



## TEACHING NOTE

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5-112-003TN

# Polaris Industries Inc.

## Case Synopsis

In September 2010 Suresh Krishna, vice president of operations and integration at Polaris Industries Inc., a manufacturer of all-terrain vehicles, Side-by-Sides, and snowmobiles, needed to recommend a location for a new plant to manufacture the company's Side-by-Side vehicles.

The economic slowdown in the United States had put considerable pressure on Polaris's profits, so the company was considering whether it should follow the lead of other manufacturers and open a facility in a country with lower labor costs. China and Mexico were shortlisted as possible locations for the new factory, which would be the first Polaris manufacturing facility located outside the Midwestern United States. By the end of the year Krishna needed to recommend to the board whether Polaris should build a new plant abroad (near-shored in Mexico or off-shored in China) or continue to manufacture in its American facilities.

## Learning Objectives

After analyzing and discussing the case, students should be able to:

- Evaluate tradeoffs between different geographic locations when establishing a manufacturing facility (off-shoring, near-shoring, and on-shoring)
- Run a sensitivity analysis on total cost
- Assess the impact of transportation costs, exchange rates, labor cost rates, lead times, and other assumptions on total costs
- Identify qualitative factors to be considered when deciding between non-U.S. facility locations, including transportation time variability, consumer perceptions, and cultural differences

## Suggested Uses

The case is appropriate for undergraduate, graduate, and executive education students. It will be effective in operations management or supply chain management courses that discuss sourcing.

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### Discussion Questions/Student Assignment

1. Why does Polaris outsource the manufacture of most components but in-source final assembly?
2. Which manufacturing location provides Polaris with the greatest cost savings?
3. Would your recommendation change if foreign exchange rates increased or decreased by 15 percent?
4. Assuming all else is constant, would your recommendation change if labor rates in Mexico increased by 20 percent annually instead of 7.1 percent?
5. What other factors should Suresh Krishna and his team consider when making the manufacturing location recommendation?

### Case Analysis

#### *1. Why does Polaris outsource the manufacture of most components but in-source final assembly?*

The decision to outsource or in-source a particular activity depends upon a variety of factors that include the scale and uncertainty of demand for the activity and whether the resources used for the activity can be used for other activities/customers. It is also affected to some extent by the relative transportation cost of performing an activity at a third party's location and then bringing it back within the company for assembly. In this case, a major reason for outsourcing components is that machines required for component manufacture are expensive and would not be fully utilized if dedicated to produce only for Polaris (as they would be if this activity is in-sourced). These machines can be used by third parties to produce components for other customers besides Polaris. Components can be packed with high density for shipping (or at least higher density than an assembled Side-by-Side), making it feasible for components to be manufactured in China and shipped to a Polaris assembly facility in the United States.

In contrast, assembly has a high enough scale (all versions of the Side-by-Side can be assembled on the same line) that in-sourcing provides sufficient economies of scale.

Instructors may refer to a more detailed discussion of outsourcing in Chapter 15 of Sunil Chopra and Peter Meindl, *Supply Chain Management*, 5th ed. (Upper Saddle River, NJ: Prentice Hall, 2012).

#### *2. Which manufacturing location provides Polaris with the greatest cost savings?*

On a total cost basis, Polaris is better off moving its manufacturing facility to Monterrey, Mexico. Our analysis evaluates the NPV over a six-year period with a discount rate of 10 percent.

	United States (US\$)	Mexico (US\$)	China (US\$)
Net present cost	43,012,777	40,015,174	41,413,953
Savings vs. United States	0	2,997,603	1,868,824

Monterrey offers the most savings compared to the base case in addition to the highest return on investment.

