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DEVELOPING WORLD-CLASS OPERATIONS

Operations management is integral to the development and delivery of goods and services throughout the global economy. In essence, operations management is about the creation of customer value through the effective and efficient management of processes. Whether we purchase a new automobile, visit a medical clinic, or converse with friends in other parts of the world via the Internet, processes in the public and private sectors underpin our daily lives. In a nutshell, processes transform inputs into value-added outputs using a variety of resources. For example, your presence in Chicago, an input, might be transformed using such inputs as a mobile phone, fiber-optic cable, customer service personnel, and billing systems into your virtual presence a continent away in London, an output.

For managers, several immediate concerns spring to mind from this general definition of operations management. How do we define value? How should processes be configured to be both efficient and effective? Which resources are most critical, and how should they be managed? How might operations contribute a competitive advantage for the organization? In fact, it is these pivotal questions that this casebook seeks to explore through decisions that confronted real managers.

CUSTOMER VALUE

To begin, it is important to identify what we mean by customer value from an operations management perspective. Customers are interested in a product, which is usually a bundle of goods and services. At the simplest level, a product might include a physical asset, such as an automobile, and a straightforward service, such as peace of mind provided by a 5-year warranty. However, increasing complex product offerings, such as the mobile phone service described earlier, must synthesize a diverse array of goods and services into a final product. Thus, value can be defined both in terms of what is offered, as well as how well particular attributes are delivered.

Operations management contributes to four general dimensions of customer value: time, quality, flexibility, and cost. Each of these is considered in multiple case settings throughout this book. Time captures aspects related to speed, reliability of delivery, and rapid product and service development. Quality incorporates both the tangible and intangible characteristics related to product or service design and consistency. Like quality, flexibility also captures elements that are seen by customers, such as the ability to customize products and services, as well as those that remain unseen, such as the capacity to accommodate significant changes in demand. Finally, the last dimension, cost, is not measured directly by customers but instead is translated by competitive forces into price.

Building Blocks of Operations Management

Six basic building blocks provide a structured approach for describing, diagnosing, and improving an organization's operations (see Figure 1.1). At the foundational level, understanding basic drivers of process effectiveness and efficiency explores three critical elements: process design, planning and control, and project management. At the immediate level, managers must develop broader systems that transcend and integrate individual process elements. Two primary systems that deserve much management attention are quality and supply chain management systems. Finally, the pattern of decisions and actions at both the process and systems levels must be integrated into a coherent operations strategy, which in turn is linked to corporate strategy.

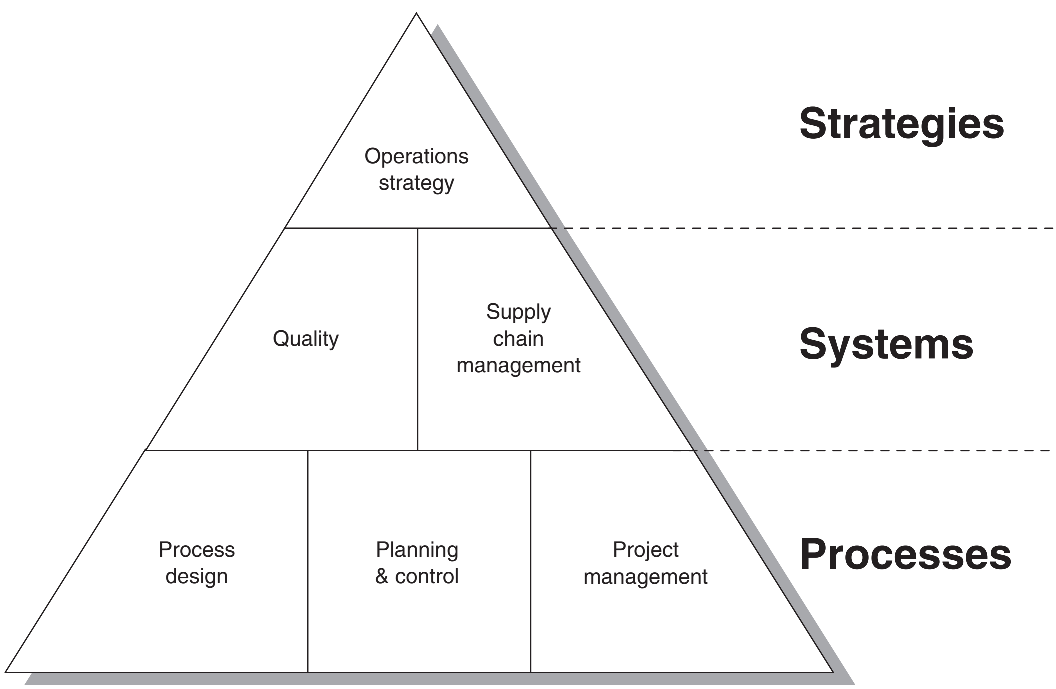

Figure 1.1 Building Blocks of Operations Management

Drawing on this model, the cases at the end of this chapter overview the basic challenges and decisions that are explored in much greater detail later in the book. Chapter 2, "Process Design," provides more insight into the fundamental structure and management of processes. Using the conceptual relationship between product volume and customization as a starting point, the cases in this chapter explore how process-related decisions often involve trade-offs between two or more dimensions of customer value. The cases illustrate a conceptual framework that links the concepts of process capacity, inventory, and variability.

Chapter 3, "Planning and Control," considers how customer demand drives much of the planning process for operations resources. Forecasts must be developed, often with very limited information, and these data can then be translated into both a plan to accommodate that demand and/or a set of management actions to influence that demand. Once long-term aggregate plans are in place, management must actively coordinate the use of resources to meet demand and budget.

Chapter 4, "Project Management," captures both strategic planning and practical tools that collectively contribute to effective project management. Understanding these issues is important for all managers throughout their careers, as much time is usually devoted to coordinating short-term, team-based projects.

Chapter 5, "Quality," focuses on defining and controlling quality. In addition, this chapter emphasizes the importance of the systematic improvement of products (including both goods and services) and processes. Improvement is undertaken through the adoption and implementation of a total quality management (TQM) system, which involves aligning the entire organization around delivering customer value. Although the definition of quality may differ between manufacturers and services, the strategic elements and quality tools of TQM are the same in both operational contexts.

Chapter 6, "Supply Chain Management," concentrates, from a total systems perspective, on the efficient and effective flow of information, materials, and services from raw materials suppliers, to production facilities, to distributors, to end customers. Supply chain management requires the timely coordination of upstream and downstream activities, and many organizations have achieved significant strategic, financial, and operational advantages through better configuring and managing their supply chains. Some of these operational advantages have included reductions in inventory levels and investment, as well as increased delivery reliability and responsiveness.

The final chapter, "Operations Strategy," involves the combination and synthesis of operating processes and systems to gain a competitive advantage. Managers in manufacturing and service organizations have recognized the criticality of developing effective operations, as well as the need to actively manage many of the process and system elements introduced in earlier chapters. Operations strategy also bridges between systems and the broader corporate strategy. Organizations that successfully develop and manage their operating resources in an integrated manner are likely to achieve an enviable strategic advantage and, in some cases, world-class status.

World-Class Operations

World-class operations is more than simply understanding the six building blocks of operations. And it is more than developing and maintaining a reputation for offering solid customer value. Organizations also must assess the business setting with their operational

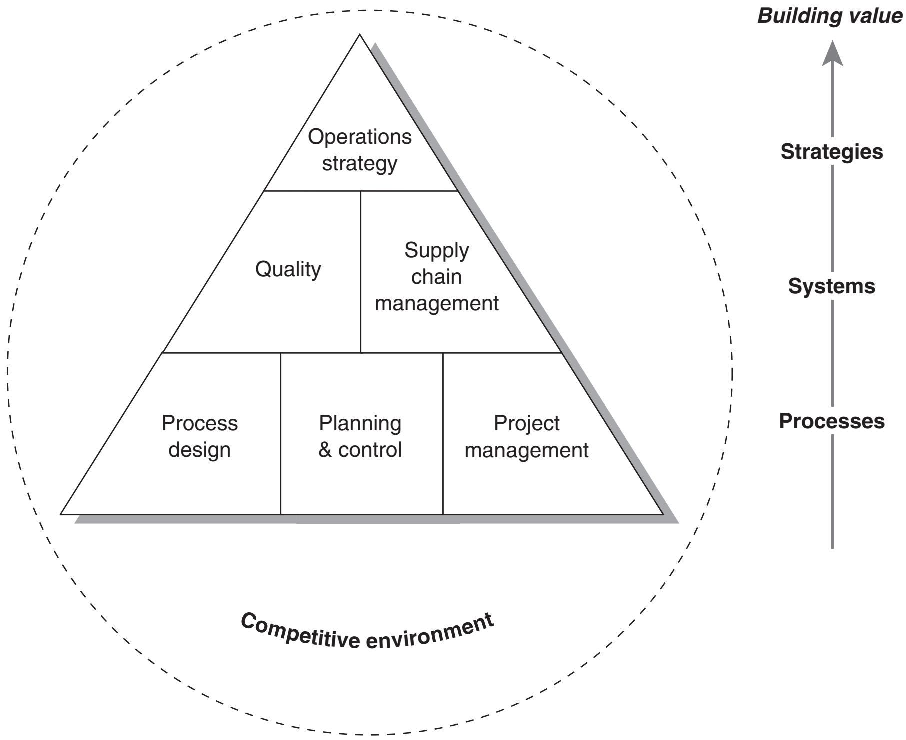

Figure 1.2 Building Value With World-Class Operations

capabilities to identify emerging and unfilled market opportunities that leverage existing strengths. Moreover, it is critical to recognize when competitive forces dictate the adaptation of existing operational capabilities or the development of new ones.

Thus, world-class operations demonstrate industry leadership. New operational capabilities must be developed ahead of the competitors, and operations must be leveraged to deliver superior value over the long term (see Figure 1.2). This emphasis on operations is a key opportunity to build a strong competitive advantage. For example, organizations described in later cases, including Spin Master Toys, Electrosteel Castings, ASIMCO, and the Atlanta Symphony Orchestra, are making great strides toward building such capabilities.

As you move through the initial introductory cases in this chapter and the six chapters that follow, two central concepts will emerge and continue to be reinforced. Both concepts are crucial for every manager to understand about operations. First, operations must be actively designed and managed to deliver and enhance customer value. Identifying important managerial levers helps us to do this. Second, building world-class competitiveness is possible through operations; however, it is not a static competence focused on a single dimension, but rather a dynamic set of capabilities that improve and evolve over time across multiple dimensions.

Industrie Pininfarina: The New Customer Decision

Pininfarina SpA, a renowned Italian manufacturer and designer of niche vehicles for major automobile companies, has traditionally competed on flexibility using a highly skilled design and manufacturing workforce and low levels of automation. However, the European auto market is threatened with a shakeout. Renato Bertrandi, manager of operations, must decide whether to accept an offer from Mitsubishi to become the exclusive European manufacturer of a sport utility vehicle. The order would more than double the company's manufacturing volume and relieve pressure to replace models currently in production. However, the fit of the order with existing manufacturing strategy is poor, and major changes in facilities and equipment as well as people and systems would be required.

Key learning points: introduce the basic concepts underlying operations strategy, examine industry-level evolution, and explore the dynamic nature of operations capabilities.

Fell-Fab Products (A)

Fell-Fab Products is a Canadian manufacturer of interior coverings for airlines, bus companies, and passenger rail services. Glen Fell, president of Fell-Fab Products, was recently approached by a key customer with a request to expand its product offerings into servicing all aspects of the interior coverings business. However, Fell was unsure whether this new service dimension fit, if at all, with existing capabilities, what the financial returns might be, or how to best leverage this opportunity.

Key learning points: examine product, process, and strategy differences for manufacturing and service operations; identify strategic opportunities for product bundles of goods and service; and understand the rationale for business process outsourcing.

Unicon Concrete Products (H.K.) Ltd.

Unicon supplies precast concrete products to the flourishing construction market in Hong Kong. Herman Li, deputy managing director, is evaluating an opportunity to pursue a "blanket" regulatory approval for Unicon's custom-designed concrete products with its largest customer, the Hong Kong Housing Authority. This opportunity promised to offer cost savings to both Unicon and this customer, although questions remain about the broader implications for Unicon's manufacturing operations and other customers. At the same time, Li must develop a plan to expand its manufacturing capacity if Unicon hopes to capitalize on the rapidly expanding market and fend off new competitors from mainland China.

Key learning points: compete on dimensions of customer value, understand product and process relationships in operations, develop congruence between operations and marketing, and adapt to low-cost competition.

Management Questions Addressed in Developing World-Class Operations Chapter

1. How is customer value defined? How does customer value prioritize price, quality, time, and flexibility?
2. What operational decisions must managers typically make, and what is the operations challenge? What are the real problems, opportunities, and issues, and what are merely the symptoms?
3. What are the basic elements of an operations strategy? How is it linked to corporate strategy? To the competitive setting?
4. What forces push management to change an organization's operational capabilities? How quickly can these capabilities be changed?
5. What drives the cost structure for operations? Which costs are fixed? Which costs are variable?
6. How important are labor versus material versus capital costs?
7. What criteria should be used to make a decision? Along what dimensions of customer value are trade-offs necessary?

