THE CASE STUDY HANDBOOK, REVISED EDITION

A STUDENT'S GUIDE

BY WILLIAM ELLET

Contents

EXHIBIT 2-A

Difference between textbooks and cases

Textbooks	Cases
Present principles and conclusions	Present information only, no principles or conclusions
Explain the meaning and significance of concepts	Require readers to construct the meaning of a case
Organize content in a logical sequence	Employ “organized disorganization”

EXHIBIT 4-A

What should Schramm decide?

Options

1. RIM
2. Parallel development
3. IHG

EXHIBIT 4-B

What should Schramm decide?

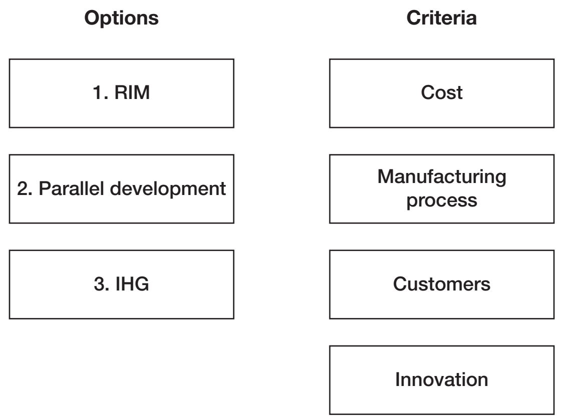

EXHIBIT 4-C

Estimating redesign cost savings, IHG versus the RIM

Part	Engineering cost	Retooling cost	Total cost	Frequency of redesign	Cost/year
IHG (old part)	$30,000	$13,000	$43,000	Every 2 years	$21,500
RIM (new part)	$5,000	$7,000	$12,000	Every 4 years*	$3,000
RIM savings/year					$18,500

* Estimated

EXHIBIT 4-D

Estimating engineering change orders (ECOs) cost savings, IHG versus the RIM

Part	Number of engineers	Percentage of engineering time/year	Engineering cost/hour	Cost/year
IHG	500	50%	$50	$24 million
RIM	500	25%*	$50	$12 million
RIM savings/year				$12 million

* Estimated

EXHIBIT 4-E

What should Schramm decide?

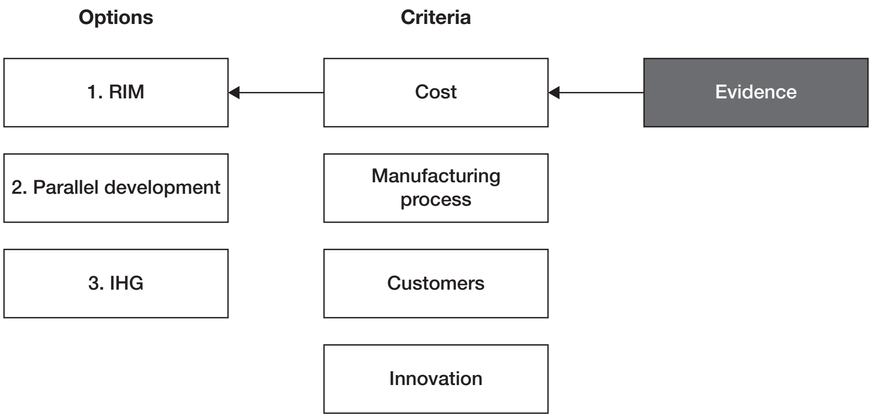

EXHIBIT 4-F

What should Schramm decide?

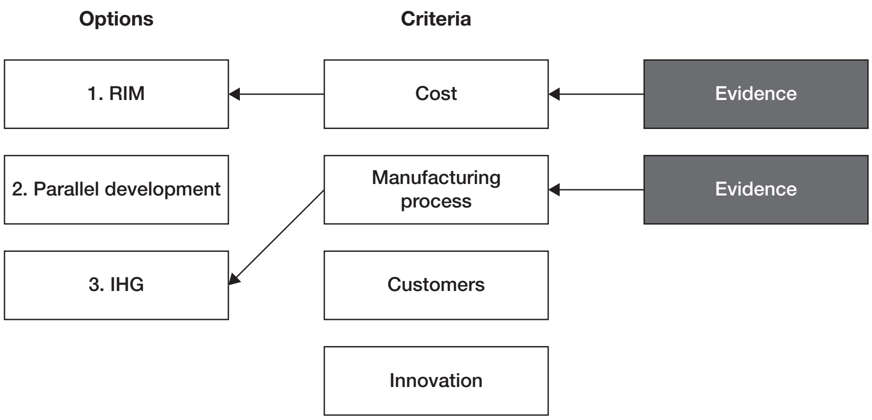

EXHIBIT 4-G

What should Schramm decide?

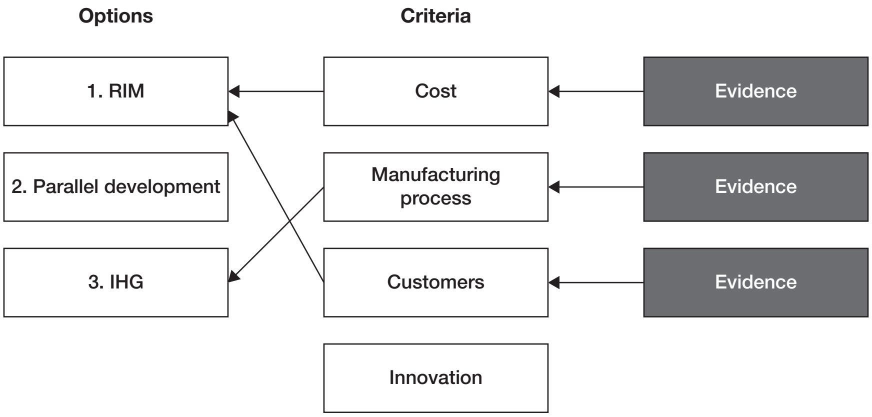

EXHIBIT 4-H

What should Schramm decide?

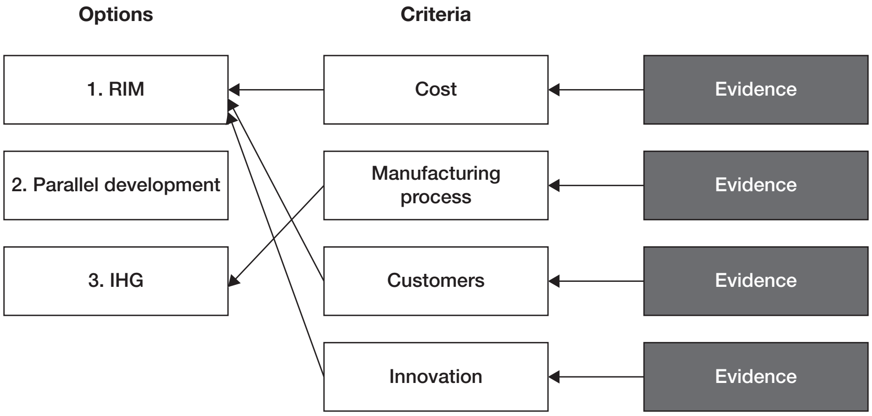

EXHIBIT 5-A

What is your evaluation of Malaysia's development strategy?

Evaluation	Criteria
Positive	Economics
Negative	Politics
Neutral	Social conditions
	Environmental issues

EXHIBIT 5-B

What is your evaluation of Malaysia's development strategy?

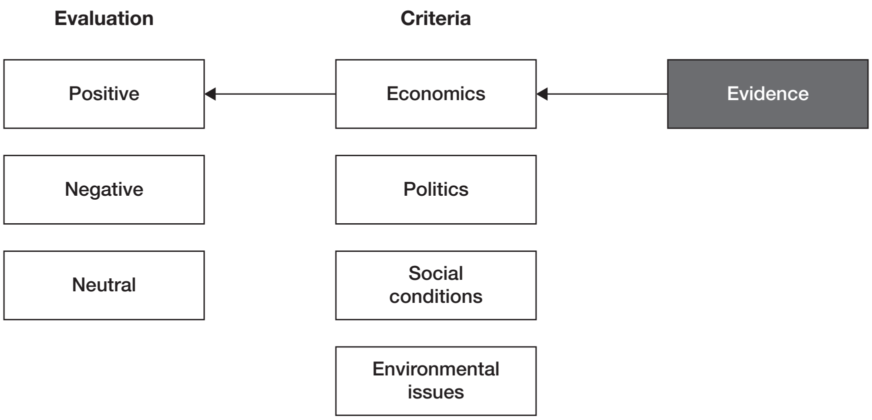

EXHIBIT 5-C

What is your evaluation of Malaysia's development strategy?

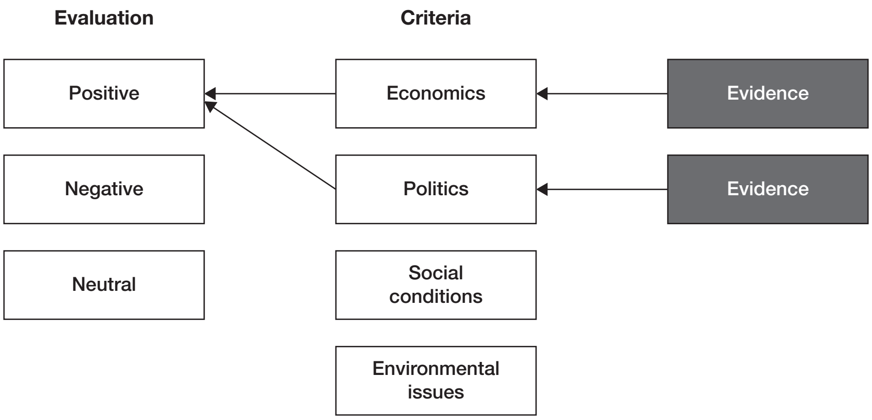

EXHIBIT 5-D

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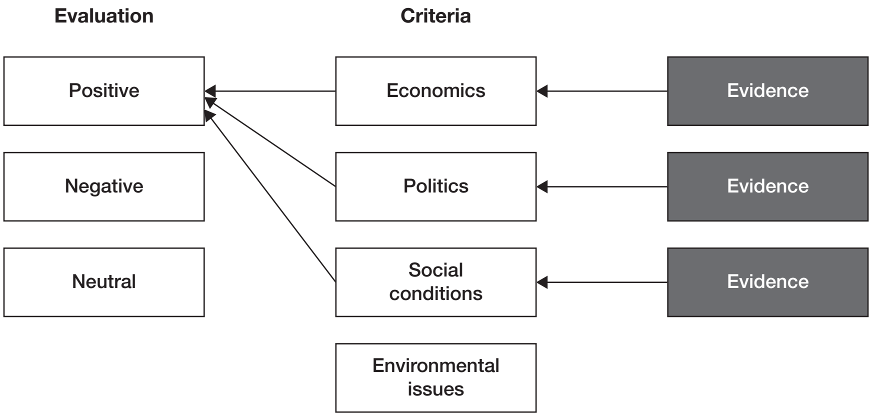

EXHIBIT 5-E

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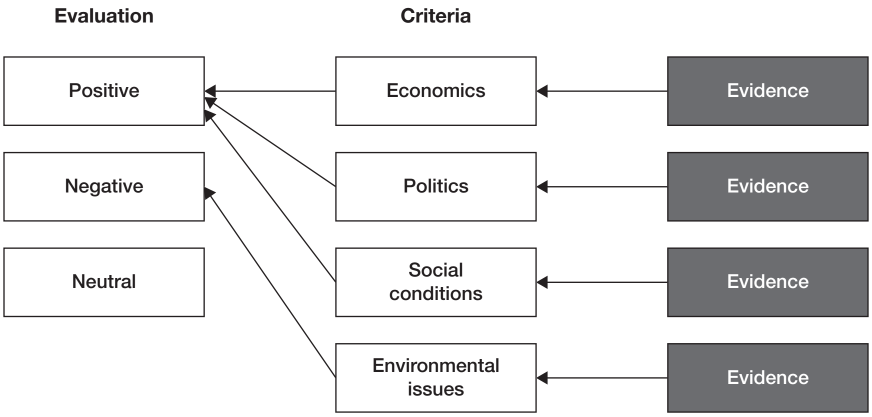

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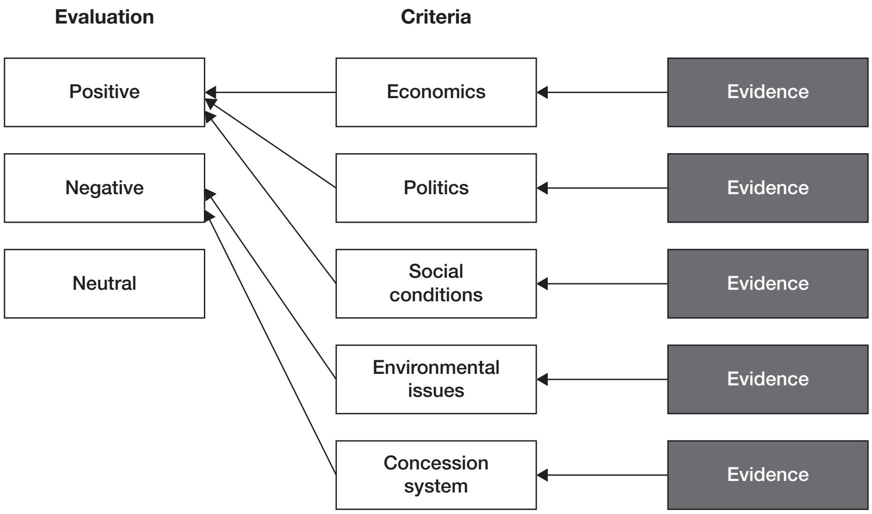


EXHIBIT 6-A

What are the causes of EPD's performance problem?

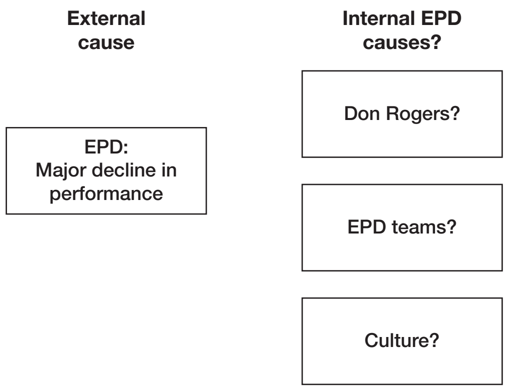
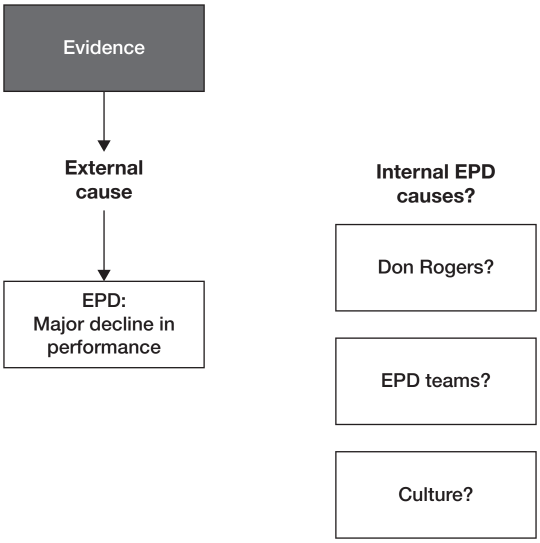


EXHIBIT 6-B

What are the causes of EPD's performance problem?



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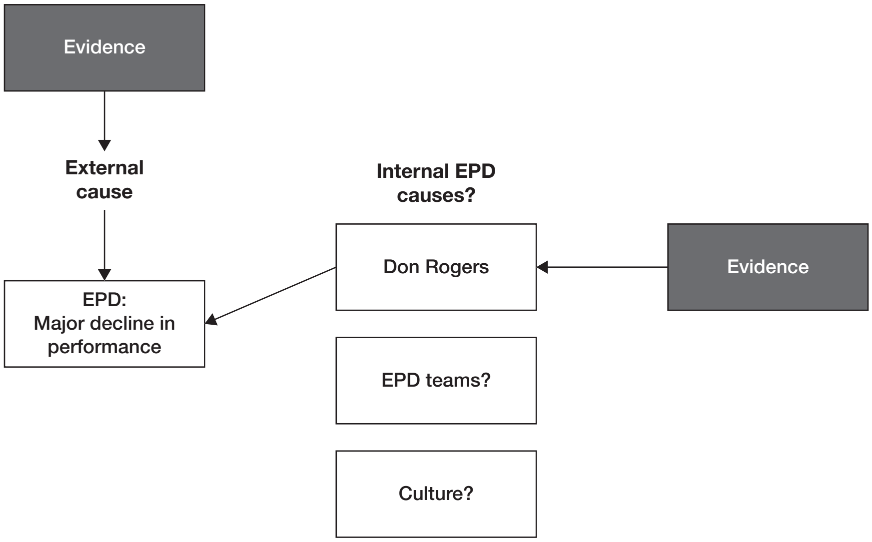

EXHIBIT 6-D

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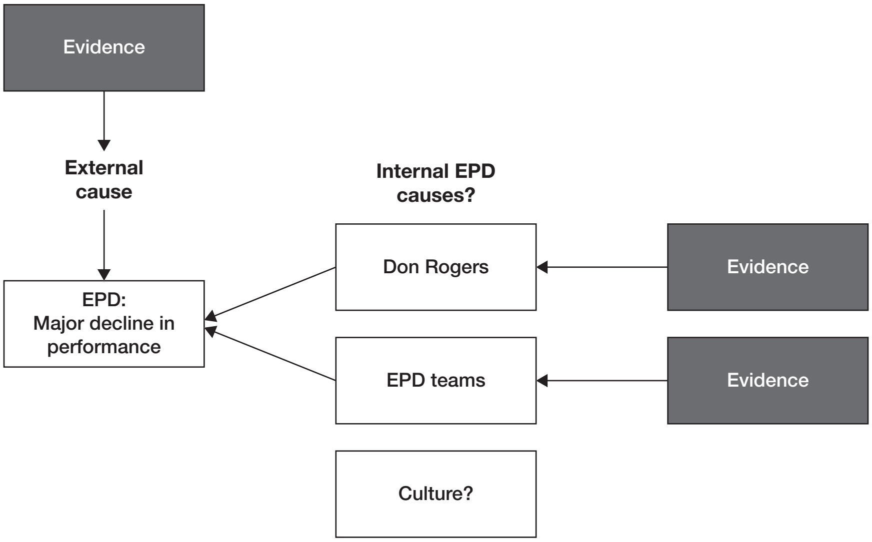

