Innovative Distribution Company:
A Total Cost Approach to Understanding Supply Chain Risk

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“Arrrgh!” exclaimed James L. Heskett, President of Innovative Distribution Company (IDC), “pirates have struck again off the coast of Somalia. It seems like every time we turn around there is another piracy on the High Seas.”

“Unfortunately that is nothing new,” replied John L. Hazard, VP of Supply Chain Excellence, “piracy has been going on for centuries and is still going on today. In 2005 there were 276 piracy incidents[1] and in 2010 there were 445 incidents worldwide?[2] While efforts have been made to eliminate piracy, there were still 245 incidents in 2014![3]

“Wow! That has got to cost someone a bundle. Who pays for that?” asked Heskett.

“I read a segment on MSN about that,[4]” responded Hazard, “the cost of insuring ships has gone up. Insurance premiums increased by 10 times in 2009. Some companies are spending more time training their crews, others are avoiding the area altogether — taking long trips around Africa’s southern tip that can adds 2,700 miles to each trip and increases fuel costs by $3.5 million annually. And, since the ships take can only make 5 round trips per year instead of 6, delivery capacity has dropped by 26%. Who pays? The customer!”

“Gee, I never thought of those costs. The supply chain really takes a hit. It is a good thing we do not ship anywhere around Somalia,” exclaimed Heskett.

“But there is risk everywhere,” challenged Hazard, “Piracy occurs around the world. They have piracy problems in Malaysia and off the coast of Brazil as well. And there are lots of other risks in the supply chain that need to be mitigated. We have embraced off-shoring because of lower unit prices but we need to consider the total cost of ownership of the supply chain. Longer transit times, fluctuating exchange rates, uncertain delivery schedules, disruptive weather patterns, multi-language requirements, political turmoil, unique tariffs and duties, all add to the cost of doing business internationally. I’m not sure we understand the true cost of our supply chain.”

“You have a great point. We ought to take a look at all the costs of sourcing IDC’s next new product and consider the entire supply chain costs,” pondered Heskett, “see what numbers you can gather and we’ll take an all-in look at the numbers.”

A few days later Hazard and Heskett met to review all of the information they had gathered about the new product. “What did you find?” asked Heskett.

New Product Sourcing Details

“There are only three possible sources of supply for IDC’s new product. Suppliers are located in Wahoo, Nebraska, Freising, Germany, and Chengdu, China. We cannot buy or hold fractional units of a product and we have a projected annual demand (based on a 365 day year) of 11,300 units with a deviation in daily sales of 11 units. Our goal is to maintain an in-stock probability of 97.7% for our customers” replied Hazard.

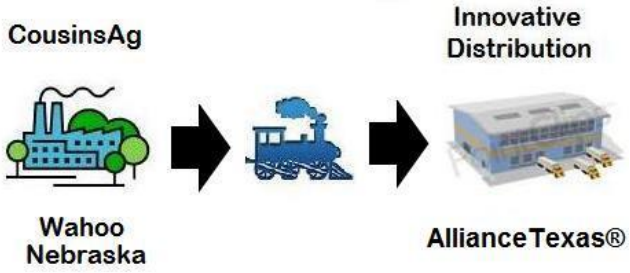
"All product (regardless of supplier) will be shipped by rail utilizing twenty-foot equivalent units (TEUs) to IDC's distribution center in AllianceTexas® where we will service all of IDC's customer's needs. A single TEU container can hold up to 600 units of the new product. Due to the nature of the product, no other product may be loaded into the same container. IDC's inventory carrying cost throughout the supply chain is 30.8%."

Hazard and Heskett recognize it will cost $91 to place each order with the Nebraska supplier and due to the complexity of international trade will cost $154 to place each order with the German supplier and $168 to place each order with the Chinese supplier.

Nebraska Supplier Details

One of the possible sources of supply is CousinsAg, located in Wahoo, Nebraska. The US Department of Labor reported that in 2002, 88,000 of Nebraska's wage and salary workers are members of unions.[5] CousinsAg is a union shop with an average labor rate in their Wahoo, Nebraska facility of $25.30 per hour. In responding to IDC's Request for Quote (RFQ), CousinsAg's price is $76.50 per unit.

Figure One
Nebraska-AllianceTexas® Supply Chain



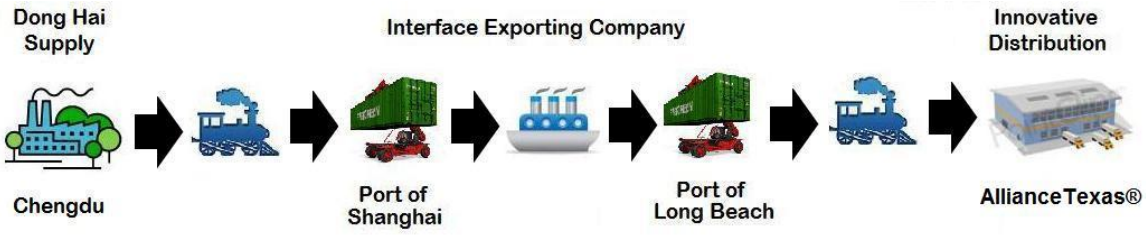
As shown in Figure One, when an order is placed with CousinsAg it will take 9 days for them to process and manufacture the order, and an additional 7 days to ship it FOB Origin Prepaid to IDC's AllianceTexas® Distribution Center. Rail shipping cost from CousinsAg to AllianceTexas® is $1,920 per TEU. Based on similar rail shipments from that part of the country, Hazard assumes the standard deviation of the shipping time from Wahoo will be 1.14 days.

