



BAYERISCHE MOTOREN WERKE AG

Teaching Note

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The *Bayerische Motoren Werke AG* case describes a situation in which the leaders of the recycling group of a major German automobile manufacturer must analyze two separate but related questions: how, if at all, should BMW modify the vehicle take-back infrastructure and what should the company do with recovered materials. Both questions are being forced by a draft legislation from BMU requiring the take-back of spent vehicles and reduction of scrap materials from vehicles in Germany.

The crux of the discussion revolves around:

- The company's strategy for modifying the take-back infrastructure in accordance with its goals and those of the BMU;
- The company's strategy for processing and disposing and/or utilizing secondary (recycled) materials;
- The economics of recycling and the implications of secondary materials use for product quality, cost, and marketing;
- The company's potential to determine the strategy for the remainder of the automobile industry and to gain a competitive advantage over other manufacturers.

Teaching Questions

It is recommended that *Bayerische Motoren Werke AG* be distributed prior to the class session when it will be discussed and the following questions be assigned to the students:

- 1) What are the contextual factors driving BMU's actions?
- 2) Who are the key constituents in the debate and what are their goals for the program? What specifically are BMW's goals?
- 3) What factors must be considered when using secondary materials?
- 4) What should BMW's take-back and secondary materials strategy be? Why?
- 5) Can the company gain a competitive advantage through the development of a pro-active recycling strategy? How?

At each point, it will be useful to distinguish between short-term and long-term factors.

Quantitative Analysis

Calculations:

Dismantler:

Labor Costs: DM 1.67
Shredder Price: DM 1.92
Transportation: DM 2.25

Shredder:

Cost: DM 4.17
Labor Costs: DM 4.05
Supplier Price: DM 9.45
Transportation: DM 2.25

Supplier:

Cost: DM 11.7
Labor Costs: DM 6.3
BMW Price: DM 22.5
Transportation: DM 2.25

Cost of Recycled Polymers: DM 24.75

Cost of Virgin Polymers: DM 16.29

Classroom Discussion

1) What are the contextual factors driving BMU's actions?

- *Solid Waste Problems:* Germany is nearing capacity in 90% of its landfills and incineration remains a contentious disposal option. In the short-term, Germany must confront its solid waste problems; over the long-term, Germany must minimize its waste stream and develop new disposal options.
- *Shredder Waste and the Vehicle Recycling Industry:* The dismantling and shredding industries are

being squeezed by competitive pressures, of which growing volumes of ASR and the costs of disposal are two. Plastics may be reclassified as special (or hazardous) waste, which would at minimum triple disposal costs. Over the long-term, more cars could end up in the Black Forest.

- *Projected Rise in the Plastic Content of Cars:* The plastic content of cars has risen from 2.0% in 1965 to over 10% in 1989. Unchecked, BMW's own vehicles are projected to contain 15% plastic content in the near future. Due to the number of different plastics used, the plastic content of new vehicles will remain largely unrecyclable.
- *Regulatory Philosophy:* Töpfer and BMU are introducing what they believe is the long-term solution to the waste problem: making companies responsible for the full environmental impact (life-cycle) of their products.
- *Costs of Waste Management:* The costs of disposal have risen 4-fold since 1987, potentially jeopardizing the vehicle recycling business and environmental protection. The calculations below represent the costs of disposal of ASR generated in 1989 by the vehicle processing and the projected costs of ASR generated from domestic automobile sales in 1989.

ASR Generated in 1989:

Status Quo:

Vehicles Processed by Network:	2.1 million
Percentage of Vehicle Recycled:	75%
1989 German ASR:	400,000 tonnes
Costs of Landfill Disposal:	120 DM/tonne
Total Cost of Disposal:	DM 48 million

Projected ASR from 1989 Domestic Sales:

Status Quo:

Projected Vehicles Processed by Network:	3 million
Percentage of Vehicle Recycled:	75%
Average Weight of Vehicles:	1400 kg
Projected ASR/Vehicle:	350 kg
ASR from 1989 Sales:	1.1 million tonnes
Projected Costs of Landfill Disposal:	500--1800 DM/tonne
Total Cost of Disposal:	DM 550 million--1.98 billion

2) Who are the key constituents in the debate and what are their goals for the program? What specifically are BMW's goals?

- *Government:* BMU wants to ensure that the appropriate level of environmental protection is being achieved by the responsible parties and that it is achieved at the lowest cost to the manufacturers,

recycling industry and general public; in this instance, the government believes the appropriate level of environmental protection requires a 60% reduction in ASR.

