Journal of Agricultural and Applied Economics, 38,2(August 2006):355–367

An Outlook for the Biofuels Industry in the Southern United States

Anthony Crooks and John Dunn

Two seemingly unrelated topics are discussed—an outlook for biofuels in the southern United States, along with an overview of the important role that information technology is playing in the fuel ethanol industry. The outlook discussion is limited to issues involving the two principal biofuels, fuel ethanol and biodiesel, and their respective feed stocks, corn and soybean oil. The two topics are linked with a description of how information technology (IT) has enabled the development of the fuel ethanol franchise and a discussion of how IT is changing the very nature of biofuel operations.

Key Words: biodiesel, biofuels, fuel ethanol, fuel ethanol franchise, information technology, IT

JEL Classifications: O14, O31, Q12, Q13, Q16

Two seemingly unrelated issues are presented herein, starting with a discussion of the outlook for biofuels in the southern United States, and following with an overview of the important role that information technology is playing in the fuel ethanol industry. The outlook discussion will be limited to issues involving the two principal biofuels—fuel ethanol and biodiesel. The two topics are linked in the methods through which information technology (IT) has enabled the development of the "fuel ethanol franchise," and how IT is not only restructuring an entire industry but is changing the very nature of biofuel operations.

Outlook for the Biofuels Industry in Southern States

There is both awareness and increased interest in the production and use of renewable fuels. However, it's unlikely that there will be any near-term regional shift in production toward the southern United States.

Of the 106 fuel ethanol plants in the United States, only two operate in the 11 state region that extends from Texas to North Carolina and Florida (Figure 1). One is located in Texas and the other in Tennessee, and the combined annual production capacity of both plants is less than 100 million gallons.

Fuel ethanol production and intentions in the South are constrained mainly by the relatively limited availability of corn, ethanol's principal feedstock. Southern corn production is confined generally to the Texas Panhandle and eastern hill country, along the Mississippi Delta, and to a much lesser extent, the coastal states of the Carolinas and Georgia (Figure 2), and it is fed primarily to the livestock raised in those respective areas—cattle in Texas, poultry in the delta, and hogs and poultry along the coast (Figures 3, 4, and 5, respectively). And while corn is in surplus in these areas, the amount of corn diverted to supply a plant would have an estimated basis impact of

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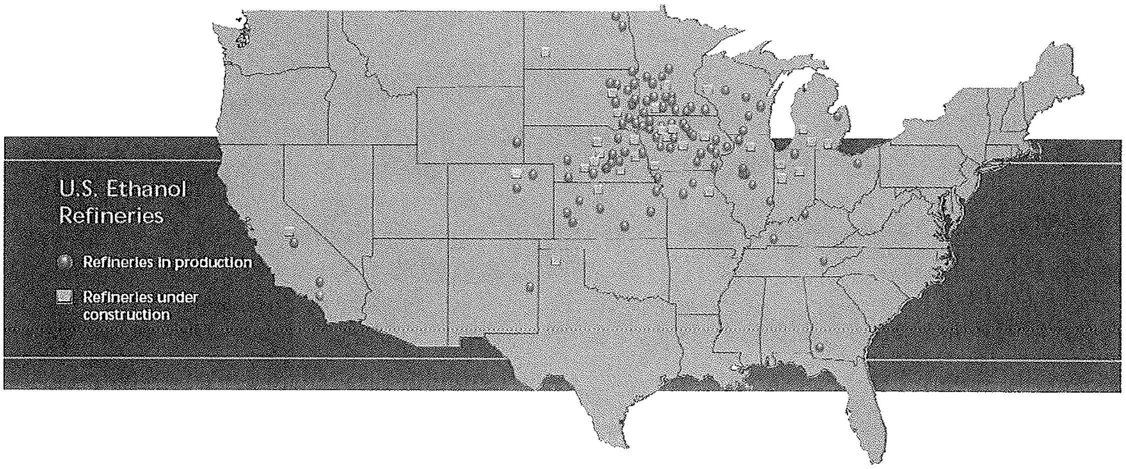


Figure 1. U.S. Ethanol Refineries in Production and Under Construction as of January 2006 (Source: Renewable Fuels Association. Used with Permission)

\$0.09 to \$0.025 per bushel, depending on its location. These basis effects to the corn price would be offset somewhat, however, because the distiller grains coproduct is increasingly included in livestock rations. Inclusion rates for distiller grains into the diets of cattle, hogs, and poultry are presently as high as 25%, 10%, and 5%, respectively.

