned in the subregion, (or even with the current networks), it would be possible to send tea containerized all the way to JNPT if the choice of land routes were expanded to include the rail connection to Nhava Sheva. Initial estimates indicate reduced travel time of an additional 1 to 1.5 weeks and reduced shipping costs of about US\$200 compared with the Chittagong route.

Case 3: Intraregional Movement of Break-Bulk Cargo of Essential Commodities to a Landlocked Region

Northeast India obtains most of its essential commodities from the rest of India. The third case examines the transportation of general cargo (freight of all kinds or FAK) from the warehouses in Calcutta to Agartala, Tripura (Table 3.3). The goods are carried on trucks in break-bulk form from Calcutta, the closest major market supplying these goods, through Shiliguri to Agartala in Tripura. The 1,615-kilometer journey from warehouse to Tripura requires about eight days. Because this is a direct movement, there are no international border crossings and no delays for customs clearances or handling cargo along the way.⁴

There have been recent debates in Bangladesh on possible options for providing Indian cargo

3. Container movement on road within Bangladesh is non-existent. The main mode for moving containerizable goods in the Dhaka-Chittagong corridor is by rail, which also is underutilized. See Background Note 4.

4. Constraints in state border crossings within India are not included here.

TABLE 3.3 CASE 3—MEDIUM-VALUE EXPORTS WITHIN THE REGION

CONSIGNMENT ATTRIBUTES

Commodity type	FAK
Shipment size	8 tons
Origin	Calcutta
Destination	Agartala
Shipment value	\$24,000

	Calcutta-Raiganj-Siliguri-Gauhati-Karimganj-Agartala		Calcutta-Petrapole-Benapole-Daulatdia Ghat-Aricha Ferry-Narayanganj-Bhairab Ferry-Brahmanbaria-Ashuganj-Akhoura-Agartala					
	All India		Proposed transshipment through Bangladesh		Reduced delays through Bangladesh		Without transshipment	
	Cost (US\$)	Time (hours)	Cost (US\$)	Time (hours)	Cost (US\$)	Time (hours)	Cost (US\$)	Time (hours)
<i>Transport & handling</i>								
Inland transport	760	180	263	41	263	41	263	41
Cargo handling	278	18	270	20	270	20	270	20
Ocean freight	—	—	—	—	—	—	—	—
<i>Cross-border processing</i>								
Cargo transfer	—	—	106	35	106	35	0	0
Customs inspection	—	—	125	151.5	125	55.5	75	12
<i>Trade-related logistics</i>								
Time cost of goods	73		96		83		96	
Insurance or pilferage & damage	240		180		180		180	
Documentation & forwarding	60		240		240		240	
Bank processing for letter of credit	96		96		96		96	

KEY RESULTS

Transport logistics cost (US\$)	1,507	1,376	1,363	1,220
Transport logistics time (hours)	198	247.5	151.5	73

Source: Logistics cost study, World Bank.

transshipments access through Bangladesh. An alternative routing would be for the cargo destined to the Northeastern Indian states to be routed through Bangladesh, thereby reducing the land route by 1,000 kilometers. A possible routing for the cargo could be via the Petrapole (India)-Benapole (Bangladesh) border crossing on the western side and enter Northeastern India at the Akhaura (Bangladesh)-Agartala (India) crossing (Map 10 at the end of this report). The route would include ferry crossings at Aricha and Bhairab.