Industrie Pininfarina: The New Customer Decision

Neil Jones

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The 25th of April is a national holiday in Italy, but it was not for Industrie Pininfarina (Pininfarina) top management in 1996. A meeting between Pininfarina and high level Mitsubishi executives lasted the entire day. The following day, a Friday, Renato Bertrandi, manager of operations at Pininfarina, sat in his office at the Pininfarina plant at Grugliasco, in the Piedmont region of Italy. In a rare quiet moment, he reflected on the challenges that lay ahead for the manufacturing operations. On Monday, he would recommend whether Pininfarina should accept European manufacturing responsibility for a new vehicle, the Mitsubishi Pajero. The vehicle presented both a major opportunity and a significant commitment, which would impact Pininfarina's fortunes through the year 2004 and beyond and it would require major changes in manufacturing. The contract would virtually double Pininfarina's output.

Once again, Bertrandi thought through the company's options and tried to evaluate the near-term benefits and challenges to manufacturing as well as the longer-term consequences. He thought with satisfaction about the many achievements in manufacturing since the 1980s. An active triathlete, he wondered where the next phase of the competitive race in the changing global automotive industry would leave the company.

Pininfarina Background

In 1904, at the age of eleven, Battista "Pinin" Farina began work in his brother's coach-making business—which also specialized in making seats for racecars. After long experience in the emerging and rapidly expanding Turin automobile industry, he founded his own company in 1930. Farina specialized in the design and production of custom and small series automobiles. While he expected to build relatively few "special" cars and was rooted in a tradition of highly skilled craftworkers, he was much impressed with the Ford system, which he had seen on a plant tour in the United States in 1920. The visit contributed to his conclusion that he had to draw on the strengths of Ford's method to be successful. As he would later say,

> I was looking for a third state, between the craft we had to leave behind and industry. The state had to have industrial norms and structures but it must not suffocate that individual reality, which can be defined as style. There was no tradition to which we could appeal, our occupation was brand new and we paid for any mistakes we made in person.

The company soon earned a reputation for the quality and beauty of its designs. By 1939, Farina Industrie employed over 500 workers and manufactured close to 800 automobiles. For a period of time during World War II, the company product line included ambulances, airline seats, and stoves, but it returned to a focus on automobiles after the war ended. And it was in automobiles where it continued to find its greatest success—producing revered designs such as the Ferrari Berlinetta Dino and the Alfa Romeo Spider Duetto (Exhibit 1). Farina's Cistalia automobile, designed in 1947, was celebrated in a collection of mobile sculptures at New York's Museum of Modern Art.

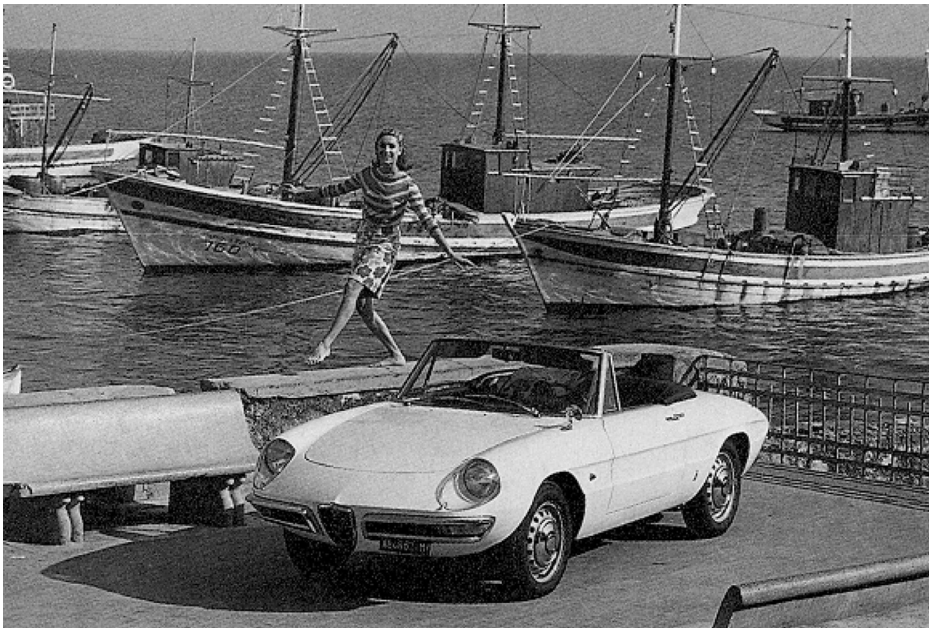
In 1954, after the great success of the Alfa Romeo Spider, the company added facilities to manufacture lower volume cars for major automobile manufacturers. To handle an increasing demand, in 1958 the company moved from Turin to a manufacturing plant in Grugliasco, a nearby suburb. Upon Farina's death in 1966, management of the business was taken over by his son, Sergio, and his son-in-law, Renzo Carli. The family name and that of the business were changed from Farina to Pininfarina by presidential decree.

Throughout the 1960s and 1970s Pininfarina continued to design and produce unique automobiles such as the Ferrari Berlinetta, the Lancia Flaminia, the Austin A 40, and the Morris 1100. By 1972, the company employed about 1900 people and was producing more than 23,000 cars per year. In 1979, Pininfarina split its design and manufacture divisions into Pininfarina Studi E Ricerche and Industrie Pininfarina (IPF), under the holding company Pininfarina S.p.A. In 1986, 30 per cent of the company's shares were listed and sold on the Italian stock market, and a further three per cent of shares were sold to Mediobanca. However, the company remained closely held by the Pininfarina family who retained 67 per cent.

The Niche Manufacturer

Pininfarina was considered a niche car manufacturer. Niche manufacturers were chiefly distinguished by their low production volumes, which were often sub-contracted from a volume manufacturer. In Pininfarina's case, typical production volumes ranged from only one or two cars per day (for example, the Bentley cabriolet) to perhaps 50 to 60 cars per day for "special" sedans such as the Fiat coupe (Exhibit 2). In contrast, volume manufacturers might produce a thousand cars per day or more at a factory dedicated to just a few models or even one model.

However, not all volume manufacturers were the same. In the early 1990s, Japanese manufacturers on average produced around 70,000 cars per model per year, while an average European or American manufacturer produced around 200,000 per model per year. Japanese producers also had shorter model lives at around three years, while European producers had been averaging four to seven years of model life. Bertrandi felt that the best Japanese volume producers were profitable on very much lower production volume per model than even the Japanese average. One Japanese producer had



Alfa Romeo Spider Duetto

Ferrari Berlinetta Dino

Exhibit 1

Fiat Coupé

Bentley Azure

Exhibit 2

told him that it would not consider outsourcing production volumes of greater than 5000 cars per year. In contrast, Pininfarina had produced over 17,000 Fiat Coupes in 1994.

Volume producers could apply considerable pressure to niche producers to keep prices low. Usually, they had detailed knowledge of the product and production processes associated with a model and often had their own experience with part of the process. Further, a given volume producer was usually a vastly larger company and represented a high percentage of the niche manufacturer's total business. Volume producer bargaining power was, therefore, high and niche manufacturer margins were narrow, especially during industry downturns. In general, margins were higher for fully assembled vehicles, and these offered more scope for production cost reductions to be achieved and captured by niche manufacturers. Profit margins for niche manufacturers were typically in the range of two to four per cent of the target unit manufacturing cost.

Advantages of Niche Production

Niche manufacturers provided three principal advantages to the volume producers who performed their own assembly for the vast majority of their production: niche manufacturers had lower total costs for cars made at low volumes, they could accept higher levels of volume uncertainty and their product designers brought both superior designs and famous brand names to volume producer models.

First, niche manufacturer costs for small-volume products were lower than those usually achieved by volume assemblers. At low daily production rates, typical volume producer process designs were too expensive to implement. A typical volume producer might have capital and other fixed costs that were more than twice the level of a niche manufacturer. Niche manufacturers were forced to limit capital investments that were specialized to a particular model because the costs had to be amortized over fewer cars. As a result, niche manufacturers designed production processes that used general purpose equipment and required fewer dies, jigs and other specialized tools. Usually they had fewer mechanically performed operations and lower levels of automation.

To achieve lower capital costs, a niche producer was also skilled in making tradeoffs between what could be accomplished by machine and what could be done by hand. Bertrandi explained:

> It is mainly our engineering that provides an advantage. We get the product to 90 per cent with our process and compensate with skilled labor to provide the last 10 per cent. For example, we might decide to stamp a door in three stages instead of the four a volume producer would use. This can result in some small waves in the door metal, but we can correct this by adding five minutes of additional handwork. This can work at a production of 30 cars per day, but it would be suicide at 1,500 cars per day.

A more highly skilled workforce than that typically found at a volume producer was used to assemble parts and ensure quality in fit, finish and function. Many niche producers did not use a continuously moving assembly line. The variety of work performed at each station led Pininfarina, for example, to design a stop and go process, with a time between moves that might vary from about 10 minutes to about half an hour, and even up to eight hours, depending on the volumes needed.

Niche manufacturers sometimes based their product and process designs on modifications to a higher volume design that was being produced at a major automobile assembler. Often, such modifications required more skill of the workforce than would be required if a similar product had been designed from scratch. For example, Pininfarina production of the Peugeot 406 coupe was based on a sedan model produced at Peugeot. Pininfarina took bodies supplied by Peugeot and inserted a stamped part that altered the slope from the roof to the trunk lid in the rear. This alteration demanded a critical hand weld at the intersection of the mass-produced and niche-produced metal parts. Achieving proper part position and a strong, flat weld, which could be properly finished, was essential to ensure quality in this operation. The higher proportion of labor required imposed an additional cost of some four to eight labor hours per car for a niche manufacturer.

The second advantage of niche manufacturers was flexibility. Consequently, they were often given contracts on models that had higher than usual volume uncertainty and larger seasonal fluctuations in sales. For example, a convertible or cabriolet might have sales in the spring that were 150 per cent of the low sales in winter. Lifetime sales and the model life of highly specialized niche vehicles were also highly uncertain, as such products were aimed at narrow consumer segments that were difficult to specify and had rapidly shifting tastes. Some of the risks associated with such products could be shifted to niche producers. Contracts typically did not fully compensate niche producers for the costs of unanticipated volume fluctuations on a seasonal or overall basis. Uncertainty over model life complicated niche manufacturer planning for new model introductions, as, for example, models with low sales might be discontinued.

Niche manufacturers coped by configuring their facilities to be flexible and by developing elaborate contingency plans. Contingency planning allowed the niche producers to rapidly shift workers from one line to another as demands fluctuated. For example, work at a given station, which might be carried out by a team of five during high volume periods, could be reduced to a team of two when volumes were low. Fewer people at a station meant that each worker had to perform a greater number and variety of the operations needed, and it usually increased station time so that the line moved more slowly. The line also had to be rebalanced so that each work station's output rate was matched to keep worker idle time to a minimum. A line that needed a higher output rate would have more workers at a station and would assign fewer and narrower tasks to each worker. When necessary, workers could be temporarily laid off or could be asked to work overtime.

The third benefit provided by niche manufacturers was highly competent and often renowned design skills in product and process. Design services were an independent source of revenue for some niche manufacturers. At Pininfarina in 1994, design and engineering revenue totalled nearly £90 billion[1] and was growing rapidly. Work might be performed for a production model or for prototype cars, which might never go into production. Although manufacturing contracts were not always awarded for suitable models that had been completed by niche manufacturers, participation in design significantly increased the chance of winning manufacturing business.

Close links and effective joint problem-solving between design and manufacturing were considered a major advantage in the success of a new car model. Some designers, such as Pininfarina and Bertone, had widely recognized brand names. These brands were believed to command premiums and suggest luxury, fashion and high performance. Although Pininfarina's major customers, Fiat and Peugeot, reported that they made little, if any, money on niche models, Bertrandi suspected their calculations excluded the positive impact of image and the attraction of niche cars in pulling potential buyers of other cars to showrooms.

Pininfarina Position in the 1990s

After relatively high profits in the late 1980s, the European auto market became less hospitable in the 1990s. Industry returns on net assets fell from their 1980s high of 10 per cent to 15 per cent to below five per cent on average in the 1990s. In the view of many, the primary problem was capacity utilization, which had averaged below 75 per cent from 1990 to 1995.

Over-capacity was partly the result of low underlying growth in the Western European consumer base and partly due to the addition of new factories by globalizing competitors. The spread of more efficient manufacturing practices, which had been pioneered by Japanese firms, also contributed to capacity growth. Although shares had been relatively stable overall, "voluntary" Japanese restraints on European market share were due to expire by the year 2000 in many large markets and Korean firms had begun to build a large European presence. In markets without restraints, Japanese producer shares were considerably higher than in markets with them. Exhibit 3 shows industry sales and share in Western Europe in the 1990s, and Exhibit 4 shows data on customer satisfaction. At the beginning of the 1990s, European producers had lagged behind other global competitors in some key areas of performance, and despite improvements were not believed to have fully closed the gap. Exhibit 5 shows comparative regional data.

Manufacturing Operations at Pininfarina

As it entered the 1990s, Pininfarina produced both bodies and fully assembled cars at two major production facilities, one in Grugliasco and the other at San Giorgio, about 40 kilometres away. The Grugliasco complex housed a full-scale wind tunnel test facility, which had been one of the first of its kind in the world. Production at Grugliasco was divided among three major buildings. In one, parts stamped by Pininfarina's suppliers were welded together to form the basic "Body in White" (BIW), so named because the completed bodies were not yet painted. Suppliers made stamped parts to specifications set by the designing firm—often, but not always Pininfarina Studi E Riserche. The stamping process itself—the sequence of steps whereby the metal was formed, was typically specified by Pininfarina process design engineers.

A second building contained the paint shop, which painted all production models. The paint shop performed six major steps, some separated by drying phases. In the paint shop, the bare steel was first galvanized, then phosphate-coated and given an electrostatic treatment. Next, a primer was applied and then a base coat, before a final clear coating completed the process. The paint shop had been upgraded in stages beginning in 1985 at a total cost of some £100 billion. It was initially designed for a capacity of 100 cars per shift, but its capacity had been increased to 140 cars per shift and then 160 cars per shift. Throughput time was about seven hours.

