Archer Daniels Midland Company (ADM)

An upstream manufacturer of bio-based raw materials, Archer Daniels Midland (ADM) has been in operation for more than 100 years, serving a wide range of customers from food, animal feed, and industrial product manufacturers. Throughout its history, the company has responded to changes in consumer needs and the broad external environment.

ADM is one of the largest agricultural processors and distributors of agricultural products in the world. More specifically, the company is one of the world's largest processors of soybeans, corn, wheat, and cocoa; it also leads in the production of soybean oil and meal, ethanol, corn sweeteners, and flour. In addition, ADM produces value-added food and feed ingredients. The company serves as a link between farmers and consumers, processing crops to make food and animal feed ingredients, renewable fuels, and naturally derived alternatives to industrial chemicals. ADM, headquartered in Decatur, Illinois, has more than 27,000 employees, more than 230 processing plants, and net sales of $70 billion for the fiscal year that ended June 30, 2008[1] (See Appendices A & B for selected financial information).

The chemical industry has undergone radical shifts in its value proposition to the market and is constantly having to adapt to myriad external forces that change almost daily. Latest among these forces is the green chemistry movement, which has become a hot topic in the industry. Green chemistry, quite generally, is the use of chemistry for pollution prevention: chemical products and processes are designed to reduce or eliminate the use and generation of hazardous substances. ADM has effectively demonstrated its commitment to green chemistry in the last few decades. For example,

[1] ADM Home Page, Investors. http://www.adm.com/en-US/investors/Pages/default.aspx (accessed February 24, 2009).

This case was prepared by Michael Valente at the Schulich School of Business at York University. It is intended to serve as a basis for class discussion rather than to illustrate the effective or ineffective handling of an administrative situation. These materials were developed through a cooperative effort of the American Chemical Society's Green Chemistry Institute and the U.S. Environmental Protection Agency (EPA) Office of Pollution Prevention and Toxics' Design for the Environment Program. Partial funding was provided by the EPA through Cooperative Agreement #X8-83077701-0. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the EPA. Any mention of trade names does not imply endorsement by the EPA.

ADM's Archer RC™ is now considered a revolutionary innovation in substantially reducing volatile organic compounds (VOCs) from coating products. In addition to the product's environmental benefits, recent tests have indicated that it is superior to traditional paints and stains.

Although ADM has won numerous awards for green chemistry, it faces some challenges. One such challenge is to fully commercialize its innovative Archer RC reactive coalescent in a very fragmented paint and coatings industry. The more pressing question, however, is how to best leverage those core competencies developed through the creation of Archer RC to further position ADM and take advantage of other opportunities in the green chemistry field.

Company Background

Archer Daniels Midland Company (ADM) was founded in 1902 by John W. Daniels to process linseed oil, which is primarily used in the manufacture of paints, varnishes, and linoleum.[2] Two decades later, Archer Daniels Company was formed when Archer-Daniels Linseed acquired Midland Linseed Products Company. Over the next 50 to 60 years, the company steadily grew in the industrial markets, supplying linseed oil and its derivatives to alkyd paint makers,[3] foundry products companies, and other industrial firms. In 1954, the company purchased the resin division of U.S. Industrial Chemicals Corporation from National Distillers Products Corporation. This advanced one of ADM's long-term objectives: to offer the paint industry a complete line of resins.

The search for new products, new markets, and new opportunities for growth led ADM to establish an international presence in 1955. Within two years, ADM was selling products in more than 50 countries, setting the stage for ADM's future work in opening foreign markets to U.S. bio-based products.

In 1962, the ADM logo changed from the Archer yeoman to a logo design meant to represent chemical molecules coming from a natural resource. Although the company sold its chemical business to Ashland Oil in 1967 to focus on agriculture, ADM has slowly clawed its way back into the chemical arena since then. In the 1970s, it commercialized the fermentation-derived fuel ethanol, which can be blended with gasoline in varying quantities to reduce air pollution and the consumption of petroleum fuels. ADM started its first ethanol production plant in Decatur, Illinois. In the 1960s, the company also developed textured vegetable protein (TVP) from soybeans, an economical source of nutritious protein. From a low of $50 million in earnings in 1965, net earnings grew to near $117 million by 1973. This increase paralleled the upward

[2] Linoleum is a floor covering made from solidified linseed oil (linoxyn) in combination with wood flour or cork dust over a burlap or canvas backing.

[3] Alkyd is a synthetic resin widely used in the manufacture of paints and varnishes. The terms alkyd paint and oil-based paint generally are used interchangeably.

swing in U.S. soybean production and exports, from 700 million bushels per day in 1965 to 1.3 billion in 1973.

Growth continued through the 1980s. By 1980, every minute of every day, ADM's global facilities were processing the equivalent of 60 football fields' worth of wheat, oats, rice, barley, corn, sorghum, soybeans, and sunflowers. As a result, almost every product found on any shelf in any grocery store contained one or more of the food ingredients made and marketed by ADM.

By 1995, ADM was performing very well, with net income levels close to $700 million on revenue of more than $13 billion and with asset levels well over $10 billion. In the latter part of the decade, ADM made a number of corporate acquisitions. In 1994, ADM expanded into China through the Wilmar Group and other JV partners. In 1996, ADM purchased a 22 percent stake in Gruma S.A. de C.V., the world's largest producer and marketer of corn flour and tortillas. In 1997, ADM entered the cocoa business by purchasing W.R. Grace & Co. The company also expanded into Brazil by acquiring Glencore's Brazilian grain operations, which provided them with 33 grain elevators and a fertilizer processing plant in Latin America. ADM also entered into the citric acid business and acquired Moorman Manufacturing Company to expand the animal feed business. At about this time, it started ADM Rice Inc.

