DARDEN BUSINESS PUBLISHING
UNIVERSITY of VIRGINIA

UV3561

BY AIR OR BY SEA?

Like clockwork, a passing late-afternoon thunderstorm pounded the roof of Montalto's Poplar facility, preventing the first shift from reaching the parking lot and, ultimately, their families and homes. With only two weeks remaining until he needed to submit his summer-internship report, Bill Small was in his office finalizing the critical pieces of the data analysis for his final manufacturing-strategy recommendation. Small's main project required him to assess the merits of producing a new motor program for Cosway, a Western European global industrial OEM (original equipment manufacturer), at one or more Poplar manufacturing facilities in China, Eastern Europe, Mexico, and the southeastern United States, where he was spending the summer. Management had already determined that the manufacturing line would be designed and started in the U.S. facility in order to leverage its engineering talent to establish an efficient process and a high-quality product as quickly as possible. Once stabilized, the production location would be optimized and most likely relocated to a low-cost region (LCR) or, possibly, multiple LCR sites.

Montalto relied on data analysis to drive most decisions, particularly major ones, and the manufacturing recommendation for the Cosway program was no exception. The assessment involved a rigorous analysis of the cost and investment at each factory stemming from the new program's required labor, overhead, inventory (both upstream from suppliers and downstream to customers), equipment and tooling, supply-chain and customer-delivery logistics, and import taxes. Throughout the summer, Small had met with associates from various functional groups to ensure that he was capturing all the financial implications of establishing production at the various sites.

The latest component, however, had him puzzled. Should his analysis assume that the manufacturing line would be relocated by airfreight or by sea freight? Montalto's regional logistics specialist assured him that airfreight was not worth wasting time on, especially for 75,000 kg of equipment and tooling. Could the economics be more complex than comparing the obviously low-cost ocean transport with a high-priced air shipment? If so, what aspects was he missing and how should he quantify them?

This case was prepared by Brian McCahill (MBA '07), under the supervision of Elliott N. Weiss, Isadore Horween Research Professor of Business Administration. It was written as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation. Company names and numbers have been disguised.

Montalto's History

Founded in the early 1970s, Montalto had grown, through a series of successful acquisitions of manufacturing companies, into three strategic platforms with leadership positions in multi-billion-dollar global markets. In FY2005, the company was a member of the Fortune 500, with tens of thousands of associates around the world generating free-cash-flow margins in excess of 10%. For the last 10 years, its stock had significantly outperformed the S&P 500.

Poplar's History

Dr. George Wythe, an Irish optics designer, immigrated to the United States in the early 1900s and started the Poplar Optical Company in Boston, Massachusetts. Poplar designed a wide variety of customized products serving a diverse set of customers, ranging from academic researchers to the military.

Some 25 years later, William Douglas, also an Irish immigrant, left his armature-winding job of 20 years and moved from New York City to New Jersey to start his own company in the basement of his home with his wife, winding their first armatures and baking insulation in their kitchen stove. One year later, Douglas moved the business to an expanded garage in upstate New York. With his business growing (to more than 60 employees), Douglas looked south for a new plant location where he could find lower taxes, rent, and labor costs. A small town in the southeastern United States offered him a lease with a purchase option on a recently vacated mill. With terms too good to turn down, Douglas moved his company.

Poplar, now run by Wythe's son, had become one of Douglas's best customers. The two businessmen had also developed a strong friendship, strong enough to compel them to merge their companies in the 1960s to form Poplar Corporation. The new entity grew quickly, expanding into two distinct operating divisions.

In the late 1990s, Montalto acquired Poplar Corporation and merged it into its Industrial Components Group, where Poplar remained one of its key brands, serving the electrical-motor market for the entire platform, which, in 2005, generated revenue in excess of $1 billion. Products ranged from motors for automated manufacturing lines to electric vehicles to heart pumps. This broad market presence, together with implementation of operational improvements, elevated Poplar to one of the most profitable businesses in its platform. Poplar boasted production facilities in the Americas, Asia, and Europe, and housed its management and engineering research-and-development center in its southeastern U.S. location. Given its diverse market segments, Poplar managed the company through three distinct business units: Custom, OEM, and Standard.

The OEM Market

The OEM market developed out of the outsourcing trend, as companies with a strong commercial presence sought to focus limited financial and personnel resources on the more profitable aspects of their value chains, such as design, marketing, and sales. Manufacturers like Poplar capitalized on this trend by aggregating production for various OEMs to achieve economies of scale in equipment, labor, and sourcing. For OEM customers with sufficient volumes, suppliers could justify global production, further reducing costs through savings in logistics and inventory investment.