EXHIBIT 6-E

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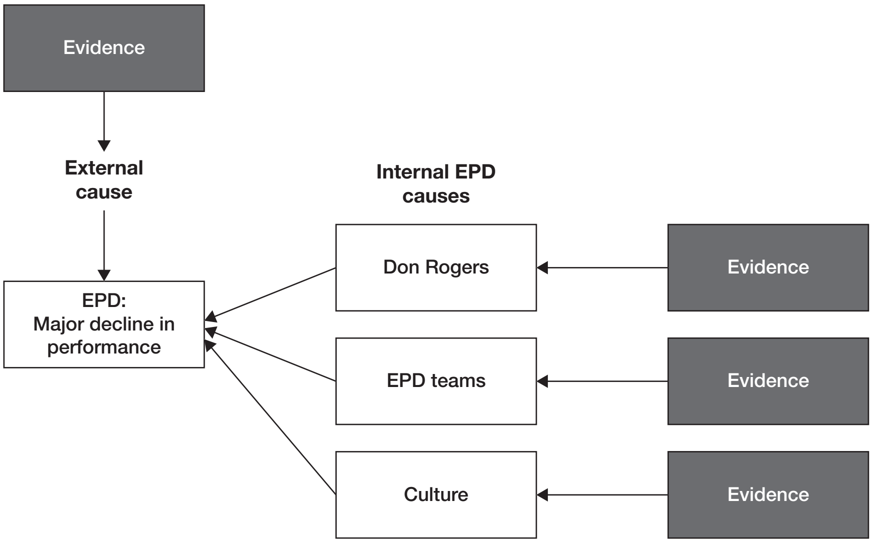

EXHIBIT 6-F

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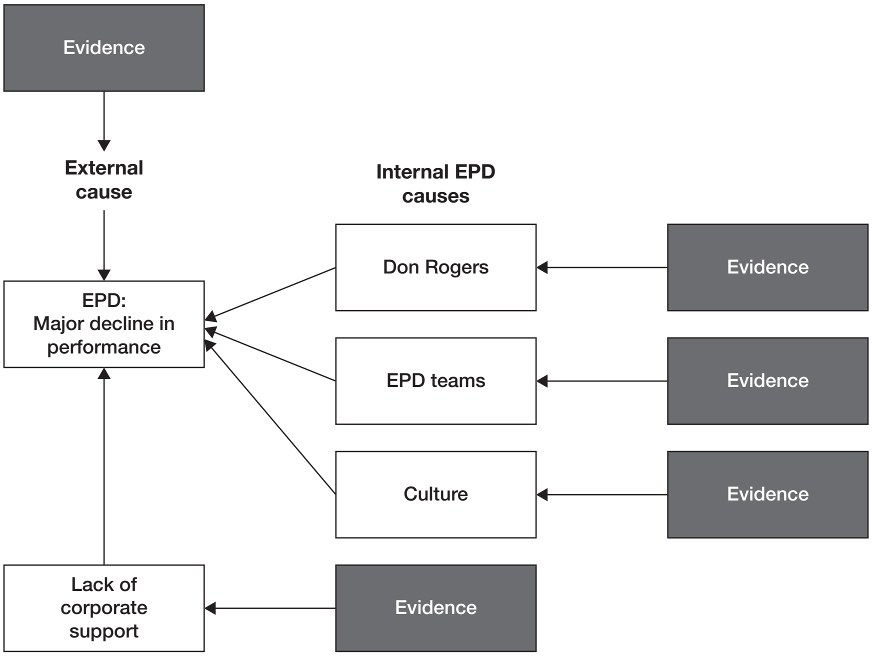


EXHIBIT 8-A

Structure of an argument

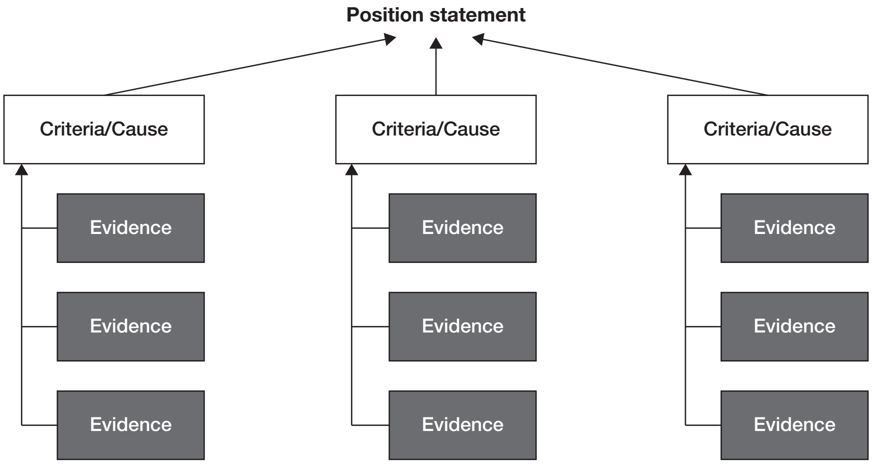


EXHIBIT 8-B

Outline of an argument

Question	Should the United States continue to support free trade or revert to protectionism?
Position statement	The United States should continue to support free trade.
Criteria	Trade increases the standard of living for lower-income Americans and eliminates few US jobs.
Proof	
Criterion 1	Free trade increases the standard of living for lower-income Americans.
Evidence	Studies show that free trade increases the purchasing power of people who are in the lower 10% of income by 62%. They also show that free trade increases the purchasing power of middle-income people by about 30%. Free trade primarily increases purchasing power because it lowers the cost of consumer goods that make up a large percentage of the purchases of poorer people. An example is clothing.
Criterion 2	Free trade eliminates few US jobs.
Evidence	About 80% of US employment is in the service industry, which is unaffected by international trade. In manufacturing, imports account for a relatively small percentage of job losses. By far, the largest cause of job losses in manufacturing is the substitution of technology for labor.

GENERAL MOTORS: PACKARD ELECTRIC DIVISION

David Schramm, the chief engineer for Cable and Component Design (CCD), glanced at the RIM grommet in his hand and considered the risks and benefits (see the **Appendix** for a glossary of terms). Packard Electric had developed the RIM (Reaction Injection Molded) grommet as a new technology for passing the wires from the engine compartment through the fire wall to the passenger compartment of passenger automobiles.

The Product, Process, and Reliability (PPR) committee, which had the final responsibility for the new product development process, had asked Schramm for his analysis and recommendation as to whether Packard Electric should commit to the RIM grommet for a 1992 model year car. It was already March 1, 1990 and, because of the lead time on the equipment and tooling, the decision had to be made within the week (see **Exhibit 1** for the project schedule). While many of the product development people were very excited by the RIM grommet's possibilities, many of the manufacturing people were dead set against it.

PACKARD ELECTRIC BACKGROUND

The Packard brothers founded the Packard Company in the late 19th century to produce carbon filament lamps and transformers. In 1899, the company moved into the fledgling automobile industry and began to produce automobiles. Eventually the automobile business was sold, but Packard continued to be a supplier of ignition systems. General Motors bought the Packard Company in 1932, and it became the Packard Electric Division of GM.

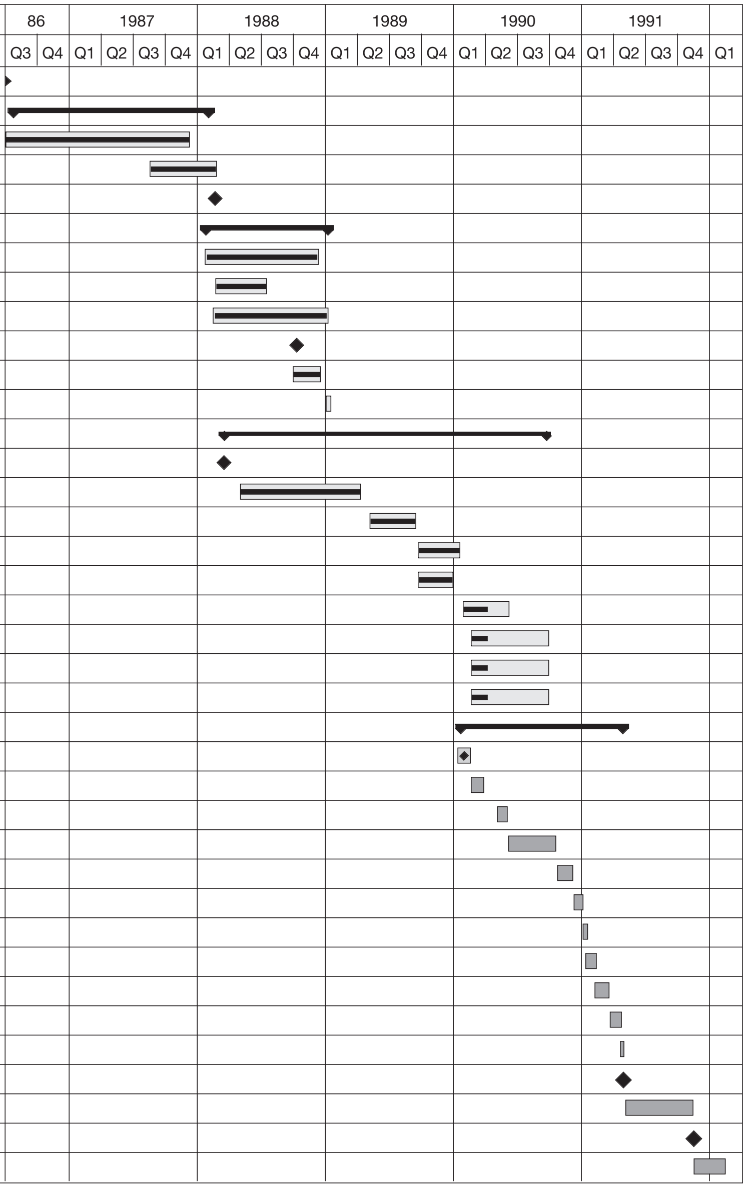
The management of the Packard Electric division had remained fairly autonomous through the years. In the first 90 years of its existence, Packard had only seven general managers. Although the majority of its sales were to GM divisions, it did receive significant business from other automobile companies.

During the 1980s, GM experienced significant competition—particularly from Japanese imports. GM's share of the U.S. market had dropped from 45% in 1980 to about 34% in 1989. Despite its parent company's problems, Packard Electric's revenues and profitability grew steadily in the 1980s at a rate of 8-9% per year. This growth was attributed to two factors: increasing sales to other automobile manufacturers, and the growing electronic content of automobiles. By 1989, Packard had over $2 billion in sales, of which 25% was to non-GM customers.

EXHIBIT 1

RIM project schedule (3/1/90)[1]

ID	Name	Duration
1	RIM feasibility identified	0d
2	Begin experimentation	414d
3	Investigate materials	370d
4	Assemble samples	104d
5	Show mock-up to customer	0d
6	Component development	250d
7	Continue material development	190d
8	Perform cycle testing	60d
9	Find tooling vendor	220d
10	Choose materials	0d
11	Order and receive materials	30d
12	Status meeting with customer	1d
13	Manufacturing development	640d
14	Mfg engineering debins effort	0d
15	Find molding machine	250d
16	Order and receive equipment	110d
17	Obtain EPA permits	70d
18	Perform tests offsite	60d
19	Install + test equipment	90d
20	Develop materials handling protocol	150d
21	Gain expertise w/RIM equipment	150d
22	Establish harness repair procedures	150d
23	System development	325d
24	Build grommets into harnesses	20d
25	Conduct 5 and 5 test	20d
26	Prototypes: build + send to customer	15d
27	Redesign + test	100d
28	Prototypes: build + send to customer	30d
29	Redesign + test	30d
30	Prepare assembly line	3d
31	Transfer equipment to plant	10d
32	Pilot run: build + send to customer	25d
33	Redesign + test	42d
34	Establish quality tests	6d
35	Begin product launch	0d
36	Build+send production parts to customer	139d
37	Achieve full-scale commercial production	0d
38	Improve quality/yield	81d



Project RIM Grommet — Critical — Progress — Summary

Date: 3/1/90 — Noncritical — Milestone — Rolled Up

[1]Early in 1988 the RIM grommet became an official project targeted at a specific customer.

Packard Electric's Products

Packard Electric executives referred to Packard Electric's business as "power and signal distribution." Packard Electric sold all the electrical cabling and connectors required to interconnect the electrical devices in a vehicle (see **Exhibit 2**). The business was divided into two areas—components and assemblies. The components side involved the individual pieces that made up an automobile's electrical system. Components included cables, connectors, and conduits (sheaths for holding several cables together neatly). Packard Electric sold to the auto companies and GM divisions (such as Delco Electronics and Harrison Radiators) that integrated Packard Electric components into subsystems for automotive assembly plants, as well as to dealers in spare parts.

The assembly products were complete harnesses or subsystems that could be installed directly into an automobile. Typically, Packard Electric would sell the complete wiring system (called a harness) for an automobile which would then be installed by the automobile manufacturer on its final assembly line. Harnesses varied widely in complexity depending on the requirements of the automobile; a complex harness might have many hundred components and nearly a mile of wiring.

The design of harnesses was complicated by the fact that the engineers had to make sure that the harness could be installed in the assembly line as a single unit. Harnesses typically contained bundles of up to 150 wires. These bundles were very stiff and so the engineers had to determine a routing path that not only fit the car's design but also could be packaged neatly for shipment and installation.

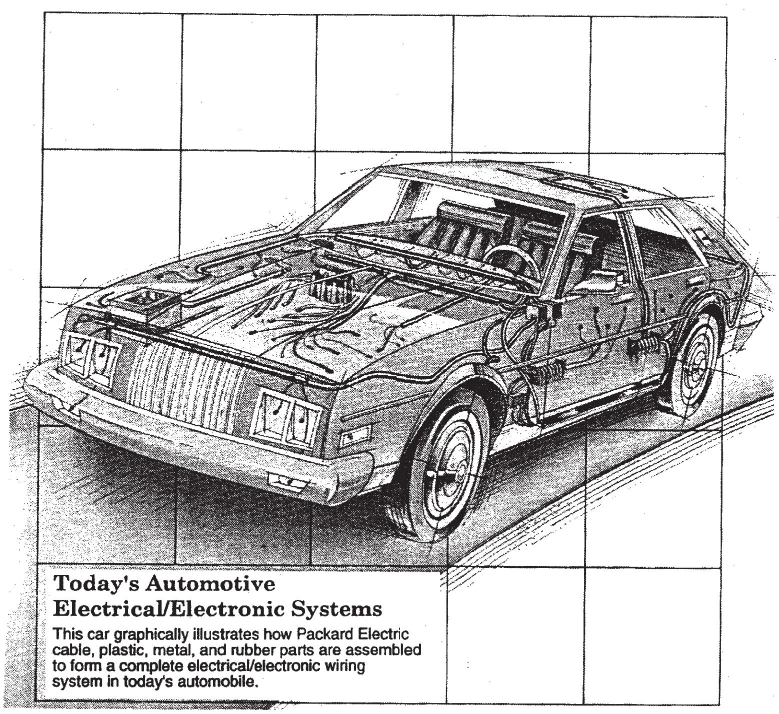
The harness installation process was complicated because the cabling spanned the entire length and breadth of the car and connections had to be made at every step of the automobile's assembly process. This installation process consumed from 60 to 90 minutes of the 20 to 30 hours required to complete the final assembly of a typical automobile. As one Packard Electric engineer noted:

> *The wiring people get to know everyone in an automotive company, from design through manufacturing. They get involved at every step of the process and must work out thousands of little details. The easiest thing you can change in a car is the wiring, so if there are any production problems, the wiring is the first thing to be changed. What's more, customers don't notice wiring unless there is a problem, and then it's a disaster. Most companies hate wiring because of all the details and the fact that you never get any positive feedback, but at Packard Electric this is what we do and we love it.*

Because of the relative ease with which an automotive designer could change a harness, engineering change orders (ECOs) were a major effort at Packard Electric. A harness for even a mature car had an average of two major ECOs, as well as dozens of minor ones, each year. These ECOs ate up a tremendous amount of engineering time; Packard Electric estimated that approximately 50% of the time of its 500 engineers was spent on ECOs. The part proliferation

EXHIBIT 2

Automobile power and signal distribution system



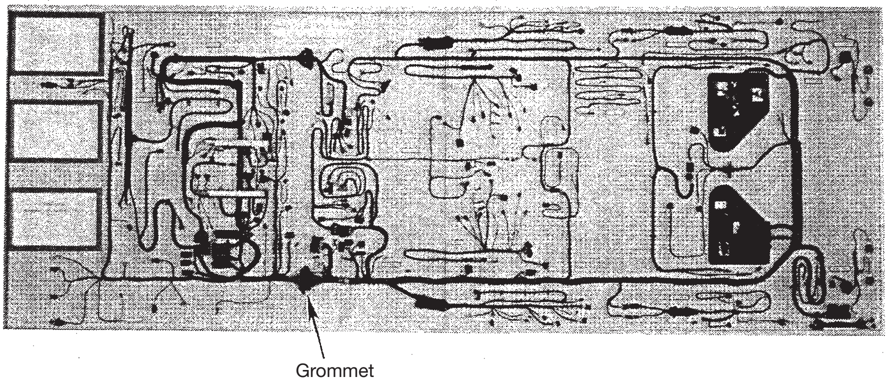


EXHIBIT 3

Statistics on part (SKU) proliferation and resources devoted to ECOs

Statistics on Stock Keeping Units (SKUs)[1]	Application Engineering	Components Engineering
Number of Active SKUs	2,800	45,000
Number of SKUs Added Annually	1,200	2,400
Number of SKUs Deleted Annually	1,100	300
Life span of a Typical SKU	2 years	10 years
Statistics on Engineering Effort		
Percent of Resources Developing New SKUs	40%	65%
Percent of Resources on Engineering Change Orders	60%	35%

[1]For Application Engineering, a SKU was an assembled harness ready for installation. For Components Engineering, a SKU was an individual component.

caused by these constant changes was dramatic (see **Exhibit 3**). Because Packard Electric had to be able to fabricate spare parts for any component it had produced, drawings and tooling on over 45,000 parts needed to be maintained. While Schramm had never been able to get any good data on the cost of maintaining these parts, he felt sure that it was significant.