ADM also spent a good chunk of the late 1990s looking into bio-based raw materials and technologies that would supplement petroleum (i.e., ethanol and biodiesel). This initiative slowed as oil prices plummeted, but when oil prices rose again in early 2000, its investment in these technologies started to look promising. ADM remains focused on this area today, as the company is already involved in ethanol and biodiesel production and is looking to expand its output levels and market opportunities. [4]

In 2001, ADM announced a new corporate logo, tagline, and advertising campaign designed to underscore the company's deep commitment to nature and global agriculture. In 2000, it decided to expand its assets in South America and Asia, due to the oil seed opportunities in the former and population growth in the latter. More recently, ADM introduced a new wave of industrial products that puts it head-to-head with some of the chemical industry's biggest players. But unlike almost all of these competitors, ADM is making its products from corn, soybeans, and other crops rather than from petroleum-derived feedstock. (See Appendix C for a selected yet more detailed account of ADM's history.)

Most recently, ADM has been awarded two U.S. Environmental Protection Agency (USEPA) Presidential Green Chemistry Challenge Awards. The first award recognized ADM's Archer RC, a reactive coalescent for the reduction of VOCs in latex paints, while the second award honored the creation of NovaLipid™, ADM's line of zero/low-trans-fat shortenings, margarines, and oils.

[4] Interview with Paul Bloom, ADM Middle Manager, March 10, 2006.

External Environment

The Chemical Industry

Every day, the United States produces or imports 42 billion pounds of chemicals, 90 percent of which are created using petroleum, a non-renewable feedstock. Converted to gallons of water, "this volume is the equivalent of 623,000 gasoline tanker trucks (each carrying 8,000 gallons), which would reach from San Francisco to Washington, D.C., and back if placed end-to-end. In the course of a year, this line would circle Earth 86 times."[5] These chemicals are used in innumerable processes and products, and at some point in their life cycles, many of them come into contact with people—in the workplace, in homes, and through air, water, food, and waste streams. Eventually, in one form or another, nearly all of them enter the earth's finite ecosystems.[6]

Global chemical production is expected to double every 25 years for the foreseeable future. Between now and 2033, the U.S. EPA expects 600 new hazardous waste sites to appear each month in the United States, adding to 77,000 existing sites. Site mitigation efforts are expected to cost about $250 billion. Given the scale, pace, and burden of chemical production, the toxicity and ecotoxicity of chemicals are of great public importance.[7]

Many chemicals that are useful to society are also hazardous to human biology and ecological processes. Scientists have expressed growing concerns about the biological implications of chemical exposure over the human lifespan, particularly during the sensitive periods of fetal and child development. "Hundreds of chemicals released into the environment accumulate in human tissues; the U.S. EPA found nearly 700 of such chemicals in a nationwide survey of Americans in 1987."[8] Many of these chemicals enter the developing organ systems of fetuses and infants through the maternal bloodstream and breast milk. Animal studies indicate that some chemicals can interact with and disrupt the development of these systems, such as the endocrine system, at very low doses. Among children, "chemical exposures are estimated to contribute to 100 percent of lead poisoning cases, 10 to 35 percent of asthma cases, 2 to 10 percent of certain cancers, and 5 to 20 percent of neurobehavioral disorders."[9]

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[5] Wilson, M.; Chia, D.; Ehlers, B. (2006: page 3). Green chemistry in California: A framework for leadership in chemicals policy and innovation. *Scientific Solutions*. 16(4), 365-372.

[6] Wilson, M.; Chia, D.; Ehlers, B. *Special Report, Green chemistry in California: A framework for leadership in chemicals policy and innovation*. http://ucop.com/cprc/documents/greenchemistryrpt.pdf (accessed February 24, 2009).

[7] California Senate Environmental Quality Committee, Testimony of Michael P. Wilson. http://www.cicc.org/pdf/Wilson%20_Testimony_6.28.06.pdf (accessed February 24, 2009).

[8] Wilson, M.; Chia, D.; Ehlers, B. (2006: page 3). Green chemistry in California: A framework for leadership in chemicals policy and innovation. *Scientific Solutions*. 16(4), 365-372.

[9] Wilson, M.; Chia, D.; Ehlers, B. (2006: page 3). Green chemistry in California: A framework for leadership in chemicals policy and innovation. *Scientific Solutions*. 16(4), 365-372.

The Toxic Substances Control Act inventories 81,600 chemicals that are registered for commerce in the United States, 8,282 of which are produced or imported at 10,000 pounds or more per year. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects, such as nausea, breathing difficulties, or birth defects. Immunological, neurological, reproductive, developmental, and respiratory systems also may be affected. Toxic air pollutants may also be deposited into soil, lakes, and streams, thereby affecting ecological systems and eventually human health through consumption of contaminated food (mainly freshwater fish). Evidence of public and environmental health problems related to chemicals continues to accumulate.[10]

A Sustainable Future: Political Involvement

Developments in the European Union and in the United States, especially among leading California businesses, are driving interest in cleaner technologies, including green chemistry. The European Union is implementing sweeping new chemicals and materials policies meant to drive global changes in ways that are expected to favor cleaner technologies, including green chemistry.[11] Similarly, the U.S. EPA has focused on identifying national technology-based performance standards to significantly reduce emissions. “The U.S. Occupational Safety and Health Administration (OSHA) has adopted workplace exposure limits for 193, or about 7 percent, of the 2,943 chemicals produced or imported by the United States at more than one million pounds per year.”[12]