Analysis of German ASR Generation: These numbers give an indication of the goals of the program, volumes of waste under the take-back scenario, and the costs of disposal. Compare these calculations to those under question 1.

ASR Generated in 1989:

Take-Back:

Vehicles Processed by Network:	2.1 million
Desired Percentage of Vehicle Recycled:	90%
1989 Desired ASR--60% decrease:	160,000 tonnes
Costs of Landfill Disposal:	120 DM/tonne
Total Cost of Disposal:	DM 19.2 million

Projected ASR Generated from 1989 Domestic Sales:

Take-Back:

Projected Vehicles Processed by Network:	3 million
Percentage of Vehicle Recycled:	90%
Average Weight of Vehicles:	1400 kg
Projected ASR/Vehicle:	140 kg
ASR from 1989 Sales:	420,000 tonnes
Projected Costs of Landfill Disposal:	500--1800 DM/tonne
Total Cost of Disposal:	DM 210--756 million

- *Executive Leadership of the Manufacturers:* They want to ensure that if the regulation comes into place, implementation is undertaken in most cost-effective and least constricting way. They are concerned about the program's implications for their bottom lines and competitiveness within European and international markets. Will the "playing field" ultimately be leveled through similar legislative actions in other countries or the European Community? Finally, they are concerned about their public image.

- *Employees of the Manufacturers:* They want to ensure that their companies are perceived as taking positive action to address the problem within their communities and, since their communities must ultimately store and take responsibility for the waste, help solve it.

- *Shareholders of the Manufacturers:* Notwithstanding their interest in environmental quality, they want to ensure the quality of their investments.

- *Dismantlers and Shredders:* They want to make sure that their businesses survive financially and that they collaborate and establish ties with manufacturers and other relevant industries.

- *Plastics Suppliers:* They want to ensure they are equipped to process used plastics in order to maintain good relations with their customers--the manufacturers--and that any new programs do not hurt business.
- *Communities Local to Disposal Operations:* Because they will be the ones affected by unchecked waste streams through reduced environmental quality, each community wants to ensure that manufacturers are taking steps to reduce waste generated by their vehicles.
- *The European Community:* Although they may not have any immediate goals for the German program, the EC is watching with interest the developments in Germany. Germany regulatory programs, especially those regarding environmental protection, have tended to become EC law.
- *BMW's Goals:* The company has a number of goals for its response to the program:
 - Minimize the costs to its bottom line of any new commitments
 - Ensure that the program does not jeopardize the quality of its products
 - Maintain its reputation as a good corporate citizen
 - Maintain some control over the provisions of the legislation
 - Gain, if possible, competitive advantage over other manufacturers
 - Preserve its image as a technological and environmental leader.

Analysis of BMW's Exposure: These numbers give an indication the current impact of BMW's past sales on 1989 levels of ASR and the future impact of BMW's 1989 sales on Germany's future levels of ASR. Each calculation includes total waste levels, projected costs of disposal and an indication of these costs versus BMW's 1989 net income of DM 386 million.

BMW's Portion of 1989 ASR:

Status Quo:

BMW's 1980 Market Share:	5.6%
1989 German ASR:	400,000 tonnes
BMW's Portion (MS x Total):	22,400 tonnes
Costs of Landfill Disposal:	120 DM/tonne
Costs of Disposal of BMW Portion:	DM 2.8 million
Costs vs. BMW 1989 Net Income:	.7%

Take-Back:

BMW's 1980 Market Share:	5.6%
1989 Desired ASR:	160,000 tonnes
BMW's Portion (MS x Total):	8,960 tonnes

Costs of Landfill Disposal:	120 DM/tonne
Costs of Disposal of BMW Portion:	DM 1.08 million
Costs vs. BMW 1989 Net Income:	.3%

ASR Generated from 1989 Sales:

Status Quo:

BMW Domestic Sales:	191,100 vehicles
Average Weight of Vehicle:	1400 kg
ASR/Vehicle (plastic, fabric, glass, fluids):	23 %
ASR from BMW Vehicles	325 kg
Total Projected ASR:	62,108 tonnes
Projected Landfill Disposal Price:	DM 500--1800/tonne
Projected Disposal Costs:	DM 31.1--111.8 million
Costs vs. BMW 1989 Net Income:	8--29%

Take-Back:

BMW Domestic Sales:	191,100 vehicles
Average Weight of Vehicle:	1400 kg
Desired ASR/Vehicle--60% decrease:	9.2 %
ASR from BMW Vehicles	129 kg
Total Projected ASR:	24,652 tonnes
Projected Landfill Disposal Price:	DM 500--1800/tonne
Projected Disposal Costs:	DM 12.3--44.4 million
Costs vs. BMW 1989 Net Income:	3.2--11.5%

Although manufacturers are not immediately responsible for disposal costs under BMU's program, the sizes of these figures and their potential impact on BMW's bottom-line is alarming.