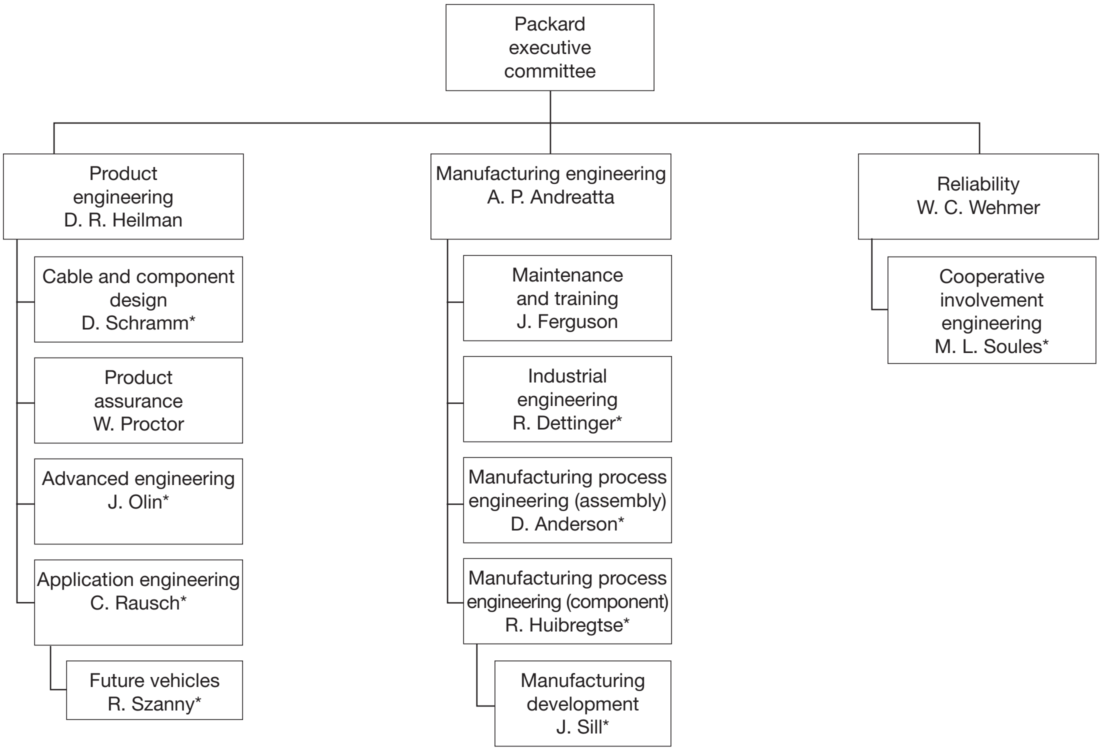
Reducing the cost of the ECOs and part number maintenance were major goals at Packard Electric. In recent years, Packard Electric had become better at forcing change to occur earlier in the initial design process and reducing the subsequent changes per part. The total number of ECOs had remained fairly constant, however, because the complexity of the harnesses (as measured by total length of cable and the number of connectors) was increasing by 6–8% per year in concert with the increasing electrical content of automobiles.

New Product Development Organization

Three functional groups were involved in new product development: *Product Engineering*, *Manufacturing Engineering*, and *Reliability* (see **Exhibit 4**). Product engineering did the product design and engineering; manufacturing engineering was responsible for developing the processes for manufacturing the components, cables, and harnesses. Reliability's mission was to oversee Packard Electric's commitment to quality and excellence in all phases of its business. *Cooperative Involvement Engineering* (CIE) reported to the director of reliability and was designed to provide a direct avenue for customer feedback into manufacturing operations, engineering,

EXHIBIT 4

Partial Packard Electric product development organization



*Signifies member of the Product, Process, and Reliability (PPR) committee.

and Packard Electric upper management. Its role was that of a customer advocate and it examined any Packard Electric decision involving a customer.

Manufacturing Engineering was divided into several subgroups. Of these, the Manufacturing Process Engineering and Industrial Engineering departments were particularly important during the product development process. Manufacturing Process Engineering made a first pass at developing a manufacturing process to achieve a repeatable process, and then followed up with refinements and documentation. Industrial Engineering had responsibility for training the operators, fitting the process into the plant as a whole, and coordinating the ramp-up of the process.

Four departments comprised the product engineering function. *Cable and Component Design* (CCD), as its name suggested, was responsible for the design of components (e.g., connectors and pass-through grommets) and cables. The design of cabling included determining the wire gauge required for the application, the number of wire strands to be wound together to make up the cable, and the type of insulation to be used. *Application Engineering* did the design of the harnesses as a whole—determining the number and length of cables, and the type of connectors and other components. Often Application Engineering would need a component that did not exist, which would have to be designed by CCD. The long term product development effort was done by the *Advanced Engineering* group. Finally, *Product Assurance* was responsible for making sure that all product designs met Packard Electric's quality standards.

Both CCD and Application Engineering had a "resident engineer program." Resident engineers were Packard Electric engineers who were assigned to one customer and who resided at the customer's plant or design center. Resident engineers from CCD interfaced primarily with the design group at the car company's internal or external electrical systems suppliers, while resident application engineers worked with the design group at the car company. The purpose of resident engineers was to help integrate Packard Electric's designs with customer needs. By taking responsibility for more and more of the electrical system design task, Packard Electric relieved the customer of the cost of doing the design and enabled Packard Electric to become more fully integrated into the design process.

The resident engineer program had been very successful, growing to almost 100 engineers. Customers were eager to reduce their engineering overhead. Some had been skeptical at the beginning, believing that resident engineers would make decisions based on what was good for Packard Electric rather than the customer. However, from the outset, Packard Electric had stressed that resident engineers' responsibility was to do what was right for the customer. Packard Electric benefited also because resident engineers were expected to make sure that Packard Electric knew exactly what the customer needed so that Packard Electric could provide the best solution.

The resident engineer program fit a trend whereby automotive assembly plant customers were transferring more and more of the design task to Packard Electric. Carl Rausch, the head of Application Engineering, described the trend:

> *One way to think about it is to divide the types of customer design specifications you might get into three levels. Level 1 is a broad functional specification where the customer tells you what he or she wants to do, but you design the whole power and signal distribution system. Level 2 is a system specification, where the customer has done a system-wide design but left the choice of components to you. Level 3 is a detailed specification where all that is left to do is manufacture the components to spec and assemble them into the product. We used to get mainly level 3 designs from our customers, but we have pushed towards level 1 specs. Level 1 gives us more freedom and leverage—we can*

integrate our operations much better and develop standard ways to attack problems. This enables us to increase quality and reduce overall system costs.

To integrate the efforts of all these functional departments, the Product, Process, and Reliability (PPR) committee had been formed. This committee consisted of the managers of Cable and Component Design, Application Engineering, Advanced Engineering, Cooperative Involvement Engineering, Manufacturing Development, Manufacturing Process Engineering, and Industrial Engineering. Its purpose was to provide an overall strategy and process for the development effort, guide major technology decisions, and help coordinate activities between functional groups.

THE RIM GROMMET

Much of the cabling in an automobile's harness needed to pass through the "front of dash" area between the engine compartment and the passenger compartment. A grommet (or housing) was used to pass the cables through the fire wall. It had three purposes: (1) to hold the cables in place so that they did not slip and possibly disconnect or wear off their insulation; (2) to dampen engine noise and keep the passenger compartment quiet; and (3) to prevent any water or vapors in the engine compartment from entering the passenger compartment.

Packard Electric's primary grommet, the injectable hardshell grommet or IHG (see **Exhibit 5**), had been developed in the late 1970s. The IHG grommet was essentially a hard plastic shell with a comb into which the cables were placed. The comb served to separate the cables; a plastic resin glue was injected into the comb area to seal it, preventing water from seeping through the grommet. Because the glue was quite viscous, however, it did not seal perfectly around all the wires. The resultant seal, although highly splash resistant, was not completely waterproof. It failed the most strenuous leak test—the static water test—which tested the seal with a column of five inches of water on one side of the seal for five minutes. (This test was commonly called the "five and five" test.)

Water in the passenger compartment had been a frequent assembly plant customer complaint in the 1980s, and Packard Electric engineers had searched to find a solution to the problem. In July 1986, Bob McFall, a process engineer at Packard Electric, came up with the idea of using reaction injection molding (RIM) technology to form a grommet around the cables. RIM was a type of injection molding technology that had been around for several years in large-sized applications like automobile door panels and fenders. The principle behind RIM was similar to that of epoxy—when two liquid materials were mixed, they set in less than a minute to form a rubbery solid (see **Exhibit 6**). Before the mixture set, it had a very low viscosity (about the same as that of water), which allowed it to seep between the cables to form an excellent seal.

EXHIBIT 5

Contrasting the options: IHG and RIM grommet

IHG

RIM Grommet

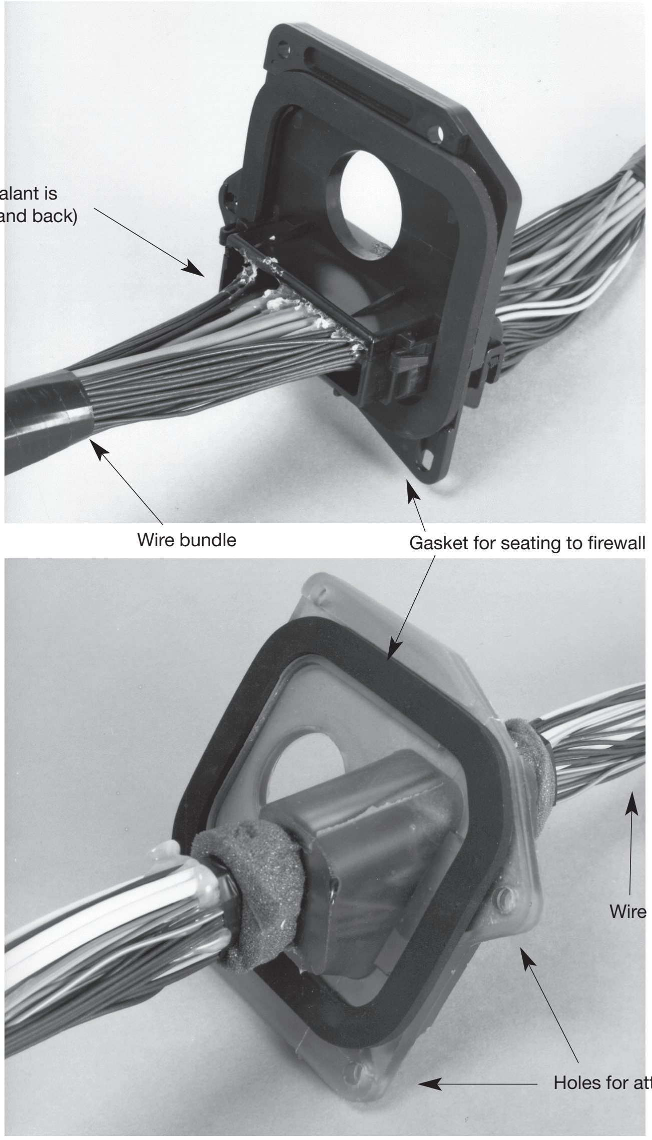
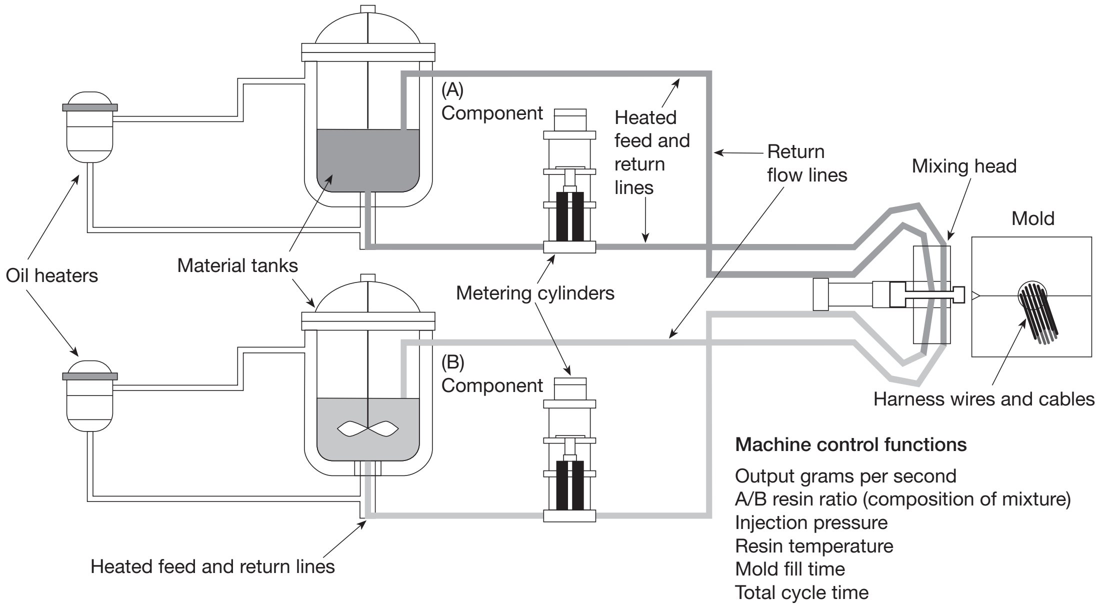


EXHIBIT 6

Schematic of RIM machine



DEVELOPMENT OF THE RIM GROMMET

From July 1986 through the end of 1987, McFall worked on a RIM grommet as a side interest (about 10% of his time), experimenting with several different materials in the Packard Electric laboratory. By early 1988, he had developed several different configurations. During this period, McFall's principal activity had been helping design components for the electrical systems for a high-end automobile customer. He worked closely with Keith Turnbull, Packard's resident engineer, who was on-site full time at that customer's development center and worked with its team planning the 1992 launch of the new vehicle. Knowing that this customer was very concerned about any water leaking into the passenger compartment, McFall brought along one of his mock-ups of a RIM grommet on one of his frequent visits to Turnbull and the customer.

At the car company, both the electrical systems design and packaging team and the assembly process engineering team were excited about the RIM grommet. Turnbull had tracked complaints from the customers' assembly plants and knew that occasional breakage of the brittle

IHG during assembly and leaks detected at the end of the line during the car's final assembly were perennial problems (see **Exhibit 7** for leak data). He had also heard talk of complaints from dealers' service mechanics through the warranty reporting system. Grommet repair after installation was a major undertaking, whether at the end of the vehicle assembly line (a minimum of two hours of labor at $45/hour) or in dealer repair shops (more than four hours of labor at a warranty cost of $35/hour).[1]

Hoping to eliminate these problems in future models, the customer (with Turnbull's urging) asked McFall if the grommet would be available for its high-end 1992 model. While McFall did not have the authority to agree to this time table, he felt that it was not unreasonable. Encouraged by the customer's reaction, McFall began to get other groups at Packard Electric involved in the effort. During the next year, CCD expanded its level of effort, and manufacturing engineering began to get involved with a low level of effort. Turnbull monitored the RIM's progress but spent most of his time on other projects until he perceived that "it definitely was a go."

During the next several months, McFall and others worked on several aspects of the RIM project. They worked on material development to find the RIM material that could best withstand the constant cycling between hot and cold without warping or becoming brittle. Eventually, they determined that the RIM grommet would need to be reinforced with an internal steel plate. They also began to look at tooling. Progress was quite slow, however, because all the engineers were involved in other projects which took up most of their time.

In January 1989, the customer requested a status report on the RIM project. They were not pleased with what they heard. The project had not progressed very far, and it was not clear that it would be ready in time for the 1992 model year. Major RIM equipment producers had not yet developed a piece of equipment small enough to be practically used in this application. All known alternatives were expensive, labor intensive, and cumbersome. The customer made it very clear that they wanted the RIM grommet and were planning to use it for the 1992 vehicle to be produced at their Rayville plant. With this increased customer pressure, Packard Electric's level of effort on the RIM project was stepped up considerably, and Turnbull began working more closely with the Packard team.

For a while, it looked like the project would stall for lack of a molding machine that was an appropriate size for the grommet application. Most RIM machines were large and expensive because they were designed to make large, relatively high value, components. It was impossible to justify the cost of such a large machine for experimentation. The project was about to be canceled, when the chief engineer from Application Engineering ran across a small RIM machine at a trade show.

This RIM machine had been developed by an eight-person company. Its cost was only $80,000, and it was about the right size for Packard Electric's application. In June 1989 the machine was ordered; it arrived in October. Unfortunately, Packard Electric was unable to start testing the machine immediately because it was discovered that, due to the toxicity of

EXHIBIT 7

Rayville auto assembly plant leak data

MEMORANDUM

To: Bob McFall, Process Engineer

From: Keith Turnbull, Resident Engineer, Application Engineering

Date: 12 February 1988

Our wiring harnesses that use the IHG grommet are still as good as any in the industry, but the water leak is a serious issue for Rayville. Your project can get us the inside track on future products if we solve the problem. My contacts working on the new car program continue to ask about progress on the RIM grommet.