There is also some intention for developing ethanol projects in the South in 2006 or 2007 (Table 1). Three of these however, are "destination" plants to be located along the Mississippi River with designs to procure a substantial portion of their grain from terminals along the Mississippi. If the development of these projects hasn't been postponed indefi-

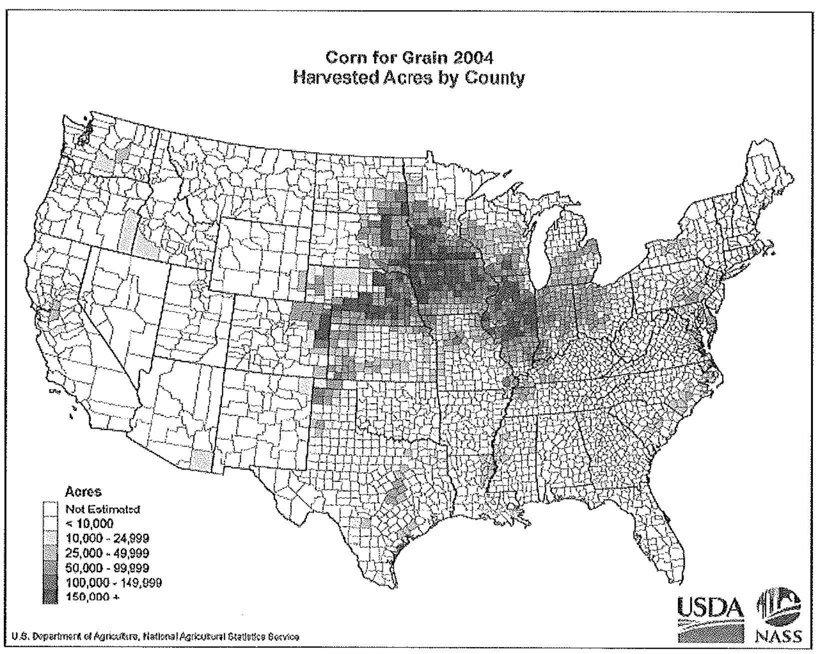


Figure 2. Corn for Grain, Harvested Acres by County in 2004 (Source: USDA, National Agricultural Statistics Service)

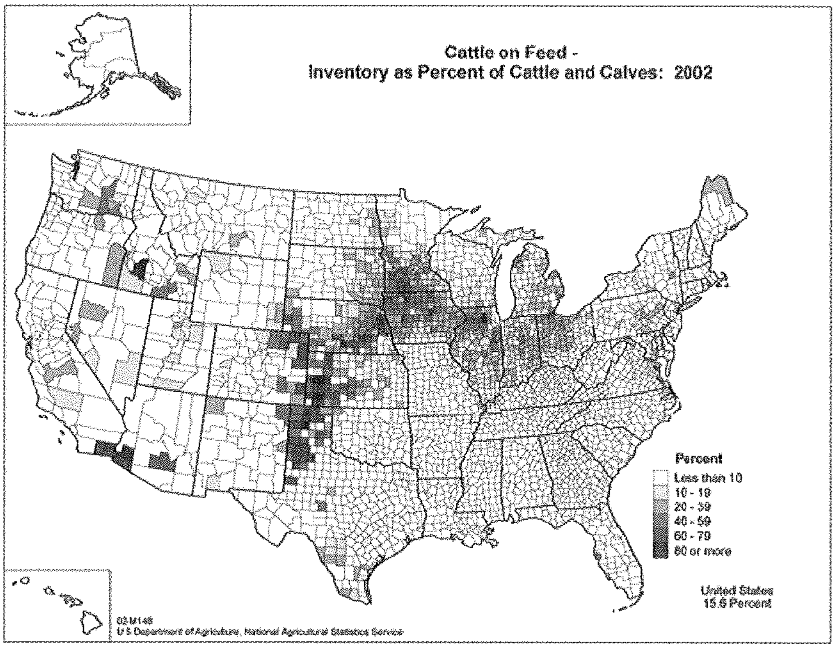


Figure 3. Cattle on Feed, Inventory as a Percent of Cattle and Calves in 2002 (Source: USDA, National Agricultural Statistics Service)