Many toxic air pollutants are emitted in the form of particulates or as VOCs. The mid- to late-1990s saw an increased regulatory focus on VOC reduction. In 1995, the U.S. EPA’s final toxic air pollutant regulation for organic chemical manufacturing was expected to reduce VOC emissions by an amount equivalent to removing millions of cars from the road.[13] In late 2005, air quality control regulators in California approved an initiative aimed at limiting VOCs for all topcoats at well below 3 pounds per gallon. Automotive body shops in California will need to comply by 2009. Following California’s example, the chemical industry could anticipate that similar paint standards will

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[10] Wilson, M.; Chia, D.; Ehlers, B. (2006: page 3). Green chemistry in California: A framework for leadership in chemicals policy and innovation. *Scientific Solutions*. 16(4), 365-372.

[11] The E.U. Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive will prohibit the use of lead, cadmium, mercury, certain flame-retardant chemicals, and other toxic materials in electronic and electrical equipment sold in the European Union.

[12] Wilson, M.; Chia, D.; Ehlers, B. (2006: page xii). *Special Report, Green chemistry in California: A framework for leadership in chemicals policy and innovation*; California Policy Research Centre: University of California. http://ucop.com/cprc/documents/greenchemistryrpt.pdf (accessed February 24, 2009).

[13] U.S. Environmental Protection Agency (EPA), Toxic Air Pollutants. http://www.epa.gov/air/airtrends/aqtrnd95/tap.html (accessed August 13, 2006).

ultimately be adopted nationwide as the U.S. EPA is currently drafting new rules calling for lower VOCs.[14]

Alternative Fuel Sources: Biodiesel and Ethanol

Former U.S. President George W. Bush encouraged investment in alternative fuel sources, like biodiesel and ethanol, to reduce U.S. dependency on traditional energy sources, such as oil and other fossil fuels. He stressed the importance of creating an economic environment that encourages entrepreneurship and risk taking around these types of initiatives.

Biodiesel refers to a diesel-equivalent, processed fuel derived from biological sources that can be readily used in diesel engine vehicles. Biodiesel is biodegradable and nontoxic and has significantly fewer emissions than petroleum-based diesel when burned. It can be distributed using today's infrastructure, and its use and production is increasing rapidly (especially in Europe, the United States, and Asia). Fuel stations are beginning to make biodiesel available to consumers, and a growing number of transport fleets use it as an additive in their fuel.

Biodiesel, or biofuel, originates from oil extracted from plant seeds, a renewable resource. During respiration, plants take up carbon dioxide, which helps to balance the carbon dioxide released when biodiesel is combusted. Moreover, biodiesel burns more completely than petroleum diesel, so the net amount of carbon dioxide released as a greenhouse gas is much less than with petroleum diesel.

Currently, biodiesel is subsidized because it is generally more expensive than petroleum-derived diesel. Subsidies would go to biodiesel blenders who would be customers of companies like ADM. With the subsidy, these companies would be able to pay real prices for the methyl esters resulting in comparable prices with regular diesel. Changing agronomics, the way crops are grown, and the oil content of the soybean could bring down vegetable oil prices. Biotech companies, for example, could devise a seed that produces double the oil and, as long as there is enough refining capacity to deal with the associated increase in supply, prices would drop significantly.[15]

In 1999, biodiesel producers sold about 500,000 gallons of fuel. In 2004, biodiesel sales totaled 30 million gallons—a 60-fold increase in five years. More than 500 operators of major vehicle fleets now use biodiesel, including the U.S. Department of Defense and the National Park Service. In the previous few years, more than 300 public fueling stations have started offering biodiesel.

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[14] Search-Autoparts.com. http://www.abrn.com/abrn/article/articleDetail.jsp?id=279663 (accessed November 13, 2007).

[15] Interview with Paul Bloom, ADM Middle Manager, March 10, 2006.

Another alternative fuel is ethanol. Drawn from corn, ethanol can be mixed with gasoline to produce a clean, efficient fuel. "E85 (85% ethanol, 15% gasoline) is considered an alternative fuel under the Energy Policy Act of 1992 (EPAct). It is used to fuel E85-capable flexible fuel vehicles (FFVs), which are available in a variety of models from U.S. and foreign automakers. As of 2008, more than 1,600 U.S. fueling stations offered E85 to the more than 7 million FFVs on U.S. roadways. "[16]

The Paint and Coatings Industry

Contemporary paints and coatings consist of countless compounds uniquely formulated for hundreds of thousands of applications. "Paint" ranges from the broad group of environmentally sound latex paints that many consumers use to decorate and protect their homes, to the translucent coatings that line the interior of food containers, to the chemically complex, multi-component finishes that automobile manufacturers apply on the assembly line.[17]

The U.S. paint and coatings industry includes more than 700 raw materials suppliers, distributors, and manufacturers, including those that produce architectural (i.e., house paint) and other coatings.[18] These coatings include product coatings—applied as part of the original manufacturing process—and special-purpose coatings for ships, offshore oil and gas rigs, and highway and traffic markings. Suppliers and distributors of raw materials (such as ADM) that go into paint and coatings production are also part of the industry.