3) What factors must be considered when using secondary materials?

- *Quality:* In the short term, using recycled plastics in all vehicle components could have a negative impact on product quality, due to the degradation of plastics during reprocessing and recasting. However, secondary materials will be confined to use in non-critical applications, such as interior linings or noise-dampening padding, that do not affect the performance or safety of the vehicle. Over the long-term, plastics suppliers may be able to create new types of plastics and develop new reprocessing and casting technologies to improve their quality during their 'second life,' which would allow manufacturers to extend use to other components, such as fuel tanks and bumpers.

- *Processing Requirements:* Labelling, separating, and reprocessing used plastic components is taxing and time consuming. Manufacturers, the vehicle recycling infrastructure, and plastics suppliers are all part of this process.

- *Cost:* Currently, secondary materials cost more than virgin plastics, due to the processing requirements, the low volumes of secondary materials processed by suppliers (no realization of economies of scale) and low demand by plastics consumers. Over the longer-term, as the supply of used plastics returned to suppliers grows, reprocessing capacity is added and the demand rises, prices for recycled plastics are likely to fall. If coupled with improved quality, lower prices could drive significant growth in the use of recycled plastics.
- *Marketing:* Manufacturers will have to assess their consumer profiles to determine what implications, if any, use of secondary materials will have on future sales.

4) What should BMW's take-back and secondary materials strategy be? Why?

It is recommended that students analyze each of BMW's take-back and secondary materials options in order to formulate their optimal strategy.

Take-Back Options

Option 1: Fight the Regulation

Costs:

- *Good Will:* The company's collegial relationship with regulators may be damaged if BMW takes a stand against the draft legislation.
- *Leadership and Image:* BMW's leadership within the industry and image as an innovator would be tarnished by lobbying against the regulation.
- *Employee Morale:* BMW employees are committed to the idea that the company is a technological innovator and leader within the industry. Fighting the regulation may cause employees to think differently.
- *Environmental Quality:* If BMW is successful in fighting the regulation, protection of the environment will be sacrificed.
- *Continued Problems within the Infrastructure:* Dismantling and shredding operations would continue to be squeezed without some form of intervention by BMU, BMW or others.

Benefits:

- *Possibility of Postponing the Regulation:* The company could postpone the implementation of the regulation in the near-term, although it is unlikely BMU would give up its plans entirely. Postponing the regulation would give BMW time to alter its secondary materials strategy to respond to potential changes in the regulatory environment.

Option 2: Create an Independent National Take-Back Infrastructure

Costs:

- *Capital Investment:* Large capital outlays would be needed to build or buy dismantling and shredding facilities; new annual O&M costs would be generated.
- *Not BMW's Core Business:* Although BMW does reprocess used parts, the business of

dismantling and recycling would require the company to acquire new expertise. BMW's new business would not focus on BMW's main strength--production of quality automobiles.

- *Image:* From a societal perspective, putting substantial numbers of dismantlers and shredders out of business may hurt BMW's public image.

Benefits:

- *Remanufacturing:* Recovery and return of remanufacturable parts would be assured, providing feedstock for a business that has generated returns to the company for 25 years.
- *Synergy of Effort:* BMW would establish a closer relationship between R&D, design and the dismantling/shredding operations, which may help BMW in any design for environment (DFE) initiatives and, over the long-term, reduce dismantling times.
- *Dismantling Cost Reductions:* The methodologies learned from BMW's current program to reduce dismantling times could be implemented immediately, which would reduce the company's costs of meeting its new obligations.

Option 3: Modify the Existing National Take-Back Infrastructure

Costs:

- *New Payment Obligations:* BMW would have to create contracts with dismantlers and shredders to accept used hulks, as currently they have no obligation to do so.
- *Potential Liability:* Establishing formal relationships with dismantlers and shredders, of which only 10% are government-certified, may create a liability for BMW. First, the company may have to help dismantlers and shredders undertake investments for improved environmental protection, such as leachate systems. Second, BMW may have to enforce proper disposal of its products throughout its infrastructure.