The auto assembly plant people gave me some representative water leak data for their current vehicle, which uses our IHG. The harness for 1987 had many ECOs, so it was pretty much a new harness. Each vehicle is given a water spray test at the end of the assembly line; QC then takes leaky vehicles off-line to determine causes. The two tables below tell the story:

RAYVILLE AUTO ASSEMBLY: DAILY WATER LEAKS (1987)[1]

	Weeks Since Model Year Launch		
	Week 4	**Week 26**	**Week 48**
Doors	57	21	11
Windows	13	2	1
Trunk	7	3	1
Under Dashboard			
Heat/Air Ducts	10	7	6
Steering Column	2	0	0
Wire Harness	30	11	3
Foot Pedals	3	1	0
Total Build Rate/Day	60 cars	300 cars	300 cars

RAYVILLE ASSEMBLY PLANT: QC ASSIGNABLE CAUSES—UNDER DASH WATER LEAKS, WIRING HARNESS, IHG GROMMET (1987)[1]

	Weeks Since Model Year Launch		
	Week 4	**Week 26**	**Week 48**
Misaligned Grommet	14	2	0
Bent Sheet Metal	7	1	0
Misaligned Screw Holes	5	1	0
Missing or Torn Gasket	2	0	1
Cracked Grommet	7	3	2
No Sealant in Combs	5	1	0
Insufficient Sealant in Combs	8	1	0
Other Leaks Through Wire Bundle	4	7	1
Missing Attachment Screws	6	1	0
Number of Vehicles with Leaks	30 (of 60)	11 (of 300)	3 (of 300)

[1]A single vehicle may have multiple defects; data is for a single day's production.

the RIM materials, EPA permits were required to run the machine. The permits arrived and testing began on the machine in January 1990. During this time, product and process development continued using RIM equipment outside of Packard Electric.

CURRENT STATUS OF THE RIM PROJECT

By the end of February 1990, several RIM grommets had been attached successfully to harnesses of the type required by the high-end customer. While the RIM grommet's leak performance was decidedly superior to the IHG, it was still not sufficient to pass the five and five test. Packard Electric engineers, however, were confident they could improve this performance and pass the test. The customer was also still very much in favor of using the RIM grommet—assuming that it could be produced reliably—despite the fact that the RIM unit cost was significantly more than the IHG (initially $7.00 compared to $4.40). **Exhibit 8** contains details of the differential costs.

There were a number of outstanding problems still to be solved with the RIM grommet process. Probably the most critical set involved materials handling. Keeping the two RIM materials separate was absolutely essential. For example, if the drum for "material A" was hooked up to the hose for "material B," the whole machine could be permanently solidified.

EXHIBIT 8

Packard's operating cost differences between RIM and IHG (estimated January 1990)

	RIM Grommet vs. IHG	
Recurring Additional RIM Cost per Vehicle	**1992**	**1994**
Labor	($.80)	($.80)
Material	$.65	$.65
Overhead*	$2.75	$.95
Total Additional RIM Cost / Vehicle	$2.60	$.80
Additional Investment Required for RIM:	$350,000	$450,000

*The overhead rate was based on non-direct charges such as salaries for management, engineering, and other non-direct labor, plant maintenance costs, taxes, and plant depreciation.

Assumptions:

1. 1992: 68,000 vehicles per year serviced by two final assembly lines, producing wiring for 300 vehicles per day.
2. 1994: 220,000 vehicles per year serviced by four final assembly lines producing wiring for 940 vehicles per day (assumes expansion to customer's other high-end models).
3. A full RIM or IHG setup required for each pair of harness assembly lines.
4. One redundant (back-up) molding system for each plant.
5. No tooling changes required.

This was not an idle worry; there had been incidents at other companies where a tanker truck had been filled from the wrong tank and the truck, hose, and tank had all been solidified into a block.

An additional problem was that, prior to mixing, "material A" froze at 64° F (18° C); once frozen, it was ruined. It was therefore very important to keep the material well above 64° F. Finally, both materials were very toxic and would require special monitoring. Because of these properties, Packard Electric had to develop and adhere to a series of strict material handling procedures.

A second set of problems revolved around the risks of a failure in the production system. A failure in harness production could completely shut down the customer's assembly line—which was generally considered the worst thing that could possibly happen. Because all of Packard Electric's customers required just-in-time delivery and were moving toward shorter and shorter lead times, there was little margin for error. It was exceedingly important that the machine be able to run 16 hours a day without fail. Packard Electric's limited experience with the system made it difficult to guarantee, as yet, such fail-safe operations.

The third set of problems involved repairing existing harnesses. The act of attaching the RIM grommet entailed some risk to the harness because the mold had to clamp down tightly on the harness to prevent the material from leaking out. If a cable were severed at this point or if the grommet were incompletely filled, the harness would have to be repaired because it was quite valuable (approximately $180) and could not just be discarded.

In addition to developing a repair process suitable for Packard Electric plants, there also was a need to establish a harness repair process for both auto assembly plants and retail dealers. Because the RIM grommet sealed tightly around the wires, once it had set there was no way to remove a defective cable. The solution would entail feeding an additional cable through a hole drilled in the grommet, but many details still needed to be worked out. Schramm estimated that four engineers would need to work approximately five months to address these issues specific to the RIM grommet.

VIEWS ON THE RIM GROMMET

Schramm knew that the RIM grommet had become a very emotional issue for several people. Product development engineers were generally very positive about it. They felt that in addition to superior leak performance, the RIM grommet offered many other advantages, such as greatly reducing the complexity of the initial feed-through design. Because a comb was required to separate the wires in the IHG, upwards of 150 dimensions had to be specified, compared to only about 30 for the RIM grommet.

The RIM grommet also reduced the variety of feed-through options required to support a broad range of automobile models. Although there was some flexibility in the number of wires that could be fit into an IHG comb, it typically was redesigned every two or three years because of changes in the number of cables in the harness. These redesigns were almost as costly as the initial design and typically required approximately 600 hours of engineering (at about $50 per hour) and about $13,000 in retooling costs.

In contrast, the RIM grommet was simpler, so that the initial design of a RIM grommet took only about 100 engineering hours (and about $7000 in tooling costs). The RIM grommet was much more flexible because the number of wires it could pass through the fire wall was limited only by the available area. With the current design, Packard Electric could double the number of wires without redesigning the grommet. Furthermore, this greater flexibility meant that it might be possible to use the same grommet for different model cars—something unheard of with the IHG. While there would probably never be a single grommet for all models, sharing the same RIM grommet across three or four models was a distinct possibility.

An additional advantage lay in the fact that the RIM grommet saved space in the pass-through area. To achieve an acceptable seal, the IHG had to be lengthened every time the number of wires was increased. Currently, the IHG was 80 millimeters longer than the RIM grommet. In addition to taking up scarce space, the IHG became more susceptible to cracking (and leaking) at this length. With a trend towards increasing the number of wires in the harness, this problem was likely to get worse.

Another argument given by engineers favoring the RIM grommet was that it was a new technology. As Packard Electric became more experienced with the technology, it could expect costs to drop significantly. This would affect the RIM grommet and other future RIM projects as well.

Manufacturing engineers generally felt very differently about RIM. They argued that the RIM process would not greatly decrease the leaks. Kitsa Airazas, a manufacturing process engineer, believed that the customer misunderstood the sources of leaks:

> *The problem is that the [customer's] engineers do the "Dixie Cup" test, which consists of filling a paper Dixie cup with water and pouring it down along the wires. This is equivalent to a static water test but the thing is, you don't submerge your car in water. The grommet really only needs to pass a splash test at the end of the assembly line—which the IHG can do. I think the car company's engineers would understand this if it were explained properly, but they've formed an opinion of IHG capabilities that is difficult to change.*

A component design engineer disputed Airazas's view:

> *Here we go again! Engineering gets a great product and process idea, the customer loves it, and the manufacturing types want to sit on it. If we waited for them, we'd never introduce new technology.*

The manufacturing engineers were quick to point out that any sensible engineer would see the obvious process reliability implications of the RIM grommet. The process control parameters were several times more complex than with IHG molding. Developing and implementing the strict materials handling procedures required would take a lot of effort and dramatically increase process complexity. Furthermore, even the act of putting the harness on the RIM machine entailed some risk because every time the harness was moved there was danger of damaging it.

The machine itself caused additional concerns. Considering the size of the vendor, it was likely that Packard Electric would be pretty much on its own. Although the IHG and RIM machines had approximately the same capacity (each could service approximately 70,000 harnesses per year), the RIM machine was much larger—requiring approximately 250 square feet compared with 100 for the IHG. At a cost of $25 per square foot per year, this differential translated to $3,750 per year per machine. Because the volume estimates for this particular 1992 model application were 50,000 to 70,000 cars per year, a single machine of either type would suffice.

The RIM machine also was much more difficult to move. Portability was quite important because the machine was likely to be moved between plants often. The RIM machine would be moved from the Warren, Ohio plant where process development was being done to Packard Electric's Mississippi plant where the initial manufacturing was expected to be done. From there, it was likely that eventually it would be moved to the final harness assembly location. Ron Szanny, an Application Engineering manager, pointed out an apparent conflict with Packard Electric's strategy:

> *The RIM grommet is a good product, but I'm not sure how well it fits with Packard Electric's manufacturing strategy. Packard Electric's strategy has been to have high-tech manufacturing of components in the U.S. and then to ship those components to Mexico where the assembly is done in a low-tech fashion. The RIM machine is a relatively high-tech machine, which eventually may be used in Mexico. The language problem and the distance would greatly exacerbate the control problems that are so important for the RIM technology.*

Airazas spoke for many of the manufacturing process people when she said:

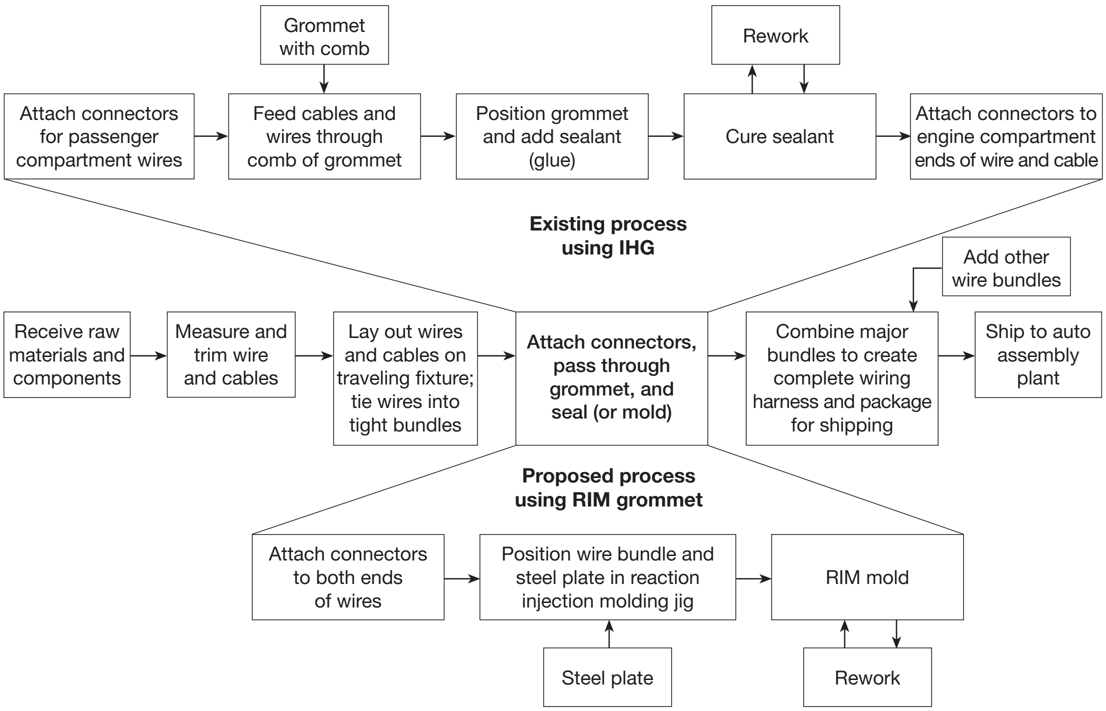
> *The car companies and our own management have been stressing the need to reduce costs. We've had travel reductions, hiring freezes, and even layoffs. Now they're talking about spending almost twice as much for a component that complicates the process, increases risk, and may not improve performance. I don't deny that RIM is an important technology for some components, but this is the wrong application for it. Going with the RIM grommet would send a very bad message.*
>
> *I want to make it clear that I believe we can get the RIM grommet up and running if we want to, but it would require a lot of work, pain, and suffering. I don't think we want to do it because this cost issue will kill us. The car company's design engineers may be excited about it, but everyone knows the car company will eventually want the RIM grommet at the IHG price.*

Schramm summed up the feelings of many of his subordinates, the product engineers:

> *Look, if nothing else, the customer wants RIM and is willing to pay for it. They feel it is very important to maintain their technological leadership and RIM will help. The funny thing is that I was over at our Reinshagen subsidiary recently and saw them experimenting with a RIM grommet for a high-end German auto maker. They didn't ask what it cost, they just said, "if it improves performance, do it."*
>
> *Furthermore, there are cost savings that no one takes into account because they are difficult to calculate. For example, with the IHG, every worker along our wiring assembly line has to insert his or her wires and cables into the IHG's comb. With RIM that task is eliminated. I don't know how to calculate that improvement since it is a small amount of labor distributed among a number of workers, but there are some savings there (see* **Exhibit 9** *for the harness assembly process).*

EXHIBIT 9

Packard's wiring harness assembly process



SCHRAMM'S OPTIONS

The RIM grommet decision was a good example of the type of situation that Packard Electric wanted to avoid. A major decision had to be made in a hurry and there was still a deep division in the views of the concerned parties. No matter what decision was made, it was very likely that one group or another was going to be faced with a challenge—either to tell the customer "no," or to develop and implement a process in a compressed time frame. Turnbull's latest memo reconfirmed that the customer was counting on Packard to resolve problems that were as much its own doing as they were Packard Electric's (see **Exhibit 10**).

Schramm felt that there were essentially three options he could recommend. The first was to go exclusively with RIM for this customer's 1992 model. This was the riskiest option because if RIM failed in a major way and impacted the customer's production line, significant repercussions would be felt by all who bore any responsibility. One way to minimize that risk was to recommend the purchase of two RIM machines, one of which would be used as a backup, but Schramm did not like this one bit. In addition to the added expense, it removed some of the pressure from operations to perfect their processes.

A second option available was "parallel development." In this case, an IHG could be prepared in parallel with a RIM grommet for this customer's 1992 requirements. The drawbacks to this plan were many and obvious. Because Packard Electric had been caught up in the design of the RIM grommet, an IHG grommet would need to be designed quickly. Furthermore, it would become a logistical nightmare when the car went into production. Two sets of raw materials would have to be ordered and kept track of, and both the auto plant and Packard Electric's plant would have two different harnesses to deal with on the assembly line.

The final option was the simplest and least risky. Schramm could recommend that Packard Electric go with the IHG for all 1992 models. He did not like giving up on the new technology, since he personally felt it had many potential benefits. He feared that if RIM were not pursued actively at this point, it would lose momentum and not be applied in 1993 or beyond.

Schramm sighed. He had to present his recommendations to the PPR committee at the end of the week on the RIM grommet; he needed not only to be clear on the RIM versus IHG decision, but also to be prepared to tell them how to restructure the company's development process to avoid such problems in the future.

NOTE

1. Depending on the cause, these charges would be billed to (or shared by) the car company or Packard Electric.

EXHIBIT 10

Packard grommet defects and car dealer data

MEMORANDUM

To: David Schramm, Chief Engineer, CCD
From: Keith Turnbull, Resident Engineer, Application Engineering
Re: IHG Replacement
Date: 30 January 1990

I want to reconfirm our customer's plan to replace the IHG with the RIM grommet for their 1992 model car. Cobbled repairs to defective grommets on wiring harnesses are not a viable solution for its upscale car. The customer is looking to get rid of defects from all sources; water leaks are an unnecessary problem.

I checked with the QC manager at our Mexican plant, who believes his quality far exceeds other harness builders even with the IHG grommet. He thinks the Dixie Cup test is helpful when a new harness is launched, but it does not accurately reflect what actually occurs in use. He believes his harnesses do not have splash leaks. His data for the ships to the Rayville auto assembly plant this past year are summarized below. The story is easy to read—he can't make leak-free harnesses even after a year of trying.

Harnesses for Rayville Auto Assembly Plant (1989): Packard's Mexico Harness Assembly Plant Data—QC Assignable Causes, Inspection Prior to Harness Ship [IHG Grommet]

	Weeks Since New Harness Launch*			
	Week 4	**Week 13**	**Week 26**	**Week 52**
Grommet location along bundle (out of tolerance ±1/4")	15	3	3	2
Improper distribution of wires in combs	14	7	3	3
Need to replace wires and reseal	3	0	0	1
Excess sealant	8	0	1	0
Nonuniform distribution of sealant	19	4	3	0
Air bubbles in sealant	7	4	4	3
No sealant one side	6	3	1	1
No sealant both sides	4	1	0	0
Leaks through wire bundle (Dixie cup test)	60	94	54	42
Total harness build rate per day	70	285	320	350

*Data for one representative day during the week indicated.

This controversy bothered me enough that I decided to visit two of the largest dealerships in the greater Detroit area to check if they saw wiring harness problems. Their files may not be complete but I did pull leak repair records. I tried to classify the defects according to handwritten comments on repair sheets for the final six months of the model year (weeks 27–52). The service managers don't like it when these under dash leak problems come in—they require hours to repair and the customers complain.

Dealer Repairs: Cause of Under Dash Leaks—IHG Wiring Harness

Cracked grommet	2	Torn gasket	1
Leaks through wires	1	Missing attachment screws	1

I estimate that this sample might represent anywhere from 1–2% of the 1989 model vehicles these dealers sold and now service. I hope that the RIM project will be a hit and allow us to get into several of the other new car programs.

APPENDIX

Glossary of Terms

CCD (Cable and Component Design)—A product development department.

CIE (Cooperative Involvement Engineering)—Reporting to director of reliability, provides a direct avenue for customer feedback.

Dash/Dashboard—The console in front of the car driver and front seat passenger that houses the radio, air vents, and so forth.

ECO (Engineering Change Order)—The formal prescriptions for changing the specifications of a product or process.

EPA (Environmental Protection Agency)—The U.S. government agency that monitors and controls the use of toxic substances.

Fire Wall—The metal wall behind the dashboard that separates the passenger and engine compartments.

Gasket—The soft, pliable material between the grommet and fire wall which forms a seal between the metal and grommet.

Grommet—A plastic fixture that holds and supports electrical wires and cables as they pass through the fire wall of a vehicle. The grommet is attached to the metal wall (fire wall) that separates the engine compartment from the passenger compartment.

Harness—The bundle of wires and cables that carry electrical signals and power to and from the car's electronic and electrical components.

IHG (Injectable Hardshell Grommet)—A grommet made from injection molding of polymer pellets. The material is quite rigid and slightly brittle.