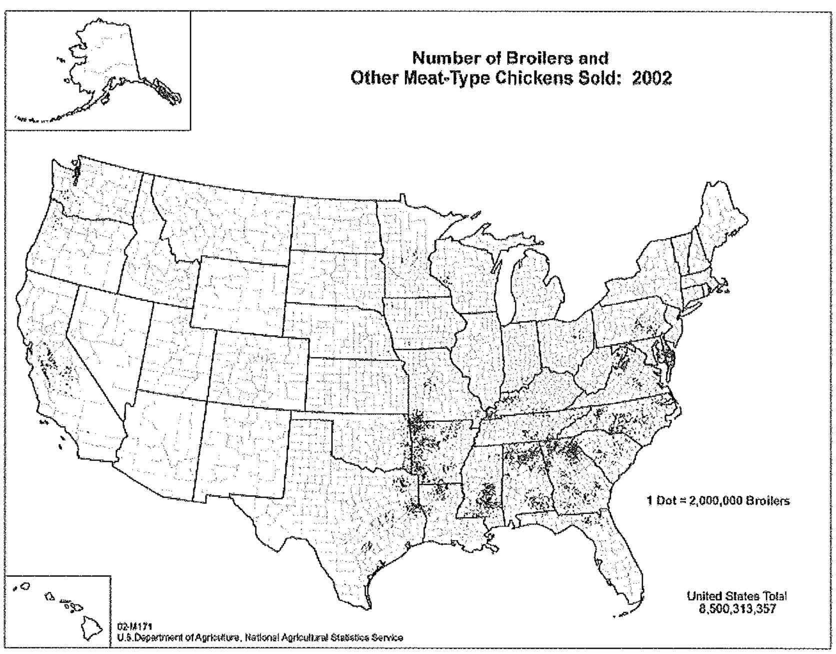


Figure 4. Number of Broilers and Other Meat-Type Chickens Sold in 2002 (Source: USDA, National Agricultural Statistics Service)

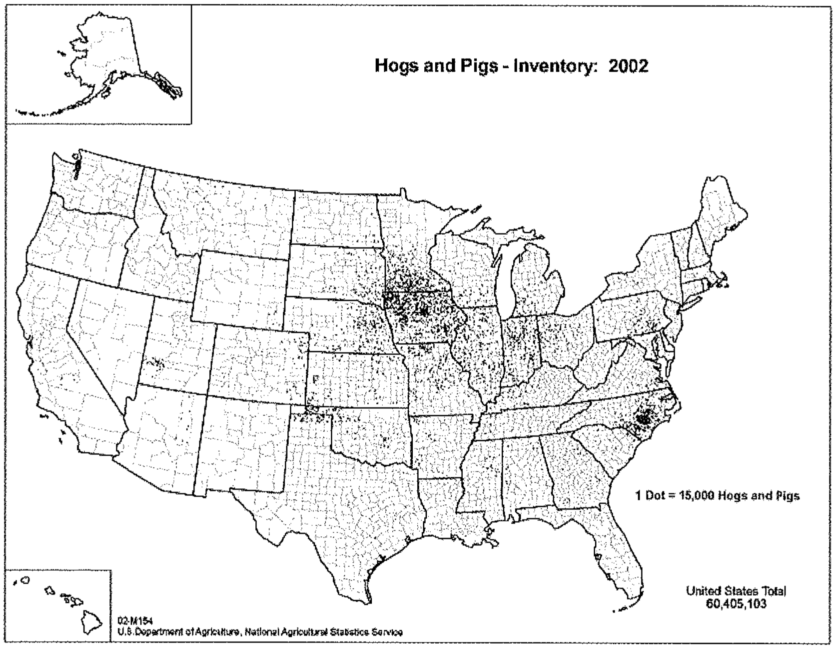


Figure 5. Hogs and Pigs, Inventory in 2002 (Source: USDA, National Agricultural Statistics Service)

Table 1. Proposed Fuel Ethanol Facilities in the Southern United States

	Proposed: Location	Groundbreaking	Capacity *Mil. of gal.*
South Central—West			
Oklahoma Farmers Union Sustainable Energy, LLC	Enid, OK	Spring 2006	50
Levelland/Hockley County Ethanol LLC	Levelland, TX	July 2005	40
Panda Hereford Ethanol		December 2005	100
White Energy Hereford	Hereford, TX	December 2005	100
Novahol Brazos River, LLC	Stephenville, TX	Unannounced	25
Ethyl Alternative Fuels, Inc.	Baton Rouge, LA	2006	50
Bionol, LLC	*Lake Providence Port, LA*	*July 2006*	*40*
South Central—East			
Rosedale Biorefining, LLC	*Rosedale, MS*	*June 2006*	*45*
Coahoma County Bioenergy	*Clarksdale, MS*	*2007*	*35*
Amory BioRefining LLC	Amory, MS	June 2005	45
South Atlantic			
Albemarle Biorefinery, Inc	Martin County, NC	June 2005	55
Berkeley Biorefinery, Inc.	Berkeley County, SC	March 2006	55

Italicized plants are 'destination' plants intending to originate feedstock from the Midwest.
Source: Ethanol Producer Magazine.

