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Case Study

# Supply Chain Management vs. Mother Nature

## Supply Chain Management vs. Mother Nature<sup>1</sup>

**What is the risk management strategy? The primary supplier just had a major disruption while orders must be fulfilled.**

The month of June had been exceptionally humid in the prairie town of Vulcan, Alberta and residents were looking for a break in the weather. However, as a summer thunderstorm shifted and skies darkened to an ominous greenish black color, it became apparent that the weather was going to get much worse before it got better.

About 800 miles east, at Close Shave company headquarters in Winnipeg, Manitoba, it was a routine Monday. Activity was focused on planning for the third quarter. Travel just over 400 miles further east and their competitors at Rapid Razor in Thunder Bay, Ontario were anticipating a positive forecast for the rest of the fiscal year. No one at either company was aware of the whirling dust debris and sudden, eerie quiet causing alarm in Vulcan.

At around 2:30 pm on Monday, June 15, Lisa Wang, a Quality Assurance Manager at Maple Leaf Blades in Vulcan, heard her cell phone chirping with an alert. Environment Canada had issued a tornado warning for the area. One hour later the warning had been upgraded to a tornado watch and, as per their tornado preparedness plans, staff moved to safe shelter in the basement of the building.

At 4:30 pm, staff emerged from the building to survey the damage. Fortunately, none of the employees had sustained any injuries but the tornado had inflicted significant damage to the building. Certainly, no one was going back to work today, and the full impact of the storm would have to be assessed immediately.

The following morning, Ravi Khullar, Rapid Razor's Director of Purchasing, was about to leave for a lunch meeting when his phone rang.

"Good morning, Ravi. It's Diane Wallace from Maple Leaf Blades. I need you to know what happened at our plant yesterday as it effects Rapid Razor."

"Good morning, Diane. That doesn't sound good. What's going on?"

"We had a tornado touch down in town yesterday and it caused major damage to the building. Fortunately, no one was hurt but we're still assessing the extent of the damage on our operations. I can tell you that the tornado struck before we loaded the trucks for the overnight deliveries. That means you aren't getting the blade delivery you are expecting today."

"I'm relieved to hear that none of your employees were hurt. However, you're right. Missing today's delivery will have an impact on us. Do you know when you will be back up and running?"

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“It’s likely going to be weeks, not days. I can provide you an update in 24 hours with our best estimate on when we’ll be able to resume operations.”

“Okay. Thanks for the call, Diane.”

Ravi Khullar cancelled his lunch meeting and sat down to consider Rapid Razor’s next steps. While Maple Leaf Blades was a key supplier, providing the blades they needed to produce their top selling disposable safety razor, it wasn’t their only supplier. They also sourced blades from Blue Steel in Zoolander, North Dakota. Their delivery is due tomorrow. Clearly, he needed to understand the volume of blades coming from each supplier and the impact of losing blades from Maple Leaf Blades. Rapid Razor shipped the completed razors to their distributor, who then provided them to the retailer, so all parts of their supply chain would be affected.

Ravi began opening multiple spreadsheets and sending emails to colleagues requesting data from their areas of the business. While it was good to be aware of his supplier issue today, he knew it would take about three days to collect all the necessary data from other parts of the business. Once he could assemble a big picture view of the problem, then he could start identifying possible solutions. He wished, not for the first time, that Rapid Razor’s information systems enabled him to access the data he needed to support decision making in a more efficient manner.

In Winnipeg, the phone rang in Keisha King’s office. As Close Shave’s Director of Procurement, she had just finished looking at this week’s orders but focus quickly shifted to problem solving as she listened to Diane explain the situation at Maple Leaf Blades.

Keisha took a minute to reflect on Close Shave’s predicament. They relied on Maple Leaf Blades as the single source of blades for their disposable safety razors. Maple Leaf Blades and Close Shave had built a trusted partnership and they’d seen the benefits of that in terms of administrative efficiency, lower inventory costs and the ability to quickly make product improvements. However, when faced with losing her sole supplier of blades for an unknown amount of time, Keisha briefly wished they had a different model.

