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Effects of Information Technologies

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The Food and Agricultural Marketing Consortium has before it a monumental task. Who, after-all, would attempt to take on the task of addressing the need for change in agribusiness public policy, when the essence of commerce is being reinvented as we speak? It is like marking a good fishing spot by painting an X on the side of the boat.

Information technology represents an evolutionary response to an increasingly complex world. Command and control structures served our nation well, meeting the needs of an industrial era that required linear responses to govern linear production processes. Our educational system supported the process by creating complete, self-packaged mental operators capable of managing and maintaining the engines of growth emanating from the industrial revolution. The age of reason and scientific thought likewise fit the epoch's requirements. Attempts were made to logically understand and describe the environment in order that planning could take place and risk reduced.

Peter Drucker described today's version of the industrial revolution as the "Knowledge Revolution." Knowledge accelerates within societies when fueled by information moving through an open network. Communication systems, carried by wires and followed by airwaves, transferred information

across barriers of time, distance and political boundaries.

The Network

Carriers of information have changed dramatically over the past few decades, but only until recently has the revolutionary aspect surfaced. The revolution is not the computer, but the network through which the computers communicate. In his book, *Telcosm*, George Gilder describes this as "The Bandwidth Tidal Wave."

Bandwidth describes the diameter of the pipe carrying information between provider and receiver. Telegraph's dashes and dots, moving through a copper wire, transformed society by reducing the barriers of time and distance relative to hand-carried messages. Television moved beyond two-way audible information transfer to include visual and audible inputs. Television and radio, unlike the telegraph and telephone, are one-way communication, which technically is not really communicating.

The arriving bandwidth tsunami results from technological advancements in the compression of digital signals and digital switching equipment. AT&T announced on July 27, 1996, a breakthrough in copper wire communication speed, from the current level of 28,800 bits per second to 6 million bits

per second. Soon speeds may approach the internal speed of the computer itself. At these speeds instead of simple telephone conversations, full motion, interactive, real-time video becomes available to every home wired with a telephone and a computer. Choice becomes the challenge. Content determines success, as always, but instead of the present model with insurmountable barriers to entry, twelve-year-olds become television producers. Interactive means everyone becomes a consumer and a producer.

Consumers and Producers Become One

A new word is needed to describe this changing fundamental business relationship. "Conducer" is the new customer emerging from the merger of consumer and producer. Producers and consumers have traditionally been viewed as adversaries; what benefits one must come at the expense of the other. This zero-sums mentality encouraged the business philosophy of "keep the customer dumb," creating economic opportunity by withholding information. Today, the most successful companies integrate the customer's perspective in the initial product development and design phase.

The old approach to marketing was comparable to harvesting apples. A farmer would pick the apples, bring them to market and depend on price to allocate inventory. A farmer using the new approach would go to the consumer first to determine the type of apple needed and the optimum time for delivery, then alter the production process to match the consumer's needs. The latter approach requires far more information to execute successfully. Transaction costs are significantly higher as a result, unless con-

sumer information is integrated as a normal part of the business process. Information technology can integrate consumer choices seamlessly into the strategic process, reducing transaction costs, while simultaneously delivering exactly what the consumer needs.

The poultry industry integrates consumer purchase decisions directly into the decision-making process through vertical integration. Daily consumer purchases at each store featuring the branded products of the producer are fed into a centralized database. Pricing patterns can then be tailored to match the exact demand at each store or locale. Which comes first: The price is established and then the consumer makes a choice, or the consumer makes a choice and then the price is established? Given the first approach, we never know how many potential customers we lose each day. The latter approach allows the producer to micro manage price relative to actual purchases the day before, reflecting the unique demographics of each store's clientele. The latter approach requires perfect information, something our capitalistic forefathers did not have.