With the current policies of not allowing foreign trucks into Bangladesh, this would require transfer of cargo at the Petrapole-Benapole border crossing to Bangladeshi trucks on the western side and again at the Akhaura-Agartala border crossing to Indian trucks. The route could reduce trucking time by about six days, but the cross-border procedures and transshipment of cargo at both sets of border crossings (Petrapole-Benapole and Akhaura-Agartala) add back eight days. The savings in trucking costs (over 50 percent) would be offset by the increased costs for cargo inspection, transshipment, and document processing at the two border crossings. There would also be the potential for additional damage during the transfer of cargo from Indian trucks to Bangladeshi trucks and back to Indian trucks. In this situation, the shorter route through Bangladesh is not significantly different in cost (less than 10 percent cost savings) and, in fact, requires 50 hours more logistics time, as shown in Table 3.3 (column 2). The routing through Bangladesh with transshipment would reduce the line-haul transport time by over 75 percent, but there would be a significant increase in the total logistics time due to the border crossing problems. Taking average estimates provided by private sector members in the subregion, the biggest problems are at the Benapole-Petrapole border crossing. They include two days of waiting in line at the border, and over 2.5 days for cross-border clearance at customs. Furthermore, there

would be customs clearance at Akhaura and at Agartala (over two days) and transshipment requirements at both sides. It must be emphasized that these are average estimates that do not include strikes and other incidents that are common to the subregion, which can increase delays by 60 to 100 percent.

If the delays for waiting in line at the Petrapole-Benapole border crossing were eliminated, and the procedures at both sets of border crossings between Bangladesh and India were simplified, the time for the transit route could be reduced by four days. This would make the route two days shorter than the route through Siliguri, but there would not be a significant reduction in cost. (Table 3.3, column 3).

A scenario to consider would be along the lines of practices in other parts of the world, including Europe and developing countries in Central Asia. It would allow Indian trucks transit access to a dedicated corridor across Bangladesh. In this case, there would be no transshipment between Indian and Bangladesh trucks at the borders. If the cargo was allowed to move in-bond in Indian trucks across Bangladesh, an additional 3.25 days would be saved because the trucks could move quickly through customs. The provision for in-bond movement would reduce both cargo transfer costs and the costs for clearance so that the logistics costs would be 19 percent less than the route through Siliguri. The savings in time would be five days (Table 3.3, column 4).

This case demonstrates the importance of border crossings as a source of delay. More efficient border crossings and protocols could produce a dramatic increase in transit traffic. Although the transit through Benapole introduces extreme delays, all cross-border movements are delayed at least one day per border crossing. Efficient in-bond clearance procedures will significantly reduce trip times.

Case 4: Intraregional Movement of Low-Value Commodities to Northeast India

Cement is an important commodity that is transported from Eastern India to Northeastern India. Consider the movement of cement from West Bengal to Agartala in Tripura. It is moved in bags on broad-gauge rail from Calcutta through Gauhati and Lumding and then down to Karimganj and Agartala. This is a total distance of 1,635 kilometers with no border crossings, assuming that the supplier and the customer have direct access to the rail sidings (Map 11 at the end of this report). The trip takes 2.5 days and costs about US\$26 per ton (Table 3.4).

The alternative would be to move the cement through Bangladesh by rail, a route that is not currently in use due to the lack of agreement between the two countries. The current broad-gauge rail connection from India extends into Bangladesh (at Darshana-Gede and Petrapole-Benapole) and stretches across the Jamuna bridge as a dual-gauge line. The broad-gauge link is being extended to Joydepur and Tongi (Background Note 3). A meter-gauge link connects Tongi to Akhaura. There are tentative plans to link the broad-gauge rail between Akhaura, Bangladesh, and Agartala, India, on the eastern side of Bangladesh's border with India. If we assume that the two countries agree on protocol to allow cargo movement for the Northeastern Indian states by rail via Bangladesh, this route would require one shift from broad gauge to meter gauge at Tongi and then back to broad at Akhaura (assuming that the other broad-gauge links are in place and completed as planned).

This alternative route would reduce the total distance by more than 1,010 kilometers, but it would require an exchange of locomotives at both borders. If this exchange is efficient, the route has a competitive advantage in time and cost. The line-haul time would be shorter by 1.25 days. The

transshipment and customs clearance was assumed to add a half-day, but this could easily increase to four to five days with a missed connection between Indian and Bangladeshi trains.