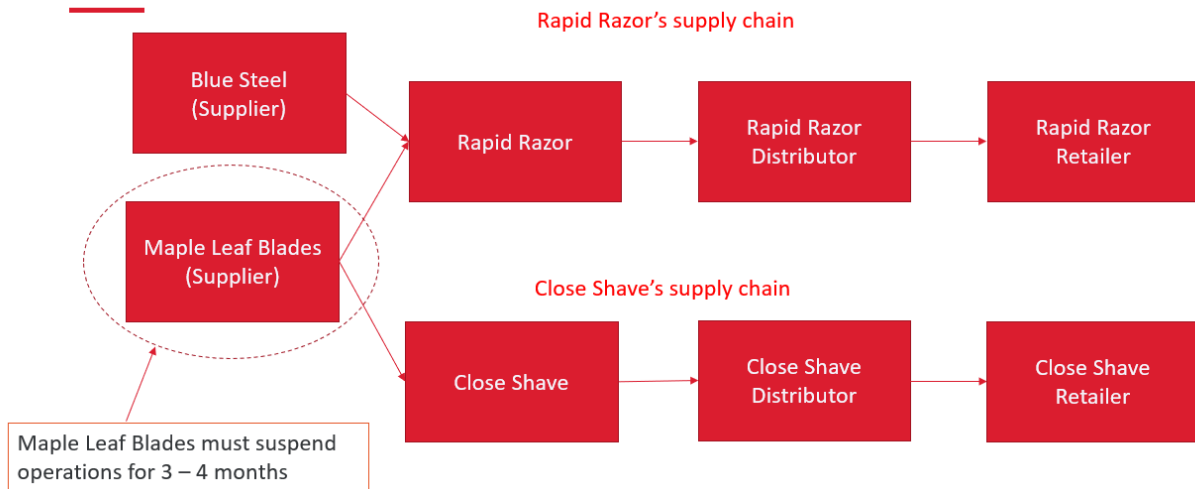
Close Shave also shipped their final product to a distributor, who then supplied the retailer. Fortunately, the software she uses enables her to do concurrent planning, which gives her end-to-end visibility of the entire supply chain. All the data she needs to analyze Close Shave’s ability to produce razors and fulfill orders or identify orders at risk is at her fingertips. Keisha refilled her coffee mug, rolled up her sleeves and started to run a variety of what-if scenarios that immediately help her evaluate the best course of action.

Twenty-four hours later, Diane Wallace is back on the phone, giving updates on Maple Leaf Blades’ operations. The news is not good. The damage they sustained requires three to four months of work before they will be back at full production capacity.