Jig—Fixture to hold wire cable bundle and steel plate in the mold while resins are injection molded around them.

PPR (Product, Process, and Reliability Committee)—Manages Packard Electric's new product development processes.

RIM (Reaction Injection Molding)—The injection into a mold of two very fluid resins (polymeric chemicals) that react to form a solid plastic with the consistency of hard rubber.

Sealant—Resins and glues used to join materials and make them impervious to water.

SKU (Stock Keeping Unit)—Each component, subassembly, or assembly that has a unique identification number and identity in Packard Electric's production system.

MALAYSIA IN THE 1990S (A)

In the early autumn of 1991, Mahathir bin Mohamad, the Malaysian prime minister, was preparing to visit New York City, where he was to address the United Nations General Assembly and to meet with American business people interested in investing in Malaysia. During the three decades since its independence, Malaysia had enjoyed rapid economic growth and relative political stability. The prime minister was determined to maintain that stability, in part by realizing even more ambitious economic objectives in the future.

Malaysia's international reputation could be tarnished by reports that the Malaysian government was insufficiently respectful of environmental values. The Western press was especially critical of what it saw as rampant deforestation in the East Malaysian state of Sarawak, in the northern part of the island of Borneo (see **Exhibits 1** and **2**). According to one British environmental group, the rain forest in Sarawak was "being cut down so fast that it will be logged out within eight years."[1] Western environmental groups were lobbying their governments to ban imports of Malaysian timber products and were trying to change Malaysian forestry policy by appealing to international bodies like the International Tropical Timber Organization.

This environmental activism further complicated an already intricate set of economic and political problems surrounding natural resource development in Malaysia. Exports of timber and other natural resources were an important source of foreign exchange. Downstream vertical integration, from the production of natural resource commodities through the manufacture of finished goods, was part of Malaysia's economic growth strategy. Concern over environmental values in Europe and the United States could shrink the demand for Malaysian products and interfere with the government's economic plans. In his address to the UN, as in the formulation of his policies, Prime Minister Mahathir had to consider the connections among his government's ambitious economic strategy, the use of natural resources like forests, and his country's relations with environmentalists and other groups outside Malaysia.

MALAYSIA

During the eighteenth century, the British took control of the colony of Malaya, south of Thailand on the Malay Peninsula; the area had previously been controlled by the Portuguese

EXHIBIT 1

Southeast Asia

and then by the Dutch. The British later assumed control of the northern parts of the island of Borneo, four hundred miles east of Malaya across the South China Sea.

During the colonial period, the British brought laborers from India to Malaya to work in the new rubber plantations. And while ethnic Chinese had lived in the region for centuries, immigrants from China came in large numbers during the period of British hegemony to work in the mines and plantations. The Indians and Chinese joined a population that already exhibited considerable ethnic heterogeneity: Islamic Malays inhabited the peninsula, while northern Borneo was populated by numerous indigenous ethnic groups.

EXHIBIT 2

Area and population

	Total Malaysia	Peninsula	Sarawak	Sabah
Area in thousand square miles	127	50	48	29
Population in millions:				
1980	13.7	11.4	1.3	1.0
1990	18.0	14.7	1.7	1.5
Population density (people per square mile), 1990	142	294	36	49
Population growth rate per year, 1980–1990	2.8%	2.6%	2.5%	3.9%

Note: Numbers may not add to totals because of rounding.

Sources: The Economist Intelligence Unit, "Malaysia, Brunei Country Profile" (September 1991); Government of Malaysia, "Sixth Malaysia Plan 1991–1995" (Kuala Lumpur, 1991).

The entire region, including Malaya, Singapore, Borneo, Sumatra, and Java, fell into Japanese hands during the Second World War. Malaya became independent of British rule in 1957, and in 1963 was joined by Singapore in the new federation called Malaysia. The states of Sarawak and Sabah in northern Borneo also joined the federation. Singapore remained in the federation for only two years, withdrawing in 1965. (The former colony of Malaya is now called "peninsular Malaysia" or "West Malaysia"; Sabah and Sarawak together are called "East Malaysia.")

Economic Strategy

The new nation of Malaysia was well situated for the production of rubber and was richly endowed with natural resources, particularly timber and tin. Nearly half of Malaysia's export revenues came from rubber as of 1960, but this figure subsequently fell as the export economy diversified. Tin contributed substantially to export earnings throughout the 1960s and 1970s; after the 1973 oil shock, petroleum and natural gas became important export earners as well. By 1980, fuels accounted for one-fourth of export earnings, and contributions from Petronas, the government-owned oil company, accounted for a similar fraction of total federal government revenue.[2]

Like many other developing nations, Malaysia pursued a strategy of import substitution during the late 1950s and 1960s, in part at the urging of the World Bank.[3] Starting in the late 1960s, the government shifted its focus to the promotion of exports, although the restrictions on imports and the incentives for firms to invest for production to serve the domestic market did not entirely disappear. The Malaysian government used a variety of policy instruments to encourage export-oriented growth. These included the establishment of a dozen free trade zones, to which components and raw materials could be imported duty-free; tax holidays and other investment incentives; and lenient technology-sharing requirements.

Low wages and the relatively widespread use of English complemented these policy initiatives in creating an attractive environment for foreign direct investment. Intel, National Semiconductor, and other high-technology firms built assembly plants in West Malaysia during the 1970s and 1980s, and Malaysia's semiconductor industry grew by 20% a year between 1975 and 1985.[4]

At the same time, Malaysia sought to diversify its natural resource portfolio further. Timber production and exports increased steadily during the 1960s and 1970s.[5] Malaysians also planted vast quantities of oil palm, a tree whose seeds are crushed to produce edible oil; by the late 1980s, palm oil was producing more export revenues than rubber. Both rubber and oil palm trees were grown on plantations after the original forest was cleared away.

In addition to this commodity diversification, Malaysia encouraged its natural resource industries to integrate downstream to escape exposure to commodity price fluctuations. Through tax holidays, other tax incentives, and restrictions on the exports of raw materials, the government encouraged the domestic manufacture of lumber, plywood, wooden moldings, furniture, tires, latex gloves, and similar products to replace the exportation of raw timber and natural rubber. In the late 1980s, however, over half of Malaysia's forest products were still exported in the form of logs, and most of the rubber was exported in raw form rather than in finished products.[6]

Malaysian officials were critical of alternative models of economic development, including not only import substitution but also the model, which they attributed to the World Bank and the International Monetary Fund, that pushed raw material commodity exports as a way of earning foreign currency with which to buy consumer and capital goods from industrialized nations. In Prime Minister Mahathir's view, such a program would lead to overproduction of agricultural and resource commodities and a fall in developing nations' terms of trade. "We are today looking at the ruins of this model in many parts of the world, especially in Africa," he said.[7]

Instead, the Malaysian government planned for continuously increasing exports of manufactured goods, while natural resource commodities gradually declined in relative importance. The government's plans called for a fourfold increase in manufactured exports during the 1990s; during the same period, revenues from export of fuels and tin were expected to fall slightly, and revenues from the export of logs and lumber were projected to drop by 50%.[8] (**Exhibits 3** through **7** show economic data for Malaysia during the 1980s, including national income, balance of payments, composition of exports, and income distribution; **Exhibit 8** shows comparative economic data for Malaysia and other nations.)

Malaysia's ambitious agenda included the promotion of Proton Saga automobiles, the first of which were produced in 1985. A joint venture between Mitsubishi Motors and a Malaysian

EXHIBIT 3

Gross Domestic Product (figures in billions of 1978 Malaysian ringgits)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
GDP	44.5	47.6	50.4	53.6	57.7	57.1	57.8	60.9	66.3	72.1	78.9
Private consumption	24.4	25.7	26.5	27.4	29.1	29.2	26.3	26.9	31.2	35.6	39.4
Government consumption	7.8	8.8	9.6	10.0	9.5	9.4	9.5	9.7	10.1	10.9	11.6
Investment	13.9	16.5	17.8	19.2	19.8	17.9	14.6	14.0	16.1	21.2	25.4
Inventory changes	–0.3	–0.5	0.5	0.4	1.0	–1.3	–0.2	0.1	1.2	–0.1	–0.5
Exports	22.6	22.4	24.8	27.9	31.7	31.9	35.6	40.8	45.6	53.9	62.2
Imports	23.9	25.3	28.7	31.3	33.3	30.1	28.1	30.5	38.0	49.4	59.2
Fractions of GDP:											
Private consumption	55%	54%	53%	51%	50%	51%	46%	44%	47%	49%	50%
Government consumption	17	18	19	19	16	16	17	16	15	15	15
Investment	31	35	35	36	34	31	25	23	24	29	32
Inventory changes	–1	–1	1	1	2	–2	0	0	2	0	–1
Exports	51	47	49	52	55	56	62	67	69	75	79
Imports	54	53	57	58	58	53	49	50	57	69	75
Agriculture, forestry, fisheries	23%					21%					19%
Mining and quarrying	10					11					10
Manufacturing	20					20					27
Construction	5					5					4
Electricity, gas, and water	1					2					2
Services	41					43					39

Note: Numbers may not add to totals because of rounding.

Sources: Asian Development Bank, "Key indicators of Developing Asian and Pacific Countries," Volume XXII (1991); The Economist Intelligence Unit, "Malaysia, Brunei Country Profile" (1991).

EXHIBIT 4

Balance of payments (figures in billions of US$)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Merchandise exports	$12.9	$11.7	$12.0	$13.7	$16.4	$15.1	$13.5	$17.8	$20.9	$24.8	$29.0
Merchandise imports	–10.5	–11.8	–12.7	–13.3	–13.4	–11.6	–10.3	–11.9	–15.3	–20.9	–26.5
Trade balance	2.4	–0.1	–0.8	0.4	3.0	3.6	3.2	5.8	5.5	3.9	2.5
Other goods, services, and income[a]	–2.7	–2.3	–2.8	–3.9	–4.6	–4.2	–3.4	–3.3	–3.9	–4.2	–3.8
Unrequited transfers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1
Current balance	–0.3	–2.4	–3.6	–3.5	–1.7	–0.6	–0.1	2.6	1.8	–0.2	–1.2
Direct investment	0.9	1.3	1.4	1.3	0.8	0.7	0.5	0.4	0.7	1.8	3.1
Portfolio investment	0.0	1.1	1.8	1.4	1.0	0.3	0.6	–0.9	–1.0	–0.2	[b]
Other long-term capital	0.1	0.2	0.4	1.3	1.0	0.7	0.2	0.0	–1.0	–0.8	–0.9
Other short-term capital	0.4	0.0	0.1	–0.1	–0.1	0.4	0.0	–1.0	–1.1	0.3	0.4
Errors and omissions	–0.7	–0.6	–0.4	–0.4	–0.9	–0.1	0.5	0.1	0.1	0.2	0.2
Overall balance	0.5	–0.5	–0.3	0.0	0.1	1.3	1.7	1.1	–0.4	1.2	1.6

[a]Of the totals shown, net investment income was –$0.6 billion in 1980, –$2.2 billion in 1984 and in 1985, and –$1.8 billion in 1990 (*Source:* IMF Balance of Payments Statistics, various years).

[b]Portfolio investment for 1990 is included in other long-term capital.

Source: Asian Development Bank.

EXHIBIT 5

Composition of exports

As a Fraction of Total	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Rubber	16%	14%	9%	11%	10%	8%	9%	9%	10%	6%	4%
Tin	9	8	5	5	3	4	2	2	2	2	1
Logs and timber	14	13	16	13	10	10	11	13	11	11	9
Palm oil	9	10	10	9	12	10	9	7	8	7	6
Petroleum	24	26	27	24	23	23	15	14	11	12	13
All other[a]	28	29	32	38	43	45	54	55	59	63	67

[a]"All other" consists primarily of manufactured goods. It also includes small quantities of food and beverage products.

Source: Asian Development Bank.

EXHIBIT 6

Economic indicators and government finance

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Unemployment rate	5.6%	4.7%	4.6%	5.2%	5.8%	6.9%	8.3%	8.2%	8.1%	7.1%	6.3%
Exchange rate (M$/US$)	2.22	2.24	2.32	2.34	2.43	2.43	2.60	2.49	2.72	2.70	2.70
Change in Consumer Price Index	6.8%	9.7%	5.7%	3.7%	3.6%	0.4%	0.6%	0.8%	2.5%	2.8%	3.1%
Change in M1	15.0%	12.8%	13.3%	7.7%	–0.6%	1.7%	2.8%	13.0%	14.6%	17.6%	14.0%
Federal government finance (in billions of M$):											
Revenue	$13.9	$15.8	$16.7	$18.6	$20.8	$21.1	$19.5	$18.1	$22.0	$25.3	$27.2
Current expenditure	13.7	15.7	16.7	18.4	19.8	20.1	20.1	20.2	21.8	24.8	26.0
Current surplus	0.2	0.1	0.0	0.2	1.0	1.0	–0.6	–2.0	0.2	0.4	1.2
Capital expenditure	7.3	11.1	11.2	9.4	8.1	6.8	7.0	4.1	4.0	5.7	8.0
Overall surplus	–7.1	–11.0	–11.2	–9.2	–7.1	–5.7	–7.5	–6.2	–3.9	–5.3	–6.8
Net domestic borrowing	2.3	4.1	6.0	4.5	3.2	3.6	5.0	8.7	7.9	2.5	3.8
Net foreign borrowing	0.3	3.4	4.9	4.6	3.1	1.0	1.3	–2.4	–3.1	–1.0	–0.8
Other[a]	4.5	3.5	0.2	0.1	0.8	1.2	1.2	–0.1	–0.9	3.8	3.8
Gross domestic product	53.3	57.6	62.6	70.4	79.6	77.5	71.6	79.6	90.6	101.5	115.0
Government financial flows as fraction of GDP											
Current surplus	0.4%	0.2%	0.0%	0.3%	1.3%	1.4%	–0.8%	–2.6%	0.2%	0.4%	1.1%
Overall surplus	–13.3	–19.1	–17.8	–13.0	–8.9	–7.4	–10.5	–7.7	–4.3	–5.2	–5.9
Net foreign borrowing	0.6	5.9	7.8	6.5	3.9	1.2	1.9	–3.1	–3.4	–1.0	–0.7

[a]Includes special receipts, use of cash balances, and asset sales.
Source: Asian Development Bank.

government-owned company designed and made the vehicles, which accounted for the majority of cars sold in Malaysia. Mitsubishi provided much of the engineering and management expertise; it took over management of the Proton plant in 1988, and in the following year Proton recorded its first profit. Pride in the joint venture's technological accomplishments and optimism about the car's market prospects abroad were tempered by doubts about whether automobile manufacture was an appropriate endeavor for Malaysia. These doubts were fueled, in part, by the continued presence of high tariffs on automobile imports. Malaysia, like many other Asian nations, protected a wide range of manufacturing industries as part of its economic development strategy.[9]

EXHIBIT 7

Average monthly household income by area and ethnic group, 1976 and 1990 (figures in 1990 Malaysian ringgits)

		1976 Value	1976 Percent of National Average	1990 Value	1990 Percent of National Average	CAGR 1976-1990
All Malaysia	Overall	850	100%	1,167	100%	2.3%
	Bumiputra	571	67	829	71	2.7
	Chinese	1,340	158	1,631	140	1.4
	Indians	904	106	1,201	103	2.0
	Other	1,677	197	3,292	282	4.9
Sarawak	Overall	719	85	1,208	104	3.8
	Bumiputra	485	57	932	80	4.8
	Chinese	1,192	140	1,754	150	2.8
	Other	4,905	577	4,235	363	–1.0
Sabah	Overall	864	102	1,148	98	2.1
	Bumiputra	579	68	895	77	3.2
	Chinese	2,005	236	2,242	192	0.8
	Other	2,382	280	2,262	194	–0.4

Sources: Government of Malaysia, "The Second Outline Perspective Plan, 1991–2000" (1991); World Bank, "World Tables 1991"; Asian Development Bank.

Malaysia belonged to the Association of Southeast Asian Nations (ASEAN), whose other members were Brunei, Indonesia, the Philippines, Singapore, and Thailand. ASEAN was established in 1967 as a consultative forum for foreign and security affairs, but turned its attention to economic cooperation after the end of the Vietnam War. For example, as of the early 1990s, Malaysia and its neighbors were beginning to discuss the creation of an ASEAN free trade area, within which trade would be subject to very low tariffs and minimal other restrictions. Some observers thought, however, that an ASEAN free trade area would be unhelpful and possibly counterproductive. "ASEAN countries have stronger economic ties with the rest of the Pacific [e.g., with the US and Japan] than among themselves. . . . ASEAN economies by and large are competitive and not complementary. Under these circumstances, any attempt to increase intra-regional trade through discriminatory tariff reductions would probably result in substantial trade diversion, shifting the sources of imports from low-cost third countries to high-cost partners."[10] (In 1988, US$5.1 billion of Malaysian merchandise exports went to ASEAN, but $4.1 billion of this total went to Singapore. The same year, Malaysia sent merchandise exports worth $4.2 billion to Japan, and $3.7 billion to the United States.[11])

EXHIBIT 8

Comparative economic and social indicators

	Malaysia	South Korea	Taiwan	Indonesia	Thailand	Philippines	Japan	United States
Area (in square miles)	128,400	38,031	12,456	782,659	198,772	116,000	143,750	3,618,769
Population (millions, 1990)	17.5	43.0	20.5	190.1	55.1	66.1	123.6	250.4
Population density (persons per square mile)	136	1,132	1,650	243	277	570	860	69
Gross national product (in billions of US$):								
1980	$22.8	$83.3	$65.1	$54.4	$47.4	$37.0	$2,080.0	$3,865.0
1988	32.3	168.9	119.4	76.2	58.0	40.4	2,856.0	4,881.0
Per capita GNP (in 1988 US$):								
1980	$1,659	$2,184	$3,659	$351	$1,012	$727	$17,810	$16,970
1988	1,972	3,950	5,968	414	1,063	639	23,290	19,840
Compound annual growth rates, 1980-1988:								
GNP	4.5%	9.2%	7.9%	4.3%	2.6%	1.1%	4.0%	3.0%
Per capita GNP	2.2%	7.7%	6.3%	2.1%	0.6%	–1.6%	3.4%	2.0%
Life expectancy at birth, 1990	67.8	69.6	74.1	60.3	66.8	65.9	79.3	75.6
Telephones per 100 people (mid-1980s)	9.1	25.5	35.9	0.5	1.9	1.5	55.5	76.0
Military expenditures (1988):								
In US$ millions	$908	$7,202	$6,156	$1,400	$1,718	$680	$28,870	$307,700
As percent of GNP	2.8%	4.3%	5.2%	1.8%	3.1%	1.7%	1.0%	6.3%

Source: Statistical Abstract of the United States.