To establish total cost, a model has been built in Excel. It details the different costs as follows:

- One-time expenses, including:
  - Capital investment for Mexico (\$9.5 million) and China (\$10 million)
  - Severance costs for Mexico and China: the company needs to lay off sixty American workers at a cost of \$20,000 each

- Yearly costs (for 2011 to 2015)

- Production costs:

$$\text{Production cost} = \text{Unit production cost} \times \text{Annual demand}$$

Unit production costs: 400 USD (U.S.); 4,560 MXN (Mexico); 1,950 CNY (China)

- Labor costs:

$$\text{Labor costs} = \frac{\# \text{ of employees} \times \text{Annual \# of hours worked} \times \text{Hourly salary}}{\text{Exchange rate}}$$

Hourly salary (2008): 26 USD (U.S.); 25.3 MXN (Mexico); 11.6 CNY (China)

Annual wage growth: 7.1 percent in Mexico; 13.4 percent in China

- Transportation costs:

$$\text{Transportation cost} = \text{Unit transportation cost} \times \text{Annual demand}$$

To compute the unit transportation cost:

- For China, the unit transportation cost is given as \$190 per unit
- For the United States and Mexico, calculations must be done as for a gravity model:

### Side-by-Sides Markets

Distribution Center Location	Units Demanded	Trucks Needed for Transportation	Roseau Total Transport Cost (\$)	Monterrey Total Transport Cost (\$)
Tacoma, WA	3,650	140	528,239	730,042
Los Angeles	7,050	271	1,347,716	938,599
Irving, TX	3,800	146	425,907	146,899
	14,500	558	2,301,862	1,815,540
Cost per unit			158.75	125.21

- Tariffs: if production is off-shored to China, the tariffs cost is:

$$\text{Tariffs} = 5\% \times (\text{Unit production cost} + \text{Unit transportation cost}) \times \text{Annual demand}$$

In this case, transportation cost represents a high percentage of total cost (excluding capital investment and severance) compared to labor cost (as shown in the table below).

	United States	Mexico	China
Labor cost as percentage of total cost	35.7%	4.9%	5.4%
Transport cost as percentage of total cost	25.4%	23.5%	34.8%

This was expected for low value-to-volume products such as Side-by-Sides. In this case, reducing transportation cost is critical. It can be achieved by moving production closer to consumption. Mexico turns out to have the lowest transportation cost because of its proximity to the largest market in southern United States.

### 3. Would your recommendation change if foreign exchange rates increased or decreased by 15 percent?

The goal of this question is to help students understand how sensitive the total cost is to changes in exchange rates. Future exchange rates cannot be predicted and could vary by more than 15 percent; the number was chosen to reflect the impact on cost of variations in the exchange rate. The exchange rates can be altered in the spreadsheet by altering the multipliers in Cells E28 and E29.

When the peso is devalued from the base case of 11.92 MXN/USD in 2008, it becomes even cheaper to operate in Mexico. Thus, it is the strengthening of the peso and the yuan that make Mexico and China potentially less attractive. If the peso strengthens compared to the dollar and the yuan, Mexican costs increase relative to the other currencies. If the peso strengthens by 5 percent (change Cell E28 in the spreadsheet to 0.95) to 11.324 MXN/USD in 2010 (same growth in following years), the savings from moving to Mexico become the same as the savings from moving to China as shown in the tables below.

#### Expected Exchange Rates

	Multiplier
Pesos 11.324 Pesos/USD	0.95
Yuan 6.47 Yuan/USD	1

#### Projected Annual Wage Growth

	Multiplier
Mexico 7.1%	1
China 13.4%	1

	United States (US\$)	Mexico (US\$)	China (US\$)
Net present cost	43,012,777	41,195,850	41,143,953
Savings vs. United States	0	1,816,926	1,868,824

The peso has to strengthen by about 12 percent (change Cell E28 to 0.88) in 2010 (and continue all other trends) to make Mexico more expensive than the United States. Meanwhile, the yuan has to strengthen by about 9 percent (change Cell E29 to 0.91) to make China less attractive than the United States.

From our analysis it is clear that if the peso and the yuan strengthen by 15 percent, the United States actually becomes the lowest-cost production option. Thus, a key question that the company must consider is whether they expect the peso or the yuan to have a higher chance of strengthening in the future relative to the dollar.