The cost for rail transport would be 43 percent less on the alternative route, while the handling and clearance would add back only 2 percent. There could be additional offsets related to delays and damage. This route would require additional handling—and handling of bagged cement inevitably involves significant losses. Missed connections at the border and losses during the transfer from broad to narrow gauge could create shortfalls in deliveries. On balance this route would be considerably less costly due to savings from the considerably shorter line-haul distance. However, this assumes that gauge conversions are completed, particularly the Akhaura-Agartala link that is still at a preliminary stage of planning. If not, the portion of meter gauge requiring a transshipment, either between rail cars or to and from trucks, would substantially increase the handling costs and the damage to the cargo.

An inland water route from Calcutta to Ashuganj by inland waterways transport was also considered. This route is available for transiting through Bangladesh to and from the Northeastern Indian states because of a bilateral protocol that was revised in October 1999. The route would require trucking the cargo from the cement plant to Calcutta, loading it on the barges, and shipping it to Ashuganj, where the cement would be loaded on trucks for delivery.

This route adds 10 days to the line-haul time and several days for loading and unloading the barges (Table 3.4, column 3). The result is a nine-fold increase in logistics time compared to the railway transit route. Furthermore, the logistics costs would increase by about 23 percent, not counting the substantial increase in cargo loss

TABLE 3.4 CASE 4—INTRAREGIONAL MOVEMENT OF LOW-VALUE, BULK COMMODITIES TO LANDLOCKED REGION

CONSIGNMENT ATTRIBUTES

Commodity type	Cement
Shipment size	2,200 tons
Origin	Calcutta
Destination	Agartala
Shipment value	\$133,000

	ROUTE 3-9 ATTRIBUTES		ROUTE 3-10 ATTRIBUTES		ROUTE 3-11 ATTRIBUTES	
	Calcutta-New Jalpaiguri-Bongaigon-Gauhati-Lumding-Karimganj		Calcutta-Gede-Darsana-Ishurdi-Jaydevpur-Dhaka-Tongi-Akhaura-Agartala		Calcutta-Narayanganj-Ashuganj by barge and Ashuganj-Agartala by truck	
	Cost (US\$)	Time (hours)	Cost (US\$)	Time (hours)	Cost (US\$)	Time (hours)
<i>Transport & handling</i>						
Inland transport	58,400	48	33,468	18	4,300	3
Cargo handling	1,022	12	2,237	24	9,774	108
Inland waterway transport & handling	—	—	—	—	29,314	264
<i>Cross border processing</i>						
Cargo transfer	—	—	—	—	511	48
Customs inspection	—	—	400	17	300	120
<i>Trade-related logistics</i>						
Time cost of goods	123		121		1,113	
Insurance or pilferage & damage	1,330		998		1,330	
Documentation & forwarding	665		665		333	
Bank processing for letter of credit	532		532		532	
KEY RESULTS						
Transport logistics cost (US\$)	62,072		38,421		47,507	
Transport logistics time (hours)	60		59		543	

Source: Logistics cost study, World Bank.

during the transfer between trucks and barges. However, the inland waterways transport route remains preferable to the route through Siliguri in terms of logistics costs—it is 23 percent less by inland waterways transport than by the long all-India rail route around India's so-called chicken's neck. The disadvantage in logistics time could also be reduced through the introduction of navigation aids, including those for night navigation.

Case 5: Movement of Perishable Commodities from Nepal: 8.5 Tons of Apples from Kathmandu to Dhaka

The final case analyzes the movement of apples from Kathmandu to Dhaka (see Background Note 7 for a full report). For both Bhutan and Nepal, the most important trade goods with the region are vegetables, fruits, and related produce. The analysis does not concern alternative routes but rather the importance of simplified border crossing procedures. The recent Phulbari corridor agreement among Bangladesh, India, and Nepal allows Nepalese goods, particularly agricultural produce such as jhumla apples, to find a market in Bangladesh. The apples travel from Nepal to Dhaka as loose cargo on trucks. The initial movement is to the border with India in a Nepalese truck, a distance of 619 kilometers. The truck crosses Nepal at Kakarvitta and travels through Panitanki and Phulbari in India to enter Bangladesh at Banglabandh, a distance of 43 kilometers (Map 12 at the end of this report).