The limited number of models produced by Pininfarina came in a total of 52 possible colors. The paint shop could change colors in about one minute, but required some manual setup to paint a specific model. At each arrival, the paint shop changed colors and set up for the appropriate model. Some cars, which needed special painting processes, were painted in a special area. The Rolls-Royce Bentley model, for example, required multiple steps of coating and surface preparation to achieve an adequate finish. About 100 hours of labor were required.

The last step—the trim facility—installed all the rest of the parts needed to form the complete automobile. Here, engines, suspension and other mechanical parts from suppliers were installed, as were details of interior and exterior finish—from door seals, seats and instrument panels to exterior mirrors and bumpers. Trim steps were greatly complicated by the wide variety of options that were supplied to customers. For example, each Fiat model came with a choice of five different engines, and each was configured slightly differently in the engine compartment. Interior options and other options also increased the complexity of process control in assembly and resulted in inventory levels higher than comparable higher volume facilities. At San Giorgio, a more modern trim facility had been built in 1985 primarily for the Cadillac Allante business. Pininfarina's test track was also located at San Giorgio.

Improvements in the 1990s

In 1992, Pininfarina faced a crisis. Production of bodies for the Cadillac Allante and Peugeot 205 and assembly for the Alfa Romeo Spider were being rapidly phased out, while volume

Manufacturer	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*
VW Group	15.6	16.4	17.5	16.4	15.8	16.7
General Motors Group	11.3	12.1	12.4	13.0	13.1	13.1
Opel/Saab/GM	11.3	12.1	12.4	13.0	13.1	13.1
Lotus	0.01	0.01				
Peugeot-Citroen	12.9	12.1	12.2	12.3	12.8	12.0
Peugeot	8.2	7.6	7.4	7.4	7.7	7.0
Ford Group	11.6	11.7	11.3	11.3	11.9	11.9
Ford	11.4	11.7	11.2	11.2	11.8	11.7
Jaguar	0.1	0.1	0.1	0.1	0.1	0.1
Fiat Group	14.2	12.8	11.9	11.1	10.8	11.1
Fiat*	10.3	9.3	8.8	8.3	8.6	8.7
Lancia	2.3	2.0	1.7	1.6	1.4	1.4
Alfa Romeo	1.5	1.4	1.2	1.1	0.8	1.1
Innocenti	0.06	0.11	0.10	0.11		
Ferrari**	0.019	0.021	0.023	0.018		
Maserati	0.015	0.011				
Renault	9.8	10.0	10.6	10.5	11.0	10.3
Mercedes	3.3	3.3	3.0	3.1	3.5	3.4
BMW	2.8	3.1	3.3	3.2	3.3	3.3
Rover***	2.9	2.6	2.5	3.2	3.3	3.1
Nissan	2.9	3.3	3.2	3.5	3.2	3.0
Toyota/Lexus	2.7	2.7	2.5	2.7	2.6	2.5
Mazda	2.1	2.1	2.0	1.7	1.5	1.4
Volvo	1.8	1.5	1.5	1.5	1.7	1.8
Mitsubishi/DMS	1.3	1.4	1.2	1.2	1.0	1.1
Honda	1.2	1.3	1.3	1.4	1.4	1.5
Hyundai	0.1	0.3	0.6	0.7	0.7	0.8
Suzuki/Maruti	0.7	0.7	0.9	0.9	0.7	0.8
Chrysler	0.3	0.3	0.3	0.5	0.5	0.6
Subaru	0.4	0.4	0.3	0.4	0.3	0.3
Porsche	0.1	0.1	0.1	0.1	0.1	0.1
Others	2.0	1.8	1.5	1.2	0.9	1.4
Total	100	100	100	100	100	100
As Per cent of 1990	100	102	102	86	90	91
Total Vehicles	13,258,807	13,504,345	13,497,536	11,428,352	11,910,952	12,012,415

Exhibit 3 Western European Manufacturer Share of Total Number of Vehicles (in per cent)

Source: Company Files.

*Includes Innocenti, Ferrari, and Maserati after 1993

**Includes Maserati after 1991

***Part of BMW Group after 1991

	Overall Index	*Parts/Service*	*Problem Incidence/ Resolution*
Subaru	142	145	150
Honda	141	151	145
Daewo	140	134	89
Mazda	137	136	145
Toyota	137	142	141
Jaguar	136	158	118
Nissan	136	127	138
BMW	132	157	121
Daihatsu	130	129	137
Mercedes	128	159	131
Mitsubishi	124	117	129
Saab	124	139	112
Audi	119	109	118
Suzuki	116	101	122
Volvo	115	116	103
Hyundai	111	102	95
Renault	106	107	109
Volkswagen	105	104	105
Citroen	100	97	96
Rover	100	108	95
Peugeot	99	96	98
Fiat	95	88	94
Alfa Romeo	94	74	80
Ford	78	72	79
Lada	62	81	28
Total Industry	100	100	97

Exhibit 4 Customer Satisfaction Survey Sample Results by Make (United Kingdom Data)

Source: Company Files.

	Japanese in Japan	*Japanese in North America*	*American in North America*	*All Europe*
Performance				
Productivity (hours/vehicle)*	16.8	21.2	25.1	36.2
Quality (assembly defects/100 vehicles)	60	65	82.3	97
Layout				
Space sq. ft./vehicle/year	5.7	9.1	7.8	7.8
Size of repair area (as % of assembly space)	4.1	4.9	12.9	14.4
Inventories (days)	0.2	1.6	2.9	2
Workforce				
% of workforce in teams	69.3	71.3	17.3	0.6
Job rotation (0 = none, 4 = frequent)	3	2.7	0.9	1.9
Suggestions/employee	61.6	1.4	0.4	0.4
Number of job classes	11.9	8.7	67.1	14.8
Training of new production workers (hrs)	380.3	370.0	46.4	173.3
Absenteeism	5	4.8	11.7	12.1
Automation				
Welding (% of steps)	86.2	85	76.2	76.6
Painting (% of direct steps)	54.6	40.7	33.6	38.2
Assembly (% of direct steps)	1.7	1.1	1.2	3.1

Exhibit 5 Summary of Assembly Plant Characteristics: Volume Producers (1989)

Source: Womack, J. P., D. T. Jones, et al. (1990). The Machine that Changed the World. New York, Rawson Associates.

*Includes all labor within factory walls.

replacement sufficient to maintain existing production levels had not yet been committed for new models (Exhibit 7, see p. 17). The shortfall eventually left 1993 production at less than 50 per cent of the average level for the 1990s to that point. Margins were also squeezed as European prices fell. Customers had begun to press for operational improvements in quality, cost and deliverability.

Further, the company had by now concluded that despite some recent operational improvements, more fundamental and far-reaching changes to improve its manufacturing performance would be necessary to ensure future viability. Faced with deteriorating financial results, Pininfarina laboriously negotiated with its unions. The resulting accord, signed on July 28, 1992, was viewed by many as a new model for Italian labor relations. It called for the early retirement and "temporary" layoff[2] of some 435 blue-collar employees—50 per cent of the total workforce.

Workforce and Quality Initiatives

Two major changes were introduced with the new accord, designed to allow Pininfarina to improve its operations to near Japanese levels, while adapting to Italian conditions. First, Pininfarina introduced a work team system modelled on the Toyota NUMMI plant in California, including systems to track morale and elicit suggestions for improvement. Second, a program of training for shop-floor workers was instituted. The training program had two major components. First, skills were built in specific operations and techniques (for example, statistical process control and problem-solving techniques). Second, workers were given interpersonal skills training intended to develop the capability of the workforce to work in teams (doubts had been expressed about the potential for Italian workers to submerge a pride in individuality to the constraints of teamwork). A training program for new workers was also instituted.

The training programs were a complement to an expansion of the quality initiative that had been underway since the middle 1980s. Renato Bertrandi had originally joined the company in 1986 as a manager of quality control, reporting to the general manager. After the accord of 1992, the quality control function reported to Bertrandi himself at the operations manager level.

Pininfarina, while adopting some of the methods and practices of the quality movement, decided to adapt the philosophy to Italian and niche producer conditions. Renato Bertrandi explained:

> As a first step in our situation, it is better not to stop the line for most types of problems. Stopping the line lowers our production and costs us more. It is better for us to have highly skilled people at the end of the line fixing problems after they have occurred. Of course, we also ask workers to identify problems they can't fix on the line and work to remove the source of some problems. I realize this violates the philosophy of lean production, but it doesn't pay to fix the root causes of all of our problems now. This will be our next step.

Supplier Development

At about the same time, and in concert with the quality program, major programs were also initiated in supplier relations. In 1991, Pininfarina had about 650 suppliers. Typically, competitive bids were held among suppliers who were asked to meet Pininfarina's predetermined design specifications. Volumes were then split among several suppliers. By 1993, the number of suppliers had been reduced to 350, despite a major decision to outsource the stamping operations, which had been lagging in the capital investment required to keep them competitive. This reduction was achieved by concentrating volumes in fewer, more capable suppliers, with whom Pininfarina worked more closely—even doing joint design work and parts planning.

Major efforts had been made with the reduced number of suppliers to increase the frequency of deliveries, to correspondingly reduce their size, and to increase quality while decreasing the total amount of combined inspection. In the 1980s, incoming parts inspection employed 70 people to inspect all incoming supplier parts. In 1993, 30 people inspected only about 20 per cent of the incoming parts. Pininfarina also believed purchase prices and inventory levels had been improved.

By 1996, the number of suppliers had increased again to 450, driven by the new production models and a shift in mix toward the assembly of complete vehicles. This trend had been offset slightly because new business was with existing customers who had substantial carryover of existing suppliers and similar needs. About 25 people were needed to manage these suppliers. Pininfarina could control the choice of supplier for about half of its purchase monetary volume and could negotiate freely on price for about two-thirds of its volume. The other one-third came mostly from major customers, who were also major parts suppliers.

The progress of Pininfarina in achieving improvements in some key operating parameters is shown in Exhibit 6, and financial results and operating statistics are shown in Exhibit 7. Bertrandi was pleased with the fact that of the 20 per cent of cars produced that did not go immediately to a buyer, only 10 per cent of these were due to quality problems. The remaining 90 per cent were due to parts shortages of one type or another, typically the result of last-minute changes in option mixes in the production schedule and a consequent shortage of the correct part.

Search for a New Customer

Budgeted improvements called for further increases in the productivity of direct labor of three per cent annually. To utilize the extra capacity created by productivity improvements, to

	1992	*1996*
Performance		
Productivity* (hours/vehicle)	60	42.5
Rework Cost** (% of Total)	12 – 15	9
Layout		
Space sq. ft./vehicle/year		380.25
Size of repair area (as % of assembly space)		N/A
Inventories (days)		.5 – 3
Workforce		
% of workforce in teams	0.25	95
Job rotation (0 = none, 4 = frequent)	3	2.7
Suggestions/employee	0	0.1
Number of job classes		4
Training of new production workers (hrs)		N/A
Absenteeism	7.7	6
Automation		
Welding (% of steps)	5	5 – 34
Painting (% of direct steps)	35	40
Assembly (% of direct steps)	5	5

Exhibit 6 Pininfarina Assembly Characteristics

Source: Company Files.

*Includes all labor within factory walls.

**Includes cost of rework labor and materials only.

	1989	1990	1991	1992	1993	1994	1995
Sales (group total in billion lira)	372.0	479.5	501.9	412.4	417.2	731.4	670.0
Expenses:							
Purchases & Services		270.7	258.7	175.2	201.0	556.6	410.4
Labor Cost		77.6	89.4	97.4	93.5	83.6	116.6
Depreciation		14.6	13.6	16.2	13.5	16.2	18.2
SG&A		92.7	113.4	121.8	98.0	72.5	117.1
Total Expenses	357.6	455.6	475.0	410.6	406.0	728.9	662.3
Operating Income	14.4	24.0	27.1	1.8	11.2	2.5	7.7
Production Model Mix	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Assembled Vehicles							
Lancia Thema SW/K SW	3,010	3,456	2,536	1,894	1,310	806	0
Alfa Romeo Spider	3,978	7,106	9,073	3,640	1,956		
Fiat Coupe					276	17,332	12,500
Bentley Azure					3	170	250
Peugeot Coupe							
Total Assembled Vehicles (Units)	6,988	10,562	11,609	5,534	3,545	18,308	12,750
Total Revenue - Assembled Vehicles (billion lira)	153	237	252	142	104	426	312
Revenue Per Assembled Vehicle (Million Lira)	21.9	22.4	21.7	25.7	29.3	23.3	24.5
Bodies							
Ferrari (Testa Rossa, 512TR, 456GT)	1,207	1,312	1,565	870	306	625	600
Cadillac	3	3,775	2,495	2,660	1,978		
Peugeot 205 cabriolet	9,303	11,051	12,982	I1,718	3,450	784	
Peugeot 306 cabriolet					414	11,154	11,600
Total Bodies	13,565	16,138	17,042	15,248	6,148	12,563	12,200
Total Revenue - Bodies (billion lira)	157	172	167	160	85	143	153
Workforce	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Direct Workers	803	964	889	846	824	927	864
Indirect Workers	443	444	431	408	352	351	344
Total Workers	1,246	1,498	1,320	1,254	1,176	1,278	1,208

Exhibit 7 Pininfarina Data

Source: Company Files.