Chengdu, China Supplier Details

There are two other possible sources of supply. The first is Dong Hai Supply, in Chengdu, Sichuan, China. Over the past decade, China aggressively developed their transportation and logistics infrastructure inland from the coast. The Chinese government is now actively promoting trade in areas such as Chengdu. Located 2,107 kilometers from the port of Shanghai, the Sichuan Administration of Price Control, Sichuan Department of Finance, and the Sichuan Labor Department have maintained strict wage controls to help develop manufacturing for export. The average labor rate in Chengdu is 10.36 Yuan per hour. Assume the current

exchange rate for use in this case is 1 CNY China Yuan Renminbi (¥) = 0.1585 US Dollar. In responding to IDC's Request for Quote (RFQ), Dong Hai Supply's price is 508 ¥ per unit.

Figure Two
China- AllianceTexas® Supply Chain

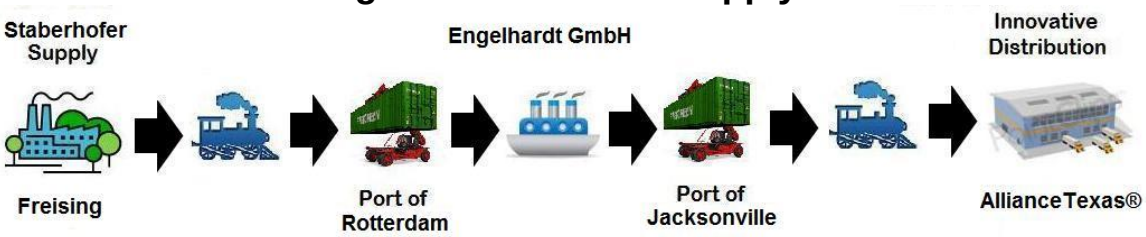


The China- AllianceTexas® global supply chain is shown in Figure Two. When an order is placed with Dong Hai Supply (EXW Chengdu, China) it will take 14.5 days for them to process, manufacture, and stuff the order into a TEU container. Dong Hai Supply will use the Interface Exporting Company (IEC) to ship the container FCA Long Beach. As a part of China's aggressive development in infrastructure, the high-speed Shanghai-Chengdu Railroad has recently been completed,[6] and will take IEC 2 days to move the container by rail from Chengdu to Shanghai. It will wait 4 days at the Port of Shanghai waiting to be loaded onto a ship, 18.5 days to cross the Pacific Ocean to the Port of Long Beach, and 3 days waiting to clear customs and be unloaded onto a dockside rail spur in Long Beach. IEC charges 12,435.5 ¥ for each TEU shipped. Import tariffs and duties are $325 per TEU are incurred at Long Beach U.S. Customs and charged separately to IDC on a monthly basis. Once the shipment clears customs and is offloaded to railcar in Long Beach it will take an additional 4 days to ship it FOB Origin Prepaid to IDC's AllianceTexas® Distribution Center. Rail shipping cost from Long Beach to AllianceTexas® is $2,250 per TEU. Based on similar mini-landbridge shipments from inland China, Hazard assumes the standard deviation of the shipping time will be 3.45 days.

Freising, Germany Supplier Details

The second international source of supply is Staberhofer Supply, located in Freising, Germany, just outside of Munich. The German transportation and logistics infrastructure is well developed and supports trade throughout the European Union. Located 649 kilometers from the port of Rotterdam, wages in Freising have been strictly controlled by the German Bundestag and Bundesrat to help stabilize the EU economy. The average labor rate in Freising is 15.68 euros per hour. Assume the current exchange rate for use in this case is 1 EUR Euro (€) = 1.1585 US Dollar. In responding to IDC's Request for Quote (RFQ), Staberhofer Supply's price is 54.8 € per unit.

Figure Three
Freising- AllianceTexas® Supply Chain



The Freising- AllianceTexas® global supply chain is shown in Figure Three. When an order is placed with Staberhofer Supply (EXW Freising, Germany) it will take 11 days for them to process, manufacture, and stuff the order into a TEU container. Staberhofer Supply will use the Engelhardt GmbH to ship the container FCA Jacksonville. It will take Engelhardt 1 day to move the container by rail from Freising to Rotterdam. It will wait 4 days at the Port of Rotterdam waiting to be loaded onto a ship, 15 days to cross the Atlantic Ocean to the Port of Jacksonville, and 3 days waiting to clear customs and be unloaded onto a dockside rail spur in Jacksonville. Engelhardt charges 1,039 € for each TEU shipped. Import tariffs and duties are $277 per TEU are incurred at Jacksonville U.S. Customs and charged separately to IDC on a monthly basis. Once the shipment clears customs and is offloaded to railcar in Jacksonville it will take an additional 5 days to ship it FOB Origin Prepaid to IDC's AllianceTexas® Distribution Center. Rail shipping cost from Jacksonville to AllianceTexas® is $2,500 per TEU. Based on similar mini-landbridge shipments from inland Europe, Hazard assumes the standard deviation of the shipping time will be 3.15 days.