Although OEM customers were less profitable than traditional commercial customers and often required specialized equipment and tooling, they generated large and steady volumes. OEM relationships were typically governed by long-term contracts to limit a variety of risks. Suppliers sought volume and pricing security to ensure a return on their investment in capital and, in some cases, engineering design. In addition to ensuring protection of intellectual property and stable costs, customers looked to recoup lost profits resulting from delayed shipments and quality issues. Owing to the scope and complexity of OEM relationships, customer acquisition required months, if not years, of cultivation.

The Contract

The Cosway-Poplar contract spanned five years and specified three types of motor models, together with a preliminary volume forecast segmented by model type and geography. Machine #1 was expected to account for 15% of total volume, #2 for 25%, and #3 for 60%. Because of Cosway's number-two market position in North America, the forecast called for 70% of the dollar demand to occur in North America. Asia represented an untapped market for Cosway, so the company conservatively expected 10% of its dollar demand to originate from that region. Cosway's European location and in-house manufacturing capability enabled it to purchase a scaled-down and lower-priced motor design from Poplar. Accordingly, forecast European unit volume was much higher than the expected dollar demand, which accounted for only 20% of the program. Finally, the contract contained a provision that allowed Cosway to move all Europe-bound motor production in-house, putting sustained European volume at risk.

Another major provision of the contract addressed logistics costs. The contract identified four Ex Works (EXW)[1] Poplar locations for the three regions where end-user demand was expected. Essentially, Cosway would assume all shipping costs and import duties associated with transporting motors from specified locations. For North America–bound motors, the EXW location was either Poplar's U.S. or Mexican facility. For Asia-bound motors, the location was

[1] "Ex Works" was defined as "from where it is made." This was an international-commerce term (incoterm) that represented the minimum obligation for a seller, stating that the buyer of a good was responsible for all costs and risks associated with transporting that good from an agreed-upon place (in this case, a Poplar facility).

Poplar's Chinese plant, and for Europe-bound motors, the chosen location was the Eastern European facility.

Sourcing

Each of the three motor-model types included a bill of materials in excess of 50 items. Although some component overlap existed, each model had unique material requirements, mainly because of varied size and duty rates. The majority of components were commodities that could be sourced from a variety of domestic suppliers. The remaining 20%, however, required supplier qualification and customized design that, owing to the resulting lead time, occurred concurrently with the contract negotiation and before the selection of a production location. More than half of the material spend (representing 60% of the key SKUs) for these key components appeared headed to Chinese suppliers. Approximately one-third of the key-component material spend (representing 18% of the SKUs) would occur in Europe (per Cosway's requirements), with the remainder sourced from North America. The total estimated per-unit landed cost[2] of materials by model type was as follows: model #1, $1,600; model #2, $1,800; and model #3, $2,500.

Production

Preliminary cost estimates for the manufacturing equipment and tooling necessary to construct a production line totaled $2 million for an annual capacity of 15,000 units. Although production of the final motor design had not yet occurred, prototype models and experience with similar motor lines enabled the manufacturing team to estimate labor requirements. Machine models #1 and #2 were expected to entail 8.5 labor-hours per unit; model #3 would require an additional hour of labor per unit.

Poplar usually produced more than daily demand in order to build up safety stock. This excess inventory allowed the company to handle unexpected variability in customer demand. For new accounts with no historical demand, the company produced additional daily demand according to the following schedule: for lead times of less than 15 days, 5 days' worth of safety stock was targeted; for lead times of less than 30 days, 10 days of safety stock was needed; and for lead times of more than 30 days, the company produced 15 days of safety stock.

[2] Landed cost included direct material cost, material overhead (e.g., handling, processing, and storage), inbound freight, and inbound taxes.

Manufacturing Locations

China

Poplar's relatively new Chinese production facility offered the lowest labor ($1.00 per hour) and variable overhead[3] ($4.50 per labor-hour) costs in the company's manufacturing footprint, although wage rates were expected to increase 12% annually. The location arose out of a joint venture with another large OEM customer when Poplar decided to move production of the customer's motor program overseas to improve profitability. Although the transition of the line took much longer than expected, with relocation costs exceeding budget, management viewed the project as a learning experience. Clearly, the lessons learned could prove valuable in a possible Cosway relocation.

While China's key performance indicators (safety, quality, delivery, inventory, and cost) were meeting expectations, the senior-management team was neither experienced nor large enough to replicate a similar performance with a program the size of Cosway. In fact, Poplar's U.S. office still made the marketing and high-level operating decisions concerning the Chinese operations. The human-resources department was confident, however, that within a year's time it could relocate, attract, or train the leadership required to manage a program like Cosway.

Space was also a key risk as the success of the existing OEM program, together with some smaller production lines, consumed all available floor space. Although the company had previously taken creative steps to free up incremental room as production requirements grew, the Cosway program, particularly at full-ramp, would simply be too big. If production were relocated to China, a new or additional factory would be required.