Note: US$1 = £1,600 (Approximately)

leverage its newly achieved production skills, and to diversify its risk of lower future volumes from current customers, Pininfarina decided to seek a third major customer in late 1994. Although some production of new models from existing customers would begin in 1996, these volumes would be insufficient to replace the production that would be phased out by the year 2000. The typical lead-time from the beginning of design until the first production vehicle was 38 months.

Pininfarina actively marketed itself in the auto industry for new business in product design and manufacture, sometimes proposing joint development of prototype design projects for niche vehicles to volume manufacturers. Such projects were a source of profit to Pininfarina's design division and could result in new manufacturing work for vehicles that were to go into production. Although at present, only the Peugeot 406 had been wholly designed at Pininfarina, the interior of the Fiat coupe had been a Pininfarina design, and Pininfarina had competed with Fiat's internal designers for the exterior as well. Bertrandi felt that the present low level of relationship between manufacturing and design projects at Pininfarina was unusual and did not represent a trend among volume manufacturers to make the two functions more independent of one another.

Pininfarina had worked with Peugeot's styling centre to create all of its major models since the middle 1950s and had regularly performed work for Fiat for an even longer time. In addition, General Motors had been a large customer. While the identity of niche manufacturers' design customers was a closely guarded secret, outside investment analysts' reports stated that Mercedes, BMW, Porsche, and Honda were among Pininfarina's current design and development customers. Analysts had anticipated the announcement of a major new manufacturing customer in 1995, but, as yet, no firm commitments from those prototyping and developing cars with Pininfarina had been received. Pininfarina's prospects for a new niche vehicle-manufacturing customer remained good, however.

The New Customer Decision

Following a marketing contact with Mitsubishi proposing a niche vehicle product design project, in July 1995 Pininfarina was surprised to receive a counterproposal from Mitsubishi. Mitsubishi proposed that Pininfarina be the manufacturer of one of their sport utility vehicles, the Mini Pajero, which was to be marketed in Europe and Asia. A Pajero built in Japan was being successfully sold in Europe. A new model was already designed to the prototype stage and would be introduced first in Japan, in 1998. Vehicles for Asian sales would be manufactured by Mitsubishi; however, Mitsubishi proposed that Pininfarina adapt the design and manufacture in Italy for all of Europe. The major design work would be in adding a left-hand drive model and in adapting the process design to Pininfarina's capabilities. Bertrandi was particularly surprised at this offer since to that point, Mitsubishi had not asked to visit or inspect Pininfarina's factories—a common practice of volume manufacturers, who wished to verify Pininfarina's manufacturing capabilities. Beyond the excellence of Pininfarina's reputation and recent performance improvements, Bertrandi suspected that Mitsubishi had factored Italy's relatively low automotive labor costs into their choice. Bertrandi believed these were one-half Germany's levels (see Exhibit 8).

The details of the Mitsubishi proposal had not been fully specified, but the basic characteristics of the proposal were clear. Based on previous experience Bertrandi believed any decision to proceed would be taken with many details not completely specified. Mitsubishi proposed that by no later than May 1999, Pininfarina should begin volume production in Europe of the new model, after a three-month trial and debugging

Germany	62.44
Belgium	44.6
Sweden	41.8
Japan	41.56
United States	38.52
Netherlands	34.75
France	33.08
Spain	28.06
Italy	27.79
United Kingdom	27.08

Exhibit 8 1996 Labor Costs in the Auto Industry (DM per hour)

period. Production would be at a rate of about 150 vehicles per day. Mitsubishi would pay Pininfarina a standard margin on a target cost that would be based on Mitsubishi's own experience in producing the model in Japan and correction for differing process, parts and transportation costs. The standard margin had not been set, but it was clear it would be low—perhaps one-half of the two to four per cent margins Pininfarina earned on its current production contracts. Bertrandi believed that if Pininfarina could achieve production costs below Mitsubishi's target, Pininfarina would be able to keep the additional profit.

Mitsubishi would guarantee that total volumes would be at least sufficient for Pininfarina to recoup any model-specific capital costs. However, Pininfarina would have to bear the risk of investment in general purpose equipment such as the basic facilities themselves or robots, which could be used for other purposes. The exact guaranteed volume would be calculated on the basis of the standard margin that was allowed Pininfarina by the production contract. Total investments were expected to be £300 billion. General purpose capital equipment for a new model was usually in the range of 10 to 15 per cent of total investment. As Mitsubishi had roughly a three per cent share of the global automobile market, and over US$20 billion in worldwide sales, Pininfarina management had few doubts as to Mitsubishi's ability to meet its commitments.

The term of the production phase would be five years, expiring in 2003, with no obligations on either side to continue the arrangement with other models or services, beyond those which might be part of the Pajero contract such as warranty obligations or spare parts production. Revenues to be collected by Pininfarina each year on average over the life of the project were expected to be £900 billion.

Some design changes would be needed for Europe. These were well within Pininfarina's capabilities, although the model development time would be less than the approximately three years needed for a typical design project. As long as the Japanese schedule was kept, Bertrandi felt product and process design changes could be made in time easily, since the model was already in the prototype phase. In process design, Mitsubishi would design much of the process. Pininfarina had only to adapt the process to its facility—designing an appropriate flow and layout—and to adapt certain processes to a somewhat more labor-intensive system. Bertrandi felt such differences would mainly be in the BIW area where Japanese producers had a tendency to place more robots than American or European producers.

Capital Investment

As a result, new production facilities would have to be acquired and equipped for Mitsubishi production. Bertrandi felt confident such facilities could be built or acquired in time since potential expansion sites had already been identified near Grugliasco. Basic facilities were expected to cost somewhat in excess of £4 billion, including land, the trim facility and adequate parking for workers. Mitsubishi would not cover these expenses. Pininfarina would not invest in welding automation for the Pajero.

The paint shop, which was currently running at capacity, would have to be run for an additional shift. To supply it, the logistics for transporting BIW from the Mitsubishi facility to the Grugliasco paint shop and back would have to be set up, but this posed no problem in principle since BIWs were already being painted at Grugliasco and transported to San Giorgio for trim. There would be additional expenses with the paint shop, however, associated with the Mitsubishi production. Currently, the necessity of cleaning the painting system with solvent to change paint color after each car placed Pininfarina near the limits of what would be acceptable under Italian pollution control regulations. Additional volumes for the Mini Pajero would force a switch to a water-based system. The Pajero would offer a two-tone painting option, and this also posed some problems for the paint shop. Two-tone painting required additional space to dry and store vehicles in between painting stages, and this space would also have to be created.

Quality

Although they had not yet been definitively set, Bertrandi knew that Mitsubishi considered its own quality standards to be very high and that its focus would differ substantially from those of Pininfarina's existing customers. Some in the company believed Mitsubishi might demand defect levels of one-fourth the level of Pininfarina's current customers, although what would be considered a defect was not clear. Experience had shown different customers considered different things in deciding what was a defect. For example, some customers closely specified the routes and positions of electrical harnesses and hoses in the engine compartment, while for other manufacturers, only the functionality was considered, aside from ensuring no basic hazards such as a plastic hose resting on a hot running part existed.

Parts Supply and Logistics

Major mechanical parts, including engines, would be supplied by production in Japan—either from Mitsubishi itself or one of its suppliers. Other parts would be sourced from Europe, predominantly from suppliers who Mitsubishi qualified. Parts supply and logistics from Japan would have to be established jointly with Mitsubishi. Mitsubishi agreed to own the inventory until it arrived at Pininfarina, but it would be shipped at Pininfarina's request. Pininfarina would be responsible for having sufficient parts on hand to meet its production obligations.

Pininfarina had some experience in long distance supply chains. In the 1980s and early 1990s, it had shipped BIW Cadillac Allantes to Detroit for final assembly. However, the supply chain to Japan was even longer and Mitsubishi and Pininfarina calculated that some 13 days shipping would be required, and a further three days of inventory at port in Italy would be needed, in addition to the normal supply of inventory at the plant. Pininfarina logistics staff believed these inventories would be adequate to ensure supply even in the event of strikes. During a strike or port closure, contingency plans would be established to divert production to a free port and to ship to Turin overland.

Many parts from within Europe would also be shipped further than was usual for Pininfarina operations. At present, the most distant supplier was 900 kilometres away for Peugeots and 65 per cent were within 60 kilometres. However, Mitsubishi, which had production in Holland, wanted to retain many suppliers with which it had familiarity. Many of these suppliers were outside Italy, with the most distant being in the United Kingdom—a three-day shipping distance.

Many of the new suppliers would be unfamiliar to Pininfarina and would present challenges. Despite the presence of Mitsubishi, Pininfarina was responsible for parts supply and negotiation of price. The volumes needed were much less than those usual for volume manufacturers, and this made negotiations of price and delivery difficult compared with what could be accomplished by larger firms. Suppliers often incurred extra costs in overhead and packaging and shipping costs, as well as additional set-up costs to supply smaller orders. Many of the suppliers would be unfamiliar to Pininfarina and might increase the number of Pininfarina's suppliers by 150 or so.

Outgoing logistics would also be more complex than usual since Pininfarina would be shipping greater volumes to dealers in major European markets, but this was not expected to present insurmountable problems. It would also be necessary to forecast sales further in advance since the interval from parts order to arrival would be about 46 days—considerably longer than for the current models. For example, for Peugeot, the current standard for orders was about 10 days in advance of production.

Workforce

While Mitsubishi would pay for tooling and fixtures under the volume guarantees at standard margins, the workforce needed was another matter. Bertrandi felt some 600 additional direct workers (inside the factory) would be needed to meet the Mitsubishi volume needs. At traditional ratios of direct to indirect workers, this would imply some 200 to 240 indirect workers. However, Bertrandi felt that while some classes of indirect workers could not be reduced from usual levels, other classes could. For example, purchasing might not need a fully proportional addition to staff because some suppliers would still be in common, some additional capacity could be added in information systems and present resources were not fully utilized. Bertrandi estimated that only one-half the historical number of additional indirect workers might be needed.

Increasing productivity would free some direct labor capacity by 1999. Further, by the year 2000, existing contract business would be ramped down so that some of the current direct labor force could be freed to work on the Mitsubishi vehicle.

The Pajero might also present Pininfarina with a learning opportunity. Bertrandi anticipated that work methods, jigs and tools would be refined in Japan prior to beginning production in Italy. Using Japanese designs and production tools and processes, Bertrandi was excited by the prospect of being able to compare his operations with world-class volume manufacturers. Pininfarina would need to learn fast. After the initial test and ramp-up phase, which would last two to three months, Pininfarina would have to meet the agreed target costs or else pay for any overages itself. Bertrandi wondered if he should accept the contract and the challenge.

Notes

1. US$1 was equal to approximately £1,600.
2. Under Italian law, the government would, under certain circumstances, use a fund created by Italian companies to pay 80 per cent of a laid off worker's salary for up to two years.

Fell-Fab Products (A)

John MacDonald

John Haywood-Farmer

Larry Menor

 Version: (A) 2001-02-09

In December 1998, Glen Fell, president of Fell-Fab Products of Hamilton, Ontario, knew it was time to respond to North American Airlines (NAA), one of Fell-Fab Products' important aircraft interiors customers. Two months earlier, NAA had asked Fell-Fab Products whether it was interested in taking over complete management of NAA's aircraft interiors business. Although the proposal was financially promising, it represented a significant departure from Fell-Fab Products' traditional business of interiors manufacturing. Now, after considerable study and discussions with NAA, Glen Fell had to decide whether Fell-Fab Products should accept the offer and, if so, how to implement it.

Fell-Fab Products

Fell-Fab Products was a family firm that the current chairman, Don Fell, had founded in 1952. The company described itself as a manufacturer of engineered textile products, all of which required cutting and sewing (or welding[1]) textiles according to a specified pattern. Its main business (75 per cent) was the manufacture of interior coverings such as seat covers, carpeting, drapes, curtains, galley furnishings and magazine pouches for the transportation industry. Airlines accounted for 80 per cent of this business; railways and bus lines accounted for the remaining 20 per cent. The company's remaining revenues (25 per cent) came from a diverse line of products such as tents and vests for the Canadian military, carrier bags for newspaper and mail delivery, liners for shipping containers and elevators, sofa beds for recreational vehicles, microwave receiver dishes[2], thermal insulation blankets for aerospace applications, custom-designed covers and the overhaul of airline seat assemblies. Its customers for these products included organizations in the aerospace, material handling, packaging, industrial and government sectors. The company's customer base and product mix had remained reasonably stable. Among its core competencies, Fell-Fab Products counted its ability to react quickly through manufacturing flexibility, materials management and constant communication with the customer.

Exhibit 1 shows an organizational chart. The company's head office and main manufacturing facility were in Hamilton, where about 20 head office and 180 manufacturing staff worked. The Hamilton plant, which was ISO 9001 certified and included a Class 100,000 clean room essential for aerospace products, produced Fell-Fab Products' full product line. FELLFAB, L.L.C. near Atlanta, Georgia, employed about 60 people and was devoted entirely to manufacturing parts for transportation interiors. The company's annual revenues were about $27 million; about $15 million of this amount originated from the Hamilton plant and about $12 million from the Atlanta plant. About $7 million came from non-transportation products.

Competitors

The North American aircraft interiors business had many relatively small producers. John MacDonald, Fell-Fab Products' director of sales and marketing, and a recent EMBA graduate, believed that Fell-Fab Products' Canadian market share was about 20 per cent. The various active companies tended to carve out roles with different degrees of vertical and horizontal integration. One Canadian competitor was a subsidiary of a textile mill. One United States company made complete seats. Other companies were involved in interiors replacement and cleaning. According to MacDonald, Fell-Fab Products' experience, consistent product quality, design capability, two manufacturing sites and ability to transfer design specifications between them electronically made it competitive. Transportation customers preferred to avoid the risks of single sources and to deal with suppliers near their major aircraft refurbishment sites. In North America, those sites included Toronto and Vancouver in Canada, and Atlanta, Chicago, Dallas and Los Angeles in the United States.