Is the fundamental role of price as the means for allocation of scarce resources changing? I find a useful analogy in production agriculture. Producers commonly make agronomic decisions based on parcels of land such as "an 80," or "the home place." Fertilizer and chemical applications match the parcels for management purposes, so the "80" might need ten tons of product applied and the home place twelve tons. Today, precision agriculture integrates geostationary satellites and sophisticated mapping databases to create management by the foot instead of management by the parcel. Managing by the foot means inputs are perfectly balanced to the unique characteristics of the land, recognizing for the first time

that huge variances exist across an 80-acre field. The result is optimum allocation of resources. Precision agriculture requires precision information systems. I believe agriculture and business in general are now moving into what I call the age of "precision pricing."

Precision Pricing

"Precision pricing" reflects the uniqueness of each purchasing decision, optimizing resource allocation based on the needs of the consumer. Supply and demand no longer become some aggregate measure, but rather reflect the complexity and diversity of the marketplace.

Diversity includes individual, as well as environmental, influences. A snow storm in one region of the country alters consumption patterns dramatically relative to a neighboring region. With real-time information systems collecting actual buying patterns as they occur, a food manufacturer can alter production and logistic schedules to respond accordingly. Real-time information systems optimize inventories, reducing wastage, saving energy and labor, and reducing capital needs dramatically. It is unlikely that a purchasing or marketing department can rival the reality of consumer choice when it comes to forecasting supply and demand.

Commodity exchanges, like the old buyer-seller relationships, are still organized as a zero-sums game. Nameless, faceless buyers meet in an organized, physical setting to transfer price risk. Commodity exchanges require standardized trading terms to facilitate trading and reduce transaction costs. For every buyer there must be a seller and for every dollar made there must be a dollar lost. The market depends on speculators to

provide liquidity in the absence of collaborating buyers and sellers. Buyers attempt to buy as low as possible and sellers attempt to sell as high as possible. The exchange acts as a hub network accumulating information and orders from outside participants to transact inside, disseminating the results via price quotations for the generic commodities traded.

Commodity Exchanges and Networks

The new era of open ubiquitous networks impacts organized commodity exchanges in at least two ways: First, in the delivery of price quotations to the public, and, secondly, in the very important but fundamental role of price as the most efficient determinant of resource allocation.

Price discovery generates more than \$40 million a year for the Chicago Board of Trade through the resale of real time quotes to third party vendors. Private vendors utilize proprietary satellite networks to re-broadcast exchange price quotes, government news, and value-added analysis. The cost of developing, maintaining, organizing and distributing information through proprietary networks was high enough to create a barrier to entry for most commodity exchanges. The Internet represents an inexpensive accessible global network, capable of breaking down barriers. Disintermediation occurs in industry segments built around proprietary electronic or physical information networks. Will commodity exchanges continue to market one of their most important assets through third parties?

Most exchanges now have World Wide Web sites on the Internet, including the Chicago Board of Trade at <http://www.cbot.com>, the Chicago Mercantile

Exchange at <http://www.cme.com>, and the Kansas City and Minneapolis boards of trade. The Chicago Board of Trade recently decreased its delay on free quotes from fifteen minutes to ten minutes. If the Internet becomes easily accessible to market participants, will the exchange continue to use an intermediary to market real-time price quotations?

Commodity exchanges' principal purpose is to provide an organized location for the gathering of buyers and sellers to discover commodity prices and transfer price risk. Organized commodity exchanges, however, do not function well in illiquid, thinly traded, or niche markets.

Thomas Stewart in the June 3, 1991, *Fortune*, (p. 44) quoted Pioneer Hi-Bred International's Research Vice-President Rick McConnell as saying, "Pioneer now can focus on individual customers—breeding strains rich in cornstarch for industrial users or in specific oils for food processors." This led McConnell to state: "Corn is no longer a commodity" (Stewart). Branded poultry products reflect value beyond the commodity itself, with production, processing and distribution controlled by a single firm. Can traditional price discovery systems provide the information necessary for allocation of scarce resources in vertically integrated or specialty markets?