Table 2. State Ethanol Production and Marketing Policies and Ethanol Production

State	Producer Incentive Payments	Retailer Incentives for Ethanol Blends and E-85	State RFS	MTBE Ban Passed	Retail Pump Label Require-ment*	State Fleet Fuel Purchase Require-ment	Ethanol Production *(Mil. of gal.)*
Top 10 Participants							
Iowa		×		×	×	×	1,263
Illinois		×		×	×		816
Minnesota	×	×	×	×			524
South Dakota	×	×		×	×		456
Wisconsin	×			×	×		210
Kansas	×			×		×	150
Indiana	×			×		×	102
North Dakota	×	×			×		34
Maine		×		×	×		
Montana	×		×	×	×		
South							
Alabama					×		
Arkansas					×		
Florida					×		
Georgia					×		
Louisiana							
Mississippi	×				×		
North Carolina				×			
Oklahoma	×	×					
South Carolina					×		
Tennessee					×		67
Texas	×				×		30

* Label required during winter oxygenated fuels program only.
Source: Renewable Fuels Association.
Updated: August 2005.

nitely by the devastating hurricanes Katrina and Rita, it surely must await the restoration of the grain transportation system and subsequent barge traffic to the ports of New Orleans and Lake Charles.

In addition to an abundant feedstock supply, an emerging southern fuel ethanol sector would also require a supportive policy and marketing environment. The most progressive environments not only encourage production with incentives, but also provide incentives to blenders and retailers through the formation of a state reformulated fuel standard and a state fleet "flexible fuel" vehicle purchase requirement, and the prohibition of methyl tertiary butyl ether (MTBE).

Table 2 places in stark relief the work needed to be done among southern states toward a renewable-fuels-friendly policy and marketing environment. It is no coincidence that 8 of the 10 states that most participate in renewable fuel production and market incentives are also the nation's top ethanol producers. Note also that the three southern states that have production and marketing incentives also have plants in production or development.

One of the policies that suggests a state's support for renewable energy production and use is the ban on the use of MTBE. Note that 9 of the 10 state policy participants have also banned the use of MTBE. Given that the legislative attempts to ban MTBE in Georgia and Florida were recently and quite adamantly rejected, the prospect for any proposed plants in

Table 3. Estimated Ethanol-Blended Fuel Use by State in 2003

Top 10 States		South	
	1,000s of gal.		*1,000s of gal.*
California	10,328,817	North Carolina	859,316
Illinois	3,853,362	Kentucky	583,898
Indiana	1,388,287	Louisiana	467,316
Iowa	1,043,910	Texas	326,243
Michigan	1,514,178	Alabama	149,856
Minnesota	2,752,096	Arkansas	—
Missouri	1,083,090	Florida	—
North Carolina	859,316	Georgia	—
Ohio	1,837,216	Mississippi	—
Wisconsin	1,078,773	Oklahoma	—
		South Carolina	—
		Tennessee	—
Totals	25,739,045		2,386,629

Source: Renewable Fuels Association.

those states for the near- or mid-term appears significantly less favorable.

Industry principals believe strongly, however, that once the nation phases out MTBE, the use of ethanol in the southeast will grow (Table 3). Note that the one state in the South that has banned MTBE is also the leading user of ethanol-blended fuel.

Other hopes in the growth of ethanol production in the southeast rest on the technological development of cellulosic ethanol—the conversion of cellulose fiber to ethanol in lieu of corn starch. And while the technology is constantly making strides, the difficult questions associated with its commercial deployment remain. (Viability remains, illusively, "five years down the road," just as it has been since the early 1990s.) The most difficult barrier to commercial viability continues to be the economic collection of cellulosic material. And those involved with research and development continue to look to the federal government to provide more financing and developmental programs. However, hope does remain, in the form of the recently passed U.S. Energy Policy Act of 2005, which requires that at least 250 million gallons of the nation's supply be cellulose-derived ethanol by 2013.

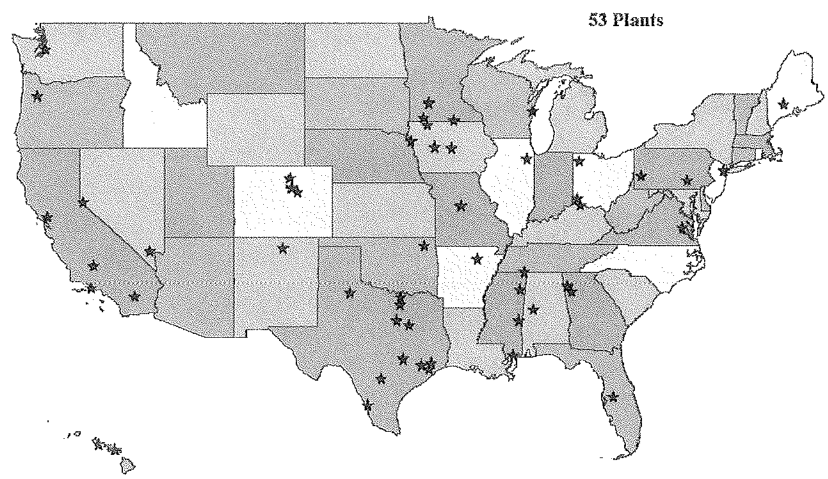
The development of biodiesel in the southern states, in contrast to that of ethanol, is showing promise. The number of southern plants nearly doubled from 20 to 34 in the eight months from April 2005 to January of 2006. In April 2005, 13 of the 20 plants were producing. As of January 3006, 20 are producing, and another 14 are under development, with one undergoing expansion (Figure 6).

