

two process trains. The machine depreciation charges on the two process trains were broken out separately, as determined at the time the machinery was purchased. For example, the General process train originally cost \$500,000 ten years ago and had an expected life of five years, or about 10,000 hours, hence its depreciation rate of \$50 per hour.

The Analysis

Meredith was able to consolidate all of the information she collected into a spreadsheet. Making what she felt were

reasonable assumptions about relevant cost factors, she was able to optimize the production plan, and she determined that it should be possible to meet the 25 percent profitability target. Nevertheless, there seemed to be several factors in it that were subject to change—things that had come up in her various conversations, such as maintenance, warehousing, and the possibility of modifying the contract. She expected that Mr. Cox would quiz her about all of these factors, and she knew it would be important for her to be prepared for his questions.

THE BMW COMPANY

Late in the summer of 1989, the government of Germany was seriously considering an innovative policy affecting the treatment of scrapped vehicles. This policy would make auto manufacturers responsible for recycling and disposal of their vehicles at the end of their useful lives. Sometimes referred to as a "Producer Responsibility" policy, this regulation would obligate the manufacturers of automobiles to take back vehicles that were ready to be scrapped.

The auto takeback proposal was actually the first of several initiatives that would also affect the end-of-life (EOL) treatment of such other products as household appliances and consumer electronics. But in 1989, no other industry had faced anything like this new policy. Managers at BMW and other German automakers struggled to understand the implications for their own company. Perhaps the first exercise was to gauge the magnitude of the economic effect. Stated another way, management wanted to know what the cost of the new policy was likely to be, if BMW continued to do business as usual.

Background

A loose network of dismantlers and shredders managed most of the recycling and disposal of German vehicles, accounting for about 95 percent of EOL volume, or roughly 2.1 million vehicles per year. Dismantling was a labor-intensive process that removed auto parts, fluids, and materials that could be re-sold. The hulk that remained was sold to a shredder. Shredding was a capital-intensive business that separated the remaining materials into distinct streams. Ferrous metals were sold to steel producers, nonferrous metals were sold to specialized metal companies, and the remaining material was typically sent to landfills or incinerators. The material headed for disposal was known as Automobile Shredder Residue (ASR) and consisted of plastic, rubber, foam, glass, and dirt. ASR was virtually impossible to separate into portions with any economic value, so shredders paid for its removal and disposal. As of 1989, the annual volume of ASR came to about 400,000 tons. On average, an automobile stayed in service for about 10 years.

Although dismantlers and shredders were unaffiliated, private businesses in 1989, it was conceivable that, under the new government policy, they would be taken over by the auto companies. Even if they remained independently

owned businesses, the costs of dismantling and shredding would ultimately be borne by the auto companies, since the policy made them legally responsible for the waste.

Economics of disposal

The costs in this system had been increasing and, in fact, were about to increase more quickly due to two major trends, one involving disposal costs and the other involving material composition. On the material side, automobiles were being designed with less metal each year and more plastics. In the 1960s, a typical car was made up of more than 80 percent metal, but the new models of 1990 were only about 75 percent metal. This meant that more of the vehicle was destined to end up as ASR. Averaged across the market, autos weighed an average of about 1,000 kg each. See Exhibit 1 for some representative figures.

Exhibit 1. Material Trends in Automobile Composition

Material	1965	1985	1995 (est.)
Iron and Steel	76.0%	68.0%	63.0%
Lead, Copper, and Zinc	4.0%	4.0%	3.0%
Aluminum	2.0%	4.5%	6.5%
Plastics	2.0%	9.0%	13.0%
Fabric, Rubber, and Glass	16.0%	14.5%	14.5%

BMW 1989 Models	Weight (kg)	Plastics Content
3 series	1,150	11.3%
5 series	1,400	10.9%
7 series	1,650	10.3%

On the disposal side, a much more significant trend was in progress. As in most of Europe, landfill options were disappearing in Germany. In 1989, about half of the waste stream found its way to landfills, with 35 percent going to waste-to-energy incinerators, and the remaining 15 percent to recycling of some kind. But the number of landfills was declining, and it looked like this trend would continue, so that by 1999 landfill and incineration would handle approximately equal shares. The effects of supply and demand were visible in the costs of disposal at landfills. Exhibit 2 summarizes recent and projected costs.