Networked "Communities"

Open networks enable producers or consumers to create communities for sharing information, or possibly for price discovery and risk transfer. Experiments in trading on the Internet already include barter sites, cash commodity trading, and even a winner-takes-all market based on the 1996 presidential

election: "The Iowa Election Markets are real money futures markets where contract payoffs depend on economic and political events such as elections. These markets are operated by faculty at the University of Iowa College of Business as part of our research and teaching mission." (<http://www.biz.uiowa.edu/iem>). Will an inexpensive, accessible, electronic network stimulate the creation of viable commodity exchanges for evolving thinly traded niche markets?

The Internet has thousands of virtual communities called newsgroups. Participants share information, questions, answers and opinions. Access is open and free in most cases. Groups range from generic computer-user groups to esoteric special interests such as bikers at the University of Michigan. Current agriculture discussion groups include everything from ratites to farm machinery discussions. As price and information become more opaque, will virtual communities spring up on the Internet to overcome the lack of publicly available information?

To prosper during revolutionary times requires introspection and examination of basic assumptions. Asking the question, What business are we really in?, is an excellent beginning toward discovering how ubiquitous information networks might alter the core services of an organization. For example, many commercial grain companies have recognized that physical assets alone no longer guarantee financial success. The returns on a multi-million dollar grain terminal are based upon the quantity of grain elevated. The quantity elevated is a function of the company's success in originating grain from other grain companies and producers throughout the grain belt. Origination success ultimately depends on relationships, services and the price offered the producer.

Sharing as a Strategic Opportunity

Relationships and services traditionally are established and delivered via a physical presence. Grain companies generate a significant amount of information regarding selling and buying patterns, quality variations, pricing relationships and general market statistics. Information gathered through the normal business process has never been considered an asset of the firm. For example, few firms publish the daily or weekly average price paid producers. Are there patterns or statistics generated by the firm internally that would aid the customer in decision making without jeopardizing the firm's proprietary data?

Limitations to this approach lie not in technology but in attitude. Opening up an organization to customers (and potentially to competitors) requires confidence in the exclusive nature of value added by the organization's knowledge-based staff, systems and other mental and physical assets. If these assets are not exclusive and unique, the organization must question in a fundamental way why it is in business today.

Learning organizations are crucial to success in the networked organizational model. Knowledge viewed as a renewable resource means constantly investing in the people side of the business as if the people were physical assets.

In the industrial age we recognized the crucial role physical assets played in the success of the firm. Repairs and maintenance are accepted as routine in every organization. Depreciation, recognizing natural decay, is accepted as an economic reserve for replacement of assets. People and knowledge are often viewed as an expense rather than capital assets. If an organization views

its intellectual assets as strategic, then constant investment is essential.

Morphing from a physical to intellectual asset focus requires a "leap of faith." For example, a grain cooperative struggles to compete with an international exporter that is located in the same community. The exporter's terminal is an inline facility feeding internal markets downstream, providing it with an inherent competitive advantage. For years, the cooperative has competed by depending on soft assets like its cooperative status, service attitude and responsiveness, taking advantage of the exporter's primary interest in the physical commodity and lack of interest in service. Price competitiveness favors the exporter. The cooperative is faced with operating at a negative economic value (returns are less than the cost of capital) if it chooses to continue operating the physical facility. In which area should the cooperative seek to establish a comparative advantage: In physical, or intellectual assets?

Intellectual assets can be a source of competitive advantage, given the scarcity of traditional firms willing to commit to sharing knowledge with their customers. In the cooperative example, the cooperative might lease all physical assets to the competitor, in exchange for managing the information flow to the producer, including marketing advice, technology training or network access.

Who in the rural marketplace can deliver both agronomic and technological knowledge services to producers, given the pace of change? In the past, the cooperative extension system served as the liaison between land grant universities and the producer. Today, financial constraints diminish extension's ability to deliver all the needed services. There is an opportunity to create a new market-driven system, interfacing land

grant institutions, producers and agribusiness. The university might market services to "information cooperatives," providing a source of revenue to the university and the cooperative. As access to information expands, the need for support and assistance increases.