Faced with this information Heskett has asked Hazard the following questions:

QUESTIONS:

Q1: Using the exchange rates cited in the case, what is the **INITIAL PURCHASE COST PER UNIT** (in US Dollars; do not include transportation costs) paid to:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q2: What is the **AVERAGE TIME** for an order filling a TEU container to come from:

a. Dong Hai Supply in Chengdu, China to IDC's AllianceTexas® Distribution Center?
b. CousinsAg in Wahoo, Nebraska to IDC's AllianceTexas® Distribution Center?
c. Staberhofer Supply in Freising, Germany to IDC's AllianceTexas® Distribution Center?

Q3: Using the exchange rates cited in the case, what is the **COST** (in US Dollars including tariffs and duties) to ship a TEU container from:

a. Dong Hai Supply in Chengdu, China to IDC's AllianceTexas® Distribution Center?
b. Staberhofer Supply in Freising, Germany to IDC's AllianceTexas® Distribution Center?

Q4: What is the **ECONOMIC ORDER QUANTITY** (use unit price only; do not include transportation costs when you calculate economic order quantity) if we purchase everything from:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q5: How many units of **SAFETY STOCK** will we need to hold if we purchase everything from:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q6: Inventory Carrying Costs are based on the value of the product at the time it is held in inventory. What is the **IN-TRANSIT CARRYING COST PER UNIT** (in dollars and cents) if we purchase everything from:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q7: What **AVERAGE INVENTORY LEVEL** (in units; be sure to consider both safety stock and cycle stock) will we hold at the IDC's AllianceTexas® Distribution Center if we purchase everything from:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q8: Inventory Carrying Costs are based on the value of the product at the time it is held in inventory. When the product is sitting in the IDC AllianceTexas® Distribution Center, its value is a combination of purchase price PLUS any transportation costs to get it from the supplier to the DC PLUS in-transit carrying costs. What is the **TOTAL ANNUAL INVENTORY CARRYING COST** (in dollars) for the safety stock and cycle stock inventory held at the AllianceTexas® Distribution Center if we purchase everything from:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q9: Inventory Carrying Costs are based on the value of the product at the time it is held in inventory. When the product is sitting at IDC's AllianceTexas® Distribution Center, its value is a combination of purchase price PLUS any transportation costs to get it from the supplier to the DC plus in-transit carrying costs. **ON A PER-UNIT BASIS** (in dollars) what is the **TOTAL ANNUAL INVENTORY CARRYING COST** for the safety stock and cycle stock inventory held at IDC's AllianceTexas® Distribution Center if we purchase everything from:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q10: Let's put it all together to determine the total cost of ownership. We have determined the unit price, the in-transit carrying cost, the transportation costs, and the IDC AllianceTexas® Distribution Center's inventory carrying cost. If we also consider the Annual Ordering Cost, what is the **TOTAL LANDED COST OF OWNERSHIP PER UNIT** (in dollars) if we purchase everything from:

a. Dong Hai Supply in Chengdu, China?
b. CousinsAg in Wahoo, Nebraska?
c. Staberhofer Supply in Freising, Germany?

Q11: After you incorporate all the risk costs, which supplier is the **LEAST TOTAL LANDED COST PROVIDER** of the new product?

Q12: There are additional risks which must be considered to better evaluate IDC's decision for the three supply chain choices.

Each member must individually present a unique answer. If there are four team members you will need to identify four new additional risks:

a. Identify **ONE ADDITIONAL RISK** which should be considered, and
b. Provide at least two realistic **QUANTITATIVE MEASURES** for the additional risk which will enable you to quantitatively evaluate the risk.

Q13: **RECOMMEND AND SUPPORT IMPROVEMENTS** to the supply chain process to reduce total landed cost.

Innovative Distribution Company:
ANSWER SHEET

		Dong Hai Supply	Cousins Ag	Staberhofer Supply
Q1:	Initial purchase cost per unit	$	$	$
Q2:	Average lead time	days	days	days
Q3:	Cost to ship a TEU container	$	$	$
Q4:	Economic order quantity	units	units	units
Q5:	Safety stock	units	units	units
Q6:	In-transit carrying cost per unit	$	$	$
Q7:	Average inventory level	units	units	units
Q8:	Total annual inventory carrying cost	$	$	$
Q9:	Total ICC per unit	$	$	$
Q10:	Total landed cost of ownership per unit	$	$	$
Q11:	Least cost (check appropriate box)			

Q12:	Additional risk #1 & two quantitative measures	One unique additional risk and two quantitative measures for that risk to be presented by each team member
Q12:	Additional risk #2 & two quantitative measures	
Q12:	Additional risk #3 & two quantitative measures	
Q12:	Additional risk #4 & two quantitative measures	

Q13: Improvements (supported) to supply chain