Exhibit 2. Recent and Projected (*) Landfill Costs

Year	Cost (DM/ton)
1987	30
1988	40
1989	60
1990	120
1991*	200
1993*	500 ± 100
1995*	1200 ± 600

Many landfills were of older designs, and public concern about their environmental risks had grown. Recent environmental regulations were beginning to restrict the materials that could be taken to landfills, and there was a good chance that ASR would be prohibited. Specially designed hazardous waste landfills were an alternative, but they tended to be three or four times as costly as the typical solid-waste landfill.

Meanwhile, the number of incinerators had grown from a handful in the early 1960s to nearly 50 by 1989, with prospects for another 25 or more in the coming decade. However, incinerators were expensive to build, and awareness of their environmental impacts was growing. In particular, the incineration of plastics had come under special scrutiny. The

net effect was that incineration was about twice as costly as landfill disposal in 1989, and it was uncertain how the relative cost of incineration would evolve in the years to come.

Trends in the Market

Prior to the 1980s, BMW cars were known for their reliability and quality. Only during the 80s did BMW acquire a reputation for performance and begin to compete in the high-end market. As a result, its domestic market share had risen from about 5.6 percent at the start of the decade to 6.7 percent in 1989. Some details of financial and market performance for BMW are summarized in Exhibits 3 and 4.

In 1989, BMW seemed poised to benefit from its successes over the previous several years, having consolidated its position in the marketplace. Long-range forecasts predicted that the economy would grow by about 2 percent in the coming decade, with inflation at no more than 4 percent. However, the proposed takeback policy raised questions about whether the company's profitability could endure. Assuming that, in the new regulatory regime, automakers bear the cost of disposal, the task is to estimate how much of the firm's net income will be devoted to EOL vehicles 10 years into the future.

Exhibit 3. Selected Companywide Financial Data for BMW

	1989	1988	1987	1986	1985
Net Sales (DM millions)	20,960	19,880	17,660	15,000	14,240
Sales (Vehicles)	511,000	486,600	459,500	446,100	445,233
Production (Vehicles)	511,500	484,100	461,300	446,400	445,200
Net Income (DM millions)	386.0	375.0	375.0	337.5	300.0

Exhibit 4. Selected Market Data for BMW Automobiles

Cases	1989 Sales	1989 Share	1988 Sales	1988 Share
Germany	191,000	6.7%	180,200	6.4%
Europe (rest)	163,200	1.7%	153,100	1.9%
N. America	69,200	6.4%	78,800	6.8%
Other	57,300	1.1%	47,700	1.1%

THE ERP DECISION*

During the 1990s, many large companies began to realize that lack of integration among their information systems was leading to serious operational inefficiencies. Furthermore, these inefficiencies were beginning to cause many companies to lose ground to other, better-organized firms. At the same time, enterprise resource planning (ERP) software, especially SAP R/3 (<http://www.sap.com/>), was reaching a high state of maturity as its penetration rate among the Fortune 1000 rose. The decision whether to convert to SAP (or a competing product) was a strategic one for many companies at this time, both because of the

high costs and risks of cost overruns (many SAP implementations had failed or been far more costly than expected) and because of the high risks of *not* implementing integrated software. This case will allow you to explore the analysis done by one typical company for this decision.

What is ERP software? An ERP system is companywide software that links all operations to a central database. ERP software is organized by module, one for each functional area such as Finance, Accounting, Manufacturing, Payroll, Human Resources, and so on. Each of these modules has a