Open Networks Alter Business Processes

Open networks allow new sources of information to evolve. The National Grain and Feed Association is developing Electronic Data Interchange (EDI) standards for the grain and feed industry. EDI speeds up commerce by standardizing document flow between trading partners. Moving physical grain between buyer and seller requires purchase and sales confirmations, bills of lading, weight and grade certificates, and settlement documents. Many transactions are chained, transferring the same physical commodity between numerous buyers and sellers in succession. EDI eliminates paper flow and re-entry of data, integrating the standardized information directly into the recipient's accounting system, reducing errors and settlement delays.

Grade and weight certificates are typically official government documents. As EDI becomes the norm in grain commerce, an official weight and grade central database could become a new source of publicly available information. Electronic warehouse receipts are available for cotton and soon other commodities may be added. What reports or information might be derived from a real-time database of receipts, including grade and quality information? Naturally, there will be resistance to increased access of logistical information, since access to information is a source of competitive ad-

vantage today. From an industry perspective, better information regarding grain movement, quality, and inventories increases the potential for making good decisions regarding scarce resource allocations, whether it is rail car utilization or processing through-put.

Disintermediation

Open networks also lead to disintermediation. A middleman in the networked world is similar to being the little guy between two big guys in a game of catch. You see a lot of activity going on, but it all goes right over you. Bureaucracies and management layers evolve to manage information flow between producer and consumer. When producer and consumer become closer, middlemen serve no economic purpose, contributing to the layoffs occurring throughout the corporate world. When manufacturer and retail store connect electronically, warehouses and inventories are reduced. When inventories are reduced, less working capital is needed. When money is transferred electronically between seller and buyer, checks and the banking facilities are no longer needed. Every intermediary must objectively justify its existence.

Consider the following examples: Crop insurance is a federally subsidized risk management program mandated most recently for farm program eligibility. Several innovative premium services are available, but few field agents understand the products or how to market them. By utilizing an open network, an insurance company could develop an interactive multimedia marketing program, explaining the benefits of each level of coverage. The producer could input data directly to receive a quote from one or several firms. Online marketing of regulated

services begins to blur the line of political regulatory boundaries.

An agricultural equipment manufacturer depends on independent dealers to market their products. Most dealers carry multiple lines of equipment. How can the manufacturer be confident that a salesperson is promoting all the equipment benefits? The manufacturer might consider bypassing the dealer network and replacing it with a virtual network. What if the manufacturer publishes specifications, feature/benefits, multimedia demonstrations, and visual testimonials on an Internet Web site?

Product and service providers are showing the most interest in bypassing intermediaries, not due to costs necessarily, but because there is better content control. Small and medium-sized businesses that cannot afford sophisticated training programs are finding the leverage available in an open networked structure attractive. These examples assume that the agricultural market will get connected.

Universal Access

It is somewhat paradoxical that in business, vertical integration is accelerating, which restricts information flow in the marketplace, while at the same time the Internet with its open architecture is expanding information availability exponentially. Has integration evolved out of a need to control information better? Will an open network replace the need for industrialization within a closed corporate structure?

Profound change will occur in the structure of organizations, particularly in agriculture. The concept of price as the instrument for allocation of resources is in question. Sharing information creates transparency,

which leads to disintermediation and blurs the traditional lines between buyer and seller. Productivity can only increase in this environment.

From a policy perspective, which is the focus of this symposium, the most important component necessary to reap the benefits of the information revolution is universal access. Rural development is dependent upon universal access. Absent of government policy, would networks like highways, post offices, electricity or telephones be available to small communities? Universal access is a social investment. Networks gain in value as their magnitude expands. Agriculture must have universal access to the communication infrastructure if it is to remain competitive.

NOTES

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