The Seat Cover Production Process

Although making interior covers for an airplane was not difficult, some salient features complicated the process. There was a considerable degree of asymmetry and variation in airline seats. Each aircraft type had its own seats, often in several configurations. Even for a single aircraft type, each airline had its own seat needs. Naturally, the larger seats in business and first

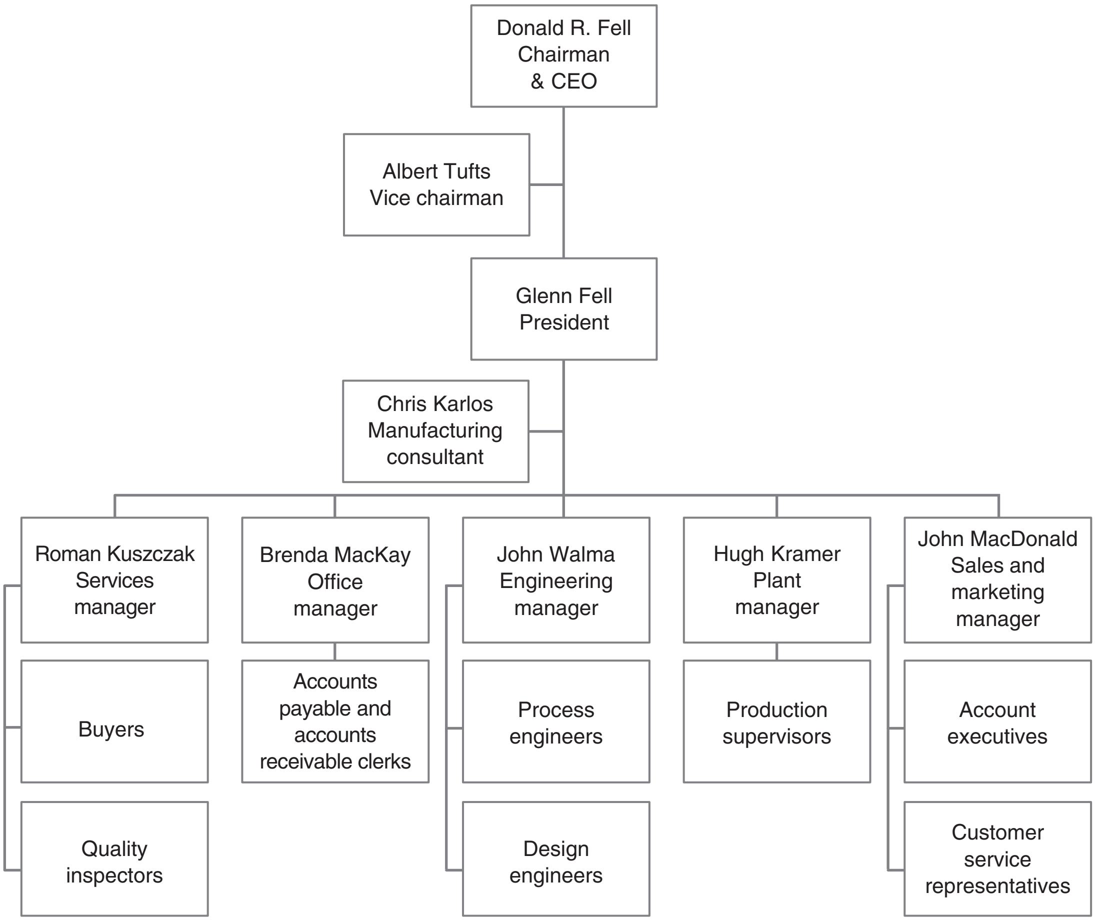


Exhibit 1 Fell-Fab Products' Organizational Chart

class required different covers than the standard economy class seats. However, left side seats could differ from right side seats, and aisle, centre and window seats could all differ. Consequently, a row of seven seats might have seven different covers. Special features of the aircraft, such as the presence of bulkheads and seats for each crew member, created yet more cover designs and/or materials. Carpeting was also complex. For example, the carpet kit for a Dash 8, a short-haul commuter aircraft, had a total of 23 pieces in 12 separate designs with up to six pieces per design. And, because some newer Dash 8-400s had custom interiors, all kits for that series were different.

Aircraft interior manufacturing began with a contract between the airline and a small number of textile mills, typically from overseas, to supply material to certain specifications. The airline then informed interiors manufacturers such as Fell-Fab Products of the names of acceptable suppliers and the product numbers and prices of the proper materials. Fell-Fab Products purchased fabric according to this list with lead times of about 12 weeks. Advance planning was crucial for Fell-Fab Products. When an airline needed interior coverings, it informed Fell-Fab Products, typically requesting delivery in about four weeks.

Fell-Fab Products drew the purchased material from raw materials inventory (which averaged about 60 days' worth) and spread it in layers on a large cutting table. The company stored designs for the interiors electronically in a computer aided design (CAD) and computer aided manufacturing (CAM) system, which was able to optimize a cutting pattern and cut up to 40 layers of material. In addition to order size, the number of layers cut depended on the thickness and composition of the material. Once cut, the material continued to be handled in batches based on the number of layers cut. It then passed through about six sewing operations and was labelled and bar coded. The final product was inspected, gathered into kits and boxed ready for shipping.

Sewing and inspection were labour intensive operations and it was more labour intensive to process leather than man-made textiles. Although it took only a few minutes to complete each step for a single interior covering, from cutting to shipping it took about a week to process a typical order for a large commercial aircraft. In common with other batching operations, queue time before, during and after production was significant.

Fell-Fab Products' transportation product customers included 10 major airlines that, in general, demanded high quality, prompt and on-time delivery, and excellent customer service. Occasionally, in the past, Fell-Fab Products had lost business because it had failed to deliver on time. All products had to be certified to particular safety specifications. Late shipments or other problems with an order could result in lost revenues for the airline as they would not fly with even a single seat cover missing. For Fell-Fab Products, the term "aircraft on ground" (AOG) was a panic signal. In such cases the company gathered the necessary materials and processed them as quickly as possible using the regular equipment and operators. Although the result might satisfy the AOG-affected customer, the practice could significantly disrupt the flow of other orders.

North American Airlines

North American Airlines (NAA) was a full service airline offering scheduled passenger, charter and air cargo transportation services. In 1998, NAA flew more than 10 million passengers to more than 200 destinations in North America and 30 destinations in Asia, Europe and Latin America. It was a founding member of a leading industry alliance and was also affiliated on a code-sharing basis with smaller regional carriers that served shorter flights, often as feeders. NAA was among the five largest passenger carriers between North America and Asia in terms of total flights. NAA had benefited significantly from its partnerships.

NAA prided itself on the quality of its service. In recent years, it had undertaken a variety of changes to its products and services based on extensive benchmarking against its competitors and partners along with customer surveys encompassing check-in, boarding, in-flight, and baggage retrieval. In evaluating NAA's airline equipment, facilities and uniforms, customers believed that the airline was "friendly but tired." Customer research identified comfort and flexibility as the important factors passengers considered when measuring a pleasant in-flight experience. Among the most visible of NAA's improvements was a complete overhaul of the aircraft fleet's interiors and change in colour schemes planned for early 1999. NAA's fleet, including those of its affiliated regional carriers, consisted of about 130 aircraft in eight different makes or models (see **Exhibit 2**).

Like its competitors, NAA spent a great deal of money managing its fleet's interior coverings. As part of its interiors management program, the buyers assigned to this product class were responsible for inventory management and servicing, as well as purchasing the coverings. Approximately every three months, while the aircraft was on the ground for scheduled servicing and mechanical upkeep at one of NAA's major service centres, an NAA crew stripped the interior coverings from the aircraft and replaced them with others from inventory. It sent the removed coverings to an independent

Aircraft		*Typical Economy Seats*		*Typical Business Seats*	
Type	*Number*	*Number per Aircraft*	*Total*	*Number per Aircraft*	*Total*
Boeing 747-400	4	379	1,516	42	168
DC10-30	10	228	2,280	24	240
Boeing 767-300ER	11	180	1,980	25	275
Airbus 320	12	108	1,296	24	288
Boeing 737	44	88	3,872	12	528
Fokker 28	27	85	2,295		
Dash 8-100	10	37	370		
Dash 8-300	14	50	700		
Total	**132**		**14,309**		**1,419**

Exhibit 2 NAA's Fleet[1]

1. Although the number of aircraft of each type and the seating configuration varied from time to time, they were reasonably stable.

cleaner who dry cleaned all of them, regardless of their condition. After cleaning, the dry cleaner returned the coverings to NAA for storage. NAA's coverings inventory was thus found in use on the NAA fleet, in stock in NAA's warehouse, in transit to or from the cleaners, and at the cleaners for service. Although colour or design modifications could prompt an earlier change, the lifetime of a seat cover was approximately one year. Wear was the most common reason for cover changes. It was important to keep track of the number of dry cleaning cycles for each seat cover because flammability specifications were typically compromised after 10 to 20 cleanings, depending on the fabric used.

NAA stored the covers in large bins, with one complete set for a given aircraft per bin. It identified the bins by aircraft type. To reduce the risk of being out of stock, NAA and other airlines often stored extra coverings for emergencies. When they came to put a cleaned set of covers on, the replacement crew might also discover that some covers had been damaged and needed replacing. The crew discarded covers it identified as damaged at the time of installation; if NAA could not find adequate replacements in inventory, it placed a rush order, under AOG conditions, with Fell-Fab Products. As soon as possible after replacing an aircraft's interior coverings, the replacement crew supplied NAA's purchasing personnel with scrappage reports. Purchasing, in turn, prepared monthly scrappage reports to help forecast future coverings purchasing requirements.

The NAA Proposal

In October 1998, NAA asked Fell-Fab Products if it was interested in widening its business relationship beyond the manufacture of interior coverings. Fell-Fab Products was one of a few airline interior manufacturers upon which NAA relied. Since becoming a producer of these products for NAA in 1965, Fell-Fab Products had seen its sales to NAA increase steadily; currently it accounted for 35 per cent of NAA's purchases of cabin interiors. **Exhibit 3** shows NAA's history of purchases from Fell-Fab Products.

In October 1998, MacDonald and a Fell-Fab Products account executive met a purchasing

	1996	*1997*	*1998*
January	12.0	11.5	21.7
February	18.5	21.3	15.1
March	4.9	14.6	11.2
April	9.1	18.1	19.7
May	21.8	12.2	23.6
June	7.6	11.9	16.9
July	17.8	21.9	15.6
August	10.9	8.0	23.0
September	10.3	18.5	15.0
October	14.6	20.0	21.2
November	13.0	15.1	19.4
December	9.2	13.8	19.0
Total	**149.7**	**186.9**	**185.5**

Exhibit 3 Fell-Fab Products' Recent Sales to NAA[1]

1. Figures are in thousands of dollars.

manager and two buyers from NAA to discuss the NAA proposal. The meeting focused on one aspect of NAA's interiors management program—the management of aircraft interior coverings. MacDonald described his impressions:

> NAA approached us to express their intent to withdraw from the interior coverings management business and offer it to an external, though reputable company like us. It makes sense: NAA is in the flight business, we are in the cabin interiors business. And, effective interior coverings management is extremely important. A single missing seat cover is enough to ground a plane. By purchasing the complete management of interior coverings from one or more external service providers, NAA would realize four benefits:
>
> - reduced costs,
> - reduced interior coverings inventory,
> - better use of their existing service crew, and
> - a simpler interior coverings management process.

Since a bin of coverings is typically unsorted and the seat covers aren't even identified by seat type, the replacement crew spends a lot of time sorting through the clean bin trying to fit seat covers by trial and error. Besides dealing with interior coverings, the crew is also involved with other servicing and mechanical tasks such as maintenance of telephones, the entertainment system, seats, lighting, the heating and air conditioning system, galleys and lavatories. Because NAA has a high overhead structure and its interiors coverings replacement crew is highly paid, NAA wants them to work more on these higher-value-added tasks. NAA officials believe that lower-waged, unskilled workers could be employed to replace coverings. However, NAA's employees are unionized and the union has objected to using unskilled workers in the past.

NAA's current process is complex because of its many logistical difficulties related to tracking the location and levels of interior coverings inventory, the choice of independent cleaners, and the sorting of cleaned covers. NAA is interested in withdrawing from the interior coverings management business if it can't simplify its process internally.

To date, no North American firm offers a service as comprehensive as the one NAA envisages. This opportunity deserves further study.

NAA's Interior Coverings Management Business

Over the following weeks, MacDonald gathered as much information as he could from NAA and other sources. NAA seemed to know little about its interior coverings management process. The officials found it difficult to provide immediate responses to basic questions such as: "How many seat covers do you own?" and, "How long does it take to change a cover?"

Interior Covering Replacements, Inventory and Cleaning

NAA restricted interior covering replacement on its Boeing 737, Boeing 767, DC-10 and Airbus A300 aircraft to two North American centres, one in the east and one in the west. In total, these sites changed an average of 1,350 seat covers per week. NAA changed the interior coverings on its Boeing 747s during layovers in a city in southeast Asia at a rate of 50 covers during each layover with four layovers per week. NAA changed the interior coverings on its DC-10s once annually. NAA's affiliated regional airlines changed their interior coverings at their major centres of operation.