The Nepalese consignment is escorted by Indian police over this route. When it crosses over to Bangladesh, the cargo is transferred to Bangladeshi trucks and carried 532 kilometers to Dhaka. The Banglabandh border crossing is a fledgling one, and it does not have a formal customs office or an official in place. The nearest customs office is in Panchagarh, about 58 kilometers away. It has to be informed every time a Nepalese consignment is expected to arrive. Total

trucking time is about three days. Another 1.75 days is spent in crossing the borders and transferring cargo between trucks. The time and cost of transferring the cargo between trucks is a relatively small part of the total logistics time and cost, but this does not include the damage to the apples as a result of the transfer. Also, the impediments faced in the process of clearing four customs points (at the two border crossings) and the absence of a customs office at Banglabandh do not provide positive incentives for trade.

The inefficiencies could be reduced if Nepalese trucks were permitted to carry the cargo all of the way to Dhaka. The impact in terms of travel time and direct costs would be relatively small, but the reduction in damage could be significant. A reduction in losses of 1 percent of the cargo value would be equivalent to the savings from handling costs and produce a total savings of 10 percent. A similar kind of analysis could be done for Bhutan, which also supplies perishables such as fruit and fruit-based products to Bangladeshi markets. These commodities are transported from Phuntsholing, Bhutan, through Jaigon and Changrabandh in India. They enter Bangladesh at Burimari, where they are transferred to Bangladeshi trucks to be carried to Dhaka markets. For sustained and improved regional markets for agricultural and horticultural products from Nepal and Bhutan, improved logistics would be key to reducing damage.

HIGHLIGHTS OF CASE STUDIES

The accuracy of the comparative analysis is limited because performance on existing routes is being compared with expected performance on new routes that are not in operation, either because of the absence of bilateral protocols and agreements or because of infrastructure inadequacies. However, these examples clearly demonstrate the importance of being able to select

among alternative routes. A fixed number of border crossings may be appropriate because the resources required to operate these crossings are limited, but there is little justification for limiting the routes between these crossings.⁵ The freedom to choose alternative routes can also help to reduce congestion at the major crossings. See Table 2.6 for a list of current and alternative routes.

Route selection is affected by the bottlenecks at the border crossings and seaports as well as by the condition of the links. The reaction of shippers to the growing congestion at the Benapole crossing is a case in point. The situation deteriorated to the point that shippers rerouted through remote and unmanned border crossings rather than wait for days at the border, especially if they were carrying perishable cargo. This issue is now being resolved through an expansion of the border crossing (discussed in the previous chapter).

Based on the comparative analysis, the following route-specific observations can be made:

- Intraregional shipments of fruits, vegetables, and other perishables from Bhutan and Nepal to India and Bangladesh require much better logistics. This can be achieved by allowing the cargo to move in a single truck from origin to destination and by ensuring that clearance time at the border on both sides does not exceed six hours.
 - High-value exports from Nepal to the Pacific Rim require faster handling at Calcutta, Chittagong, and Haldia, while shipments to Europe and the U.S. East Coast require direct (intermodal) connections to the JNPT. Both
- require containerization of the cargoes at the earliest point in the logistics chain. The ability to ship in containers will be substantially improved with the operationalization of the three ICDs on the Nepalese border.
- Truck routes via Bangladesh can offer reductions in time and cost for medium-value goods moving between East and Northeast India. This will require an effective protocol for in-bond movements and coordination between customs checkpoints to significantly reduce delays and eliminate transshipment. The savings to the shippers should be sufficient to support tolls to cover the cost for road maintenance resulting from the increase in transit traffic.
 - For trade in high-value goods between India and Bangladesh, trucks will be the dominant, if not exclusive, mode. Travel time will be the major concern and route selection will be based on reducing door-to-door delivery time. Significant improvements in rail operations will be needed if this mode is to capture some of this traffic.
 - Low-value goods, especially bulk cargoes, will move primarily by rail because of the higher costs for trucking and the longer transit times for inland water. However, inland waterways could play a more prominent role in the transport of the low-value bulk cargoes that move between Calcutta and north and east Bangladesh, which is not yet served by broad-gauge rail. With improvements in night navigation aids, the transit times by inland waterways could be reduced.
 - If the Indian and Bangladesh railways continue to integrate their systems and to extend their broad-gauge networks, they might capture some medium-value break-bulk cargoes. However, delays will continue at the border

