Sustainability Challenges, Scientific Research and Lessons Learned in Linking Knowledge to Action:

One Person's View from MARS

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The Situation As Harold Sees It

- Food and Agriculture **Footprint** in Global Society: Environment, Health, Economics, etc
- The **Important** Role of Science in Shaping the Food and Agriculture Footprint
- The **Current** State of Science in shaping Food and Agriculture
- What the **Future** Shape of Science in Food and Agriculture Could Be
- The Role of **Strategy** in Defining the Role of Science in Food and Agriculture
- The role of Science in Shaping the **Cocoa Sector** is a Compelling Case Study from which to **Learn**

IBM Advertisement in *Wall Street Journal*

Conversations for a Smarter Planet

Why chocolate matters to a smarter planet.

Even in tough economic times, chocolate provides one of life's simple and inexpensive pleasures. But the next time you savor a bite, think of this: that sweet treat is the product of a vast global supply chain that includes shippers, processors, marketers, delicate natural habitats and 6.5 million farmers. For many of them, your minor indulgence comes with major consequences.

Cocoa, the key ingredient in chocolate, is the base of an intricate global system of people, families and communities who depend upon cocoa for their livelihood–a system that supplies millions of people around the world with more than 3 million tons of chocolate every year.

The cocoa plant itself is so fragile it only grows within a narrow geographical band around the equator. It takes nearly five years for a cocoa tree to produce its first beans. And more than a third of the world's cocoa crop is lost every year to fungal infestations, boring insects, disease and drought.

This $700 million loss has a major impact on developing nations in West Africa, Southeast Asia and Central and South America, which produce more than 90% of the world's supply.

A smarter food system would help farmers improve the quality and quantity of their crops and facilitate sustainability for future generations. And that's exactly the goal of an ambitious project spearheaded by Mars, Incorporated, the world's largest chocolate company; the USDA's Agricultural Research Service; and IBM.

Together, we hope to sequence and analyze the entire cocoa genome, which consists of some 400 million base pairs of DNA. By combining computational biology with supercomputing expertise, researchers can sift through massive amounts of biological data to uncover genetic patterns that could lead to hardier plants, more abundant harvests and smarter farming practices. The resulting genetic information will be made freely available through the Public Intellectual Property Resource for Agriculture, helping farmers around the world grow new plants that are more disease resistant and require less water, fewer pesticides and chemical fertilizers, yielding better-tasting beans.

And if we can grow smarter cocoa, we can also grow smarter corn, grains and soybeans. Just imagine the impact of smarter rice – the main food source of more than half the world's population, making up 20% of the total food energy intake for every man, woman and child on earth. (Actually, that's something IBM is working on, too–using our World Community Grid to study the structures of the proteins that make up the building blocks of rice.)

Since the dawn of agriculture, farmers have sought hardier crops and higher yields. On a smarter planet, the infusion of intelligence can improve yields and diversification, reduce costs and inefficiencies, and create more economic opportunity for everyone involved. Which would be sweet, indeed.

Let's build a smarter planet. Join an ongoing conversation about the most critical issues facing our planet today at **ibm.com**/think

FINANCIAL TIMES

USA Monday July 25, 2005

USA $2.00 Canada C$2.50

World Business Newspaper

Mars finds the good in cocoa compounds

By Jeremy Grant in Chicago and Clive Cookson in London

The idea that cocoa could actually be good for you may sound like a guilty chocoholic's fantasy.

But Mars, the confectionery maker, will on Monday unveil research showing that cocoa compounds could help treat diabetes, strokes and vascular disease.

The company said it would also reveal that it has discovered how to replicate such compounds know as flavanols a finding that holds out the prospect of the creation of "a potential major new class of medications" available for development by pharmaceutical companies.

It will also tell a gathering of scientists in Switzerland that it is in "serious discussions" with pharmaceutical companies about licensing the development of these "synthesised flavanols".

Norm Hollenberg, professor of medicine at Harvard Medical School, which shared some of the research with Mars, said: "The mounting scientific evidence on cocoa flavanols is extraordinary. This is a scientific breakthrough that could well lead to a medical breakthrough.“

Studies have shown health benefits from eating flavanols: plant chemicals that occur not only in cocoa beans but also in other foods such as green tea, red wine and tomatoes.

But the application of flavanols in medicines offers a chance to use them directly to treat the sick rather than simply as part of diets to help avoid the onset of illnesses.

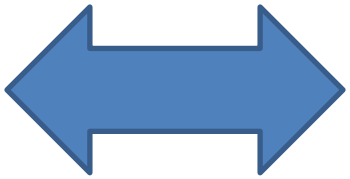
The novelty of Mars's approach is that by discovering how to replicate naturally-occurring flavanols, its researchers have hold out the prospect of significant commercial potential because they have been patented - a key attraction for pharmaceutical companies.

Many pharmaceutical companies are struggling to come up with new blockbuster drugs at a time when existing products are coming off patent protection.

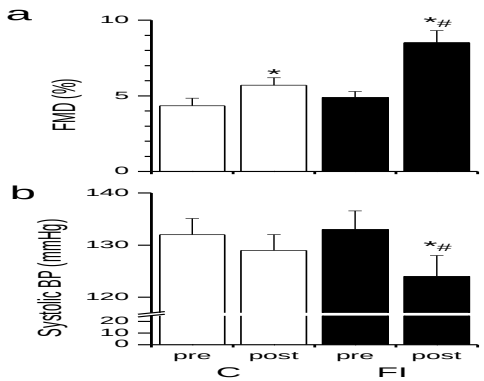
Harold Schmitz, Mars' chief science officer, told the Financial Times: "We are in a position that none of us could ever have dreamed of. We have a valuable asset that's not just about food, it's about the pharmaceutical sector.“

Mars is at the forefront of such research because ownership by the secretive Mars family has allowed it to invest without recourse to external shareholders.

The ‘Old’ World Of Cocoa



The ‘New’ World of Cocoa, Sustainability, Science and Society



Heiss et al., JACC, 2010