Generally, paints and coatings protect products from environmental corrosion and improve their consumer appeal. In some cases, paints and coatings are an essential part of a product's use, such as coatings that protect food and beverages stored in metal cans from contamination and spoilage. Of course, paints and coatings also have an aesthetic value to society. Aggregate sales of the paint industry, which includes manufacturers, raw material suppliers, and distributors, are approximately $17 billion annually.[19]

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[16] U.S. Department of Energy (DOE), Ethanol. http://www.afdc.energy.gov/afdc/ethanol/e85.html (accessed February 24, 2009).

[17] National Paint & Coatings Association, Historical Context. http://www.paint.org/con_info/facts.cfm (accessed March 9, 2009).

18 NPA (Never Paint Again), Paint and wall coatings: What are they? A definition. http://www.neverpaintagain.co.uk/article/What-is-paint-what-are-coatings (accessed March 9, 2009).

[19] Interview with Paul Bloom, ADM Middle Manager, March 10, 2006.

Traditional latex coatings have many benefits relative to oil-based coatings: they dry quickly, resist fading and chalking, blister less, remain flexible longer, tolerate alkaline surfaces like masonry, do not yellow, resist mildew better than oil, and clean easily.[20]

Despite these benefits, traditional latex coatings are based on small-particle emulsions of synthetic resin,[21] which require substantial quantities of a coalescent to facilitate the formation of a coating film as water evaporates after the coating is applied. The coalescent softens (plasticizes) the latex particles, allowing them to flow together to form a continuous film with optimal performance properties. Once the film formulates, traditional coalescents slowly diffuse out of the film and into the atmosphere as VOCs.[22,23]

VOCs are highly evaporative, carbon-based chemical substances that produce noxious fumes; they are found in many paints, caulks, stains, and adhesives. VOCs are some of the most toxic ingredients in air pollution. A single tube of caulking may contain more than 500 grams of VOCs per liter. These compounds affect indoor air quality and the health of occupants, workers producing and using the materials, and the environment. "Multiply this by all the tubes of caulking, gallons of paint, sheets of plywood, and pressure-treated wood used every day, and the impact on both health and environment is enormous."[24]

Little progress has been made in the drive to reduce VOCs in coating formulations. Inventing new latex polymers that do not require a coalescent is an option, but these polymers often produce soft films and are expensive to synthesize, test, and commercialize. "Without a coalescent, the latex coating may crack and may not adhere to the substrate surface when dry at ambient temperatures."[25]

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[20] Home Addition Plus, Oil Based Paint versus Latex Based Paint. http://www.homeadditionplus.com/Painting-info/Oil-vs-Latex-Based-Paint.htm (accessed February 24, 2009).

[21] Such as acrylate- and styrene-based polymers.

[22] U.S. Environmental Protection Agency (EPA): Office of Pollution Prevention and Toxics. http://www.epa.gov/gcc/pubs/docs/award_recipients_1996_2008.pdf (accessed August 20, 2008).

[23] The glass transition temperature of the latex polymer increases as the coalescent molecules evaporate and the film hardens. Alcohol esters and ether alcohols, such as ethylene glycol monobutyl ether (EGBE) and Texanol® (2,2,4-trimethyl-1,3-pentanediol monoisobutyrate), are commonly used as coalescents.

[24] Environmental Health Association of Nova Scotia. http://www.environmentalhealth.ca/politicalagenda.htm (accessed February 24, 2009).

[25] U.S. Environmental Protection Agency (EPA). http://www.epa.gov/gcc/pubs/pgcc/winners/dgca05.html (accessed August 17, 2006).

Inside ADM

According to its Web site, ADM's core values revolve around being the best company it can be, working consistently as a team of diverse individuals to make a positive difference in the world.[26]

ADM essentially serves as the link between farmers and upstream manufacturing companies who require bio-derived raw materials:

Because everything ADM does begins with agriculture, our partnership with the farming community is vital. Farmers are essential to the overall economy, and that's why we work to be essential to them—creating thousands of products from their crops, hundreds of markets for their crops.[27]

To do this, ADM has developed particular areas of expertise that it calls separation, purification, and conversion. As part of its core business, ADM processes and separates, at a very large scale, agricultural materials—like oilseeds, corn, wheat, and cocoa—into highly purified, value-added raw materials. Vegetable oil extractions or corn processing through wet and dry milling are examples. More specifically, ADM produces corn oil from the actual corn kernel, converting it into starch, then glucose, and, ultimately, ethanol.[28]

These capabilities allow ADM to hold a broad and diverse portfolio of oils and associated fatty acid materials (e.g., oilseeds, vegetable oil, corn oil, linseed oil, soybean oil, flax oil, and even coconut oil). Similar to petroleum companies that are back-integrated into the supply of crude oil, ADM is back-integrated into the bio-derived feedstocks that are available today in large quantities.

ADM has been involved in the paint and coatings industry since its inception more than 100 years ago. The company was initially involved in linseed oil, which is used for alkyd or oil-based paints and a variety of adhesives, inks, and other materials. As market needs change, ADM works to develop the expertise to adapt to these markets. One of ADM's research managers said, "We've been in the coatings industry since our beginning. So when opportunities arise where we can make new derivatives to address the concerns that are facing today's markets, like VOC, we design chemicals based on the fit with our material supply and what nature provides. So we look for opportunities to expand our paint and coatings business by adapting to changing needs in the marketplace."