5. There are many reasons for restricting the use of routes by international traffic, including issues of security and safety.

unless compatible rolling stock is introduced and the shortage of locomotives ends.

- Seaports are very important factors in determining route selection because of the large delays and high costs for transferring cargo through the port. More cargo would be routed through efficient seaports that eliminate unnecessary customs procedures and delays in cargo handling.

DAMAGES, DELAYS, AND CORRUPTION

In this and previous chapters, frequent references have been made of the cost of damages; however, data were not available to determine how damage varied by route. The insurance for pil-

ferage and damage was assumed to be 1 percent of cargo value for longer routes and 0.75 percent for shorter routes. Insurance covers only part of the losses because the existing legislation regarding carriage of goods does not clearly assign liabilities.

In order to understand the impact of damages, comparisons were made between the reported logistics costs and typical costs for damages. It was assumed that the losses per intermediate transfer average between 0.25 and 1.5 percent of cargo value, depending on the type of commodity and cargo form. The lower rate applies to containerized cargo and the higher rate to agricultural products shipped in break-bulk form. Table 3.5 shows the number of intermediate handlings and expected losses per handling.

TABLE 3.5 ESTIMATED IMPACT OF DAMAGE

Origin/destination	Mode	Cargo	Total time (days)	No. of handlings	Damage per intermediate handling (percent)
<i>Domestic</i>					
Calcutta-Argatala	Rail	Cement	9.8	2	1.00
Calcutta-Argatala	Truck	General cargo	8.3	3	0.50
<i>Regional</i>					
Kathmandu-Dhaka	Truck	Agricultural produce	4.6	3	1.50
Thimpu-Dhaka	Truck	Limestone	3.6	3	0.75
Calcutta-Dhaka	Truck	Yarn	11.3	3	0.50
Calcutta-Argatala	Barge	Cement	19.0	4	0.75
<i>International</i>					
Karimganj-Calcutta-Liverpool	Truck	Tea	37.4	3	0.25
New Zealand-Calcutta-Kathmandu	Truck	Wool	33.4	4	0.50
Singapore-Calcutta-Thimpu	Truck	Polypropylene	29.5	4	0.50
Dhaka-Chittagong-United States	Truck	Cotton garments	34.3	3	0.25
Kathmandu-Calcutta-Bremen	Truck/rail	Carpet	39.1	4	0.25

Source: Logistics cost study estimates, World Bank.

TABLE 3.6 IMPACT OF DAMAGE AND DELAYS

Origin/destination	Cargo	Logistic cost (as percentage of cargo value)	Delay cost ^a (as percentage of cargo value)	Damage ^b (as percentage of cargo value)
<i>Domestic</i>				
Calcutta-Argatala	Cement	44.7	0.39	1.00
Calcutta-Argatala	General cargo	4.3	0.17	0.50
<i>Regional</i>				
Kathmandu-Dhaka	Agricultural produce	18.1	0.59	1.50
Thimpu-Dhaka	Limestone	119.3	0.11	0.75
Calcutta-Dhaka	Yarn	3.2	0.45	0.50
Calcutta-Argatala	Cement	58.7	0.76	1.50
<i>International</i>				
Karimganj-Calcutta-Liverpool	Tea	12.3	2.25	0.25
New Zealand-Calcutta-Kathmandu	Wool	8.0	0.67	1.00
Singapore-Calcutta-Thimpu	Polypropylene	24.6	0.59	1.00
Dhaka-Chittagong-United States	Cotton garments	4.1	0.69	0.25
Kathmandu-Calcutta-Bremen	Carpets	2.9	0.78	0.50

a. Additional cost for the consignee's inventory, assuming delay equal to 15% of total travel time.

b. Excludes initial loading and final unloading.