Benefits:

- *Preservation of Jobs:* BMW intervention would help preserve jobs and local communities dependent on the continued operation of the take-back infrastructure.
- *Costs and Flexibility:* The industry would maintain an incentive to continuously improve efficiency (cut costs, develop new technologies), as opposed to relying on BMW or regulators to subsidize the costs of disposal.
- *Potential Competitive Advantage:* BMW has an advantage over most other manufacturers in establishing contracts with dismantlers and shredders--because spent BMWs are worth more than spent vehicles made by most other manufacturers and the market for remanufactured BMW parts is well-established, dismantlers and shredders will opt to process BMWs before other vehicles. This could result in reduced costs to BMW.

Secondary Materials Options

The following is an analysis of each option available for BMW's secondary materials strategy. At the end of each analysis, an assessment is made of the option's ability to meet the goal of a 60% reduction in ASR. This is not to imply that one option is superior to the others or that one option should independently comprise BMW's strategy. On the contrary, students will have to use a

combination of options to create BMW's short-term and long-term secondary materials strategies.

Option 1: Take-Back Processed Vehicles and Landfill ASR

Costs:

- *Declining Availability:* Landfill space continues to decline at a rapid pace.
- *Costs and Uncertainty:* Landfill costs are projected to skyrocket. Given the uncertainty surrounding future prices, BMW's exposure is substantial; for its 1989 cars alone, disposal costs range from DM 31--112 million (see calculations under question 2). As a result, landfill disposal may only be a practical option for the first years of any strategy.
- *Environmental Implications:* Landfill disposal in older operations may be environmentally-unsound, potentially jeopardizing groundwater supplies and creating toxic waste sites.
- *Public Concern and Image:* The public remains concerned about continued reliance on landfill disposal without significant efforts to reduce waste volumes, and in its eyes, recycling is superior to landfill disposal. As a result, the company's image could be damaged.

Benefits:

- *Possibility of Maintaining the Infrastructure:* Dismantling and shredding operations would not have to make substantial changes to their operations, and their continued operation may be ensured by BMW intervention.
- *Minimal Effort:* BMW's involvement and effort in recycling is minimized; BMW can continue its operations as is and need only write a check to dismantlers and shredders to fulfill its obligations.
- *Environmental Implications:* Depending on the quality of environmental protection precautions at each operation, landfill disposal may have less impact on the environment than incineration.

Does Not Meet Objective: Under this scenario, BMW would not meet the objective of a 60% reduction in ASR.

Option 2: Take-Back Processed Vehicles and Incinerate ASR

Note that BMW could either utilize current incinerator operations or develop new incineration technologies alone or in concert with other parties, such as Mercedes-Benz:

Costs:

- *Costs and Uncertainty:* Although the incineration costs are not projected to rise as severely as landfill rates, political problems continue to make reliance on incineration risky.
- *Environmental Risk:* The BMU is already wary of incineration of plastic and does not want to reduce incentives to recycle.
- *Image:* In the public's eye, recycling is superior to incineration.

Benefits:

- *Possibility of Maintaining the Infrastructure:* Dismantling and shredding operations would not have to make changes to their operations, and their continued operation may be ensured

by BMW intervention.

- *Minimal Effort:* BMW's involvement and effort in recycling is minimized; BMW can continue its operations as is and need only write a check to dismantlers and shredders to fulfill its obligations.
- *Environmental Implications:* Depending on the quality of the environmental protection precautions at each operation, disposal via incineration may have less impact on the environment than via landfill.

Does Not Meet Objective: Under this scenario, BMW would not meet the objective of a 60% reduction in ASR.

Option 3: Recycle Plastics for Use in Other Industries

Costs:

- *Costs:* The costs of recovering plastics are substantial, due to the requirement that only homogeneous plastics be reprocessed. In order to make the process work, BMW may have to subsidize these operations.
- *R&D:* In order to get a handle on these costs, BMW may have to initiate significant R&D efforts with its plastics suppliers.
- *Recycled Plastics Market Uncertainty and BMW's Core Business:* In concert with its suppliers, BMW would have to develop a new capacity to find buyers for its recycled materials, which is outside of BMW's core business.

Benefits:

- *Costs:* The costs of recovering plastics and R&D may be cheaper over the long term than disposing of them.
- *Environmental Quality:* Recycling has a minimal impact on the environment, reducing the extraction of resources for virgin materials and substantially lowering energy costs in production.

Meets Objective: Under this scenario, BMW could meet the objective of a 60% reduction in ASR.

Option 4: Use Recycled Polymers in BMW Vehicles

Costs:

- *Costs:* The cost of recovering plastics is substantial, and in order to make the process work, BMW may have to subsidize reprocessing operations.
- *R&D:* In order to get a handle on these costs, BMW may have to initiate significant R&D efforts with its plastics suppliers.

