CASE STUDY (1)

Managing Growth at SportStuff.com

In December 2008, Sanjay Gupta and his management team were busy evaluating the performance at SportStuff.com over the previous year. Demand had grown by 80 percent. This growth, however, was a mixed blessing. The venture capitalists supporting the company were very pleased with the growth in sales and the resulting increase in revenue. Sanjay and his team, however, could clearly see that costs would grow faster than revenues if demand continued to grow and the supply chain network was not redesigned. They decided to analyze the performance of the current network to see how it could be redesigned to best cope with the rapid growth anticipated over the next three years.

SportStuff.com

Sanjay Gupta founded SportStuff.com in 2004 with a mission of supplying parents with more affordable sports equipment for their children. Parents complained about having to discard expensive skates, skis, jackets, and shoes because children outgrew them rapidly. Sanjay's initial plan was for the company to purchase used equipment and jackets from families and surplus equipment from manufacturers and retailers and sell these over the Internet. The idea was well received in the marketplace, demand grew rapidly, and, by the end of 2004, the company had sales of $0.8 million. By this time, a variety of new and used products were being sold, and the company received significant venture capital support.

In June 2004, Sanjay leased part of a warehouse in the outskirts of St. Louis to manage the large amount of product being sold. Suppliers sent their product to the warehouse. Customer orders were packed and shipped by UPS from there. As demand grew, SportStuff.com leased more space within the warehouse. By 2007, SportStuff.com leased the entire warehouse and orders were being shipped to customers all over the United States. Management divided the United States into six customer zones for planning purposes. Demand from each customer zone in 2007 was as shown in Table 5-15. Sanjay estimated that the next three years would see a growth rate of about 80 percent per year, after which demand would level off.

The Network Options

Sanjay and his management team could see that they needed more warehouse space to cope with the antici-

TABLE 5-15 Regional Demand at SportStuff.com for 2007

Zone	Demand in 2007	Zone	Demand in 2007
Northwest	320,000	Lower Midwest	220,000
Southwest	200,000	Northeast	350,000
Upper Midwest	160,000	Southeast	175,000

TABLE 5-16 Fixed and Variable Costs of Potential Warehouses

	Small Warehouse		Large Warehouse	
Location	Fixed Cost ($/year)	Variable Cost ($/Unit Flow)	Fixed Cost ($/year)	Variable Cost ($/Unit Flow)
Seattle	300,000	0.20	500,000	0.20
Denver	250,000	0.20	420,000	0.20
St. Louis	220,000	0.20	375,000	0.20
Atlanta	220,000	0.20	375,000	0.20
Philadelphia	240,000	0.20	400,000	0.20

pated growth. One option was to lease more warehouse space in St. Louis itself. Other options included leasing warehouses all over the country. Leasing a warehouse involved fixed costs based on the size of the warehouse and variable costs that depended on the quantity shipped through the warehouse. Four potential locations for warehouses were identified in Denver, Seattle, Atlanta, and Philadelphia. Leased warehouses could be either small (about 100,000 sq. ft.) or large (200,000 sq. ft.). Small warehouses could handle a flow of up to 2 million units per year, whereas large warehouses could handle a flow of up to 4 million units per year. The current warehouse in St. Louis was small. The fixed and variable costs of small and large warehouses in different locations are shown in Table 5-16.

Sanjay estimated that the inventory holding costs at a warehouse (excluding warehouse expense) was about $\$600\sqrt{F}$ where F is the number of units flowing through the warehouse per year. This relationship is based on the theoretical observation that the inventory held at a facility (not across the network) is proportional to the square root of the throughput through the facility. As a result, aggregating throughput through a few facilities reduces the inventory held as compared with disaggregating throughput through many facilities. Thus, a warehouse handling 1 million units per year incurred an inventory holding cost of $600,000 in the course of the year. If your version of Excel has problems solving the nonlinear objective function, use the following inventory costs:

Range of F	Inventory Cost
0–2 million	$\$250{,}000Y + 0.310F$
2–4 million	$\$530{,}000Y + 0.170F$
4–6 million	$\$678{,}000Y + 0.133F$
More than 6 million	$\$798{,}000Y + 0.113F$

If you can handle only a single linear inventory cost, you should use $\$475{,}000Y + 0.165F$. For each facility, $Y = 1$ if the facility is used, 0 otherwise.

SportStuff.com charged a flat fee of $3 per shipment sent to a customer. An average customer order contained four units. SportStuff.com, in turn, contracted with UPS to handle all its outbound shipments. UPS charges were based on both the origin and the destination of the shipment and are shown in Table 5-17. Management estimated that inbound transportation costs for shipments from suppliers were likely to remain unchanged, no matter what warehouse configuration was selected.