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[26] ADM Home Page, Our Company, Ethics & Values. http://www.admworld.com/en-US/company/philosophy/Pages/ethics.aspx (accessed February 24, 2009).

[27] ADM Home Page, Our Company. http://www.admworld.com/naen/about/ (accessed November 13, 2007).

[28] Interview with Paul Bloom, ADM Middle Manager, March 10, 2006.

Archer RC

Archer RC reactive coalescent is a revolutionary, non-hazardous, naturally derived ingredient for the paint and coatings industry that lowers latex paint's overall VOCs while providing similar levels of function and quality as traditional coalescing agents. Unlike traditional, solvent-based coalescing agents, which volatize into the atmosphere upon drying, Archer RC remains in the paint, forming a strong and durable film. Corn and sunflower oils are preferred feedstocks for Archer RC because they have a high level of unsaturated fatty acids and tend to resist the yellowing associated with linolenic acid, which is found at higher levels in soybean and linseed oils. According to the Green Chemistry Resource Exchange, "because Archer RC remains in the coating after film formation, it adds to the overall solids of a latex paint, providing an economic advantage over volatile coalescents."[29]

The architectural market used 618.4 million gallons of latex paint in 2001. Typically, coalescing solvents constitute 2 to 3 percent of the finished paint by volume, which corresponds to an estimated 120 million pounds of coalescing solvents in the United States and perhaps three times that amount globally.[30] Currently, nearly all of these solvents are lost into the atmosphere each year.

ADM has developed and tested, through PRA Laboratories Inc., a number of paint formulations using Archer RC in place of conventional coalescing solvents. Results revealed that its coalescent does not contribute to VOC emissions,[31] and unlike traditional coalescing solvents that volatize into the atmosphere, its reactive coalescent remains in the coating. According to ADM, Archer RC has consistently performed as well as commercial coalescents such as Texanol®, providing equal color intensity and equal or improved sheen and opacity. Moreover, Archer RC has comparably lower odor, increased scrub resistance, and better opacity relative to competing brands using traditional coalescents.[32]

Archer RC has been in commercial use since March 2004, and many paint companies and raw material suppliers have successfully formulated paints with Archer RC and their existing commercial polymers. The fragmentation of the paint industry has hampered wide adoption of Archer RC, however, as each manufacturer requires a customized version of the coalescent.

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[29] Green Chemistry Resource Exchange. http://www.greenchemex.org/?module=resources.edit&id=6&fs=1 (accessed February 24, 2009).

[30] U.S. Environmental Protection Agency (EPA), Green Chemistry. http://www.epa.gov/greenchemistry/pubs/pgcc/winners/dgca05.html (accessed February 24, 2009).

[31] When tested as part of a representative paint formulation, according to EPA Method 24.

[32] U.S. Environmental Protection Agency (EPA), The Presidential Green Chemistry Challenge. http://www.epa.gov/gcc/pubs/docs/award_recipients_1996_2008.pdf (accessed November 15, 2008).

Green Chemistry Performance Awards

The Presidential Green Chemistry Challenge Award was established in 1995 by President Bill Clinton to recognize businesses and individuals who have made outstanding achievements in significantly reducing pollution at its sources and used green chemistry to improve the environment. The program provides national recognition of outstanding chemical technologies that incorporate the principles of green chemistry into chemical design, manufacture, and use, and that have been or can be utilized by industry in achieving their pollution prevention goals.

ADM was lauded as the winner of two U.S. EPA Presidential Green Chemistry Challenge Awards in 2005. The award-winning technologies were Archer RC and NovaLipid.[33] Typically, five Presidential Green Chemistry Challenge Awards are given annually: three to industry and government sponsors, one to an academic investigator, and one to a small business. ADM was the first to receive two of the three awards for industry and government sponsors.

As an agriculture company, we rely on the earth's bounty for our livelihood and our commitment to environmental stewardship is a part of our daily operations throughout the company. Having the innovation of our ADM Research division and our company's respect for our environment recognized by the U.S. EPA through these two awards is truly gratifying (Allen Andreas, Chairman of ADM).[34]

Opportunities and Challenges at ADM

Senior managers at ADM wondered how they might be able to deal with some of the existing challenges at ADM while capitalizing on some lucrative opportunities in the marketplace. While some of these opportunities sound intriguing, senior managers wondered if these initiatives were in ADM's best interests.

Culture of ADM

ADM has a relatively flat organizational structure. Most people in the company are quite accessible and employees characterize the company as a friendly, cooperative place to work. The company's innovative culture spawns interesting ideas that are quickly narrowed down to those that demonstrate the most potential for success.

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[33] NovaLipids are low trans fats and oils produced by enzymatic interestification of vegetable oils.

[34] Oil Mill Gazetteer [Online] 2005, Vol. 111, (reprinted with permission from *BioTimes*, a publication of Novozymes). http://www.iomsa.org/leads/OMGjul05.pdf (accessed February 24, 2009).

Fragmented Nature of the Paint and Coatings Industry

ADM's customer market for Archer RC—paint and coatings manufacturers—is very fragmented. Each manufacturer has its own set of formulations, which results in the thousands of paints available today. Each formulation has its own set of ingredients, making it difficult for suppliers like ADM to produce raw materials for multiple customers. ADM doesn't have a large sales force for the paint and coatings industry. It relies on its Web site to convey information, uses large distributors for small-volume sales, and sells direct to large customers.