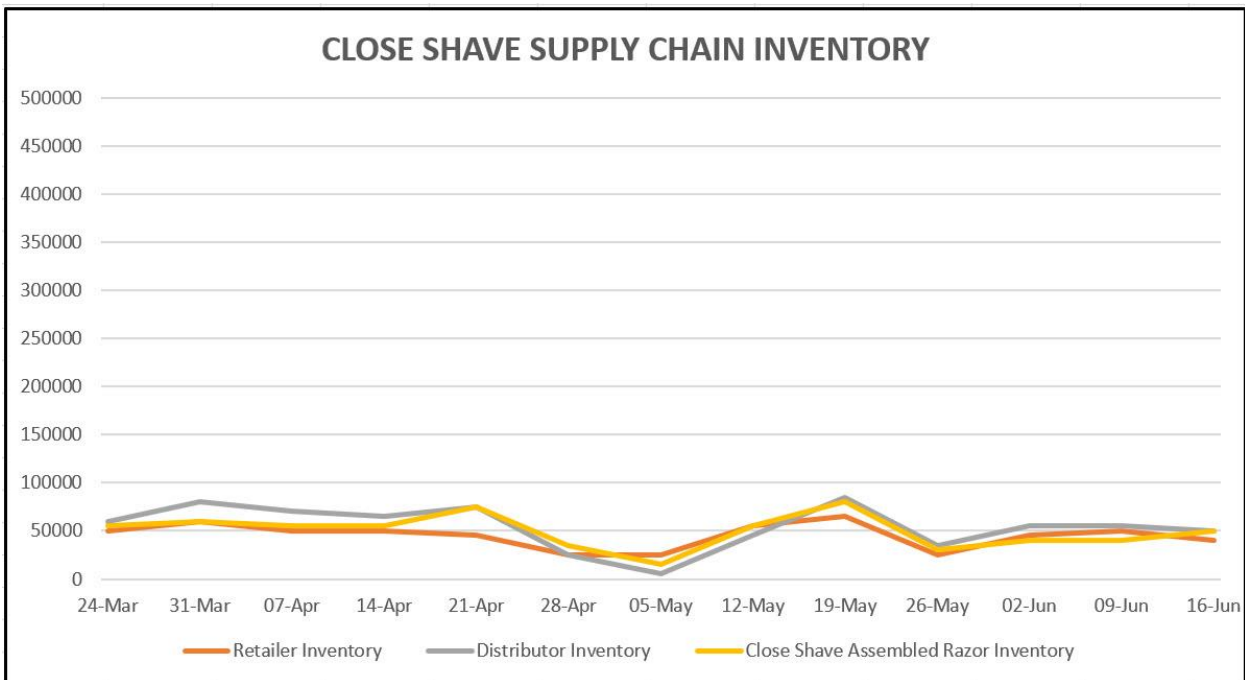
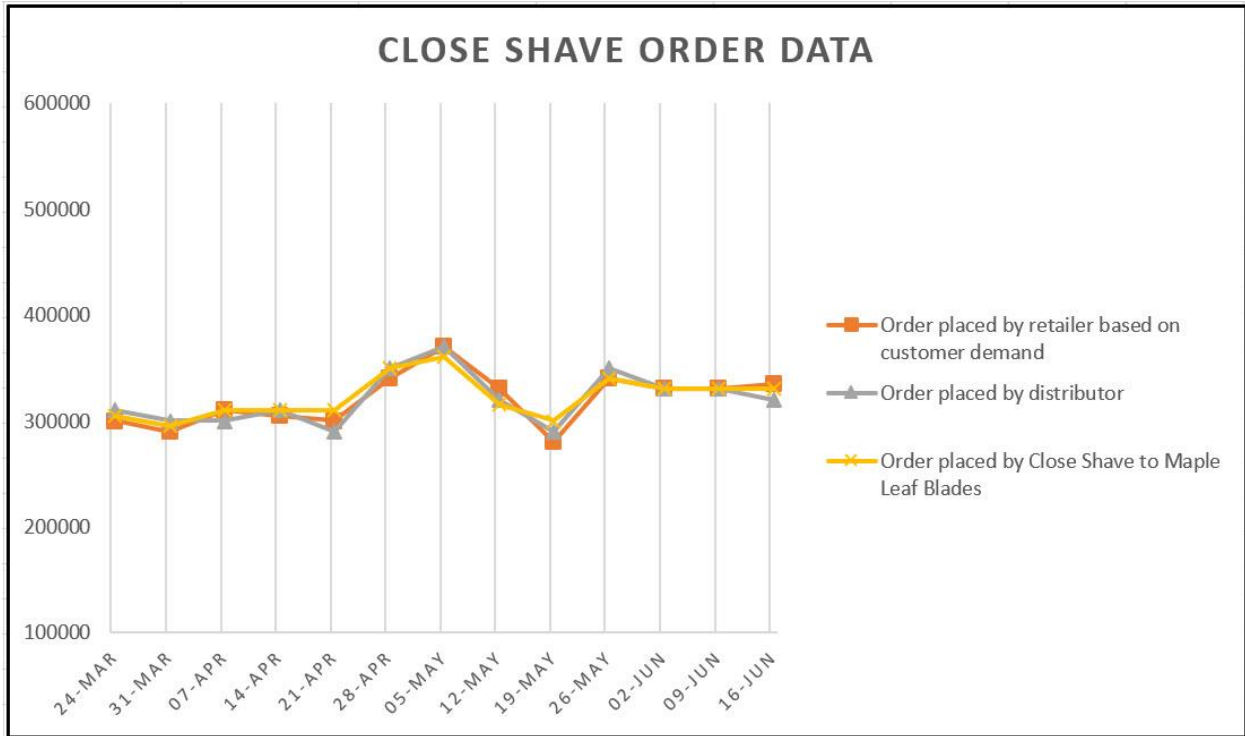
Given the updated information, both Rapid Razor and Close Shave have a clearer understanding of the situation. Ravi and Keisha must now develop their respective responses to the loss of Maple Leaf Blades from their supply chain. They know their leadership team will be looking for their recommendations on how to weather this crisis.

