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NOVA INCORPORATED: F-CASE TWO YEARS LATER

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NOVA MANUFACTURING COMPANY: F-CASE
TWO YEARS LATER

As John Fisher reflected on the past two years, he rightfully was proud of the significant changes that he, the management team and the many former and newly hired employees had implemented. They truly succeeded in improving the performance of the company. One key improvement was in the area of customer service. The dramatic improvement in fill rates and reliability of supply over the past two years has been evident to both competitors and customers. This improvement has also become a central theme of Nova's push to increase its market penetration. As a consequence of this improved performance, sales and profitability increased substantially, which resulted in increased cash flows. This resulted in several major changes to Nova's product offerings. A new lower cost product was developed that had great acceptance primarily throughout Eastern Europe, Western Europe, and Asia Pacific. To meet the increased demand for both the established and new product lines, changes were made to Nova's production strategy.

The management team decided to produce the entire new product line in its London plant. To produce this new product line required all of the production capacity in the London manufacturing facility. Hence, the management team decided to move the production for the old product line to the Cincinnati manufacturing facility. This made economic sense since the growth in demand for the old product line over the past two years was substantially greater in both North and South America than in the remainder of the world. Table 1 shows the current demand rates in each region for the established product line.

Current Estimated Daily Demand Rates (Units)

Part Number	North America	Europe	Eastern Europe	South America	Asia Pacific	Total
1	86.2	45.7	35.9	45.6	5.6	219.0
2	45.9	30.4	23.1	17.3	4.8	121.5
3	9.4	9.1	8.1	11.4	16.3	54.3
4	21.2	6.9	5.9	6.5	3.1	43.6
5	3.6	8.3	6.4	2.3	1.5	22.1
6	1.4	5.1	3.1	6.9	2.9	19.4
7	3.1	1.7	1.5	4.2	7.6	18.1
8	0.4	0.2	0.3	2.1	3.9	6.9
9	0.2	0.2	0.3	1.1	3.1	4.9
10	0.0	0.0	0.2	0.1	1.9	2.2
Total	171.4	107.6	84.8	97.5	50.7	512.0

Table 1

The Cincinnati plant had again been modernized to take advantage of new processing technology. New equipment was purchased to replace and augment machines. Furthermore, Nova instituted a plant-wide preventive maintenance program that greatly reduced the downtime of its equipment. Nova also switched suppliers for its raw materials. All raw materials were now purchased from a single supplier – Supplier 2.

The new supplier helped Nova achieve its success to a substantial extent. The supplier provided excellent on-time delivery of virtually defect-free materials. The resulting component costs and purity levels are shown in Table 2. Furthermore, Nova and Supplier 2 are collaborating in planning raw material inventory levels (inventory position). Each day, the stock on-hand plus on-order, plus the stock in the transportation pipeline is determined and appropriate incremental quantities are ordered to meet future known demands, projected demands and capacity-driven safety stock requirements for finished products.

Nova's new third party logistics (TPL) provider now guarantees two-day delivery time from the raw material supplier for regular shipments, and next-day delivery for expedited shipments. Since shipments of raw materials now arrive in the early morning at Nova, it is

possible to order material today for use tomorrow provided that the more costly expedited transportation mode is selected. Daily outbound shipments to the DCs now depart in the evening instead of at noon.

Component Costs And Purities

Component Number	Supplier 2	
	Price	Purity
1	$102.06	99.50%
2	$127.36	99.50%
3	$163.34	99.50%
4	$38.00	99.50%
5	$49.40	99.50%
6	$64.58	99.50%
7	$13.18	99.50%
8	$16.98	99.50%
9	$17.12	99.50%
10	$18.82	99.50%

Table 2

Jackson's reorganized Cincinnati plant now operates two shifts per day. Over these two shifts, the plant is presently running at about 87% of its capacity, not counting setup time. In Sector 1, Nova replaced the manual assembly operation with an automated robot as had been recommended by Jackson's team. There are now two new machines running in parallel in the bottleneck operation in Sector 2. A new, faster machine was installed in Sector 3 to reduce the total flow time through the facility. Operating data for these machines are given in Tables 3 through 6. Note that setup times are substantial for Machine 1 in Sector 2. Also observe that this machine is capable of producing only products 1, 2, 3, 4, and 7. No tooling has been purchased for the other products. As the data show, Machine 2 in Sector 2 is capable of producing only products 3, 4, 5, 6, 7, 8, 9, and 10. No tooling exists for producing either products 1 or 2 on this machine.