Most plants use or plan to use refined soybean oil as a feedstock given soybeans' relative prominence in the South (Figure 7). However, one plant processes cottonseed oil and another, beef tallow. There is one intended canola oil plant, and three southern plants expect to process yellow grease or recycled cooking oil.

A combination of tax credits and high petroleum prices appears to be the biggest impulse behind the biodiesel expansion. And while there is a risk associated with the credits not being extended beyond their appropriation date of 2008, the market environment would have to change significantly to lose such support:

Extension of the biodiesel tax credit. The biodiesel tax credit has been extended through December 31, 2008. The tax credit extension date included in the Senate's version going into conference was through 2010. The biodiesel tax incentive is a federal excise tax credit that brings lower-cost biodiesel to consumers. The credit equates to one penny per

Commercial Biodiesel Production Plants (January 13, 2006)



Biodiesel Production Plants Under Construction (February 15, 2006)

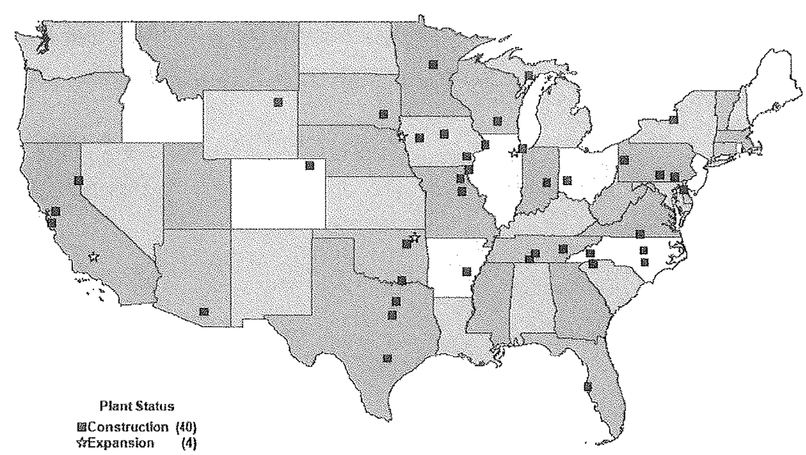


Figure 6. Commercial Biodiesel Plants in Production and Under Construction (Source: National Biodiesel Board. Used with Permission.)

one percent of biodiesel in a fuel blend made from agricultural products like vegetable oils, and ½ penny per one percent for recycled oils. The incentive is given at the blender level, meaning petroleum distributors, and is passed on to the consumer.

Credit for installation of alternative fuel refueling infrastructure. Installation of infrastructure that dispenses biodiesel blended fuel (B20 minimum) qualifies for this credit.

Small agri-biodiesel producer tax credit. This tax credit establishes a 10 cents per gallon tax credit for agri-biodiesel producers. The credit is applicable up to 15 million gallons of agri-biodiesel produced and limited to producers under 60 million gallons of annual production.

Biodiesel engine-testing program. This program provides $5 million per year funding authorization (FY 2006–2010) to initiate a collaborative research project testing biodiesel in advanced diesel engine and fuel system technology.

Other alternative fuel incentives. There is a hope in the future potential of biodiesel becoming the preferred lubricity solution when the Environmental Protection Agency's Ultra-Low Sulfur Diesel fuel regulation goes into

