

Human's Dependence on Earth's Mineral Resources Mining and Mining Impacts

Post-Unit Homework (Reading)

A Can of Soda . . .

In Chapter 2 of the book *Lean Thinking* (2003) and Chapter 3 of the book *Natural Capitalism* (1999), the authors trace the production stream of a case of cola in Britain, a process that is likely representative of the production streams of many of the products found in grocery and other stores, although the details will vary. These steps are briefly summarized below.

A Can of Soda

To make the cans for the soda, which is the more time- and cost-consuming part of the process, bauxite is mined from a large-scale mine in Australia. Once sufficiently accumulated, the ore is transported via huge trucks to a chemical reduction mill not too far away. In a large-scale process, it takes about 30 minutes to create two tons of powdery alumina from four tons of bauxite.

Once enough alumina is created to fill an ore carrier (approximately 500,000 tons or 10 million cans worth), it is shipped by sea to Norway or Sweden for smelting, taking advantage of their cheaper hydroelectric power. The alumina may wait here for about two months until, in another large-scale process, about a ton of aluminum metal is made from two tons of alumina in about two hours. This uses about 20 times the amount of energy needed to melt down used cans for recycling.

The melted aluminum is poured and cooled to make ingots 1 x 1 x 10 meters long. The ingots are stored over a two-week period and then shipped to a hot rolling mill in Germany or Sweden, where they are again stored for about two weeks.

The aluminum ingots are reheated to about 500°C and run through rollers multiple times, which thins the ingot from 1 meter to 3 millimeters. The aluminum sheet is then wound into a 10-ton coil and stored again, this time for about four weeks.

This coil is then shipped to a cold rolling mill in Germany or Sweden and stored again. The sheets are then thinned from 3 mm to ~0.3 mm, and then cut into narrower swaths, wound into a 10-ton coil again, and stored, on average, for about a month.

Ready to be made into cans, coils are shipped to England and stored until needed. The coils are punched, shaped into cans without a top, and then washed and dried. Two coats of paint are applied to the can, the second of which includes the color scheme and promotional material of the soda, and cans are sprayed on the inside to protect them from corrosion.

Once inspected, the empty cans are loaded onto pallets and stored. Eventually they are trucked to the bottler's facility, stored until needed, then unloaded, washed, and filled with water, caramel color, sugar, phosphoric acid, carbon dioxide, and caffeine. The phosphorus is mined in Idaho in

open-pit mines and refined to create food-grade phosphate in an energy-intensive process. The sugar comes from beets grown in France and must be harvested, processed, and refined. The caramel color is derived from corn, which must be grown, harvested, and processed, and transported various times as well. A chemical manufacturer creates the caffeine that is then transported to the cola manufacturer in England.

The lids, which have experienced a type of processing similar to the cans through a separate supply chain, are now put on the filled cans. The date is stamped on each can and the cans are packaged into cardboard cartons made from wood pulp harvested in any number of countries.

The cartons must then be put onto wood or plastic pallets, plastic-wrapped, and shipped to a central warehouse where they are stored. Pallets will be picked up when orders are made and transported to stores.

Once at the store, the soda is sold in approximately two days, on average. Once purchased it may be stored again, then refrigerated, and then quickly consumed, sometimes in minutes. Disposing of the can is easy and quick. Some consumers may recycle the can, which can be smelted to create new cans, but at the time *Lean Thinking* was written, only about 16% of these types of cans in the United Kingdom were recycled and transported back to Norway for smelting. According to Hawken et al. (1999), more than half of the aluminum in the United States is from virgin ore and the United States “throws away enough aluminum to replace its entire commercial aircraft fleet every three months.”

The total processing time of the can was approximately 319 days, although nearly all of that (99%) was either for storage, shipping, or reworking the materials (i.e., rolling and unrolling the coils, loading and unloading). The process also creates about 24% scrap aluminum due to the punch method, damage to empty cans in transport, and for lack of recycling by the end consumers.

The process described above does not include the product streams needed to create, power, and transport additional materials used in the cola-making procedure. Most products have similarly complex production trails, most of which are hidden from nearly all consumers, and include external costs and impacts not described above.

Sources

James P. Womack and Daniel T. Jones. 2003. Chapter 2 of *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. New York: Free Press, a Division of Simon & Schuster, Inc.

Paul Hawken, Amory Lovins, and L. Hunter Lovins. 1999. Chapter 3 of *Natural Capitalism: Creating the Next Industrial Revolution* New York: Back Bay Books.