On average, a seat cover was inspected every 300 flying hours. NAA carried up to six spare seat covers per aircraft aboard for emergencies to eliminate the need to carry stock at each of its line stations. NAA did not currently account for the number of dry cleaning cycles by seat type.

Interior Covering Management Responsibilities and Expenses

Replacing a seat cover required approximately 19 worker minutes per seat at an average cost of $20 per worker hour. The most recent scrappage report indicated that for the preceding 12-month period, NAA discarded approximately 4,500 seat covers. The total number of seat covers cleaned for 1998 numbered 48,000 at its western centre and 27,000 at its eastern centre for an estimated total cost of cleaning of Cdn$75,000, not including transportation, repairs, sorting, or cover replacement.

The more Glen Fell and MacDonald investigated this business opportunity, the more they became intrigued by it. They estimated that it would substantially increase Fell-Fab Products' revenues and profits as the service offered a potentially high contribution. Margins in the interiors manufacturing business were 20 per cent to 60 per cent, with almost all of them at the low end of that range. The two estimated that a contract with NAA would provide annual revenues of $1.2 million with costs of $475,000 per year for labour, transportation, cleaning and storage.

They were also able to confirm that the airline industry was moving towards buying such services. Further, NAA's offer to Fell-Fab Products had not gone unnoticed; several of NAA's alliance partners as well as NAA's primary competitor were interested in the outcome of the proposal.

MacDonald was concerned that the NAA offer was too great a departure from Fell-Fab Products' traditional business. He described his views:

> Fell-Fab Products has an established reputation as a quality-conscious manufacturer of engineered textile products. Over the years, we have made efforts to improve our production processes as well. For example, we have incorporated CAD/CAM technology to ensure the most economical use of materials. This has improved our fabric yield and further eliminated human error. Our computerized cutting equipment ensures a high degree of accuracy in cut parts and permits us to work within tight tolerances and our full electronic data exchange capability and product bar coding provides more efficient materials management and inventory control. Companies do business with us because we're good at making things. We probably made the carrier bags like those there on the wall used to deliver your newspaper and mail today.

NAA's proposal would require us to invest about $250,000 to acquire a crew experienced in dressing aircraft, suitable cleaning equipment, and a fleet of service vehicles to transport the crew and covers to airport locations. Operating costs would be extra.

Accepting NAA's offer would require us to be more of a service-based business. Service organizations make money by being good in executing activities, not through making things. Fell-Fab Products currently provides some auxiliary services to its air interiors customers. We have an in-house staff of design engineers that can assist in the design stages of particular products. Covers for the Canadarm and robots and nuclear reactor insulation are examples. Also, although we are able to provide our customers with historical information regarding inventory, consumption and other reports as needed, these services are not our principal order winners.

What kind of service would NAA expect? Cleaning, inventory management, and repair are the obvious ones. But others are also possible. The actual service would depend on just what NAA wants. The quality of any service we provide to NAA would rest on our ability to respond and be reliable. At a minimum, the interior coverings management business would necessitate greater interaction with the customer. Would our sales staff be able to provide the levels of assurance and empathy required when dealing with an airline executive forced to ground an aircraft because we were not able to service all his or her aircraft interior needs? Value for Fell-Fab Products would have to include issues related to customer allegiance too.

Glen Fell's Dilemma

Glen Fell had decidedly mixed feelings concerning this decision. Before committing to NAA's interior coverings management proposal, he was mulling over a list of issues that he had to address. He contemplated his vision for the future of his company's involvement in the airline industry. He described his thoughts:

This could be a very attractive business for us. It is a natural extension that complements our core business of manufacturing aircraft interiors. We already know this market. We also know NAA and many of the other players in it. We understand them well and have good relations with them. In fact, a move like this should strengthen our relations with NAA. In addition, it wouldn't involve adding facilities as we could use our existing ones, except for space for dry cleaning. We already have a building lined up near our Hamilton plant for dry cleaning. And, we could use this as an opportunity to learn about running a service operation. That would be a real asset if we decided to extend our non-core businesses into service too.

The demand for such a service seems to be there, although the picture is not entirely clear. Lots of airlines are making noises about outsourcing interiors management. One claims to have saved some $5 million per year by doing so.

There are really two types of airlines. One is already outsourcing a certain amount of business. In those cases, our job would be to convince them to switch suppliers. The other type does it in-house. Our job would be to convince them that we can do a better job than they can do themselves. But, many of them have strong labour unions who recognize outsourcing as a real threat to their jobs. It would be tough to get them to go to the wall with their workers over outsourcing refurbishment services.

The possibility of a deal with NAA is intriguing. They seem to want to help us by sharing what they know. It was clear from our meeting that they are going to go with someone. If we wait, they will go with someone else, and we will find ourselves very much behind.

Despite its potential, this deal makes me nervous. Extending beyond our core competence in interior coverings production is potentially risky. We don't have the logistical expertise at the centre of NAA's problems so we would have to develop our own or get assistance. Over the years, we have grown by diversifying. It is always risky to put all your eggs in one basket. This diversification has taken two routes. Don [Fell] is always looking for opportunities to use our core strengths in sewing fabric. Whenever he sees a possibility, we investigate it. This has led to our wide range of small volume products, which really share only one thing—they involve sewn or welded fabric. But, we miss out because we don't understand the industries to which we sell the products. They don't have much in common at all.

The second route in our diversification has been the acquisition of companies that make products involving sewing or welding. Over the years, we have made at least 10 of them. And yet, not one of them is still operating. We have tended to focus on the sewing and welding while ignoring other aspects of the production process. In some cases, we have not had the management skills to handle those differences. In other cases, production has been no problem, but we have had trouble growing sales because of our inexperience in those markets. We have been reluctant either to leave our acquisitions alone or to develop the necessary skills inside the company to deal with them. Would the NAA opportunity be a success or would it simply be one more failed attempt to diversify?

If we were to go ahead, what would be the impact on our manufacturing business? With our failures in the past, we have been protected from major effects because the part in trouble has been relatively small. But this time, it would be different. I am sure that if we were to fail to adequately serve airlines through a logistics or cleaning mistake, we could hold up an aircraft. Not only would that cost us money, but the whole company would get a bad reputation. And, we think that the airlines currently buy about 20 per cent more interiors than they actually need because they don't maintain them very well. Even if we were to succeed in service, it might hurt our interiors sales.

We would also have to find, hire and train the right people. We don't quite know what service people would be like, but we do know that our current staff probably wouldn't be right. And, we would need new management systems for a service arm. The whole logistics area would be quite different. Managing aircraft interiors involves a lot of inventory control that we don't have experience in. Our main inventory task right now is handling a small amount of raw materials. In this business, we would have to handle large numbers of finished goods and make quality calls for our customers. It would be our decision whether a seat cover was torn or worn badly enough to need replacement. And, of course, we know nothing about dry cleaning. We wouldn't want to have a problem and have seat covers last only half as long as they should because we made an error in the mix of solvents in the dry cleaning process that affected fire retardation.

The Atlanta plant certainly adds to administrative load and costs. Aircraft interior refurbishment might mean a large number of additional sites, and fairly quickly. A large carrier like NAA probably wouldn't want to wait too long while we expand to other centres to serve them.

In our current business, we have a pretty good idea what quality is and how to manage it. We have a set of benchmarks to go on and well described standards set out in product specifications. When we produce a new seat cover, the first two units we produce become test standards. We send them to our customer for checking. If the customer is satisfied, it signs off on them and returns one sample to us as a reference that we can always refer to if we have to. But how do you do that on the service side? There are no benchmarks and certainly no reference standards. And, almost everything would be done by people. Their work is not nearly as reproducible as a machine's. Of course, maybe each customer would want it different each time. We would have to develop some comfort in dealing with quality in such an environment and some systems to handle it. These factors all point to developing a high level of communication with customers.

It probably sounds odd for a manufacturer in the just-in-time and zero inventory age to say it, but services present a problem because they don't involve inventory. Although we try to cut inventory wherever possible, the penalty we pay is that inventory isn't there to buffer the business from fluctuations in the market. You wind up with a very different capacity management task. We don't have any experience managing capacity in an inventory-free environment. I am not sure we are up to it.

On the bidding side, we have limited experience in estimating service contract costs. If we were to get a fairly long-term contract below cost, we could lose our shirt.

It seems to me that there are several key success factors in implementing such a service. First, communication between the customer and service provider is vital, especially during the early stages of developing the service relationship. The customer must communicate its needs to the service provider, while the provider must communicate its capabilities to the customer. Second, both parties must be committed to the long-term success of the venture. Third, a successful external aircraft interiors management business rests on developing a partnership between the customer and the service provider.

So, my decision comes down to heading off in a new direction with an attractive set of benefits but also significant costs, or continuing to work on improving our existing core manufacturing business, which, as you can appreciate, is far from perfect. NAA plans to introduce a new colour scheme in March 1999, so I have to decide quickly

Notes

1. Welding two pieces of synthetic textile together was very similar to welding two pieces of metal, except that the source of heat was radiofrequency radiation rather than an electric arc or acetylene combustion. Like metal welding, the two pieces of textile had to be of similar composition.

2. The heart of a microwave receiver was a small electronic device, typically located at the focal point of a curved reflecting surface where the radiation was concentrated. The curved surfaces of some dishes were made from fabric supported by a rigid frame. Fell-Fab Products made the reflecting fabric surface rather than the supporting frame or the electronic components.

Unicon Concrete Products (H.K.) Ltd.

Fraser Johnson

Rob Klassen

 Version: (A) 2000-09-25

Herman Li, deputy managing director of Unicon Concrete Products (H.K.) Ltd. (Unicon), was considering what action he should take to address the growing demand for two of his company's products, precast concrete facades and slabs. It was now November 1997, and the construction industry in Hong Kong was flourishing. Mr. Li felt that an opportunity existed for Unicon to make changes to the current process of submitting structural design drawings to the Hong Kong Housing Authority for approval. He believed that streamlining this process would both reduce lead times and eliminate unnecessary costs. Because of the long lead time associated with such a change, Mr. Li felt compelled to finalize his strategy quickly. He was concerned, however, about the implications of this change on Unicon's operations and competitive position.

Hong Kong

Hong Kong was an important centre of economic activity in southeast Asia. Located on the South China Sea, Hong Kong was the economic gateway to the People's Republic of China (PRC). In fact, 60 per cent of all of China's exports passed through Hong Kong, while the Territory accounted for approximately 70 per cent of the direct foreign investment in the PRC. Hong Kong had the world's largest container port, where exports of electronic products, clothing and textiles passed through to North America and Europe.

Hong Kong reverted back to China from the British on July 1, 1997, under the "one country, two systems" approach to government. Although the per capita income of Hong Kong was second in Asia only to that of Japan, the Special Administrative Region (SAR) faced certain problems. With over six million people on only 1,076 square kilometers (415 square miles), affordable housing was one of the most critical problems facing the Hong Kong government.

Needless to say, housing in Hong Kong was among the most expensive in the world. A typical 800 to 1,500 square foot apartment in Hong Kong, with two or three bedrooms ranged in price from HK$15 to HK$35 per square foot per month for rental and between HK$5,500 to HK$8,000 per square foot to purchase.[1] Even apartments at the low end of the market, with only two bedrooms and 500 to 800 square feet, cost about HK$10 per square foot per month to rent and between HK$3,200 to HK$5,500 per square foot to purchase.

Concrete Construction Market

As a supplier to the construction industry, Unicon sold its precast concrete products to general contractors in Hong Kong. General contractors were large firms capable of co-ordinating the construction of large, expensive building projects. These firms had expertise in building construction and design, together with the capabilities to finance such ventures. Although there were many general contractors in Hong Kong, the largest of these, numbering approximately 12, controlled an estimated 80 per cent of the market. Unicon had historically worked with all 12 of these organizations.

While seasonal variations were relatively small, construction activity followed a cyclical pattern, with infrastructure and superstructure developments peaking at different times. A developer interested in constructing a superstructure complex would secure the services of an architectural firm to coordinate the design and build the project. The architectural firm would provide engineering support, dealing with both the substructure (the foundation below ground) and superstructure (the building complex above ground).

The typical process called for the architect to engineer both the substructure and superstructure concurrently. Under the existing superstructure submission procedure for private development, detailed design calculations and drawings had to be prepared by a Registered Architect and a Registered Structural Engineer (RSE) jointly and submitted to the Government Building Department for approval. The submission could be approved, minor changes requested, or rejected. This submission and review process could take up to two months.

In Hong Kong, tender offers for the superstructure were requested just prior to completion of the substructure. General contractors then were expected to be capable of immediately commencing construction of the superstructure following formal review of the tenders. This placed considerable pressure on the bidder to have subcontractors and suppliers that could meet very tight schedules on time.

When constructing superstructures, the general contractor used either the traditional method of pouring concrete walls and floors on-site, using forms built in place, or alternatively, assembled precast concrete facades and slabs, which were produced elsewhere. Facades were the exterior walls of the superstructure, and slabs were the interior floors. The use of either method was determined in advance from the architect's specifications during the design phase. With either method, the general contractor typically used subcontractors to complete this phase of the construction project.

Unicon's products were used in all three primary categories of superstructures in Hong Kong (industrial, residential and office buildings). Although the cost of the precast materials was generally three to four per cent more than the traditional, pouring on-site method, other advantages favored its use. First, precast systems provided opportunities to reduce total costs in the construction project. Building assembly time could be shortened, site construction simplified and site congestion reduced.

Second, reliance on skilled tradespeople, such as carpenters and steel-fixers, was reduced. Skilled tradespeople were in short supply in Hong Kong, and these workers typically commanded salaries of HK$1,500 per day, although during peak times they could reach as high as double that. Furthermore, the reduction of on-site workers decreased the need for supervisory personnel and administration.