## Appendix

Figure A: Supply chain network design

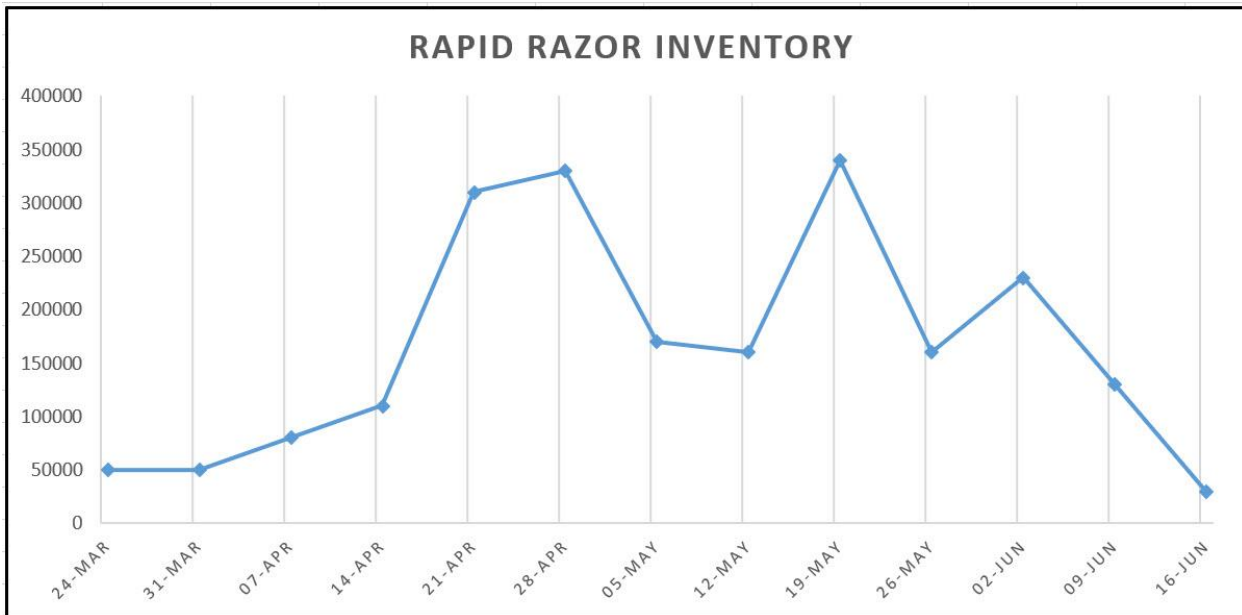
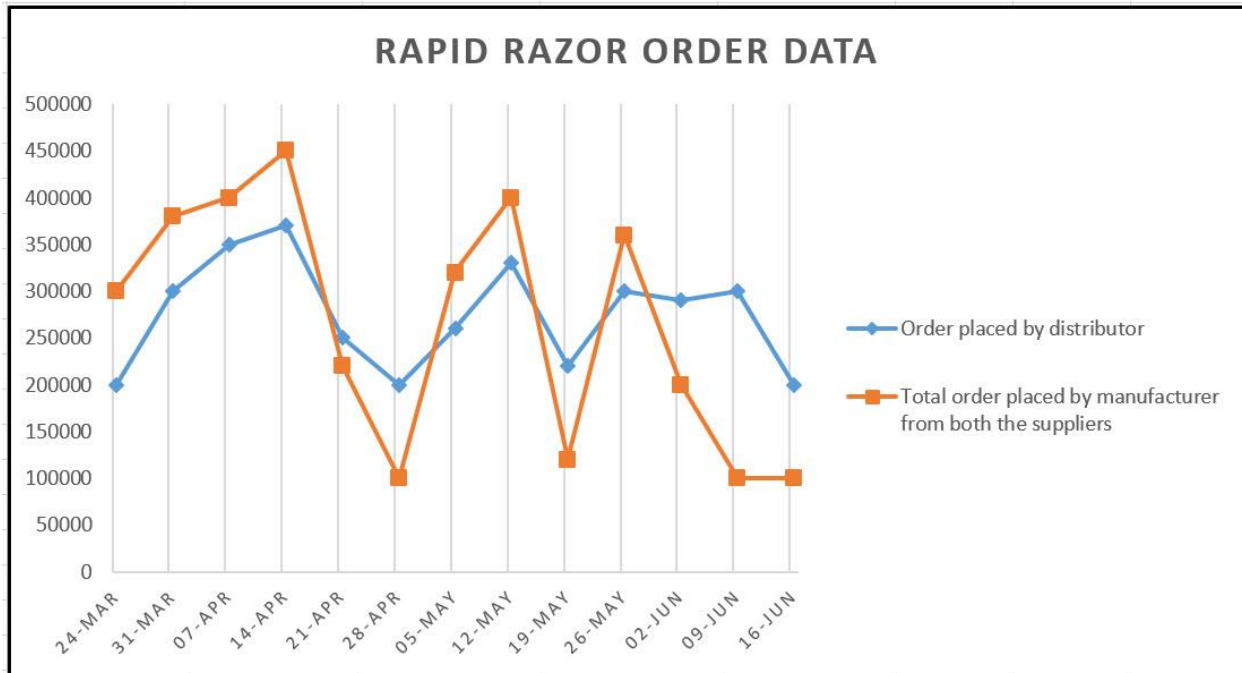