ADM's challenge is to ensure that its product ingredients, such as Archer RC, fit well with the manufacturers' paint formulations or recipes. ADM has set up a paint-formulation laboratory where its scientists develop suggested formulations for its customers. Moreover, the company uses this laboratory to compare the performance of the old and new formulations.

Emerging Competition

Recently, resin companies have eliminated the need for a coalescent—the ingredient mainly responsible for VOCs—in the first place. Consequently, paint manufacturers must change the entire polymer, which is the basis of the paint formula. As a result, changing from an old polymer to a new, coalescent-free one begs the question of whether it will last as long as its predecessors. Accelerated or predictive tests, which closely resemble 50 years, expose a polymer to UV light and higher temperatures for one year. Although these tests have gained legitimacy, players in the sector recognize that nothing beats placing a board with some coating in real, harsh conditions for 50 years. The traditional polymers and resins that do contain the coalescent have been on the market for 20 to 30 years and have thus been tested for this long. Obviously the length of time that a formulation or ingredient demonstrates durability will essentially determine the warranty lengths of the product as firms gain confidence that the formulation will mimic these results when commercialized.

Removing the coalescent in polymers may lead to a softer coating—one that becomes adhesive and picks up dirt.[35] ADM is also worried that because Archer RC replaces traditional coalescents, it may also result in an adhesive-type outcome. Thus far, four to five years of testing has not demonstrated such a problem. The quantity of Archer RC used dramatically impacts the quality of the coating, however. Too much Archer RC will make the coating too soft, so ADM actually encourages the use of a certain amount of Archer RC and educates manufacturers to the potential problems of using too much. Although ADM offers standard formulations with specified amounts of Archer RC, each paint manufacturer has to run its own tests determine the level of Archer RC required.

Paint companies thus are always concerned that new polymers may not perform as well as their predecessors. ADM suggests keeping the existing resin, which has demonstrated durability, and changing the formulation's ingredients that will reduce

[35] Interview with Paul Bloom, ADM Middle Manager, March 10, 2006.

VOC emissions, which really only account for 2 percent of the overall product ingredients (unlike 25 to 30 percent in the new resin formulas).

Beyond Archer RC

Leveraging its success in the Archer RC technology, ADM continues to explore new chemicals and materials that can be used in both latex paints and other coating applications to lower VOC levels. The company was recently granted a patent for latex paint thickeners that are partly based on fatty acids. This patent combines petrochemical-based materials and fatty acids derived from vegetable oils to create a reactive thickener.

Without a coating thickener, paint runs down the wall once applied. To solve this problem, ADM added the same type of reactivity to the thickener that is built into the fatty acid of the Archer RC. The thickener now has the potential to react well with the Archer RC reactive coalescent. ADM is ultimately trying to transfer the RC capability to the other groups of raw materials that make up the paint and coatings industry to build a formulation based on fatty acid technology. This will both reduce VOCs more generally and ensure consistency in coating quality by aligning the components for optimal reactivity.[36]

Opportunities in other sectors

The paint and coatings industry provided ADM with competencies that might be transferable to other industrial applications, such as adhesives. The company is also trying to understand how renewable-based chemicals may supplement or replace existing petroleum chemicals on the market. ADM recently announced it was building a propylene glycol plant. Propylene glycol is a large-volume chemical that is presently produced from petrochemicals. Propylene glycol is used to maintain moisture in medicines, cosmetics, food, and tobacco products. It also is used as a flavoring agent, a solvent for food colors, a carrier for fragrance oils, a food-grade antifreeze, and an ingredient in hand sanitizers.[37] ADM's goal is to supplement the petrochemicals with glycerol or sorbitol carbohydrate-rich feedstocks.

Unlike Archer RC, which has the same function as a coalescent but uses a different molecule, the propylene glycol that ADM produces would be exactly the same chemical produced from petroleum, but from a biological source.[38] Several ADM customers have

[36] This is very similar to the old alkyd technology (solvent-based), but in an aqueous system. Although the reactivity part of an old non-aqueous alkyd technology was good, the solvent package required was mostly VOC.

[37] Wikipedia, propylene glycol. http://en.wikipedia.org/wiki/Propylene_glycol (accessed February 24, 2009).

[38] One can determine whether the carbon comes from petrochemical sources or old carbon versus new carbon through radio isotope testing methods.

expressed interest in bio-based materials or incorporating higher levels of bio-based materials in their existing products. Customers could then benefit from this offering without the arduous task of changing existing product lines.

Opportunities also exist in the biodiesel sector. Although most people view biodiesel as a fuel supplement, ADM also considers biodiesel a possible engine lubricant. In October of 2006, U.S. EPA required that diesel producers lower sulfur emission levels in regular diesel.[39] Sulfur adds lubricity to the fuel, which extends the longevity of vehicle engines. With lower amounts of sulfur in diesel, engine wear could occur in shorter time periods. Biodiesel is an alternative lubricant that could ultimately replace the role of the sulfur. Adding just 2 percent of biodiesel to diesel fuel could meet the lubricity required to prolong engine wear. U.S. diesel consumption is about 50 billion gallons per year; at 2 percent, 1 billion gallons of biodiesel is a promising market for ADM.

Going Forward

ADM faces a combination of opportunities and challenges. The more pressing challenge is to leverage the Archer RC innovation in an industry that is heavily fragmented and has many options to minimize VOC emissions. ADM is considering how it can leverage some of its competencies developed from the Archer RC brand more broadly in other related fields. Perceptually, one of ADM's greatest opportunities lies in the industrial chemical arena. Applications would include polymers, adhesives, and solvents, which are the main classes of chemicals used today.