Third, because precast products were produced in a controlled environment, production was not affected by the traditional problems that beset the construction industry. For example, bad weather and unscheduled shortages of labour and equipment were not problems that affected precast production. Consequently, availability of products could be assured. Fourth, for related reasons, precast products offered quality advantages. The exterior finish was regarded as superior to on-site construction, and the window frames could be cast in the concrete so as to avoid water seepage.

Notwithstanding these advantages, there were several factors that continued to favor the use of the traditional construction method. If the superstructures were not initially designed with precast materials in mind, and precast materials were then considered, the general contractor was required to resubmit revised designs for approval. This resubmission could result in substantial delays. Since the expectation was that construction of the superstructure would begin immediately following the formal review of the tenders, opportunities to redesign the project to accommodate precast components usually did not exist. Consequently, precast systems had to be specified by the architect at the outset of the design process. In addition, precast systems had to conform to standard dimensions in order to be economically viable. Such requirements placed restrictions on the creativity and originality that an architect could apply to overall building design.

Finally, construction activities differed substantially when precast systems were used compared to traditional methods. There was less reliance on skilled labor and increased dependence on equipment, such as tower cranes. As a result, general contractors had to be capable of supporting this particular method of superstructure construction.

Hong Kong Housing Authority

The Hong Kong Housing Authority (HKHA) was a government agency responsible for providing affordable housing for local residents. The HKHA provided both rental "blocks" and home ownership scheme (HOS) "blocks." The approximate number of apartments in a residential block was 640; a typical block consisted of a 41-floor superstructure, which required 1,120 facades and 3,400 slabs. A typical floor plan for a residential block is provided in Exhibit 1.

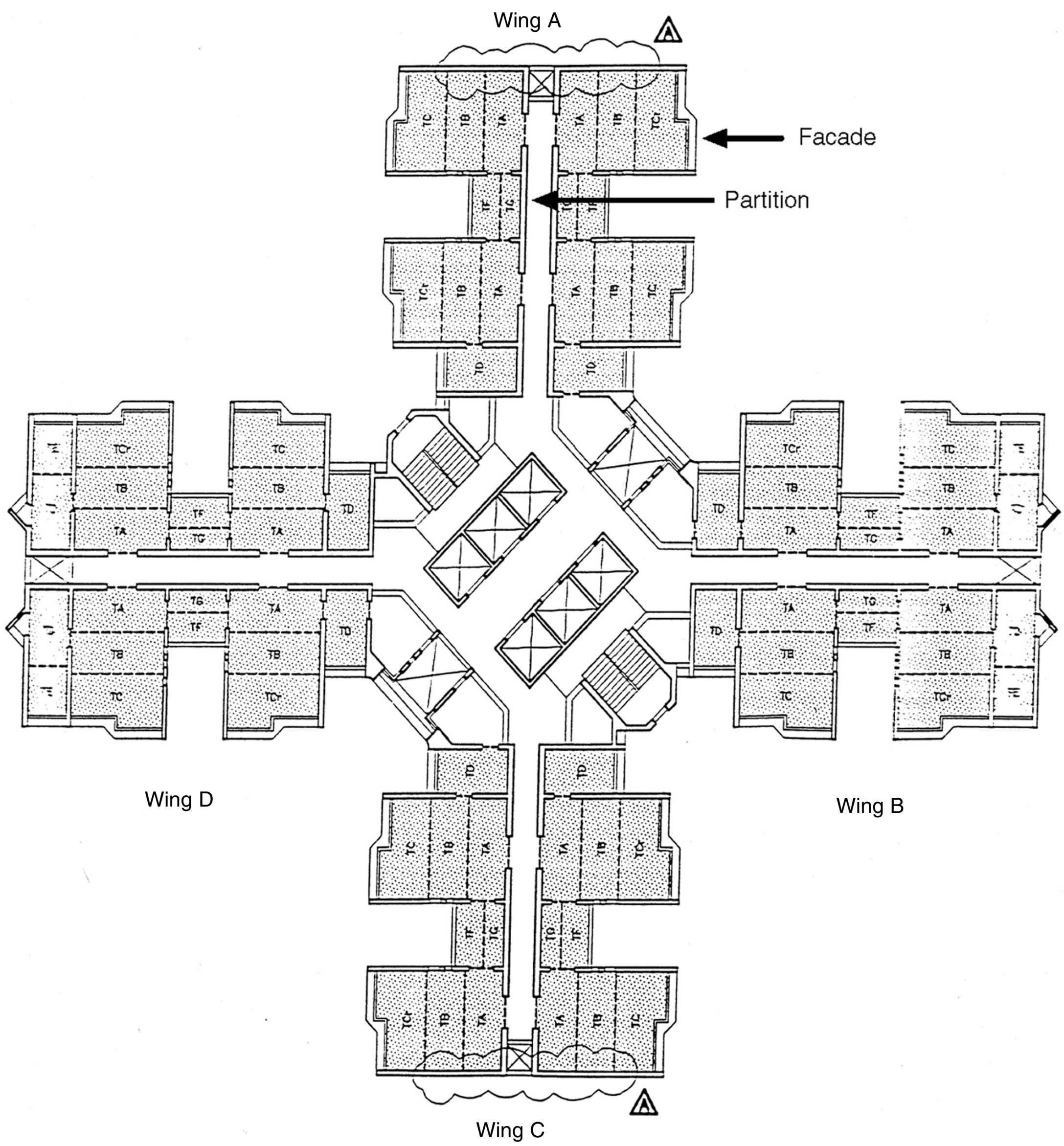
The rental blocks offered apartments at below market rates, while the home ownership schemes provided Hong Kong residents with an opportunity to acquire units at discounted prices. In order to qualify for either the rental or ownership properties, residents had to meet certain income restrictions and not own other property. From a design standpoint, each block, whether rental or HOS, had the same structural layout. However, the HOS building had a different finish that was slightly more stylish.

Current regulations restricted the manufacture of facades and slabs for HKHA projects to production facilities located in Hong Kong. However, the regulations were being revised to permit firms in the PRC to supply these. This revision was expected to take place by 1998.

For HKHA projects, the approval process was quite similar to other superstructures. Detailed design calculations and drawings had to be prepared by an RSE employed by the general contractor, who had successfully tendered for the contract. These drawings were submitted to the project architect, who was the supervising officer representing the HKHA, for approval. The architect was obliged to issue his comments within 28 days.

HKHA construction projects represented the largest segment of Unicon's sales. Mr. Li expected that approximately 80 per cent of the company's sales would be supported by HKHA projects, while the balance would be split between industrial and office projects. Under present market conditions, Unicon expected to receive HK$11.3 million per block, HK$4.8 million for facades and HK$6.5 million for slabs.

The Hong Kong government had recently announced an ambitious four-year program for the construction of new residential blocks. The most recent forecast provided to Unicon by the HKHA indicted that contracts for a total of 179 blocks would be tendered in just the next year alone. It was expected that approximately 50 per cent of these would require precast materials for construction. Under present conditions, Mr. Li felt that Unicon had the capacity to manufacture sets of facades and slabs for seven



Precast Facade and Partitioning Location for Typical Floor Plan

Exhibit 1 Residential Block Diagram

blocks per year. Total current industry capacity was estimated at only 20 blocks per year.

UNICON CONCRETE PRODUCTS (H.K.) LTD.

Unicon was part of International Tak Cheung Holdings Limited (ITC), a multi-billion dollar holding company with interests mainly in Hong Kong. The 1997 ITC financial report listed 44 subsidiary and associated companies, with activities in a wide range of areas, including property development, construction, petroleum trading and sales, and electronic products.

A primary business activity of ITC was real estate development and construction. In addition to Unicon, ITC also owned Paul Y.—ITC Construction Holdings Limited (Paul Y.). Paul Y. was a major general contractor in Hong Kong with annual sales of HK$7.5 billion in fiscal 1997. Approximately one-third of Unicon's sales were to this affiliated company.

Unicon manufactured precast concrete products, consisting of four principal product lines: facades, slabs, stairs and partitioning walls (Exhibit 2). Each of these products was used in the construction of large, high-rise residential, office and industrial complexes. Company sales for fiscal year 1997 were HK$88 million, and next year's revenue was expected to continue to grow substantially for fiscal 1997-98. Similar growth was forecast for the following year (1998-99), after which sales were expected to stabilize.

Company Products

Partitioning walls, the interior wall used in the construction of superstructures, was the only product manufactured by Unicon when it was founded in 1992. Mr. Li described the company's evolution into other precast concrete products:

> Our factory was originally built for producing partitioning walls. Unfortunately, we were unable to support our operations with only that one product. Eventually, we ventured into precast facades. This led to the development of our process for precast slabs as well.
>
> In general, we are shifting our production process from a reliance on skilled trades-people, which are in short supply in Hong Kong these days, to a more standardized product, which is machine-dependent. This strategy has been enormously successful for us. Of course, with the current high level of demand, three other firms have entered the market, and we expect to see two more before the end of this year.

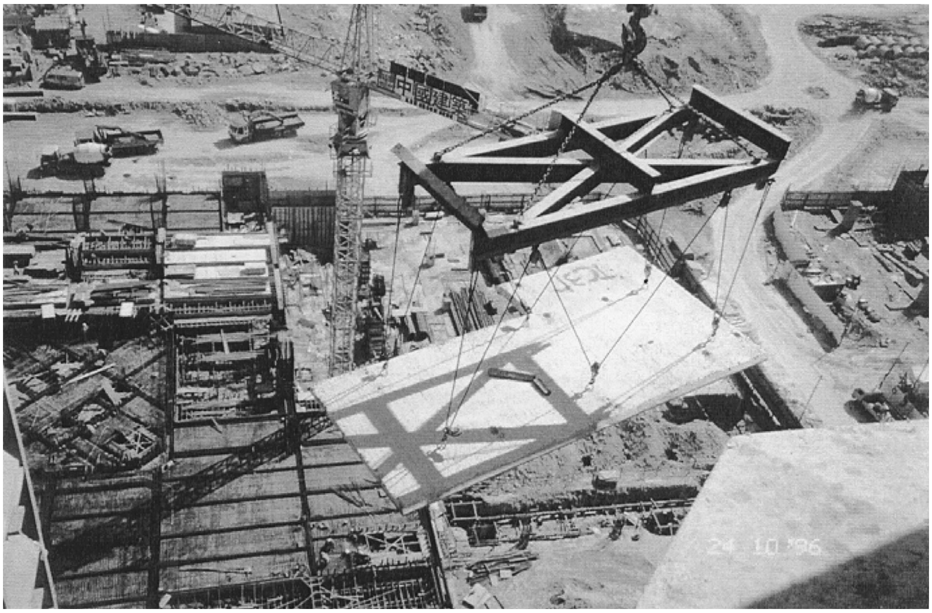
Although partitioning walls were a proprietary design, they came in a variety of standard sizes, with the typical product measuring approximately eight feet (2.44 metres) high, two feet (0.6 m) wide and three inches (0.075 m) thick. This product was engineered to meet certain performance requirements, such as fire resistance, structural support and sound dampening. It was up to the company to provide engineering certificates demonstrating the quality of its partitioning walls. In fiscal 1997, this product represented 40 per cent of company sales. Growth in this market segment was expected to correlate with the overall level of activity in the residential construction industry.

The other two major product lines were facades and slabs. Sales of these two products were interrelated. Since designs were not standardized among the four Hong Kong manufacturers, customer orders tended to require corresponding commitments for both products. Consequently, production of slabs and facades were make-to-order only. In contrast, sales of partitioning walls, because of their modular design, were independent of facades and slabs. Thus, production of partitioning walls could be make-to-stock.

Sales of facades represented 20 per cent of total sales in 1997, while slabs were 34 per cent for the same period. Management predicted that sales of these product lines would grow much faster than partitioning walls as general contractors and architects became more familiar with the advantages of their use. Mr. Li considered profit margins on both facades and slabs to be very good—significantly higher than the margin on partitioning walls.

Stairs were the smallest of Unicon's product lines, accounting for only six per cent of sales in fiscal 1997. Profit margins on the stairs business

Precast concrete facades ready to be assembled and installed onto the floor slab



Precast concrete slab being hoisted into position

Exhibit 2 Unicon Products

was comparable to that of the facades, which was somewhat less than that of slabs. Roger Cheung, sales director at Unicon, described the situation as follows:

> Stairs are a fairly standardized product, with no engineering approvals required. Design is standardized. Customers that buy our facades and slabs do not necessarily have to use our stairs. Usually, we can't justify contracts for producing stairs based on industry pricing. However, if I can pick up the business at a good margin, we will take it.

Facade and Slab Manufacturing

Unicon operated a 7,500 square metre facility in Yuen Long, in the New Territories. All shipments into and out of the plant were made by highway transport. The plant layout is depicted in Exhibit 3. Partitioning walls were producted at one end of the plant, labeled "drywall production area," while slabs, facades and stairs were producted at the other end.

Currently, Unicon employed 64 people, including 46 in the production department and 18 staff. The production department included supervision, quality control, maintenance and 14 production workers. These production workers were dedicated exclusively to the manufacture of partitioning walls.

In contrast, subcontractors were used for facade, slab and stair production. One subcontractor provided two teams of four workers for facade production, another provided three teams of four for slab production, and a single team of three workers was provided by a third contractor for stair production. Finally, another 14 production workers in the bending area prepared the reinforcing bar. These workers also were provided by a subcontractor.