**Figure B:** Historical order and inventory data



Close Shave follows a just-in-time (JIT) strategy with a continuous flow of goods and real-time monitoring of the supply chain so that inventory costs are reduced. Their supply chain planning software enables concurrent planning so they can quickly mitigate risks associated with this approach and respond quickly to disruptions.

**Figure B (continued):** Historical order and inventory data



Rapid Razor follows a cascaded planning approach in their supply chain management processes. They only have visibility into their own inventory. When forecasting or responding to disruption, they must rely on historical views of their data to shape new plans.

**Figure C: Current inventory levels**

**Close Shave Supply Chain**

Blade Inventory		
	Maple Leaf Blades	Close Shave
Inventory on hand	0	50,000
Maximum inventory capacity	400,000	400,000
Disposable Safety Razor Inventory		
	Close Shave Distributor	Close Shave Retailer
Inventory on hand	50,000	40,000
Maximum inventory capacity	150,000	150,000

The blades that Maple Leaf Blades had ready to ship were destroyed in the tornado, reducing their inventory to zero. Close Shave has a weekly maximum manufacturing capacity of 400,000. The lead time for Close Shave to fulfill distributor orders is 2 days.

Assumptions:

- There are no constraints on the other parts needed to assemble the razors.
- Close Shave does not have any storing constraints on its finished goods inventory.
- Maple Leaf Blades does not have any raw material constraints.
- On average, 43,000 units are sent from Close Shave to their distributor daily per their just-in-time inventory strategy.