Social Conditions

Malaysian leaders saw rapid economic growth as a precondition for political stability. Many Malaysians and foreign observers regarded ethnic and religious tension as the central problem for Malaysian politicians and, indeed, the central fact of Malaysian life. For example, *The Economist* wrote in 1987 that "Malaysia remains an uneasy racial mix, in which the tensions have perhaps been kept in check only because there has been high employment and more money in the pay packet each year."[12]

The Malays, along with members of the numerous indigenous ethnic groups of northern Borneo, were classified by the government as *Bumiputras*, literally "sons of the soil." Together, these groups made up just over half of the Malaysian population in 1990. The Chinese accounted for about a third of the Malaysian population, and Indians for most of the rest.

The Chinese in Malaysia formed the nucleus of the modern business community under British rule and continued to dominate Malaysian economic activity after independence.[13] "Malays continued to lag behind in everything from education to commercial enterprises, and their resentment finally erupted into riots in 1969, when the Chinese opposition parties more than doubled their parliamentary seats, threatening Malay political primacy."[14] Hundreds died during the rioting.

In response, the government instituted its New Economic Policy (NEP), described by the government as "an exercise in social engineering designed to reduce the socio-economic imbalances among ethnic groups and across regions."[15] The NEP included ethnic quotas "in education, employment, and ownership, as well as a variety of subsidies, licenses, and credit schemes."[16] The plan called for Malays to increase their share of corporate equity ownership from 1.5% in 1971 to 30% by 1990. "New universities and technical institutions for Malay students were established, and Malay became the official language of university instruction. The Chinese were denied the right to have their own Chinese university. Quotas were established for university admissions, and in the higher civil and diplomatic services a 4 to 1 ratio of Malays to non-Malays was required."[17]

Under the NEP, the disparities among incomes of various ethnic groups had shrunk; the average income of richer Chinese households rose, but that of *Bumiputra* households rose faster. (See **Exhibit 7**.) The NEP did not eradicate income differentials among ethnic groups, and also failed to meet some of its numerical targets, like the 30% equity ownership figure. Still, in 1991 the government declared the NEP an overall success: "Malaysia is . . . one of the very few countries which has, in a span of 20 years, succeeded remarkably well not only in achieving growth but also in addressing more effectively the problems of poverty and economic imbalances." The government concluded the NEP and instituted the National Development Policy (NDP), which included many of the same objectives but did not contain explicit numerical targets.[18]

Under these plans, Chinese-managed companies needed Malay partners to satisfy the corporate ownership requirements. These and related regulations arguably led to new forms of rent-seeking and inefficiency. One Malay entrepreneur said, "My partners are all Chinese; they put up the capital and I demand 51% share. I make sure my investors are with the right faction in politics. I go see government officials, politicians to make sure we get all the licenses and approvals we need. They get to do what they want to do, and I make a lot of money."[19]

Defenders of the NEP claimed that the policy's critics failed to understand or appreciate the need to redistribute wealth among ethnic groups in order to enhance political stability. "We are sitting on dynamite, and there are plenty of fools who want to shorten the fuse," said a Cabinet minister in 1991. "Our job is to keep them from becoming important actors." The prime minister constantly stressed the importance of eliminating poverty and redistributing wealth so that each citizen would see himself or herself as having a stake in the Malaysian economy. By investing heavily in education, further modernizing the country's infrastructure, continuing to attract foreign direct investment, and integrating downstream from natural resources, Malaysia planned to become a "fully developed country" by 2020.

Political Structure

Since its founding, Malaysia's parliamentary government had been dominated by a coalition of political parties, collectively called the Barisan Nasional (BN). The dominant party within the BN was the United Malays National Organization, or UMNO, whose members were Malay. The BN included several other parties, among them the Malaysian Chinese Association, the Malaysian Indian Congress, and the Gerakan party. In Sarawak, the BN was represented by the Sarawak National Party, the Parti Pesaka Bumiputra Bersatu, the Sarawak United People's Party, and the Parti Bangsa Dayak Sarawak. For the most part, each of the constituent parties of the BN included members of a single ethnic group.

According to *The Economist*, "Malaysia is not a democracy in the exact sense of that word. Every adult has a vote. The elections are conducted almost fairly. . . . The UMNO coalition may win easily, or not so easily, but it will always win. The opposition can never expect to form a government, although if an opposition party does well it may be invited to join the coalition and take part in the decision making and share the perks of office."[20] The Malaysian style of government, with a broad coalition allocating seats in the legislature and cabinet among its constituent parties, and consistently winning elections, was seen by some as similar to that of Japan.

Economic Performance

Even while its leaders concentrated much of their efforts on income distribution and political stability, Malaysia's economy grew at 7.6% per year in the 1970s.[21] The economy stumbled in the mid-1980s, when world prices of petroleum, tin, rubber, and palm oil plummeted simultaneously, but Malaysia ended the decade with three years of real GNP growth averaging 9%. Over the 1980s, the real growth rate was 5.9%. These impressive numbers seemed to support Prime Minister Mahathir's conviction that Malaysia could become a fully developed country in 30 years, increasing per capita GNP tenfold from its 1990 level of US$2,300. Other observers, however, worried that Malaysia remained dependent on foreign investors who would seek even lower-cost labor in Thailand, Indonesia, China, or Vietnam as Malaysian wages rose. They also pointed out that the richest fifth of the Malaysian population still had 16 times the income of the poorest fifth, making Malaysia's income distribution less equal than that of Korea, Taiwan, Singapore, or Indonesia.[22]

THE FOREST PRODUCTS INDUSTRY IN MALAYSIA

In 1991, timber generated more foreign exchange for Malaysia than tin and rubber combined (see **Exhibit 5**). The forest products industry received considerable attention from Malaysian government officials, who saw it as an ideal setting for resource-based industrialization. It also received attention from Western journalists and environmentalists, who saw an ecological horror story involving waste, overharvesting, and destruction of traditional cultures.

Like most other governments in the world, Malaysia's intervened heavily in the forest products industry. Most Malaysian forest land was owned by the states. Although the states of peninsular Malaysia had effectively transferred much of the authority over forestry policy to the federal government, the East Malaysian states of Sabah and Sarawak retained direct control over the exploitation of forest resources within their boundaries.

Timberland Classification and Forestry Planning

Government agencies set harvest levels for timber from their lands through a complicated scheme of land classification and planning. Government officials designated each forested area according to the uses to which it seemed best suited. Most of the government-owned forests were classified as Permanent Forest Estate (PFE). The government forest agencies were required to manage the PFE "with the objective of maximising social, economic and environmental benefits for the Nation and its people in accordance with the principles of sound forest management."[23] Other lands were designated as wildlife preserves or national parks, and timber production there was forbidden. The rest of the government-owned lands were called stateland forests, and were slated either for forestry or for conversion to agricultural use. (**Exhibit 9** shows the acreage in each category in peninsular Malaysia, Sarawak, and Sabah.)

If an area of stateland forest was slated for agricultural use or for plantations of rubber or oil palm trees, then timber harvesting there resulted in the removal of all of the original forest cover (a process called clearcutting). By contrast, statelands not suitable for agriculture were supposed to be harvested in a way that would ensure the ability to reharvest later. So were all of the lands in the PFE. According to Malaysian foresters, natural stands of rain forest in the PFE were harvested selectively. Only three or four trees per acre were harvested. Over the subsequent 25 to 30 years, the largest of the remaining trees would attain the size of the trees that had been harvested. Government planners assumed that after that time had elapsed, the area could be reharvested, again selectively, and the cycle repeated indefinitely.

The Concession System

The government agencies that controlled Malaysian timberland granted logging concessions to private parties. A concession from the forest agency gave the holder the right, contingent on payment of fees and royalties, to harvest a certain amount of timber from a specified tract

EXHIBIT 9

Land use and timber harvests

	Peninsula	Sarawak	Sabah	Total
Land Use (1988; in millions of acres)				
Natural forest:	15.2	23.3	11.0	49.4
logged	7.5	7.9	7.3	22.6
undisturbed	7.7	15.4	3.7	26.8
Tree crops	8.4	0.7	1.3	10.4
Plantation forests	0.1	0.0	0.1	0.2
All other	8.8	6.5	5.9	21.2
TOTAL	32.5	30.5	18.2	81.2
Administrative Status of Government-owned Lands (in millions of acres)				
Permanent forest estate:	11.7	11.0	8.3	31.0
logged	4.6	4.1	4.9	13.6
undisturbed	7.1	6.9	3.5	17.6
Other state-owned lands:	3.6	9.4	2.3	15.3
logged	3.2	6.1	2.2	11.4
undisturbed	0.4	3.4	0.1	3.9
"Totally protected areas" (national parks and wildlife preserves)	1.5	0.7	1.2	3.4
TOTAL	16.8	21.2	11.8	49.7
Percentage undisturbed	53.6%	52.1%	40.9%	50.1%
Harvests	**Peninsula**	**Sarawak**	**Sabah**	
Years	1981–87	1983–90	1984–87	
Annual average area logged (thousands of acres)	578	546	436	
Annual average harvest volume (million cubic meters)	9.35	11.76	N/A	
Average annual acreage logged/total forest acreage	3.8%	2.3%	4.0%	

Note: Numbers may not add to totals due to rounding.

Sources: Malaysian Ministry of Primary Industries, "Forestry in Malaysia" (n.d.); Sarawak Forest Department, "Forestry in Sarawak Malaysia" (1991).

of timberland over some period of time. Concession holders commonly contracted the actual logging to other firms.

Concessionaires could sell their logs to independent mills or process the timber from the concession lands themselves. In 1990, over 1,000 sawmills and 80 mills producing veneer and plywood competed for raw timber in Malaysia. (In addition, some 650 other timber-processing mills made furniture, parquet flooring, chipboard, fiberboard, wooden molding, matches, pencils, and other wood products.[24]) Alternatively, concessionaires in Sabah and Sarawak could still sell their logs into export markets.

In the hill forests that comprised most of Sarawak's commercial timberland, government foresters regarded harvesting cycles of about 25 to 30 years as appropriate. Licenses on the PFE in Sarawak had lifetimes of 10 to 15 years, but could be renewed on expiration with the approval of the state forest department. Each concession in the PFE covered an area ranging from 50,000 to 250,000 acres. (By contrast, Rhode Island's area is 776,000 acres.)

The license holders paid royalties to the government based on harvest volumes. Royalties typically ranged from 15% to 30% of the price of the logs, depending on the species; timber royalties accounted for 40% to 45% of the Sarawak state government's total revenues. In addition to the royalties and permits, concessionaires paid relatively small premiums to the government which were earmarked for medical and educational services provided to inhabitants of the rain forest.[25]

Some Western observers were offended at the manner in which the logging concessions were allocated and operated, charging that it contributed to rapid deforestation. Concessionaires were typically corporate entities whose only substantial asset was the concession itself, and the identities of the people who controlled these concessions were not normally made public. *The Economist* wrote in 1990 that "Sarawak's chief minister hands out logging licenses at his discretion," that the chief minister before 1987 had granted concessions covering over 3 million acres to members of his own family, and that the chief minister's replacement, himself a relative of his predecessor, had allocated another 4 million acres to his family members. The state's tourism and environment minister "exercises no restraint—but then he owns three large concessions himself," *The Economist* wrote.[26]

Illegal logging by some concessionaires, their contractors, or other parties was held to be a significant problem. With only about 1,600 employees in total, the Sarawak Forest Department policed a rugged, undeveloped, largely roadless area the size of the state of New York. Harvest targets were difficult to enforce. A single log of meranti, the most widely harvested hardwood tree in Sarawak, might contain wood worth two and a half months' income for the average Malaysian.

Malaysian government officials argued that the existing system, however imperfect, was better than any imaginable alternative. "If the actual harvests are 10% to 20% greater than the amounts in the Forest Management Plan, that is an acceptable price to pay for political stability," said one senior minister.

Encouragement of Downstream Industries

The governments of Malaysia, Sarawak, and Sabah all used subsidies and tax breaks to encourage the local production of lumber, veneer, furniture, and other wood products. At the same time, they restricted entry into wood processing industries: firms required government licenses in order to build new factories. Despite the incentives, the export of logs from Sabah and Sarawak remained the most valuable operation in the Malaysian forest products sector in the early 1990s (see **Exhibit 10**).

EXHIBIT 10

Wood production and exports

A. Wood products production and exports (includes lumber, plywood, and veneer)	W. Malaysia	Sarawak	Sabah	Total
Production, 1980 (thousands of cubic meters)	6,112	380	646	7,138
Production, 1990 (thousands of cubic meters)	7,529	781	2,375	10,685
Exports, 1990 (thousands of cubic meters)	3,642	544	2,391	6,577
Exports/production, 1990	48%	70%	101%	62%
Annual growth rate in production, 1980–1990	2.1%	7.5%	3.9%	4.1%

B. Log production and exports	W. Malaysia	Sarawak	Sabah	Total
Production, 1980 (thousands of cubic meters)	10,453	8,399	9,063	27,915
Production, 1990 (thousands of cubic meters)	10,620	18,838	8,445	37,903
Exports, 1990 (thousands of cubic meters)		15,898	4,564	20,462
Exports/production, 1990	0%	84%	54%	54%
Annual growth rate in production, 1980–1990	0.2%	8.4%	–0.7%	3.1%

C. Destination and value of Malaysian log exports	Japan	Korea	Taiwan	Thailand	All Other	Total
Volume, 1980 (thousands of cubic meters)	8,825	1,689	2,847	—	1,725	15,087
Volume, 1990 (thousands of cubic meters)	10,439	3,118	3,137	765	2,857	20,316
Average value, 1980 (M$/cubic meter)	200	180	123	NA	114	173
Average value, 1990 (M$/cubic meter)	222	194	149	208	171	199

Note: Total export figure for 1990 differs slightly between parts B and C of this exhibit due to inconsistencies in original data.

Sources: Malaysian Ministry of Primary Industries, “Statistics on Commodities,” pp. 150ff.; Sarawak Forest Department, “Forestry in Sarawak,” p. 35.

In 1985, the Malaysian government banned the export of unprocessed logs from peninsular Malaysia to encourage the domestic processing of wood. By 1991, officials were thinking of raising export duties on lumber and plywood to encourage even further vertical integration. For similar reasons, the Malaysian federal government encouraged the restrictions of log exports from Sabah and Sarawak, but log exports from East Malaysia continued in the early 1990s.

Downstream integration into lumber, plywood, or furniture would free Malaysia from the alleged collusion of the Japanese trading firms who purchased most of the logs, as well as from the usual tyranny of volatile commodity prices. Downstream integration would increase employment in the forest products sector; it arguably would reduce the pressure on the forests at the same time, since the same amount of timber would produce more jobs and export revenues. (In Sarawak, timber and related industries were said to employ about 75,000 people, or close to a tenth of the market labor force.)

The Sarawak state government rebated 80% of the royalties on logs if the logs were processed within the state boundaries. In addition, the federal Malaysian government offered generous tax breaks for companies investing in wood processing factories. Companies with "pioneer status," which included most forest products companies in Sarawak, received five-year exemptions from income tax, and investment tax credits further reduced the federal tax burden for new wood processing firms.[27]

Environmental Concerns

According to a widely cited report by the World Commission on Environment and Development (WCED), about 2.25 billion acres of tropical rain forest still existed worldwide in the 1980s. By that time, however, human activity had destroyed the forest cover on another 1.5 billion to 1.75 billion acres. Each year, more than 25 million acres of tropical rain forest were eliminated, and another 25 million acres were seriously disrupted.[28]

For several reasons, this loss of tropical rain forest was deeply disturbing to environmentalists. At the local level, loss of forest cover could increase erosion, soil loss, and the chance of catastrophic floods. Tropical deforestation also accelerated the extinction of plant and animal species. Although they covered only 6% of Earth's land area, tropical rain forests contained at least half, and possibly up to 90%, of the world's species of plants and animals. Many biologists believed that the human-caused rate of species extinction was hundreds or thousands of times higher than the background rate.[29]

Loss of these species, most of which had been poorly studied and many of which probably were never identified, meant that any potential they might have for human development went untapped. Many wild species had already proven useful in producing medicines, in creating new strains of agricultural crops, or in contributing "gums, oils, resins, dyes, tannins, vegetable fats and waxes, insecticides, and many other compounds."[30] Unknown numbers of other species might prove similarly useful.

Loss of forest cover was also thought to contribute to increases in global average temperature caused by the buildup of carbon dioxide and other gases in the earth's atmosphere. Different studies suggested that between 5% and 15% of global climate change might be due to deforestation.[31]

Although Malaysia contained no more than 2% to 3% of the world's tropical forests, the thick forests—rich in biological resources—that covered the hills of northern Borneo received particular attention from environmental groups and the Western press, and were the center of especially heated controversy.

Reliable data on timber harvesting and forest loss were difficult to obtain in Malaysia and in most other tropical countries. It appeared, though, that logging in Malaysia had affected between 2% and 4% of the country's forested area annually during the 1980s (see **Exhibit 9**). Western environmental groups argued that the amounts of timber harvested exceeded the growth of the remaining timber, so that the forests were being "mined." This raised questions about economic welfare in the long run as timber harvests declined.[32]

Malaysian forestry officials disagreed. First, they argued that the environmentalists failed to realize that logging an acre of rain forest did not mean destroying it; trees would be left standing on the site, and the same acre could be logged again 25 or 30 years later. Second, while acknowledging that timber harvests from Malaysia as a whole were greater than the sustainable level, the officials thought it made no sense to include forests slated for conversion to agricultural use in calculating the sustainable yield.