Source: Logistics cost study estimates, World Bank.

The costs of delays to the shipper were included in the logistics costs presented above, and they are based on the estimated carrying costs to the shipper for the value of cargo while in transit. This assumes that the shipper borrows against the letter of credit for the time the cargo is shipped to when it is received. The other cost of delay derives from the uncertainty of the period of shipment. The consignee must maintain sufficient inventory to prevent an outage if goods are not delivered in the maximum delivery time.⁶ The cost of financing this inventory is the value of the in-

cremental inventory required, multiplied by the annual rate of interest paid by the consignee.⁷ This additional inventory is then related to the annual shipment of goods to obtain a percentage of cargo value. For the purposes of comparison, the reorder rate was assumed to be 3 months for textiles and carpets, 1.5 months for building materials, 1 month for tea, and 2 weeks for agricultural products. Table 3.6 summarizes the results, which assume the delays are 15 percent of the expected transit time, including ocean transport.

6. If the product is reordered every x weeks and maximum delivery time is y weeks greater than the average, then the minimum stock at the time of order must be the amount consumed during the average delivery time plus y weeks.

The net impact of the uncertainty in delivery time is that the consignee must maintain an extra y weeks worth of inventory or x/y of a typical shipment.

7. The prevailing commercial interest rate is used. The proper rate, the consignee's cost of capital, is larger.

Table 3.6 compares the costs of delay with damage and logistics costs. The impact of damage and delay are greatest for the high-value cargoes because the amounts are comparable to the other logistics costs. For Nepalese carpets, Bangladeshi garments, Indian yarn, and imported wool, the costs for damage and delay is equal to 25 to 45 percent of the logistics costs. For Bhutanese limestone and Indian cement, these costs are equal to just 1 to 3 percent of the logistics costs. For Indian FAK, Nepalese agricultural products, and Assam tea, the costs are 11 to 20 percent of the logistics costs. Assam tea is most sensitive to delay because the logistics time and the reorder time are similar, whereas Bhutanese limestone is the least sensitive because the logistics time is small compared to the reorder time. Damage is more important for the non-containerized cargo with several intermediate handlings. The requirement for introducing containers to reduce damage is greatest for agricultural products. The reduction in intermediate handlings to reduce damage is greatest for cement.

The impact of corruption was also examined by requesting information on informal payments. These include not only payments to customs officials at the border crossings, but also payments to police at checkpoints along the route and to cargo handlers in port. Most of the information collected was anecdotal, although an attempt was made to relate payments to shipments as shown in Table 3.7. These indicate small costs relative to the value of the cargo, with the exception of the imports of polypropylene.

Examples of informal costs cited by shippers include:

- 30 percent of invoice value for a consignment on the Bangladesh-Phulbari corridor through Kakarvitta,
- US\$150 per consignment on imports and exports via Haldia,
- Rs6,000 per container and Rs2,000 to Rs3,000 per truck on average at the Indian border crossing points, and
- Rs80 per ton at the Raxaul-Birgunj border crossing, payable at the Indian side of the Nepalese border.

VARIATIONS IN TRANSPORT LOGISTICS PERFORMANCE AND COST

The logistics cost estimates presented earlier are subject to variations as dictated by operating conditions prevalent at the time. Under less favorable operating conditions, processing the activities in the transport chain can take much longer and therefore affect transport logistics costs adversely. As interest in minimizing inventories and shortening reorder times has increased, so has concern for the reliability of shipment time and cost. Each link in a logistics chain poses a risk of additional delay and, when appropriate, additional informal payments. Reducing the uncertainty associated with the cost and time for delivery has already been given greater priority than absolute cost and time for some trades. Unfortunately, information on this variation is difficult to collect. The small sample of stakeholders consulted during the exercise did not allow for a reliable estimate of the variance in logistics time and cost. However, the stakeholders did estimate that about 10 percent of the shipments during the course of the year experience above-average delays. These occur during the following:

- **Claiming shipment at the gateway port.** This can occur because of late notification of ship arrival notice, long preparation time for

assembling documents for customs clearance, or other reasons, thereby increasing port clearance time by 14 days.