The final consideration concerned import taxes. China used trade restrictions to boost exports and domestic production. Most finished products imported to China were subject to a 17% value-added tax (VAT). Imported components could avoid the VAT as long as they composed a product for export. Still, even imported components eventually exported as finished goods would be subject to a variety of additional import duties, ranging from 5% to 10%.

Eastern Europe

Like the Chinese operation, the Eastern European facility did not possess the management bench strength required to serve the Cosway program adequately. In fact, the factory had only recently gained traction with Poplar's business methods, so sustained operational efficiency and product quality were still a year or two away. An OEM program, however, did provide the volume stability conducive to successful implementation of many core Poplar processes.

---

[3] Variable overhead included fringe benefits, variable facility charges, travel, etc.

Capacity would not be an issue in Eastern Europe as the facility had ample floor space for a program the size of Cosway. After the facility's host country joined the European Union (EU) in 2004, trade restrictions became fairly liberal, as demonstrated by average tariffs of 3%. Manufacturing costs were relatively low, with labor costs of $6.00 an hour and variable overhead of $9.75 per labor-hour. Wages were forecast to increase 8% annually.

Mexico

Within Poplar's global manufacturing footprint, wages in Mexico were the second lowest, at $1.75 an hour, and were expected to track U.S. inflation of 3% a year. Because of employee benefits, however, many of which were mandated by the Mexican government, and high turnover, the facility's variable overhead was relatively high, at $16.00 per labor-hour.

Mexico's proximity to the United States allowed Poplar to transfer seasoned leadership for training and management more easily than it could to other LCRs. Similar to the Eastern European location, the Mexican factory had sufficient excess capacity to absorb the Cosway program. Although membership in NAFTA and the EU Free Trade Agreement liberalized much of the world's trade with Mexico, it maintained a protectionist stance against its major LCR competitor, China, as exemplified by tariffs ranging from 10% to 20%.

Southeastern United States

For a variety of reasons, the southeastern U.S. operation offered quality and capability superior to the international locations. First, most associates had spent their entire careers in the southeastern U.S. facility, and thus possessed marketing, technical, and production expertise. Second, all functional departments (e.g., engineering, procurement, marketing, finance, and human resources), with associated leadership, were represented on-site, allowing for frequent collaboration and associate rotation. Finally, the location boasted the largest concentration of production volume and capacity.

With the rise of LCR manufacturing, the major drawback to any U.S. location was production cost, and this facility was no exception. Direct labor rates averaged $18.00 an hour, with variable overhead accounting for an additional $30.00 per labor-hour. U.S. production, however, faced limited import taxes owing to the country's liberal trade laws.

The Relocation

The manufacturing team estimated that the manufacturing line and process would be stabilized and standardized within six months of launch. The team also expected that the breakdown and reconstruction of the line would consume at least 20 working days. The volume forecast in the Cosway contract assumed a steep ramp-up, with demand increasing by 33% every

six months for the first three years. Cosway and Poplar expected to maintain a level daily production plan throughout the contract, and agreed to target delivery[4] of 1,500 units during the first six months of production. Unsure of when the relocation would actually occur, Small decided to analyze two volume scenarios, one assuming immediate relocation and the other assuming a transfer at the end of the second year.

Transport to Mexico seemed straightforward, as long-haul trucks and rail offered a cost-effective solution. Given lead times and cost, however, overseas relocation presented a more complex analysis. Ocean shipments would occur via 40-foot full-container loads (FCLs). Depending on dimensions, which were currently unknown, a 40-foot FCL could hold between 20,000 kg and 32,000 kg. Logistics had recently solicited shipping quotes from Montalto's preferred freight forwarders. Based on the lowest quote, door-to-door shipment from the southeastern U.S. facility to the Eastern European and Chinese facilities would run $3,310 and $2,967, respectively, per 40-foot FCL. Ocean time in transit to either location would run 30 working days. For airfreight of the equipment, Logistics was quoted $1.61/kg and $1.76/kg to the Eastern European and Chinese facilities, respectively. Estimates of air time in transit totaled five working days for both locations.

The other issue to consider was the buildup of inventory required to continue meeting demand while relocating the line. Given the expected relocation and the low initial volumes, management would staff the line lightly to minimize training investment and maintain high labor utilization. Accordingly, production in excess of daily demand would require overtime. The low staffing levels implied that only 50% of the hourly associates would be available for overtime each week. Overtime wages ran about 150% of the standard direct labor rate. Finance used a 12% cost of capital as a proxy for inventory-carrying costs. Because of the size of the motor and facility limitations, the excess inventory would require custom storage and handling, estimated to cost an additional 5%.

Small believed that he had more than enough data to run a detailed analysis of the line-relocation freight costs, but he was unsure of where to start.

[4] Poplar produced and shipped product five days a week, 50 weeks a year.