Further, Malaysian government officials felt that small-scale, temporary conversion to agriculture was a bigger problem than commercial logging. Rural people would clear and burn small patches of jungle and plant crops, moving on to clear and burn other areas a few years later. According to the Sarawak forest department, a state agency, shifting cultivation was responsible for much of the forest loss in Sarawak.[33]

Some Western groups also argued that logging violated the rights of self-determination of indigenous people in the Borneo jungle. Attention centered on the Penans, nomadic forest dwellers whose way of life was threatened by logging; their number was estimated at 9,000 by the Singaporean and Malaysian British Society (SIMBA), although Malaysian government officials said that only 300 still pursued a traditional nomadic way of life. When indigenous people tried to stop the logging by burning bridges or blocking roads, they were prosecuted and jailed.[34]

POSSIBLE CHANGES IN FOREST MANAGEMENT

The ITTO Report and Its Recommendations

In 1989 and 1990, the governments of Sarwak and Malaysia invited the International Tropical Timber Organization (ITTO) to send a group of observers to Sarawak to visit the timberlands, assess forestry practices, and present some recommendations. The ITTO, whose member governments were exporters and consumers of tropical forest products, worked with both environmental groups and trade associations. Its purpose was "to strike a balance between utilization and conservation of tropical forest resources through enhanced benefits to promote sustainable management of such forests."[35]

The mission released its report to the ITTO in May 1990. Its central recommendation was that the timber harvest in Sarawak be reduced to 9.2 million cubic meters per year: 6.3 million cubic meters per year from the PFE, and another 2.9 million from the statelands that apparently were not needed for conversion to agriculture or plantations.[36] The mission based this recommendation on its own calculation of the sustainable annual yield from the PFE and the stateland forests in Sarawak, after excluding the parts of the forest that it thought were too steep to be logged in an environmentally acceptable manner. According to foresters in the Sarawak government, harvests in the state in 1990 totaled about 18 million cubic meters, or nearly twice the total that the ITTO recommended. About one-third of this total came from land clearing on the statelands, and the rest from the PFE. The Sarawak government stated formally that it "accepts in principle the recommendations in the ITTO Mission Report and will implement the recommendations based on available resources and with the assistance and cooperation of the international community."[37]

Controversy persisted after the ITTO report was released. One of the mission's main recommendations was that "the staff of the Forest Department must be comprehensively strengthened."[38] A year and a half after the mission's completion, however, practically no new foresters had been hired. The Sarawak government needed permission from the federal government to increase its employment; officials in the Forest Department said they were anxious to hire at least 400 people, but that officials in Kuala Lumpur were sitting on the necessary paperwork. Federal officials countered that responsibility for the hiring really rested in the Sarawak capital of Kuching. Meanwhile, harvests continued at a rate well above the ITTO recommendations.

Other Measures

Many observers, including the ITTO mission, suggested that the Sarawak and Malaysia governments increase the size of their Totally Protected Areas (national parks and wildlife preserves). Sarawak had agreed to quadruple the acreage of those areas. This meant management headaches in the short run, as people were displaced from areas where they had traditionally used the forest, and could also mean forgone revenues in the long term. In response, some westerners suggested that, since the Sarawak rain forests were in effect a globally valuable asset, the inhabitants of Borneo should somehow be compensated for maintaining them in a pristine state.

A Western Timber Ban?

Less-patient environmentalists suggested that Western nations ban imports of forest products from Malaysia until the government reformed its forest policies.[39] In response, Malaysians pointed out that most of the furniture they exported to the United States and Europe originated in West Malaysia, while all of the log exports came from East Malaysia. Further, Malaysia's biggest log customers were in the Far East. It seemed unlikely that they would join any sort of boycott of Malaysian wood.

Many Malaysians saw behind the proposed timber trade restrictions the sinister hand of the Western softwood timber producers. Government officials and industry leaders alike spoke of alliances between the Western environmental groups and the companies that produce lumber and plywood in North America and Scandinavia. "They are worried that they will lose market share to tropical timber, so they fund the environmental groups to engage in anti-tropical hardwood campaigns," said one official. And Prime Minister Mahathir's own speechwriters had written in the draft of the address he was to give before the United Nations in September 1991 that "the idea that the tropical forests can be saved only by boycotting tropical timber smacks more of economic arm-twisting than a real desire to save the forests. . . . This is a ploy to keep us poor."[40]

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14. Margaret Scott, "Where the Quota Is King," *The New York Times*, November 17, 1991, VI, p. 63.
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18. Malaysia, "Second Outline Perspective Plan," pp. 45, 7–21.
19. Quoted by Scott, p. 67.
20. Colquhoun, p. 8.
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22. Andrew Cowley, "Asia's Emerging Economies," *The Economist*, November 16, 1991, Survey p. 17.

23. Ministry of Primary Industries Malaysia, "Forestry in Malaysia" (n.d.), p. 6.

24. Ministry of Primary Industries Malaysia, "Statistics on Commodities" (1991), pp. 156–157.

25. In "The dwindling forest beyond Long San," *The Economist* (August 18, 1990, pp. 23ff.) reported that royalties in Sarawak were just 2% of the timber's value. In 1990, the Sarawak government took in 520 million Malaysian ringgits (M$) in timber tax revenues, according to government budget documents; that year, log exports from the state were worth about M$2,800 million. Various premiums totalled M$52 million in 1990.

26. "The dwindling forest beyond Long San," *The Economist* (August 18, 1990), p. 23.

27. Ministry of Primary Industries Malaysia, "Profile: Malaysia's Primary Commodities," p. 1.

28. World Commission on Environment and Development, *Our Common Future* [also known as "the Brundtland report"; hereinafter cited as "WCED"] (Oxford: Oxford U.P., 1987), p. 151.

29. WCED, p. 150.

30. WCED, p. 156.

31. See "Global Climate Change" and Supplements (HBS Case Nos. 391-180 through 391-188).

32. See "Sarawak: The Disposable Forest."

33. Sarawak Forest Department, "Forestry in Sarawak" (Kuching, 1991), p. 8; see also Ministry of Primary Industries Malaysia, "Profile: Malaysia's Primary Commodities," p. l38.

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ALLENTOWN MATERIALS CORPORATION: THE ELECTRONIC PRODUCTS DIVISION (ABRIDGED)

In July 1992, Don Rogers took a moment to reflect on the state of his organization. He had become the Vice President and General Manager of the Electronic Products Division (EPD) at Allentown Materials Corporation following his predecessor's untimely death two years before. The EPD faced a number of problems, and Rogers was not sure what he needed to do. He felt increasing pressure from headquarters. EPD was expected to continue to meet the corporation's 10% average annual growth rate and aggressive profit targets, despite increased competition in the electronic components industry. The division's performance had declined in 1991 and 1992 (See **Exhibit 1** for EPD's operating data) and most component manufacturers anticipated that they were competing for a shrinking total market. In addition, EPD's reputation for delivery and service had slipped, and their number of missed commitments was very high. Rogers commented:

I have had some difficult times in my division over the past two years. Our business is becoming fiercely competitive and this has led to a decrease in sales. To deal with the downturn in business we have reduced the number of people and expenses sharply. This has been painful, but I think

EXHIBIT 1

EDP sales and operating income, 1985–1992 ($ thousands)

	1985	1986	1987	1988	1989	1990	1991	1992
Sales	$54,518	$93,177	$93,852	$85,854	$108,496	$113,780	$102,206	$102,986
Operating income*	12,902	23,349	24,964	12,846	21,746	17,868	6,680	6,745

*Income margin equals less manufacturing, administrative, and sales expenses.

Source: Company records.

This case was prepared by Research Associate Jennifer M. Suesse (under the direction of Professor Michael Beer).

these actions have stemmed the tide. We are in control again, but the business continues to be very competitive. Morale is low; there is a lot of conflict between groups that we can not seem to resolve. There is a lack of mutual confidence and trust. The organization is just not pulling together and the lack of coordination is affecting our ability to develop new products. Most of my key people believe that we are having conflicts because business is bad. They say that if business would only get better we will stop crabbing at each other. Frankly, I am not sure if they are right. The conflicts might be due to the pressures we are under but more likely they indicate a more fundamental problem. I need to determine if the conflict between groups is serious, so I can decide what I should do about it.

ALLENTOWN MATERIALS CORPORATION

Allentown Materials Corporation, a leading manufacturer of specialty glass, was established in Allentown, Pennsylvania, in the late-1800s. The corporation's growth and reputation were based on its ability to invent and manufacture new glass products, and it had major businesses in a number of different glass and ceramic markets. In 1992, Allentown was in a strong financial and profit position. Its investment in R&D as a percent of sales was quite significant in comparison with that of other companies in industry. The company had established the first industrial research laboratory in the early 1900s, the Technical Staffs Division (R&D), which conducted basic research and product and process research in glass and related technologies. Strength in manufacturing contributed to Allentown's technological edge. Until now, Allentown had always been in the enviable position of growing profitably without substantial competitive pressures. Patents, technological know-how in manufacturing, and the requirement of substantial capital investment made it difficult for others to offer serious threats.

Corporate organization Allentown's corporate organization reflected the close link between its growth and its technology. R&D was highly regarded by top management. Its vice president reported directly to the chairman of the board. Next to R&D, Allentown's strongest functional area was manufacturing. Many considered it to be the function through which one could rise to the top, as many of the company's top executives had been promoted from the ranks of manufacturing. To foster a strong manufacturing orientation, the company had developed a control system in which plants were viewed as profit centers. Financial results were reported every 28 days and were reviewed 13 times a year. These periodic reviews were conducted at all levels of the corporation.

For many years all of Allentown's operations were based in its headquarters, but as the company grew, plants and sales offices were established throughout the world. In 1992, all but two of the corporation's eight line divisions had their headquarters in Allentown. Thus, most divisions could discuss business problems on a face-to-face basis; the corporation operated like a relatively close-knit family. People saw each other frequently on Allentown's premises, on the streets of the town, and on social occasions. People at all levels and from diverse parts of the corporation interacted informally. It would not be uncommon for top-level corporate officers to meet divisional personnel in the main office building and to engage them in informal discussions about the state of their business—asking about orders, shipments, sales, and profits for the period.

THE EPD AND ITS HISTORY

The Electronic Products Division (EPD) manufactured high-quality electronic components (resistors and capacitors) for several markets. More than half of the EPD's 1992 sales were to original equipment manufacturers (OEMs) who bought resistors and capacitors in large volume for use in a variety of their products. The remainder of the division's sales were to distributors who resold the components in smaller quantities. Much like other Allentown businesses, the components business grew due to the EPD's unique technological capabilities. Many of their competitively unique new products were invented in response to needs from OEMs who wanted the EPD to apply its research and development strength to meet their stringent component specifications.

The Component Market Through the mid-1980s, the space program and the military's reliance on missile defense systems created demand for highly reliable components, since failure threatened the integrity of very sophisticated and expensive equipment. The government was willing to pay premium prices for components that met its very strict specifications, and Allentown's knowledge base enabled it to serve this market well.

In the late 1980s, the nature of EPD's business began to shift. As the cold war began to ebb and the military market declined, the division concentrated more of its efforts in commercial markets. For example, the personal computer (PC) market was exploding. The growing market in telecommunications devices, such as cellular telephones, personal pagers (beepers), facsimile machines, and other consumer electronics products also provided new opportunities for the EPD components. Using its unique technological capabilities in product development and manufacturing, the EPD was able to enter these new markets and quickly establish a major position in them. In response to the high-volume demands of these markets, the EPD built a plant in Evans, Georgia in 1990.

By 1992, 60% of the EPD's sales were to the computer, telecommunications and consumer electronics markets. The EPD's management felt continual pressure to extend existing product lines as OEMs developed new end-use products for their growing markets. Responding to customers' unique needs with new product extensions was a competitive necessity because new products commanded higher prices in their early stages of development and thereby offered an opportunity for growth. At the same time that these commercial markets were growing, buyers were becoming more price sensitive. This prompted increased and often fierce price competition among component suppliers.

Competition hinged primarily on price but quality and service were also important. Customers were giving special consideration to manufacturers that could assure short delivery lead times (usually no more than four weeks), but efficiency in manufacturing operations demanded longer lead times. Stricter quality standards were also being demanded because poor quality often could shut down an OEM's production operation. As suppliers competed for large-volume contracts from major OEMs, prices fell sharply, putting pressure on costs. To Rogers and his managers, it appeared as if the EPD was becoming a commodity business.

The EPD's future in this dynamic and uncertain environment looked bleak indeed. It was the subject of much discussion and controversy in the division. Volume could always be increased by taking low-price business, but this reduced profitability. Most people within EPD looked to new products as a major source of both new volume and profits. Some managers wondered whether their division could meet Allentown's high expectations for profitability and growth, or even survive.

Management History: Joe Bennett's legacy Before 1990, Joe Bennett headed the EPD. An entrepreneur who sought to get his division into new businesses, Bennett had been in charge of the EPD since its infancy and nurtured it into a significant business for Allentown. Under Bennett's leadership, the EPD was one of the two Allentown divisions with headquarters outside Allentown, Pennsylvania. This was a source of some pride to Bennett. He fostered the desire to grow and a spirit of experimentation at the EPD. For example, Bennett seized one opportunity for growth by personally initiating research into a new technology that sought to bridge components and integrated circuits. Scott Allen, the division's controller until 1990, felt Bennett exemplified the division's strengths:

> *We always tried new things. We always experimented. We set a fast pace. There was a feeling of urgency and commitment and dissatisfaction with the status quo. As an example, we were 14 steps ahead in computer applications. This stemmed from Bennett and the dynamic industry we were in.*

Bennett, who was 48 years old when he died, was a big man with a quick and creative mind. He ran the division almost single-handedly. For example, both the Barnett (capacitors) and the Hopewell (resistors) plants had separate on-site market development and product development groups. The managers of all these groups reported to Bennett. Many of the key decisions were made by him and none were made without his knowledge and approval. People respected and also feared Bennett. A product development manager for capacitors described Bennett and his style:

> *Joe was very authoritarian with me and others. As a result, the most successful people working for Bennett were political and manipulative. People did not extend themselves very much to disagree with him.*
>
> *Bennett had a significant impact on our organization; our managerial styles came to reflect his. We were all more authoritarian than we might otherwise have been. I was less willing to let my*

> *people make mistakes even though I thought it was important that people learn from their mistakes. The pressure and unrealistic standards were transmitted down to people throughout the organization. This resulted in our commitments often being unrealistic.*
>
> *There was little group activity and decision making by the top team except where there was a specific problem. It was not a natural group. We were never together except at formal managers' meetings. There was no cohesiveness in the group reporting to Bennett.*

Bennett was a man of paradoxes. Although most people felt he was extremely directive in his management style, he was intensely interested in the field of organizational behavior and its applications to management. In 1989, Bennett initiated a division-wide management and organization development program. The program was to include several phases: an examination of individual management styles, group effectiveness, interfunctional coordination, and organization-wide problems. In all phases, action plans for improvement were to be developed.

DON ROGERS TAKES CHARGE

When Rogers took charge in June 1990, he inherited an organization which employed 900 people, 175 of whom were salaried managerial and professional employees. It had three plants and four sales districts and, with the exception of some R&D support from Allentown's Technical Staff Division, was a self-contained multifunction organization. Reporting to Don Rogers was a controller, a manufacturing manager, a marketing manager, a sales manager, and a product development manager. (**Exhibits 2** & **3** provide information about the EPD's organization.)

Rogers' managerial background Prior to 1990, Rogers had been the director of electronic materials research in Allentown's Technical Staffs Division. His promotion to Vice President and General Manager was considered unusual because he lacked line experience. However, most of his colleagues realized that his knowledge and background were relevant to the EPD's business and he had a number of qualities that indicated his potential for a top management position. As electronic materials research director, Rogers had been responsible for all the research and development work going on in Technical Staffs. He was therefore knowledgeable about EPD's technology. He often sat in on the EPD's meetings and had a general knowledge of the electronics business.

Rogers also had considerable personal assets. He was very bright, quick thinking, and could express himself extremely well in both small and large groups. EPD managers were impressed by his capacity to grasp a wide variety of complex problems ranging from technical to managerial. He was always very pleasant and friendly and could get people to be open with him, since he was also ready to share information and his own thoughts. In fact, people were often surprised by the things he was willing to reveal and discuss. He also involved people in problems and consulted them on decisions.

EXHIBIT 2

Background of EPD executives

Don Rogers—vice president and general manager, Electronic Products Division, 40 years old. He received a Ph.D. in chemistry from the University of Cincinnati, a master's in chemistry from St. Johns University, and a B.S. from Queens College in New York City. He joined Allentown in 1981 as a chemist in its Technical Staffs Division (R&D). In 1985 he became manager of electronic research and in 1988 director of electronic materials research in the same division. He was appointed the EPD's division manager in June 1990.

Bill Lee—marketing manager, 39 years old. He received a B.S. in chemical engineering from Rutgers. He joined Allentown Materials in 1974 as a staff engineer, and subsequently held several engineering and supervisory positions in glass plants. Following an assignment in corporate market planning, he became manager of marketing in the EPD in 1991.

Ben Smith—manufacturing manager, 43 years old. He received an engineering degree from Clarkson College. He became EPD's manufacturing manager in 1991 following numerous manufacturing positions in Allentown's Computer Products and Technical Products Divisions. He had started as a plant engineer and had also been a department supervisor, production superintendent, and plant manager in several glass plants in these divisions. Just before moving to the EPD he had been manufacturing manager in the Laboratory Glassware Division.

Ted Moss—product development manager, 45 years old. After receiving a degree in mechanical engineering from City College in New York City, he joined Allentown Materials Corporation as a staff engineer. After five years in other divisions he joined EPD in its early infancy. He served as a project engineer first and then held several managerial positions in product and process development. He became manager of product development for the EPD in 1992.

Carolyn Green—division controller, 31 years old. She joined Allentown Materials Corporation in 1986 after completing a B.S. in industrial administration at Yale, working in a major accounting firm, and completing an MBA at the Harvard Business School. Before joining the EPD as its division controller in 1991, she served in a variety of plant accounting positions in Allentown's Computer Products and Display Panel Products Divisions.