More broadly, ADM recognizes the importance of using bio-based resources for products typically made from petroleum. Agriculture can help meet the world's growing energy demands. But ADM cannot do this alone. ADM offers separation, purification, and conversion technologies; it has the expertise to scale things up to enormous volumes; it understands the chemistries of the bio-based materials; and it has competencies around molecule bending that most companies lack. But it is vital for stakeholders downstream to find applications for these revolutionary raw materials.

Chemicals have many end-uses. From tire manufacturers and textiles, to the paint and coatings industry, a number of stakeholders have the relevant skills to find applications in their particular industries. Very few large manufacturers, however, have expertise across a diverse range of product lines. Accordingly, ADM's fragmented customer market means that multiple stakeholders must become involved in the revolution to switch from petrochemical to bio-based materials. A research manager at ADM explained this importance further:

What we don't have is an application staff. So if you think of all the different markets of end-chemical use, all the people that make tires, textiles, coatings, adhesives, there's a number of stakeholders that have their own application expertise. So the buy-in from

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[39] U.S. Environmental Protection Agency (EPA, Diesel Fuel. http://www.epa.gov/otaq/regs/fuels/diesel/diesel.htm (accessed November 17, 2008).

these multiple end-users who will sell the final product is very important. We need that buy-in and cooperation to develop these products so that all can.

ADM recently visited major players in the industry—including petrochemical companies, customers, governmental agencies, and green chemistry institutes—to talk about these opportunities and how the industry as a whole should move forward with bio-based materials for long-term sustainability. But these discussions are only at a preliminary stage.

Although the bio-based raw materials sector has proven quite lucrative in the past, the complexity of the environment is changing rapidly. For instance, corn and soybeans might appear to be the energy crops of the future, but as with other bio-based feedstocks, this might change. Similarly, soybeans are a commodity of choice right now and ADM has become rather proficient in its production. What happens when this changes? Those companies that can keep up with the changes and the latest trends associated with those changes will be most successful.

Overall, senior managers wondered what directions ADM should consider in light of the many opportunities and challenges facing the company at the moment. ADM's history has created a very resilient brand in the minds of its customers. The managers wondered how they might strengthen this brand further while staying abreast of the many changes in the external environment.

Case Discussion Questions
(these are meant to act as a guide only)

1) Describe the industry in which ADM competes. What are the defining characteristics of this industry? What is the competitive structure of the industry? What other external factors should ADM consider?

2) How successful has the company been to date? Support with data. What factors account for ADM's success?

3) What are ADM's strengths and weaknesses? What competencies and capabilities does the company have that its rivals lack?

4) What is ADM's organizational paradigm? What does the company stand for? Describe its culture.

5) How should ADM position itself in the paint and coatings industry? The industrial products industry? What internal capabilities should it leverage in this positioning strategy?

6) If you were asked by ADM's CEO to recommend specific strategies for the next five years, what strategic options would you consider and what options would you recommend? Why?

7) How do you suggest ADM implement these recommendations?

Appendix A

Consolidated Statement of Earnings
Archer Daniels Midland Company
Year Ended June 30[40]

	Year Ended June 30		
	2005	2004	2003
	(In thousands, except per share amounts)		
Net sales and other operating income………….	$35,943,810	$36,151,394	$30,708,033
Cost of products sold…………………………….	33,512,471	34,003,070	28,980,895
Gross profit……………………………………..	2,432,339	2,148,324	1,727,138
Selling, general, and administrative expenses...	1,080,811	1,401,833	947,694
Other expenses (income) – net………………….	(165,847)	28,480	148,471
Earnings before income taxes………………..	1,516,375	718,011	630,973
Income taxes…………………………………….	471,990	223,301	179,828
Net earnings…………………………………….	$1,044,385	$494,710	$451,145
Basic earnings per common share……………...	$1.60	$0.76	$0.70
Diluted earnings per common share…………..	$1.59	$0.76	$0.70
• Average number of shares outstanding – basic.	654,242	647,698	646,086
Average number of shares outstanding – diluted	656,123	649,810	646,863

[40] ADM 2005 Annual Report [Online] (page 35). http://www.adm.com/en-US/investors/Documents/2005-ADM-Annual-Report-Eng.pdf (accessed March 9, 2009).

Appendix B

Consolidated Balance Sheet, Archer Daniels Midland Company[41]

	June 30 2005	June 30 2004
	(In thousands)	
Current Assets		
Cash and cash equivalents	$522,420	$540,207
Segregated cash and investments	908,001	871,439
Receivables	4,102,263	4,040,759
Inventories	3,906,698	4,591,648
Other assets	271,319	294,943
Total Current Assets	9,710,701	10,338,996
Investments and Other Assets		
Investments in and advances to affiliates	1,879,501	1,832,619
Long-term marketable securities	1,049,952	1,161,338
Goodwill	325,167	337,474
Other assets	448,404	443,606
	3,703,024	3,775,087
Property, Plant, and Equipment		
Land	209,130	190,136
Buildings	2,660,267	2,568,472
Machinery and equipment	10,962,390	10,658,282
Construction in progress	298,963	263,332
	14,130,750	13,680,222
Allowances for depreciation	(8,946,370)	(8,425,484)
	5,184,380	5,254,738
	$18,598,105	$19,368,821
Current Liabilities		
Short-term debt	$425,808	$1,770,512
Accounts payable	3,399,352	3,238,230
Accrued expenses	1,318,766	1,580,700
Current maturities of long-term debt	222,938	160,795
Total Current Liabilities	5,366,864	6,750,237
Long-Term Liabilities		
Long-term debt	3,530,140	3,739,875
Deferred income taxes	779,427	653,834
Other	488,202	526,659
	4,797,769	4,920,368
Shareholders' Equity		
Common stock	5,385,840	5,431,510
Reinvested earnings	3,011,015	2,183,751
Accumulated other comprehensive income	36,617	82,955
	8,433,472	7,698,216
	$18,598,105	$19,368,821

[41] ADM 2005 Annual Report [Online] (page 36). http://www.adm.com/en-US/investors/Documents/2005-ADM-Annual-Report-Eng.pdf (accessed March 9, 2009).