The company operated a single shift that ran between 8:00 a.m. and 6:00 p.m., with a one-hour lunch break from noon till 1:00 p.m. The average production worker at Unicon was paid HK$15,000 per month, including benefits, but not including overtime. The plant operated a regular production schedule from Monday to Saturday, plus overtime every other Sunday. Over the course of the year, employees were entitled to 14 statutory paid holidays, in addition to regular paid vacation days. Mr. Li estimated that labor costs were 30 per cent of total revenue, while material costs were approximately 40 per cent. The balance was for plant overhead and profit.

The plant had 25 facade moulds and 64 slab moulds, and some slab moulds were capable of producing two slabs. Consequently, the production of slabs could range from as low as 64 per day to as high as 101 units per day, depending on the design of the building under construction. The production process for both facades and slabs was identical, involving four groups of activities (a detailed process flow diagram for facades is provided in Exhibit 4).

Mould Setup

Mould setup, the first group of activities, began each morning at about 8:30 a.m. First, the steel moulds were cleaned with a high-pressure air gun to remove loose debris. Oil was then applied to the metal moulds in order to avoid bonding between the mould and the concrete. Cast-in items were then added to the mould. In the case of facades, this included windows, sockets and electrical boxes. In the case of slabs, areas were "boxed-out" for electrical conduits. Steel reinforcing bar was then placed into the mould. This material was included to provide structural support to the finished product, and was prepared earlier in another dedicated area. Finally, a quality control audit was performed before the mould was "closed" and ready for pouring. Mould setup activities were typically completed by 11 a.m.

Pouring

Concrete was added to the mould during the pouring stage. Concrete, which was comprised of a mixture of cement, aggregate (e.g., stone or gravel) and water, was mixed off-line by three Unicon employees in the batching plant and delivered to the moulds via an overhead crane. Pouring commenced at 10:30 a.m. and concluded at approximately 2 p.m. This operation was suspended during the lunch break.

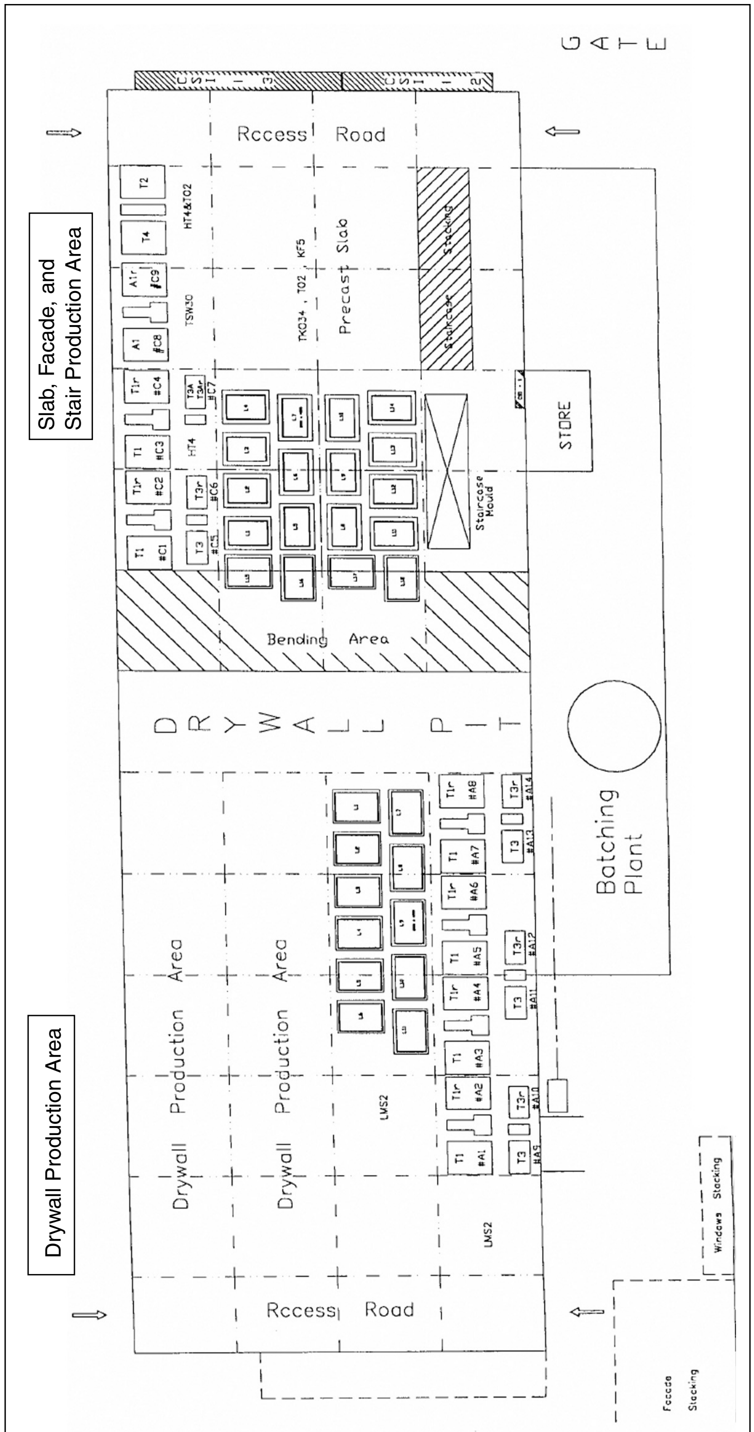


Exhibit 3 Unicon Plant Layout

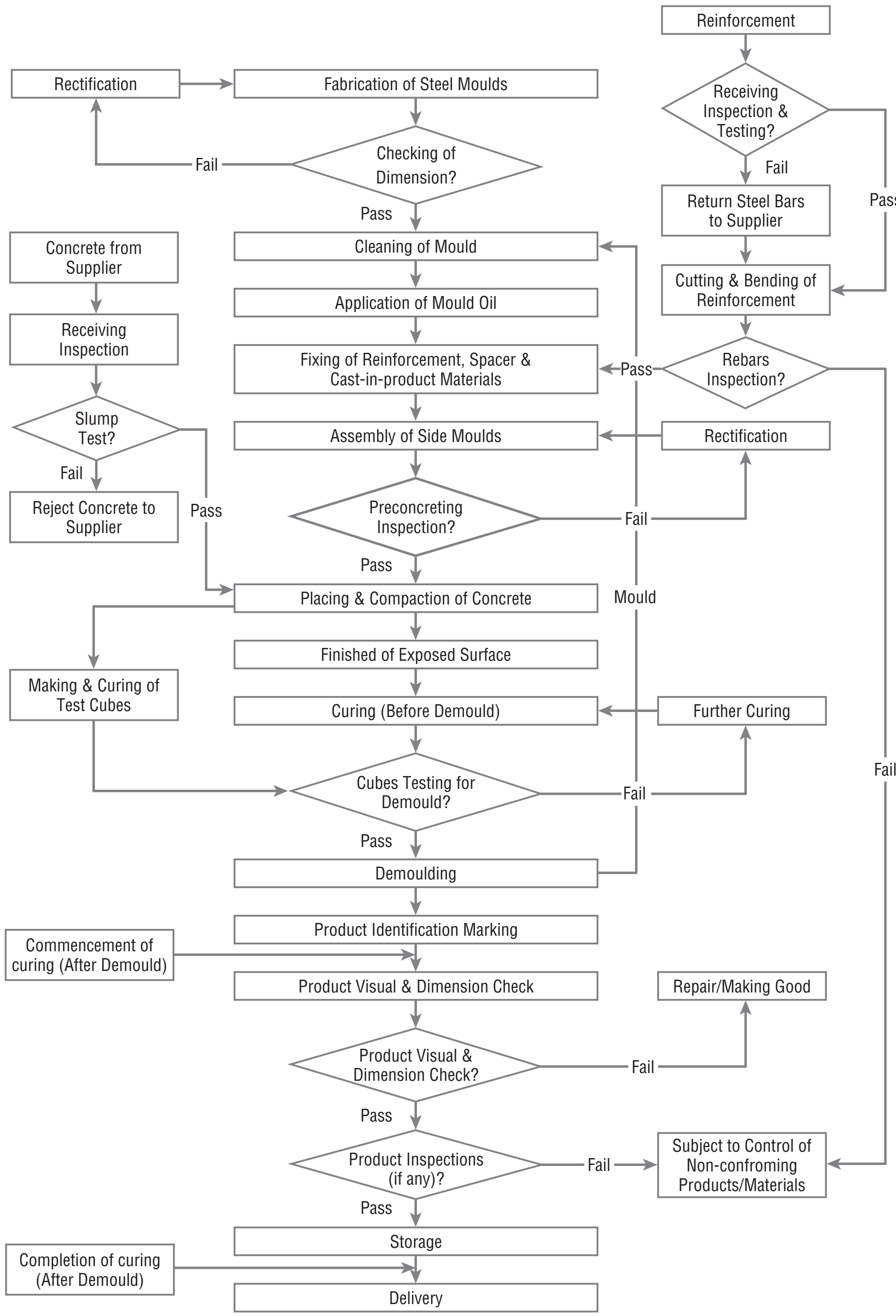


Exhibit 4 Process Flow Diagram

Finishing

Finishing commenced at about 11:00 a.m. Each product was specified as requiring either a smooth or rough finish. Finishing was completed in two phases. The first phase started immediately after the pouring operation, while the second occurred approximately 90 minutes later, because the concrete finish deteriorated as it settled. Finishing concluded at approximately 4:30 p.m. in the summer months. However, in the winter months, steam curing was required, which extended this process till about 6:30 p.m. Finally, the mould was then covered with a canvas overnight. Each mould was required to cure for 14 hours following the second finishing phase, before stripping the next morning. If accelerated steam curing was applied, the curing period could be reduced to eight hours.

Mould Stripping

The last group of activities was performed the next morning after curing was completed. Starting at 8 a.m., the steel mould was vibrated to separate the mould from the finished precast slab or facade. The mould and the precast product was then rotated 90 degrees, after which the mould was returned to it normal position on the plant floor. An overhead crane was used to remove the precast product to the finished storage area where "remedial" work was performed to repair any visual defects. Stripping was usually complete by 10:30 a.m.

Teams often worked on different activities concurrently. For example, as part of the team finished the stripping operation, other members of the team would start the mould setup operation.

Quality was an important element of Unicon's operations. The company was first ISO 9002 certified in 1994. As part of the company's quality plan, samples were taken from products throughout the manufacturing cycle to test for conformance to material specifications.

Capacity Expansion

The current demand for Unicon's product lines, facades and slabs in particular, had forced Mr. Li to evaluate possible options to expand capacity. Mr. Li was considering the expansion of the plant by 5,000 square metres in an effort to double capacity. However, he did not expect that the expansion could be completed before August 1998.

The market was in the middle of a boom and Mr. Li did not want to miss this opportunity. He was considering two alternatives to expand capacity in the short-term. First, he could add a second shift. Mr. Li wondered how this would affect quality and customer responsiveness. Furthermore, he was concerned about how his organization would cope with such a change and what the additional costs of such a plan would be.

The second alternative was to re-allocate plant space. Plant space currently dedicated to the production of stairs and partitioning walls could be converted to slabs and facades. The difficulty of this strategy was that Unicon would be abandoning two products, and Mr. Li was concerned that such a move was short-sighted. However, with the plant expansion, the opportunity existed to re-enter the partitioning wall and stairs markets in the future.

Strategy to Pursue a Blanket Approval

Mr. Li was considering a strategy whereby approved technical submissions for HKHA projects could be resubmitted for future projects and would not require review and approval by an RSE or government authority. Mr. Li explained his logic:

> Despite the fact that the design has been used for 10 previous projects, you still have to submit it for approval. This costs both time and money.
>
> We want to get approval for future contracts if the design has been previously approved by the HKHA. Of course, we would still have to submit our plans for record purposes, and the general contractor would still expect to see our quality plan and method statement.

If his plan was accepted, the use of facades and slabs in superstructure construction would be similar to that for partitioning walls and stairs. Unicon would still be required to submit technical drawings for record purposes, but avoid the long, expensive review process. Mr. Li anticipated that on a typical contract, cost savings for one housing block would be about HK$150,000.

Mr. Li could see additional opportunities for savings if his plan was implemented. For example, lead times could be reduced by approximately one month. This represented the delays Unicon experienced as part of the approval process. Furthermore, the company could extend its product standardization. Minor changes to moulds based on individual comments from engineers would no longer be a concern. From Mr. Li's perspective, the decision regarding his efforts to establish a blanket approval process was obvious:

> This will reduce our costs as the engagement of a RSE incurs expenses in the form of professional fees. Another big advantage is that I won't have to wait for an order to support production. There are no significant disadvantages that I can see.

The Future

Mr. Li was concerned with the matter of establishing the blanket approval process with the HKHA. He wondered if this was an appropriate move for the company; there were still several lingering issues in his mind. What implications would it have for his manufacturing operations? How would such a move impact Unicon's competitive position in the marketplace? In the short-term, his order book was full. However, Mr. Li knew that the marketplace would adjust, and he wondered about the long-term implications.

He felt that two issues had to be resolved. First, should he continue with his plans to establish a blanket approval? When he contacted others in the precast industry, no one seemed interested in working to develop industry-wide standards. Second, if so, how could he convince the HKHA to accept his recommendation? The chief architect of the Design and Standard Section at the HKHA had the authority to approve such a proposal. However, he would need to demonstrate the mutual advantages of his plan.

Mr. Li expected that it would take approximately four months to negotiate a blanket approval arrangement with the HKHA. He knew that the process would have to be initiated quickly, if this arrangement was to be in place in time to take full advantage of the booming market expected next year.

Note

1. In November 1997, HK$1 was equivalent to US$0.1290 and C$0.1818.