Current Operating Characteristics

Sector 1 Robot

Product Numbers	Run Times	Setup Times	Scrap Rates
1	0.1	0.3	0.02%
2	0.2	0.3	0.02%
3	0.2	0.6	0.04%
4	0.2	0.8	0.04%
5	0.3	0.8	0.10%
6	0.2	0.8	0.08%
7	0.3	0.8	0.10%
8	0.2	0.8	0.08%
9	0.2	0.8	0.08%
10	0.3	0.9	0.10%

MTBF	MTTR
10,000	75

Table 3

Current Operating Characteristics

Sector 2 Machine 1

Product Numbers	Run Times	Setup Times	Scrap Rates
1	2.2	15	0.68%
2	2.7	15	0.68%
3	2.9	18	2.02%
4	3.0	18	2.42%
7	3.2	21	2.70%

MTBF	MTTR
900	60

Table 4

Current Operating Characteristics

Sector 2 Machine 2

Product Numbers	Run Times	Setup Times	Scrap Rates
3	4.6	2.0	0.44%
4	4.7	2.5	0.54%
5	4.7	2.5	0.50%
6	4.9	2.5	0.60%
7	5.0	3.0	0.60%
8	5.2	3.0	0.60%
9	5.5	3.0	0.60%
10	5.5	3.0	0.90%

MTBF	MTTR
3,000	50

Table 5

Current Operating Characteristics

Sector 3 Machine 1

Product Numbers	Run Times	Setup Times	Scrap Rates
1	0.2	0.4	0.04%
2	0.2	0.4	0.04%
3	0.2	0.9	0.06%
4	0.4	1.1	0.06%
5	0.4	1.1	0.14%
6	0.3	1.1	0.14%
7	0.4	1.2	0.14%
8	0.3	1.1	0.14%
9	0.3	1.1	0.14%
10	0.5	1.3	0.14%

MTBF	MTTR
4,000	35

Table 6

Fisher and his management team continue to look for ways to improve Nova's operations. They realize how important it is to keep innovating to maintain industry leadership and to increase earnings. As part of this innovation strategy, Julia Anderson is launching a new forecasting system that is being implemented jointly with several large customers. It is a business-to-business web-based system in which customers will provide timely and accurate forecasts. Based on a contractual agreement with these customers, timing of firm orders should differ by no more than one day from their projected date, and order quantities should vary by no more than 15% from their forecasted values. Thus, the manufacturing facility's ability to foresee and respond to dramatic variations in demand should improve substantially. Jackson is enthusiastic and agrees that the new forecasting system will add value; however, he is not entirely sure how he will use the information to manage the flow of material through the supply chain.

The distribution system for the established product line has been modified, too. After careful analysis, Larry Judge determined that his plan to close all the distribution centers was not wise. He and others finally agreed that inventories of the products should be held and

customization operations should still be performed in Nova's distribution centers in all of the five regions. However, stock levels at each location have been reduced substantially. Inventories are now maintained only to meet short lead-time demand. All other demand is satisfied from shipments to the regional centers from the central warehouse on an as needed basis. Transportation time data are given in Table 7. Observe that products can still be sent either using regular or expedited transport. In either case, the shipping container for finished goods holds a maximum of 25 units.

Revised Lead Times From Central To Regional Warehouses

			From Central Warehouse: North America	
			Min. (Days)	Max. (Days)
To Regions	N. America	regular	2	2
		expedite	1	1
	Europe	regular	2	4
		expedite	1	2
	Eastern Bloc	regular	2	4
		expedite	2	2
	S. America	regular	2	4
		expedite	1	2
	Asia/Pacific	regular	3	4
		expedite	1	2

Table 7

Transportation and warehousing operations have also been improved over the past two years. Table 8 shows the current cost and shipping constraint data for finished goods to each regional warehouse. One result of improving the warehousing and logistics operation is that shipments made to regional warehouses are available for shipment to the customer on the current day plus the transportation time. Table 9 shows the costs for stocking and transporting raw materials. The major change in the operations and information systems has resulted in a dramatic reduction in the fixed cost for stocking, picking, and packing each product type.