- **Port terminal processing.** Equipment breakdowns can increase processing time by three days and a labor strike can cause delays of more than a week.
- **Customs clearance at the port.** Any of a number of issues, including incorrect documentation, container inspection necessitated by a broken seal, or uncertainty over the dutiable amount of import item, can increase the clearance time by one day to (in the case of incorrect documentation) more than a week.
- **Egress from and access to the port.** Frequent political strikes and transport industry strikes outside the port cause congestion and inhibit mobility, thereby increasing the transit time by one to several days.
- **Road-line haul between the port and the border crossing or destination.** Delays of one day to more than 15 days can result from truck accidents, truck breakdown, police inspection or harassment, the driver visiting home if it is along the route, truck bans in the city, ferry crossings, and other issues.
- **Land exit or entry port in the transit country.** Congested traffic access and egress (particularly on Mondays in the Nepal-India border), late arrival of sealed cover, and local political strikes may increase the processing time by one to several days.
- **Land entry or exit port in the destination country.** Incorrect or incomplete documentation or disagreement over the description or classification of the goods, as well as the

TABLE 3.7 INFORMAL PAYMENTS

Route	Commodity	Informal payment (% of cargo value)
<i>Domestic</i>		
Calcutta-Argatala	Cement	0.0–0.3
Calcutta-Argatala	General cargo	0.15–0.5
<i>Regional</i>		
Kathmandu-Dhaka	Agricultural produce	1.2–1.2
Thimpu-Dhaka	Limestone	0.9
Calcutta-Dhaka	Yarn	0.25
Calcutta-Argatala	Cement	0.25
<i>International</i>		
Karimganj-Calcutta-Liverpool	Tea	0.3–0.5
New Zealand-Calcutta-Kathmandu	Wool	—
Singapore-Calcutta-Thimpu	Polypropylene	1.0–4.3
Dhaka-Chittagong-United States	Cotton garments	0.18
Kathmandu-Calcutta-Bremen	Carpets	0.3

Source: Logistics cost study estimates, World Bank.

valuation of the goods subject to customs duty, may increase the clearance time by two days to more than a week.

The magnitude of the impact of these additional delays depends in many respects on how many delays occur for a given shipment. Conceivably all could occur per shipment in the worst-case situation; alternatively, just one incident could befall a shipment. To demonstrate the high impact on transport logistics cost, calculations for two routes have been made, using data from exporters, freight forwarders, and importers.

The first concerns the case of yarn import from Calcutta to Dhaka. In this case, additional delays

are incurred through several points in the system, namely:

- Trucking from Calcutta to Petrapole increased to 24 hours (from 5 hours) because of congested traffic caused by political protests along the way;
- Waiting at Petrapole customs increased to 108 hours (from 84 hours) because of unusually long lines;
- Indian customs clearance at Petrapole increased to 24 hours (from 1 hour), plus speed money (informal payments) doubled, because of incorrect documentation that required fixing at Calcutta;
- Waiting and unloading at the Bangladeshi customs storage area in Benapole increased to 96 hours (from 60 hours) because of equipment breakdown;
- Bangladeshi customs clearance at Benapole increased to 120 hours (from 72 hours), plus speed money doubled, because of incomplete and incorrect documentation that required additional documentation from Dhaka;
- Loading cargo onto Bangladeshi trucks at the Benapole customs storage area increased to 24 hours (from 12 hours) due to equipment breakdown again; and
- Line-haul trucking from Benapole to Dhaka increased to 24 hours (from 12 hours) due to delayed ferry crossing and the untimely arrival at Dhaka during a period when trucks were banned.