**Rapid Razor Supply Chain**

Blade Inventory			
	Blue Steel	Maple Leaf Blades	Rapid Razor
Inventory on hand	Unknown	0	30,000
Maximum inventory capacity	Unknown	Unknown	350,000
Contribution to total order	20%	80%	
Disposable Safety Razor Inventory			
	Rapid Razor Distributor		Rapid Razor Retailer
Inventory on hand	Unknown		Unknown
Maximum inventory capacity	Unknown		Unknown

The blades that Maple Leaf Blades had ready to ship were destroyed in the tornado, reducing their inventory to zero. Rapid Razor has a weekly maximum manufacturing capacity of 450,000. The lead time between Rapid Razor and their suppliers is 7 days and between Rapid Razor and their distributor is 7 days. They expected to receive 100,000 blades from their suppliers the week the tornado occurred.

Assumptions:

- There are no constraints on the other parts needed to assemble the razors.
- Rapid Razor does not have any storing constraints on its finished goods inventory.
- Neither Maple Leaf Blades nor Blue Steel have any raw material constraints.

**Figure D: Pricing Information**
**Close Shave**

	Price	Cost	Gross Margin	Net Profit per 10,000 Units
Maple Leaf Blades	\$0.15	\$0.11	27%	\$120
Close Shave	\$1.19	\$0.36	70%	\$2,499
Close Shave Distributor	\$1.40	\$1.19	15%	\$630
Close Shave Retailer	\$2.00	\$1.40	30%	\$1,800

- It costs Maple Leaf Blades \$0.11 to produce each blade and they sell the completed blades to Close Shave for \$0.15 each which is a 27% gross margin. For every 10,000 units sold, they make a profit of \$120.
- It costs Close Shave a total of \$0.36 to produce the final product (disposable safety razor) and they sell the razor to their distributor for \$1.19 each which is a 70% gross margin. For every 10,000 units sold, they make a profit of \$2,499.
- Each member of Close Shave's supply chain is achieving a net profit of 30%.
- Assume that inventory cost = \$0.04/unit and back order cost = \$0.01/unit for all parts of the supply chain.

**Rapid Razor**

	Price	Cost	Gross Margin	Net Profit per 10,000 Units
Maple Leaf Blades	\$0.20	\$0.11	45%	\$180
Blue Steel	\$0.20	\$0.14	30%	\$120
Rapid Razor	\$1.19	\$0.71	40%	\$952
Rapid Razor Distributor	\$1.40	\$1.19	15%	\$420
Rapid Razor Retailer	\$2.00	\$1.40	30%	\$1,200

- It costs Maple Leaf Blades \$0.11 to produce each blade and they sell the completed blades to Rapid Razor for \$0.20 each which is a 45% gross margin. For every 10,000 units sold, they make a profit of \$180.
- It costs Blue Steel \$0.14 to produce each blade and they sell the completed blades to Rapid Razor for \$0.20 each which is a 30% gross margin. For every 10,000 units sold, they make a profit of \$120.
- It costs Rapid Razor a total of \$0.71 to produce the final product (disposable safety razor) and they sell the razor to their distributor for \$1.19 each which is a 40% gross margin. For every 10,000 units sold, they make a profit of \$952.
- Each member of Rapid Razor's supply chain is achieving a net profit of 20%.
- Assume that inventory cost = \$0.04/unit and back order cost = \$0.01/unit for all parts of the supply chain.