Benefits:

- *Market Creation and Costs:* As a high volume consumer, use of recycled materials by BMW would help establish a market for recycled materials and potentially lower costs.

- *Environmental Quality:* Recycling has a minimal impact on the environment, reducing the extraction of resources for virgin materials and substantially lowering energy costs in production.

Meets Objective: Under this scenario, BMW could meet the objective of a 60% reduction in ASR.

Option 5: Incorporate Design for Environment (DFE) Methodology

Costs:

- *R&D:* DFE would require high R&D costs. However, BMW has set aside \$500 million to acquire businesses related to its vehicle production, and may be able to use it to augment its DFE capacity.

Benefits:

- *Minimizes Future Environmental Impact:* DFE will likely enhance the recyclability of vehicles and minimize negative environmental impact.
- *Flexibility:* BMW will have greater flexibility in responding to future regulatory changes.
- *Synergy with Product Development:* BMW may develop a new expertise in materials and DFE methodology that is directly relevant to further improving the company's product line.
- *Leadership and Image:* BMW will demonstrate leadership in new product and process designs, which contributes to its image as a technological and environmental leader. This will likely be beneficial in its interactions with regulators and to its public image.

Meets Objective: Under this scenario, BMW could meet the objective of a 60% reduction in ASR. Due to the lengthy period between car design and disposal, however, DFE could only be part of BMW's long-term strategy.

5) Can the company gain a competitive advantage through the development of a pro-active recycling strategy? How?

- *Technological Leadership:* Recycling presents an opportunity for BMW to demonstrate its leadership, which may lead to a cost advantage over other manufacturers.
- *Industry Leadership:* BMW could become the recycling leader within the automobile industry. The company could determine the take-back strategy for the remainder of the automobile industry in Germany and market that strategy to regulators (BMW's cost-effective strategy becomes law). As a result, BMW could gain a cost advantage over other manufacturers.
- *'Regulatory' Leadership:* Because of BMW's willingness to work with the draft legislation, BMW may be seen as the manufacturer to contact about future environmentally related and non-environmentally related issues that affect the industry.
- *Environmental Leadership:* As environmental quality becomes a greater priority for businesses, the public and government, BMW could more securely position itself as the

environmental leader. BMW can serve as the environmental role model.

Summary and Conclusions: BMW's Take-Back and Secondary Materials Strategy

BMW opted to pro-actively manage the vehicle recycling issue. The company announced at the Frankfurt Auto Show in September 1991 that it would take-back all spent vehicles from its customers.

Take-Back Strategy:

BMW opted to use the existing recycling infrastructure to ensure that its vehicles are processed. Choosing from the 10% of the network that was certified for operation by the government, BMW has established relationships with 9 dismantling operations throughout the country to create BMW recycling centers. The vehicle recycling techniques that the company has created for each of its models are passed along to these centers immediately. Plastic components, labelled by type, are separated by type and shipped to the appropriate suppliers. BMW intends to expand this network to 200-300 centers by the mid-1990s.

Secondary Materials Strategy:

BMW opted to support the recycling materials markets by utilizing recycled materials when reasonably cost effective and to launch a campaign to incorporate design for environment methodology throughout their new vehicles. The company currently uses a 'rule of thumb' for when to use recycled plastics for new components--when the cost of secondary plastics is equal to or slightly more expensive than virgin plastics. The new 3 series vehicles use recycled plastics in non-critical applications, such as linings, noise dampening pads and some parts of the interior.

The German Environment:

Dr.-Ing. Horst-Henning Wolf has taken a leadership role within the German automobile industry on the recycling issue. Under his leadership:

- BMW successfully marketed its external strategy to Töpfer and his colleagues--BMW's plan is the plan for all of Germany.
- PRAVDA, the association of automobile companies examining recycling, has reached out to plastics suppliers such as Hoechst, BASF and Bayer to work on new plastics recycling techniques.

The EC and North American Environments:

BMW has also made it clear that its policy in Germany will be its policy in its other markets:

- BMW has set up pilot dismantling and recycling operations in Germany, the Netherlands, France, Austria, Switzerland, the United States (New York, Chicago, and Los Angeles) and is finalizing plans for sites in Japan and Canada.
- Wolf has become the director of the recycling group within the EC's Directorate General on Strategic Direction. This group maintains responsibility for developing EC-wide recycling strategies for particular industries.
- In Britain and the Netherlands, BMW has begun using a new marketing slogan: "Motoring

pleasure (that) doesn't have a price tag today's children will have to pay tomorrow."