Furthermore, the third party logistics provider has agreed to ship raw material from either Supplier 1 or Supplier 2 on a per-unit cost basis. That is, there is no longer a fixed container transportation charge for raw material, as there is for finished products. The transportation costs are given in Table 9.

Finished Goods Transportation and Warehousing Costs

To	Container Charge ($/box)	Box Size	Fixed Stocking/ Picking cost per product type ($)
N Amer (regular)	100	25	1
(expedite)	150	25	1
Europe (regular)	220	25	1
(expedite)	340	25	1
E Bloc (regular)	290	25	1
(expedite)	500	25	1
S Amer (regular)	200	25	1
(expedite)	300	25	1
Asia Pac (regular)	330	25	1
(expedite)	500	25	1

Table 8

Raw Material Transportation and Warehousing Costs

	Transportation Charge ($/unit)	Fixed Stocking/ Picking cost per product type ($)
Supplier (regular)	.81	2
(expedite)	1.42	2

Table 9

Assignment 1. Analysis of Customer Demand Data

As we have observed, the demand for Nova's products has increased substantially during the past two years. New customers were a major source of this growth in demand in each region; some existing customers also increased their purchases. To understand the current customer order patterns, analyze their order data for the past year in each region. Specifically, conduct appropriate Pareto and time series analyses. Examine order patterns for individual customers. What do you observe? Jackson wants to know what impact of ordering patterns has on the need for production capacity. He also knows that capacity and its use are related to customer lead times. What are the lead time requirements for each customer? Based on these analyses, with which customers would it be most beneficial to establish a B2B forecasting relationship and why?

Assignment 2. The Value of B2B Collaboration – an "I" for and "I"

Jackson has continued to ponder what the value of Julia Anderson's new collaborative, web-based system will be to him. Julia has told him that this system will permit rapid communication of not only customer to the DCs and factory, but a better idea of what customers will be ordering in the future.

Jackson has looked at data indicating customer ordering patterns. He knows that the variability present in these customer order patterns has caused him to carry more stock than he would like and to work more overtime than he believes is necessary given the factory's overall utilization rate.

Anderson's staff has promised to show Jackson what the customer *demand* data could do for him. Since the majority of the staff is working feverishly to finish the improvements to the new forecasting system, Anderson has asked your team to conduct the analysis for her.

Specifically, using the data set provided to you, establish what the *demand* patterns are for each customer, compare them to the *ordering* patterns and ascertain how Jackson might benefit from Nova's having these data available on a routine basis. How would you use these data to assist in forecasting future orders and workload on the factories and supplier? Is there any other information you would like from the customers? If so, what is it, why do you want it, and how will you make use of it?

Assignment 3. Creating an Inventory and Production Strategy for Nova

Now that the management team has been briefed on the value and implications of Anderson's information system strategy, Fisher wants to know how this strategy will affect operational decisions, inventory requirements and costs. He asks Jackson to first create a new inventory and production strategy that uses these data. He asks Judge to have his staff work with Jackson to determine what products should be stocked at each regional warehouse and at the central distribution facility.

Judge and Jackson have asked you to assist them; Use the results of the previous assignments to assist you in this task. Your proposed strategy should indicate, in principle, the basic rules you will use to control production (i.e., what to produce, where to produce it, what to carry in stock, etc.), the logic you will use to allocate inventory to regional warehouses, the stock levels for each product at each regional warehouse, and your logistics (transportation) strategy.

Assignment 4. Using Optimization Models to Plan Operations

Fisher's son has been studying how to use optimization tools in supply chain design and operation. During a school break he told his father that Nova could possibly benefit from using such models to create collaborative purchasing, manufacturing, and distribution plans. Fisher relays these comments to both Judge and Anderson at a staff meeting.

Judge and Anderson had been approached in the past by consulting firms concerning the application of optimization models to Nova's operations. Judge had always been skeptical; however, both he and Andersen agreed that it is important to ascertain the potential value of such models.

Judge had auditors on his staff that were trained to understand the rudiments of optimization models. Judge has tasked them to work with you to develop and assess the value of such a model.

Judge specifically has asked the following questions.

1. What is the goal in creating such a model?
2. What is it that is being "optimized"?
3. What constraints or restrictions are considered and how would they be expressed?
4. How would the model be used in business processes?

In addition, Judge's audit staff would like, if possible, a mathematical representation of the model.