Appendix C
Historical Timeline of ADM[42]

Year	Activity
1902	John W. Daniels founds Daniels Linseed Company in Minneapolis, Minnesota, and is named president.
1903	George A. Archer joins John W. Daniels in Minneapolis The first bottle of flax linseed oil is made at the Archer-Daniels Mill on February 17.
1905	The company name is changed to the Archer Daniels Linseed Company.
1911	Capitalization reaches $1 million.
1914	The company's first expansion takes place when a linseed mill is leased in Superior, Wisconsin.
1915	The company expands to compete in eastern U.S. markets by building a linseed mill and a public grain elevator in Buffalo, New York.
1923	The company hires its first chemist for research. The Midland Linseed Products Company is purchased; the company's name changes to Archer Daniels Midland Company (ADM).
1929	ADM purchases the Werner G. Smith Company of Cleveland, Ohio, the country's largest manufacturer of core oils. ADM starts crushing soybeans in its Toledo and Chicago plants, becoming a leader in the rapid development of soybeans in the United States. ADM acquires the Commander Larabee Corporation, one of the largest flour milling operations in the United States at the time.
1933	ADM begins manufacturing formula feeds.
1934	ADM installs the first continuous solvent extraction unit in the United States at the Chicago plant and begins the solvent extraction of soybeans.
1940	New product development through research grows rapidly, turning raw linseed and crude soybean oil into several hundred different products.
1954	ADM purchases the resin division of U.S. Industrial Chemicals, with plants in Newark, New Jersey, and Pensacola, Florida.
1958	ADM enters the isolated soy protein business.
1962	The ADM logo is changed from the Archer yeoman to a logo design meant to represent chemical molecules coming from a natural resource.
1963	ADM completes its grain export terminal at Destrehan, Louisiana. This is its first direct outlet to the Gulf Coast.
1964	T.L. Daniels steps down as chairman and Erwin A. Olson is elected as chairman.
1966	ADM begins producing textured vegetable protein (TVP®) at the Decatur East Plant.
1967	ADM sells its Chemical Group to Ashland Oil & Refining Company in a refocus on agricultural products.
	ADM completes its soybean oil refining and hydrogenation plant in Decatur, Illinois.
1970	ADM acquires assets of companies, enabling the company to return to the mixed feed and dry corn milling businesses.
1971	ADM acquires an 83 percent interest in Corn Sweeteners, Inc., a wet corn milling plant in Cedar Rapids, Iowa.
1972	ADM forms the American River Transportation Company.

[42] ADM, History. http://www.adm.com/en-US/company/history/Pages/default.aspx (accessed March 9, 2009).

1974	ADM acquires soybean plants in Holland and Brazil, its first processing facilities in Europe and South America.
1978	An ethanol production plant starts up in Decatur, Illinois.
1980	Net earnings are $116 million on net sales and other operating income of $2.8 billion. Shareholders' equity increases to $767 million. ADM Industrial Oils is established. The Peoria, Illinois, ethanol plant is purchased.
1981	An ethanol production plant starts up in Cedar Rapids, Iowa.
1982	ADM purchases Clinton, Iowa, ethanol production plant.
1986	Expansion in Europe: ADM acquires Unilever plants in Hamburg and Spyck, Germany, and Europoort, The Netherlands.
1989	ADM constructs an industrial soy protein facility in Decatur.
1991	ADM enters citric acid business. Walhalla, North Dakota, ethanol plant bought.
1992	ADM builds pilot plant operations for canola oil-based biodiesel fuel in Leer, Germany.
1994	Asian expansion: Investments into Wilmar Holdings, Singapore, are made with main JV partner in Asia; first investment into China, East Ocean Oils & Grains (EOGI) in Zhangjiagang, is initiated.
1997	Brazilian expansion: ADM acquires Glencore's Brazilian grain operations, including a head office in Sao Paulo, 33 grain elevators, and a fertilizer processing plant. ADM enters the cocoa business.
2000	Construction of five new crushing plants in China begins.
2001	ADM acquires Doysan yah Sanayii, a Turkish vegetable oil producer with a crushing plant, refinery, and packaging operations. ADM acquires Sociedad Aceitera del Oriente, S.A. (SAO), a Bolivian vegetable oil producer with a crushing plant, refinery, packaging operations, and grain elevators. ADM announces a new corporate logo, tagline, and advertising campaign designed to underscore the company's deep commitment to nature and global agriculture. ADM creates a technology council with P&G Chemicals to develop innovative, natural-based products.
2002	ADM completes its acquisition of Minnesota Corn Processors, LLC (MCP). With the acquisition, ADM adds corn wet milling plants located in Marshall, Minnesota, and Columbus, Nebraska.