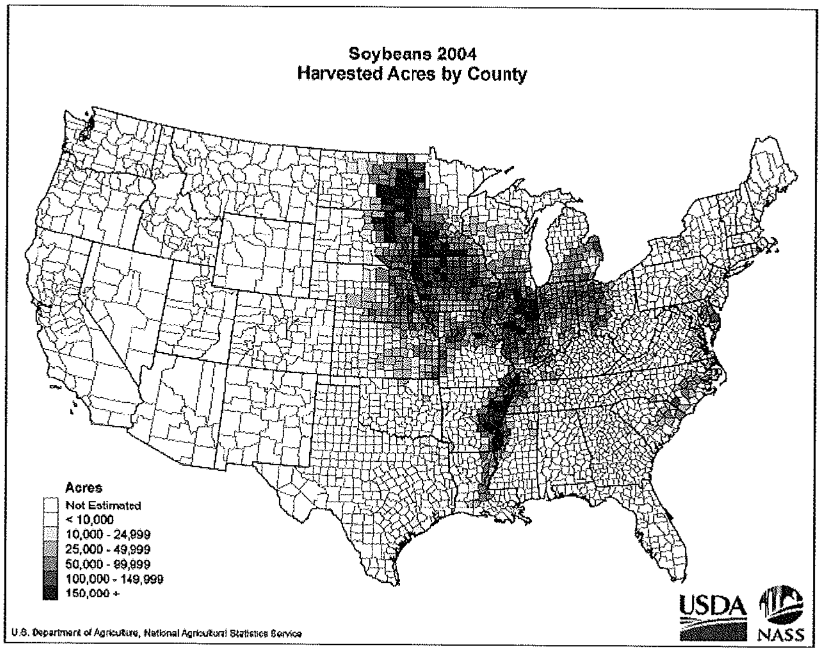


Figure 7. Soybeans, Harvested Acres by County in 2004 (Source: USDA, National Agricultural Statistics Service)

affect in June 2006. Other programs that could encourage the production and use of biodiesel include the addition of biodiesel to the Strategic Petroleum Reserve and the mandated use of biodiesel in federal vehicles.

No outlook discussion would be complete without mentioning the roles and influences of developing technologies upon the sector in question. In addition to the production efficiencies afforded to them by way of standardized design technologies, southern biofuels plants under construction and in development will almost certainly attempt to exploit recent developments in advanced information technology. The balance of this manuscript is used to describe and account for the increasingly influential role of information technology. In particular, the rise of the fuel ethanol franchise is described and the role of information technology in restructuring an industry and changing the very nature of biofuel operations is discussed.

The Important Role of Information Technology on Plant Design and Efficiency

Advanced information technology (IT) and an increasingly transparent financial sector have become key driving business forces in recent years; they have major impacts on operations, strategies, structures, ownership, and performance. These forces cut across many industries to force changes, which, in turn, have had significant economic and social impacts in rural communities.

It is precisely because of evolving IT and business process–processing that mid-sized firms from all over the world compete now on a more level playing field. Suddenly, mid-sized and even small businesses have access to the same advantages that were once held exclusively by the larger, vertically integrated firms.

As the fuel ethanol industry emerges from its developmental stage into a more established role within the U.S. fuels industry, a substantial portion of investments are being made in single plants with annual capacities that range from 50 to 100 million gallons. Not all ethanol ventures have succeeded. However, a substantial flow of capital investment into ethanol plants continues unabated.

This emerging industry structure is in sharp contrast with what is typically observed in sectors that process bulk agricultural commodities. Typically, a commodity sector is composed of a few, large multiplant firms that achieve relative prominence after attaining significant economies of scale, size, and scope. These plants then work to capture additional value through their trading and financial operations. These traditional industries are also characterized by a high degree of vertical integration and/or coordination.

The ability of traditional firms to achieve competitive advantage is predicated, in part, on their capacity to develop efficient internal information systems to provide market coordination and links between their operations and global commodity and financial markets. However, the rapid and widespread change in information technologies has arguably eroded the power provided to these global processing concerns.

The Rise of the Ethanol Plant "Franchise"

In the early 1980s, a number of people were exploring the idea of small, portable on-farm stills and 1-million-gallon per year plants. They discovered that, besides being expensive to build, these plants had to be staffed 24 hours a day and that the job turned out to be much more sophisticated than throwing some corn in a vat, then opening up a spigot the next day to fill up a tractor with ethanol.

Broin, Fagen/ICM, and other engineering firms design and build "cookie-cutter" ethanol plants with standard designs that can be easily built in most locations. They also provide the financing, conduct feasibility studies, and will "hand-hold" producer-investors through the entire process. They can offer an entire package—from feasibility to turnkey and beyond.

This prospect did not exist in the early 1990s, when there were many questions about the right way to build a plant. Builders of a 30-million-gallon per year plant had to follow a more traditional construction route. This involved hiring a process firm, an engineering firm for the design, and a construction management firm, all or some of which may have had no prior experience building an ethanol plant. Uncertainty added significantly to start-up costs and, subsequently, to each step in the process.

However, enough plants have been built to develop a large body of knowledge and experience, which has reduced the degree of uncertainty about such projects. Time and expense has been reduced for everything from the first planning meeting to pouring the first gallon of ethanol.

The standardized designs and business models were pioneered mainly by Broin, Fagen/ICM, and a few other companies. These firms began with the recognition that producer groups were developing an investment interest in these plants. They also understood the operating point at which these plants could be profitable—at that time, it was around 10–15 million gallons per year.

Compared with 10 or 15 years ago, standard design technology has cut in half the costs of construction and the nonenergy portion of operations. And while it is unfortunate that higher natural gas costs have wiped out much of that savings, today's plants are being built for half the money and operate twice as efficiently as those of the 1990s.

Several factors have contributed significantly to lowering operations costs, including greater corn-to-ethanol conversion rates, which are now commonly 2.5 bushels per gallon, up to three gallons (on a denatured basis), given the right variety of corn. Reduced cost and increased efficiency of enzymes mean that enzymes cost only half of what they did 10 years ago.