The impact of these delays is to increase the cycle time by 64 percent and the transport logistics cost by 9 percent over the results obtained under average conditions.

The second example refers to carpet export from Kathmandu to Bremen. In this case, the additional delays are incurred at the following points in the system:

- Nepalese trucking from Kathmandu to Birgunj customs increased to 24 hours (from 12 hours) due to an accident along the way;
- Unloading and packing cargo into a container in the Birgunj customs storage area increased to 12 hours (from 6 hours) hours due to equipment breakdown;
- Nepalese customs clearance increased to 48 hours (from 3 hours) because of incorrect documentation;
- Loading the container onto an Indian truck increased to 24 hours (from 3 hours) because of a labor strike in the Birgunj customs storage area;
- Trucking to Raxaul at the Indian border increased to 8 hours (from 5 hours) because of traffic congestion between Birgunj and the Indian border;
- Line-haul trucking from Raxaul to Calcutta port increased to 220 hours (from 100 hours) because of a truck breakdown along the way;
- Waiting time to enter Calcutta port increased to 96 hours (from 48 hours) because the truck missed the last sailing and had to wait for the next one;
- Container handling in the terminal increased to 72 hours (from 36 hours) because of labor unrest;
- Waiting for the vessel and loading it increased to 120 hours (from 60 hours) because of equipment breakdown.

The impact of these delays is to increase in the cycle time by 39 percent and the transport logistics cost by 10.7 percent over the results obtained under average conditions.

CONCLUSIONS

The various insights developed in this chapter can be summarized as follows:

- The entire logistics chain must be examined when considering route selection. The information on an individual component can produce incorrect results. For example, relative transport distance is not directly related to either the time or cost of moving cargo along a route. For most of the routes, the procedures at border crossings introduced substantial and avoidable costs and delays that made the route less competitive. Requirements to transfer cargo from one vehicle to another were particularly expensive and time-consuming. Similarly, the seaports were the major source of costs and delays. This could discourage shippers and consignees from choosing a route that relies on a port as a gateway regardless of the route's advantages.
- The problems with customs procedures include not only the annoyance of informal payments but, more importantly, the unnecessary and uncertain delays and the damage that can result during cargo inspections. Some of these delays are due to capacity constraints or lack of cargo-handling equipment rather than inefficient inspection and clearance procedures. Improvements in cross-border procedures could significantly increase the use of a route.
- Certain cargoes have specific problems that affect route selection. For high-value goods with short reorder times, uncertainty with regards to the actual time in transit (measured as a percentage of the average value) introduces a significant cost for importers that they will avoid by seeking the fastest, most reliable route. For cargoes that are susceptible to damage, multiple handlings along a route will be a major disincentive to using a route. Perishable cargoes are susceptible to damage due to intermediate handlings, long travel times, and uncertain delivery times. Shippers of these cargoes will look for reliable services that involve a single vehicle or container. At the extreme are higher-value perishables that will be transported by air freight. Only for the lowest-value, bulk commodities will shippers be concerned exclusively with logistics costs.
- Truck transport normally has a competitive advantage over rail transport, but efficient unit trains can compete effectively for cargo moving over medium to long distances where there are direct rail connections. The short-term improvements in rail transport, such as gauge harmonization, unit train operations, and increased private sector operations, are expected to improve the competitive position of rail transport compared to trucking, especially for containerized cargoes. However, the long-term improvements planned for the road network, such as widening roads and strengthening bridges, will increase the market share of trucking relative to rail.
- Over the next decade typical goods being shipped will increase in value and thereby increase the demand for better logistics. Intra-regional trade for Nepal and Bhutan will increasingly be in consumer goods, pharmaceuticals, garments, and fresh fruits and vegetables. All these products will require better logistics, lower costs, and significant reductions in time, if they are to compete in regional markets.