TABLE 5-17 UPS Charges per Shipment (Four Units)

	Northwest	Southwest	Upper Midwest	Lower Midwest	Northeast	Southeast
Seattle	$2.00	$2.50	$3.50	$4.00	$5.00	$5.50
Denver	$2.50	$2.50	$2.50	$3.00	$4.00	$4.50
St. Louis	$3.50	$3.50	$2.50	$2.50	$3.00	$3.50
Atlanta	$4.00	$4.00	$3.00	$2.50	$3.00	$2.50
Philadelphia	$4.50	$5.00	$3.00	$3.50	$2.50	$4.00

Study Questions

1. What is the cost SportStuff.com incurs if all warehouses leased are in St. Louis?
2. What supply chain network configuration do you recommend for SportStuff.com? Why?
3. How would your recommendation change if transportation costs were twice those shown in Table 5-17?

CASE STUDY

Designing the Production Network at CoolWipes

Matt O'Grady, vice president of supply chain at CoolWipes, thought that his current production and distribution network was not appropriate, given the significant increase in transportation costs over the past few years. Compared to when the company had set up its production facility in Chicago, transportation costs had increased by a factor of more than four and were expected to continue growing in the next few years. A quick decision on building one or more new plants could save the company significant amounts in transportation expense in the future.

CoolWipes

CoolWipes was founded in the late 1980s and produced baby wipes and diaper ointment. Demand for the two products was as shown in Table 5-18. The company currently had one factory in Chicago that produced both products for the entire country. The wipes line in the Chicago facility had a capacity of 5 million units, an annualized fixed cost of $5 million a year, and a variable cost of $10 per unit. The ointment line in the Chicago facility had a capacity of 1 million units, an annualized fixed cost of $1.5 million a year, and a variable cost of $20 per unit. The current transportation costs per unit (for both wipes and ointment) are shown in Table 5-19.

New Network Options

Matt had identified Princeton, New Jersey; Atlanta; and Los Angeles as potential sites for new plants. Each new plant could have a wipes line, an ointment line, or both. A new wipes line had a capacity of 2 million units, an annual fixed cost of $2.2 million, and a variable production cost of $10 per unit. A new ointment line had a capacity of 1 million units, an annual fixed cost of $1.5 million, and a variable cost of $20 per unit. The current transportation costs per unit are shown in Table 5-19. Matt had to decide whether to build a new plant and if so, which production lines to put into the new plant.

TABLE 5-18 Regional Demand at CoolWipes (in thousands)

Zone	Wipes Demand	Ointment Demand	Zone	Wipes Demand	Ointment Demand
Northwest	500	50	Lower Midwest	800	65
Southwest	700	90	Northeast	1,000	120
Upper Midwest	900	120	Southeast	600	70

TABLE 5-19 Transportation Costs per Unit

	Northwest	Southwest	Upper Midwest	Lower Midwest	Northeast	Southeast
Chicago	$6.32	$6.32	$3.68	$4.04	$5.76	$5.96
Princeton	$6.60	$6.60	$5.76	$5.92	$3.68	$4.08
Atlanta	$6.72	$6.48	$5.92	$4.08	$4.04	$3.64
Los Angeles	$4.36	$3.68	$6.32	$6.32	$6.72	$6.60

Study Questions

1. What is the annual cost of serving the entire nation from Chicago?
2. Do you recommend adding any plant(s)? If so, where should the plant(s) be built and what lines should be included? Assume that the Chicago plant will be maintained at its current capacity but could be run at lower utilization. Would your decision be different if transportation costs are half of their current value? What if they were double their current value?
3. If Matt could design a new network from scratch (assume he did not have the Chicago plant but could build it at the cost and capacity specified in the case), what production network would you recommend? Assume that any new plants built besides Chicago would be at the cost and capacity specified under the new network options. Would your decision be different if transportation costs were half of their current value? What if they were double their current value?

Problem: 3

The distribution system for a company consists three plants, two ware houses, and four customers. Plant capacities and shipping costs per unit from each plant to each warehouse are as follows:

Plant	Warehouse		
	W1	W2	Capacity
P1	4	7	400
P2	8	5	600
P3	5	6	350

Customer demand and shipping costs per unit from each warehouse to each customer are

	Customer			
Warehouse	C1	C2	C3	C4
W1	6	4	8	4
W2	3	6	7	7
Demand	300	300	300	400

- Assign the capacities of the plants to customer as well as to warehouse