Distributed Control Systems

Prior to the mid-1980s, process automation was composed of analog loop controls and complex pneumatic controls with individual, large circuit boards dedicated to each control loop. These systems were normally located in control rooms, so the sensors and controller outputs had to be physically connected to the control room. This resulted in large cable runs full of wires and tubing.

Because the systems were bulky and required direct interconnections with the process, there were often several satellite control rooms for each part (or subpart) of the process. These systems required sophisticated maintenance by skilled instrument technicians, and data logging was done on strip chart recorders. Despite the awkward implementation, these systems replaced hardwired relays and manual controls for critical systems, allowing plants to reduce labor and improve consistency of operation.

But an even more significant contributor to plant efficiency has been the development of information technology systems, the so-called distributed control systems (DCS), and the electronic automation that is evolved in the plant. DCS were introduced in the late 1980s, enabling centralized process monitoring and control. DCS replaced integrated circuit board controllers. Inputs from field instruments and outputs to valves and pumps were converted to electronic signals.

They generally run short distances to cabinets in the process area that contain a manageable number of control loops. Each DCS cabinet is connected to a main control computer. Process instruments, output to pumps and valves, and controller settings are driven from a computer console (dashboard) located in a central control room. This design also enables monitoring and control from multiple (and redundant) locations, such as local control rooms, engineering offices, or even remote locations.

Expanding System Capabilities

During the 1990s, these systems grew in capabilities in step with the geometric growth of information technology applications and abilities. This evolution reduced labor requirements by more than 50% during the past 15 years. As computer control, process monitoring, and laboratory capabilities further improved, sophisticated data warehousing and analysis systems were adopted to convert the ever-increasing volume of data into useful information. These systems can now monitor process conditions and control settings, as well as laboratory measurements when integrated with a LIMS (laboratory information management system).

Whereas early systems could only retrieve historical information, today's systems perform complex mathematical manipulations, display graphical results, and project future outcomes, all in real time. Data manipulation and extraction capabilities enable much narrower process tolerances to further reduce costs and simultaneously increase yields and productivity.

The advantages of DCS, data warehousing, and analysis include: a reduction in manpower by allowing one operator to monitor and control several processes at once; the ability to see small changes in production variables and correlate them to changes in conditions, raw materials, or ingredients; and an increase in overall plant efficiency, because operators can fine-tune process parameters using realtime data and sophisticated analysis.

Early on, plants scheduled several maintenance shutdowns during the year to prevent equipment failures. With the data collection capabilities of DCS, preventive maintenance programs came into a world of their own and analysis as "predictive" maintenance programs. These processes and technologies continue to evolve and become even more significant.

Business Process and Bioprocess Metrics and Benchmarking

DCS plants all have the same production and business processes and share a data collection and analysis protocol called "benchmarking." Benchmarking is an array of performance measures that are monitored daily, gathered weekly, and summarized monthly to be reported to management and the board. If, for example, a group of ten plants of common design are all linked together, the business and biological process benchmarks for this group are very well understood.

The manager of any one plant, therefore, can adjust and refine the process to improve their performance and thereby raise the standard of the whole group, in a stair-step fashion. This business process is possible only with today's information technology, and even now it is time-intensive to perform, but it would have been virtually impossible 10 years ago. Firms like Broin and Fagen/ICM have been able to expand to their present capacity level because of the information technology employed by the new plants. Broin and Fagen/ICM each direct the operations of some 25 to 30 plants.

The talent pool to manage and operate these plants has grown with the process. Both firms employ a cadre of well-seasoned managers who learned during the difficult years how to run a plant efficiently. Both companies provide management services, marketing, and procurement contracts to mid-sized plants. This is a far cry from the old days when managers were still putting contracts out and doing everything by hand.

Now, by using information technology and business process technology, a group has the ability to manage 15 to 18 plants as one plant. Fifteen years ago, it would have been nearly impossible to market the product for that many plants and do a good job. Now, an entire array of management services is provided.

There is no way those plants could be managed in this way without improved information technology. The plants themselves are physically too far apart. It would be impossible to oversee so many variables in different parts of the country. The necessary staffing wouldn't be available because of the expertise required at the control points.

Consolidated Marketing Partnerships

The rise of marketing firms has been instrumental in this trend. Ethanol is not marketed at the processing plant. Buyers (the refiners and blenders of gasoline) are unwilling (or unable) to deal with all these small plants. They demand bulk purchasing in hundreds of millions of gallons. Buyers want to sign contracts for 50–180 million gallons and want to trade with a marketer for at least 500 million gallons per year.