*4. Assuming all else is constant, would your recommendation change if labor rates in Mexico increased by 20 percent annually instead of 7.1 percent?*

In its calculations, Polaris management is assuming a 7.1 percent annual increase in labor costs in Mexico. The goal of this question is to evaluate whether moving operations to Mexico would still show a cost advantage if labor costs were to increase significantly. The annual increase in labor costs can be changed by altering the multipliers in Cells D32 and D33. The analysis below shows that even if labor costs in Mexico increased by 20 percent (change Cell D32 to 2.8) a year over the five-year forecast period, Mexico still offers greater cost savings than China. This result further demonstrates the effect that transportation cost has on the total delivered cost of a product manufactured in a foreign facility.

#### Projected Annual Wage Growth

		Multiplier
Mexico	20.0%	2.8
China	13.4%	1

	United States (US\$)	Mexico (US\$)	China (US\$)
Net present cost	43,012,777	41,103,661	41,143,953
Savings vs. United States	0	1,909,116	1,868,824

*5. What other factors should Suresh Krishna and his team consider when making the manufacturing location recommendation?*

Besides the quantitative reasons for choosing to manufacture Side-by-Sides in Mexico, several qualitative parameters were also considered.

*Transportation lead times:* Management was concerned with both the long lead time and variability in transportation time associated with manufacturing in China. Due to the distance, shipping time—and therefore order lead time—was expected to be much longer when sourcing from China compared to Mexico. The variability in transportation time was also higher when sourcing from China. Higher transportation time variability would lead to greater unpredictability in delivery dates, meaning that Polaris would have to increase its investment in safety inventory to maintain current service levels.

*Culture:* Polaris management reported that it felt more comfortable working with people in Mexico because they were schooled in the Western way of doing business. Management expected this to result in fewer communication issues between headquarters and the manufacturing facility.

*Time-zone and physical proximity:* There is only a one-hour time difference between Polaris headquarters in the United States and Monterrey, Mexico, compared to a twelve-hour difference with China. In addition, management could quickly travel to Mexico if required to, whereas travel to China takes much longer and requires a visa.

*Future sales growth:* Polaris expected that much of its future sales growth would come from emerging markets. In order to facilitate this demand, management is pursuing expansion into these markets. In terms of domestic sales growth, the majority of consumer demand for Side-by-Sides is expected to remain in the southern half of the United States, which would be better served from Mexico.

*Consumer perception of quality:* Management was concerned that products would be perceived as being of lower quality if they were manufactured in either Mexico or China.

*Employee perception:* Polaris management was concerned about a risk of backlash from American employees and a reduction in productivity if some manufacturing was moved out of the United States. Polaris traditionally manufactured exclusively in the United States and was a major employer in several small Midwestern towns.

*Talent pool:* Polaris believed the United States would have a limited pool of skilled trade labor in the future. By contrast, Polaris reported that Mexico and China had plenty of skilled trade labor.

## **Supplementary Materials**

An Excel spreadsheet model is available for the instructor's use with the case.

## **Epilogue**

Given the significant total cost savings, Polaris decided to build its next manufacturing facility in Monterrey, Mexico. The plant opened in 2011 ahead of schedule. Although there were still consumer concerns regarding sustained quality in manufacturing after the first year of operation, Monterrey was performing well by Polaris's quality metrics, possibly due to the significant amount of management attention on the new facility. One factor management did not consider at the time the decision was made was the security situation in Mexico. Drug trafficking activity resulted in violence and the situation continued to deteriorate as of 2012. This has led to high security costs and reduced Polaris management's travel to Monterrey.

Furthermore, as part of an overall restructuring of its supply chain to drive more cost savings, Polaris originally planned to close the Osceola plant. It was the only facility in its network that did not construct vehicles; it supplied engines and other components for the other plants. The plan was to move Osceola's existing factory operations into the respective counterpart plants, that is, snowmobile engine manufacturing into the snowmobile plant in Roseau, and so on. However, with the strong demand across all divisions over the past two years, Polaris's domestic plants were running near capacity. Instead of closing down Osceola, Polaris decided to reduce its footprint and keep it open for the interim to help provide additional capacity.