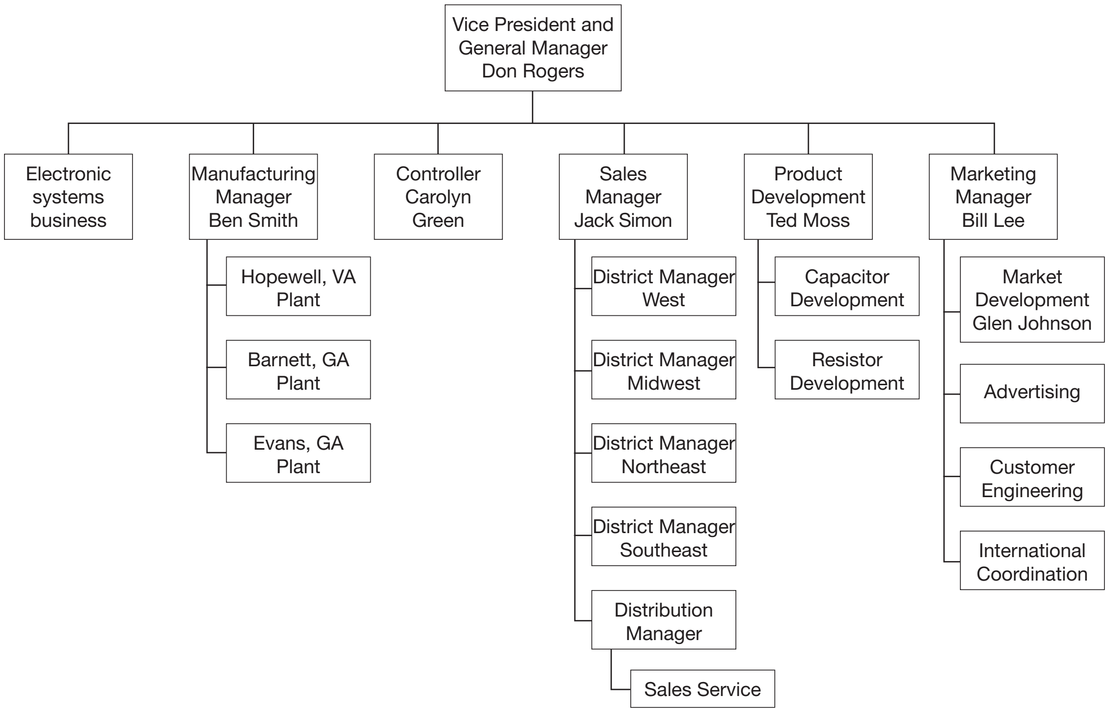
Jack Simon—sales manager, 34 years old. He went to St. Bonaventure University, where he received a degree in sociology. He joined Allentown in 1988 as a salesman. All of his experience with Allentown was with the EPD. He was a district sales manager when promoted to the division's sales manager in 1991.

Despite these very positive attributes and managers' genuine liking and respect for Rogers, some aspects of his management style attracted criticism. His personality and his superior intellectual capabilities almost always assured that he was a dominant force in meetings. Some also had questions about how comfortable he was with conflict and how much leadership he took in difficult situations. Some of the EPD's managers described Rogers' style:

> *Rogers does not listen too well. He interrupts, which prevents him from hearing others' opinions and makes it seem as if he really does not want criticism. What's more, he has been too soft on me. He should be holding me to my goals. I have not met some of these goals and he should be climbing all over me. Furthermore, you get the same record back from him regardless of what you say. It is safe to be open with him and tell him what's on your mind, but he does not always hear what you are saying.*
>
> *He is not involved enough in the problems that arise from differences in the goals of functional departments. This may be because he spends too much time away on corporate assignments. But it doesn't change the fact that he is not involved enough.*
>
> *Wave-makers are not wanted in the division and are being pushed out. People at the top do not create and confront conflict.*

EXHIBIT 3

Electronic Products Division organizational chart



Source: Company records.

Rogers' actions When Rogers became Vice President and General Manager of the EPD, he made a number of changes in the organization. At the urging of top management and believing that the EPD had to learn to relate more closely to the corporation, Rogers moved the headquarters from Barnett to Allentown. He also brought the market development groups back to Allentown. Furthermore, although the product development groups themselves remained at the plants, Rogers consolidated product development under Ted Moss, who was located in Allentown. Shortly after his promotion, Rogers also separated the marketing and sales functions. As he said later:

> *It seemed to me that marketing and sales had sufficiently different responsibilities to justify their separation. Sales, I felt, should be concerned with knocking on doors and getting the order while marketing should be concerned with strategies for pricing, new products, and identification of new opportunities for the future. Marketing is a strategic function, as opposed to a day-to-day function.*

Another major change had to do with personnel. Rogers replaced all of his key managers with the exception of Ted Moss, the product development manager. Ben Smith, the new manufacturing manager, had held a similar job in Allentown's Laboratory Products Division. Bill Lee, the new marketing manager, had held positions in manufacturing in Allentown's other divisions and had recently been in charge of corporate market planning. Carolyn Green, the new controller, had worked in plants in Allentown's Computer Products Division. Of the new division staff only Jack Simon, the new sales manager, came from within the EPD.

Rogers also turned to improving the EPD's service. An information system was developed by the sales service function. In addition, the manufacturing manager held plant managers responsible for meeting specific goals for delivery commitments and shortening delivery lead times. Furthermore, Rogers requested a report on Bennett's organizational behavior program, which originally was designed to span a three-year period. Rogers learned that the program had made a positive impact on the division, but that the final phase, dealing with the improvement of interfunctional coordination, was not yet complete. In light of business difficulties and his relative newness to the division, Rogers decided to discontinue Bennett's program. He was not sure that the program was an effective way to tackle the problems he faced. He decided to review what he knew about each of the functional areas.

REVIEW OF THE FUNCTIONAL DEPARTMENTS IN 1992

Manufacturing Resistors and capacitors were manufactured in high volume at three plants—located in Evans, Georgia (resistors), Hopewell, Virginia (resistors), and Barnett, Georgia (capacitors). Each of these plants had a plant manager and a full complement of line and staff functions including production, engineering, quality control, purchasing, accounting and control, and personnel.

The plant managers, with one exception, had grown up in the EPD. As profit center managers, their performance was evaluated on the basis of gross margins and other manufacturing variances, including lead times and missed delivery commitments to customers. These plant managers felt that their reputations and therefore their promotability were dependent on plant growth and good gross margin performance. All saw their future advancement within the manufacturing hierarchy of the company leading to the possibility of promotion to general manager of a division. Since manufacturing was the dominant function, such an expectation was not unrealistic.

EPD's plant managers were extremely upset by the lack of growth in the division's business. In the last two years their volume had shrunk and, because of price cuts, their dollar volume had dropped substantially. Managers were thus under enormous pressure to reduce costs in order to maintain their gross margins. While they were able to reduce some costs, gross margins still declined. With some exceptions, EPD's plants had the smallest gross margins in the company. Plant managers expressed the following statements:

> *We are experiencing price erosion in our product lines, and I do not see a large number of new products. We need something new and unique. I do not see growth potential in our existing products.*

The frustration experienced by the manufacturing people was expressed most in their attitudes toward the sales and marketing functions. They felt sales focused exclusively on volume with no concern for gross margin. They blamed sales for getting low-gross-margin business and not fighting hard enough to get better price. Sales, in other words, was giving profits away at manufacturing's expense, and sales was not penalized for it.

Manufacturing was even more critical of the marketing function. They felt that marketing had failed in its responsibility to provide the division with a direction for profitable growth. They particularly blamed Bill Lee, the marketing manager, for lack of "strong leadership." They were upset by what they called the "disappearing carrot syndrome." As manufacturing saw it, marketing would come to the plant and project a market of several million dollars for a new resistor or capacitor (the carrot). On the basis of this projection, manufacturing would run samples and make other investments in preparation for the new product only to find out six months or a year later that marketing was now projecting much smaller sales and profits. Manufacturing concluded that marketing lacked the ability to forecast marketing trends accurately and was generally incompetent. Many felt that Bill Lee and some of his staff should be replaced.

Manufacturing was also unhappy with product development, which they felt had not always given them products that would run well on their production lines. They looked to product development to identify new low-cost components and saw nothing coming. When product development requested special runs on their manufacturing lines to develop new products, manufacturing wondered how they would be compensated for this sacrifice in efficiency.

Marketing Marketing comprised several activities, including customer engineering, advertising, and its most important function, market development. Under Glen Johnson, market development was responsible for developing sales projections for the next year, market plans for the next three years, analyses of market share, and plans for improving market position. One of the primary means for increasing market share was the development of new types of resistors and capacitors (product extensions). It was market development's responsibility to identify these new opportunities and to assure the development of new products in coordination with other functions. Because the identification of new market opportunities was primarily their responsibility (with help from sales), as was the development of the new product plan, marketing felt the pressure for new product development fell on them.

The marketing function had many new people since it had been established as a separate function just a year earlier. Most of the people had transferred from the sales department. Johnson, for example, had been a district sales manager. The marketing specialists were generally recent technical or business graduates with one or two years of sales experience.

Overwhelmed by the tough job of forecasting, planning, and formulating strategy in a very turbulent marketplace, the marketing people felt that no one appreciated their difficulties. Some felt that Allentown had such high standards for profitability on new products that it was impossible to meet them in the components business. Johnson, the market development manager, said:

> *While corporate financial people will admit that we need a different set of criteria, they informally convey to us that we are doing a lousy job, and it makes us run conservatively. The corporate environment is not a risk-taking one. We tend to want to bring a proprietary advantage to our business which we cannot do. This is slowing us down.*

Marketing people were also critical of product development and its responsiveness to the divisions' needs. As marketing people saw it, product development's priorities were wrong and their projects were always late. According to Johnson, "Moss takes projects on without fully considering the resource implications. There are no procedures or criteria to establish priorities in development. Seventy percent of his time is in process rather than product development."

Marketing felt most resentful about the lack of cooperation and the continual sniping from manufacturing. They saw manufacturing as conservative and unwilling to take risks. This was particularly aggravating because many marketing people felt they were distracted from their primary responsibility by having to spend inordinate amounts of time dealing with manufacturing. Johnson indicated that he would not have taken the marketing job had he known that it would involve the many frustrations of getting manufacturing and others to do things.

Sales EPD products were sold through a direct selling force of approximately 25 salespeople, organized into four sales districts. Each district was managed by a district sales manager who reported to the national sales manager, Jack Simon. Simon, like all the district sales managers, had come up through sales. The direct sales force visited manufacturers whose products incorporated electrical components, with the objective of learning about the customer's needs by talking to purchasing agents and design engineers, and then obtaining contracts for resistors or capacitors. The sales force consisted of both college graduates and older, more experienced salespeople who had worked in this industry for a long time.

The sales force was integrated, meaning that EPD salespeople sold capacitors and resistors to the same customers. Thus, the EPD sales force had to develop many relationships with purchasing agents and engineers, and relied on good relationships to obtain market intelligence and an opportunity to bid on contracts. But salespeople also had to negotiate with these same people to obtain the best possible price. Since their performance was evaluated on the basis of sales volume, they worked hard to beat their budgeted sales targets. However, the sales force was not paid on a commission basis; this was a subject of some discussion and discontent amongst them.

Simon reported mistrust, gamesmanship, maneuvering, and politicking between sales and marketing. He said, "We in sales do not believe that the information marketing gives us is the best." Major conflict arose in budget-setting sessions, partly because sales based its forecasts on customer canvassing while marketing used analytical tools to develop its projections. Simon said, "Conflicts are not resolved based on facts. Instead there are accusations. I don't trust them [marketing], and I do not trust that they have the capability to do their jobs." His view of manufacturing was somewhat more positive:

> *Relations with manufacturing are personally good, but I have a number of concerns. I do not know and no one knows about actual cost reductions in the plant. I don't think manufacturing gets hit as hard for lack of cost reduction as sales takes it on the chin for price reductions. Another problem is Hopewell's service. It's putrid! There is constant gamesmanship in the Hopewell plant.*

At lower levels of the organization, relationships between sales and manufacturing seemed even worse. There were shouting matches over the telephone between the Midwest district sales manager and the Evans plant manager. In one instance, sales had requested quick delivery to meet a major customer's needs, feeling that a slow response would damage the EPD's position with the customer. The plant said it could not provide delivery on such short notice without upsetting plant operations. The sales service manager commented, "The relationship with the Hopewell plant is bad. Measurement for plant managers has to change. They are not really measured on service. Things have improved somewhat, however, and they are a bit more concerned about service."

Product Development Unlike the other Allentown divisions, the EPD had its own product development group. The EPD's product development group was responsible for developing extensions of the current product line, although they also relied on Technical Staffs for research and development support. (Most other divisions relied totally on the Technical Staffs Division for technical product development support and only had engineering groups for manufacturing staff support.) The product development department often became involved in manufacturing process development as well.

Usually, between 10 and 12 new product development projects were under way, often requiring significant technological development. The development group was divided into two parts: resistors (located in the Hopewell plant) and capacitors (located in Barnett). The manager of product development was based in Allentown, Pennsylvania, along with the rest of the divisional staff. The group was composed of technical people who had spent their careers in research and development work. While some of these people had come from the corporate R&D group, many had worked in the division for most of their careers or had held technical positions in other companies in the electronics industry. Ted Moss, manager of product development, described his relationship with other groups:

In general, my department's relations with the plants are pretty good although some problems exist at Hopewell. My biggest concern is with marketing. I do not feel that marketing provides detailed product specification for new products. In addition, marketing people do not understand what is involved in specification changes. I think that writing specifications jointly with marketing would help this problem. Another problem is that marketing people have to look ahead more and predict the future better. They always need it yesterday. We need time!

We also have problems with sales. We need comments from the sales group on our new products. I wanted to get the call reports they write and asked Simon for copies. He would not give them to me because, 'the marketing department has the responsibility for interpretation.' I finally had to go to Rogers to resolve the problem.

Moss was also critical of Allentown's Technical Staffs Division, which on occasion did product development work for the EPD:

It is difficult to get a time schedule from them. Their direction is independent of ours since they report elsewhere. They will not wring their hands if they are behind schedule. They will more quickly try to relax requirements for the development if it is behind schedule. I need more influence on specifications when it comes to things they are working on. I often have to go upstairs [to speak with their bosses] to solve the problems that occur with this group.

THE NEW PRODUCT DEVELOPMENT PROCESS

As Rogers completed his review of the functional areas, he continued to ponder the EPD's new product development process. Two recent situations illustrated that the process was far from smooth.

Two cases The situation with the W-1201 capacitor, a new product for the computer market, was one example. The W-1201 project had been killed and resurrected four times because different parts of the organization had differing knowledge of its status at given points in time. Marketing saw the W-1201 product as a clear opportunity and product development thought it was technically feasible. But sales questioned the product's ability to compete in the marketplace, because manufacturing's cost quotes were so high. As discussions progressed on needed product modifications to reduce costs, marketing's estimate of the potential market changed as did product development's assessment of technical feasibility. Because each function's management judged the viability of the product independently, the status of the project was never clear. At one point in time, salespeople were actually obtaining orders for samples of the W-1201 without knowing that manufacturing and marketing had decided that the product was unfeasible and had killed the idea.

In another case, severe conflict between marketing and plant personnel erupted over a potential new coating for resistors. Marketing had determined that a new, uniform coating was needed for competitive and efficiency reasons. They presented their views to the division's management and received what they thought was a commitment to change resistor coatings. But the plants were reluctant to convert their operations. They questioned whether product development had proved that the new coating would work and could be manufactured to meet product specifications at no additional cost. Moreover, the plants completely distrusted marketing's judgment of the need for this change. The marketing specialist in charge of the project would return from plant meetings angry and completely discouraged about his ability to influence plant people to advance the project.

Product Development Meetings Two day-long meetings were held in Allentown, Pennsylvania, once each accounting period (28 days) to discuss, coordinate, and make decisions about new products. Separate meetings were held for capacitors and resistors. In all, approximately 20 people attended each meeting, including the division manager, his immediate staff, plant managers, and a few other key people in the other functions.

A continual stream of people flowed in and out of these meetings to obtain information from subordinates in their functional area. It was not uncommon for a plant manager to leave the meeting to call an engineer in his plant for details about a project's status. At one meeting Ted Young, a marketing specialist, was repeatedly cited as the person who knew the most about the project under discussion, yet he was not present. On other occasions marketing specialists (who were located in Allentown) were called in to share their information about a project. If necessary, plant people and product development people were also sometimes brought to Allentown for the meeting.

The meetings were chaired by Johnson, the market development manager, who typically sat at the head of the table. Johnson published an agenda ahead of time and usually directed the discussion as it moved from one project to another. For each project, progress was checked against goals agreed to by each function at the previous review. Each function described in some detail what had been done in its area to support the project (for example, what equipment changes had been made in a plant). If a function had not met its goals, as was often the case, new deadlines were set. While problems encountered were always described, the issue of slippage in goals and the underlying reasons for it were rarely discussed. Differences in opinion usually proved very hard to resolve. Often, these conflicts were ended only when people agreed to disagree and moved on to the next item on the agenda. While tempers flared occasionally, open hostility or aggression was rarely expressed in the meetings. Afterward, however, people often met in pairs or small groups in the hallways, over coffee, or in other offices to continue the debate.

In the past, the division manager had not attended product development meetings. In 1992 marketing asked Rogers to attend these meetings to help in moving decisions along. Rogers took a very active part in the meetings; he usually sat across the table from Johnson. He often became involved in the discussion of a new product, particularly its technical aspects. Frequently he explained technical points to others who did not understand them. His viewpoints were clearly heard and felt by others, and people thought that meetings had improved since he decided to sit in. Nevertheless, Johnson still dreaded the product development meetings:

> *I never sleep well on the night before the meetings. I start thinking about the various projects and the problems I have in getting everyone to agree and be committed to a direction. We spend long hours in these meetings but people just don't seem to stick to their commitments to accomplish their objectives by a given date. Projects are slipping badly and we just can't seem to get them moving. In my opinion, we also have some projects that should be killed but we can't seem to be able to do that, either. Frankly, if I had it to do over again, I would not take this job. After all, how much marketing am I really doing? I seem to spend most of my time in meetings getting others to do things.*

THE OUTLOOK FOR 1993

Rogers knew that something needed to be done. As 1992 drew to a close, Rogers and his top management group were preparing for their second GLF (Great Leap Forward) meeting. This meeting had been instituted the year before as a forum for discussing major problem areas and developing commitment to division objectives for the coming year. Now it was time to look ahead to 1993.