This rule of thumb allows both negotiating parties to share relatively equal footing in the marketplace. The first impact of modern IT on the ethanol industry is as a horizontal coordinator. Mid-sized firms with annual production of 50 million gallons or less consolidated their marketing activities out of necessity to bargain with the handful of fuel ethanol buyers, who trade in volumes many times the annual capacity of any one plant.

Successful consolidated marketing efforts have led to innovative applications of these powerful new IT technologies to coordinate other activities horizontally—such as procurement and logistics, risk analysis, and eventually plant management—among several plants simultaneously. This horizontal coordination and consolidation role across enterprises, companies, and time/space is now performed by five or six firms. Their services are contracted to a substantial majority of the mid-sized, farmer-owned plants.

The management responsibilities of these firms have grown so large and complex that some have created subsidiaries to share the workload. The management portfolio of one such subsidiary is composed of 51 contracts distributed over 17 different plants. Over the past few years, the market share of the industry's major producer (ADM) has dropped from 60% to less than 30%. The balance has been taken by marketing firms such as United Bio Energy, Ethanol Products, Aventine Renewable Energy, Inc., and a few others.

The Impact of IT on the Ethanol Industry

Information technology (IT) is a key driving force in fuel ethanol business operations, strategies, structures, ownership, and performance. IT innovations and applications have cut across the ethanol industry, forcing change in ways that have significant economic and social impacts in rural communities.

The impacts of information technology upon the nation's rapidly expanding fuel ethanol industry are profound and far reaching. The once highly concentrated industry may very well return to a concentration of ownership into the hands of a few large processing firms. Presently however, there seems to be a structural balance between more than 70 mid-sized firms and the largest firms. This equilibrium is supported by an industry-wide adoption of contemporary information technologies that serves to enhance mid-sized firm access to both markets and inputs and simultaneously diminishes the relative importance of vertical coordination activities. Contemporary information technologies have fundamentally changed not only the way information flows, but also the scale of operations, access to markets, the relative importance of horizontal coordination at the expense vertical coordination, sources of finance, and the overall competitive landscape for mid-sized, independent processing firms. The cost savings associated with IT, which enables better access to information and financing, have more than offset the cost savings traditionally associated with vertical integration in processing industries.

Innovation related to new IT is leading to the development of new ethanol products innovation and commercialization. IT strips operational costs out of the system, promotes standardization, and mitigates production risks. IT squeezes time out of the system by speeding up construction time, from groundbreaking to turnkey, and by reducing operational downtimes, increasing the days of operation from 340 to 361. IT not only gets plants up and running as much as 6 to 12 months sooner than they might otherwise, but also keeps them running to increase plant production efficiency. IT facilitates the inflow of capital into the industry by helping to quantify the risks associated with plant investment and operations for prospective investors.

IT has altered the nature of the firm by digitizing and decomposing on-site activities to be outsourced, off-shored, and otherwise moved around. This changes the economics of plant location by impacting where various assets are deployed. IT changes labor mobility by moving jobs to labor as well as labor to jobs. IT alters the skill sets needed for plant management and labor. IT further separates ownership from management. IT allows firms to transform themselves faster.

IT has altered the firm's relationships to business and industry because it supports a contract-based industry structure that creates significant linkages and collaboration and enables coordination across enterprises, companies, and specialties. IT gave rise to the ethanol franchise and has used the standardization of that model to narrow the bounds of uncertainty. A better understanding of the associated risks allows the financial community to reduce lenders' equity participation requirements, to reduce interest rates and the overall cost of capital, and invite participation among outside investors. IT has altered the view of the traditional market structure. Economic power now lies in aggregating information assets not in the physical assets of plant and equipment associated with production.

With regard to IT and the future dynamics of the industry, as IT applications within the ethanol industry continue to evolve, competitive forces will spur efficiencies and dynamic growth. Work activities will increasingly be dispersed across geography, institutions, and dimensions as managers and decision makers ask, "What else can be digitized, decomposed, and outsourced?" The balance of economic power within the industry shifts daily from the traditional aggregation of physical asset ownership to the aggregation and integration of information services. However, competitive advantage held today is more easily eroded and replaced. This understanding raises the question, "Will the emerging price discovery mechanisms (futures market and market transparencies) change the comparative advantage of the information aggregators?" The dynamic intellectual-property nature of IT continues to shape the competitive structure of the industry. Where will the talent to continue operations in this environment come from?

Information technology has eroded and distributed the market power once held exclusively by global giants. Enhanced access to factor and product markets among mid-sized fuel ethanol firms arising from the adoption of information technologies may inspire similar developmental opportunities in rural America. The notion that firms may achieve competitive advantage from an efficient, internalized information system in lieu of the high levels of vertical and horizontal coordination typically garnered solely with "largeness," provides both an encouragement for the relative success of mid-sized firms and a developmental template for similar enterprises in rural areas.

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