**Figure E: Open Market Data**

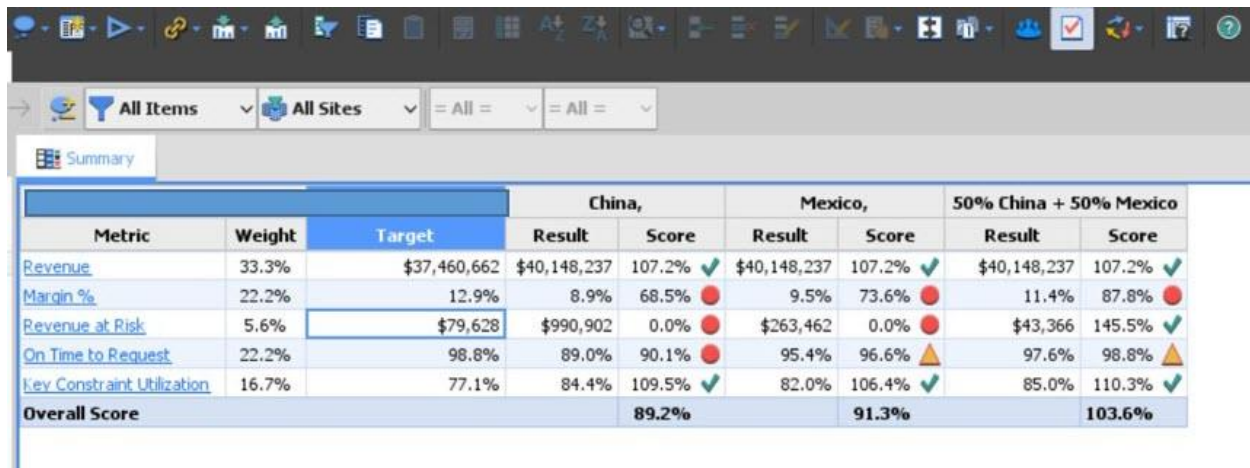
The cost of buying blades from the open market is \$0.30 per blade.

	Price	Cost	Gross Margin	Net Profit per 10,000 Units
Close Shave	\$1.19	\$0.51	57%	\$2,040
Rapid Razor	\$1.19	\$0.81	32%	\$752.00

Because the blades on the open market cost more than the price Close Shave and Rapid Razor have negotiated with their preferred suppliers, that increase in cost has an overall impact on profits:

- Close Shave sells their assembled razor to their distributor for \$1.19 but the razor cost has gone up to \$0.51 each which is gross margin of only 57% and reduced net profit per 10,000 units.
- Rapid Razor sells their assembled razor to their distributor for \$1.19 but the razor cost has gone up to \$0.81 each which is gross margin of only 32% and reduced net profit per 10,000 units.

**Figure F: Supplier Scorecards: Comparing Mexican and Chinese Alternate Suppliers**



Metric	Weight	Target	China,		Mexico,		50% China + 50% Mexico	
			Result	Score	Result	Score	Result	Score
Revenue	33.3%	\$37,460,662	\$40,148,237	107.2% ✓	\$40,148,237	107.2% ✓	\$40,148,237	107.2% ✓
Margin %	22.2%	12.9%	8.9%	68.5% ●	9.5%	73.6% ●	11.4%	87.8% ●
Revenue at Risk	5.6%	\$79,628	\$990,902	0.0% ●	\$263,462	0.0% ●	\$43,366	145.5% ✓
On Time to Request	22.2%	98.8%	89.0%	90.1% ●	95.4%	96.6% ▲	97.6%	98.8% ▲
Key Constraint Utilization	16.7%	77.1%	84.4%	109.5% ✓	82.0%	106.4% ✓	85.0%	110.3% ✓
<b>Overall Score</b>				<b>89.2%</b>		<b>91.3%</b>		<b>103.6%</b>

## **Metric Definitions**

### **Revenue**

Revenue is the total amount of income generated by the sale of goods or services related to the company's primary operations.

### **Margin %**

Displays the difference between the revenue and cost of goods sold expressed as a percentage of revenue. The margin % is calculated by dividing the gross margin by the revenue.

### **Revenue at Risk**

Displays the value of the revenue for late customer orders. Customer orders are considered late if their available date is later than their demand date.

### **On Time to Request**

Displays the percentage of orders that can be fulfilled on or before the requested date. The On Time Request percentage is calculated by dividing the total number of lines that are available on or before their request date by the total number of lines for the metric horizon, which is then expressed as a percentage.

### **Key Constraint Utilization**

Displays the available load that is scheduled to be utilized for key constraints for this metric. Utilization is expressed as a percentage. Key constraints are the constraints that have been identified as important to the organization. The key constraint utilization is calculated by dividing the scheduled key constraint usage by the available key constraints and expressing it as a percentage.

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