“GLOBAL INFODUSTRIAL SOCIETY: THE IMPACT OF IT & COMMUNICATIONS ON THE SUGAR INDUSTRY”

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ABSTRACT

Rapid technological advances have created the Global Infodustrial Society. This paper examines the future of information technology (IT) and communications in this society, and its impact on the sugar industry. The biggest single driver accelerating the pace of technology change is the Internet and its graphical interface - the World Wide Web (WWW), and this is creating a global cybermarket. The Intranet, Extranet, Internet and WWW, called knowledge nodes by Jeff Papows, CEO of Lotus, are collaborating with each other, and through their continual interaction, helping us connect to our constituents - customers, employees, vendors and suppliers. Moore's law which predicts the doubling of computing power every 18 months, and Metcalfe's law, which says that while the cost of a network expands linearly with increase in network size, its value increases exponentially, are the basis for this IT revolution.

The Web has a major impact in three key areas - critical mass which uses the principles of Metcalfe law, mass customisation, which allows individual preferences and volume to coexist simultaneously, and mass communication where there is no trade off between the amount of information and its cost of distribution. Digitalisation is leading to universal networks and the convergence of communications, computers, consumer electronics and content (4 C's). There are an estimated 150 million computers connected to the Net today and this will increase to over one billion in the next 6 years with business of US$ 0.5-1.0 Trillion being done via the Net by 2002.

We will be moving towards near perfect competition, and the new battle will be for customer profiles, with information systems becoming more market oriented. All the factors mentioned so far, will bring about a cultural change in our organisations towards adaptability and flexibility, and a new era of trust, security, and openness, will incentivise information sharing. The economic fulcrum is tilting in favour of enterprises built on ideas, innovations, and intellectual assets, which are becoming more important than conventional factors like labor, raw material, or capital.

This impact is also being felt in the sugar industry across the globe and in the Indian sugar industry, the greatest impact will be on the agricultural side leading to substantial improvements in productivity, sucrose content and ratooning of cane. Information sharing will help in developing better varieties and remote sensing could accelerate advance weather forecasting, disaster management, pest control etc.

The next generation of ‘Smart Scada’ products shall be voice based, self organising, interacting with each other, and will be continually accessing large related external databases. Buyers will have access to comprehensive real time information through multiple global electronics bulletin boards, and usage of these new networks and e-commerce would cut out some of the traditional intermediaries in the distribution chain. Techniques such as ERP and Supply Chain Management will bring significant efficiency improvements in operations. Further the internationlisation of sugar operations will lead to a concentration of efficient global players.

Computer interaction is also changing with developments in computer vision, speech recognition, and
more importantly, self-organising abilities. The next revolution is forecast to be biological, where DNA cells themselves will do computations. The molecules will be self-organising, and have the ability to manipulate. Nanotechnology would give us greater flexibility in the manufacturing process and cut costs radically. As Rodney Brooks of the Massachusetts Institute of Technology has said, “there will be more power in a sugar cube than what exists in the world today”.

A) The Infodustrial Society

The Industrial revolution of the last century affected about 200 million people. Today’s information revolution has directly affected over 4 billion people. The relentless drive to globalise, which has been made possible by the rapid technological advances, is changing how billions of people live, work and think. Today, technologies are being introduced faster than in any previous period, and our society is a fusion of these complimentary forces. Hence the phrase “global infodustrial society”, and in this background, the paper examines the future of information technology (IT) and communications, and its relevance and impact on the sugar industry.

It is clear, that whichever nation, and in fact, whichever industry, absorbs and uses these technologies effectively will be the most competitive, and have the highest growth rate. Nearly half of the capital investment in the United States today is spent on enhancing IT, and over a third of the recent growth in the United States GDP, has been due to the growth in information technology. It is probably unparalleled in history where a single industry has had such a profound impact on an entire developed nation’s economy.

B) The “Knowledge Nodes”

Speed is of paramount importance, and it gives those who use it, a significant competitive edge. Today, we talk of web periods lasting three months at the most, rather than the traditional year long business cycle. Probably the single biggest driver accelerating the pace of technological change, is the internet and its graphical interface - the World Wide Web (WWW). In the cyber space, which we have all willingly entered, there are four key elements of strategic importance to our competitiveness:

1) The Intranet, which is a secure internal network employing digital information technology to promote the sharing of information and knowledge amongst employees of a single company. ABB in India is connected to all the ABB units worldwide through the Intranet, and is thereby integrated with 60,000 users.

2) The Extranet, which employs similar technology, but goes beyond the confines of an enterprise to external communities, and effectively links the enterprise to its suppliers, customers, and other businesses.

3) The Internet, which arrived on the scene just before our last Congress, is a public information highway, and was originally developed by the US Government to protect its military installations from nuclear attack. Today, it is open to anyone having access to a computer equipped with a modem.

4) The World Wide Web (WWW), which is a fast growing entity on the Internet, was created in 1989 at the European Laboratory for Particle Physics to provide easy access to pages of information through “hypertext” links. Through these links, any computer on the web has instant access to information published on any other computer on the Internet, regardless of distance. Distances are no longer an economic disadvantage in today’s infodustrial society, and individual skills are becoming increasingly portable.

As Jeff Papows, the CEO of Lotus has said, it is critically important to recognise that each of these “Knowledge Nodes” as he calls them, are not separate areas of information technology, but an integral component of the same IT revolution. These Nodes are really collaborating with each other, not competing, and through continual interaction, are creating the present and future global cybermarket, or simply put marketspace. E-mail is just
one example, and helps us connect our constituencies - customers, employees, vendors, and suppliers with each other, through the Intranet, Extranet, and over the Internet and the Web.

C) The "IT Laws"

There are two so called laws which have had a profound impact on the IT revolution. The first is Moore's law, named after Gordon Moore, the Intel founder, who in 1966 forecast that computer processing power would double every 18 months. This has happened for the past 32 years, and it is forecast that it will probably continue to happen for the next 15 to 20 years. To give an example, by end 1999, Intel would have processors in the 700 Mhz range, and by 2001, a gigahertz CPU is on the cards. Over the next few years, we expect a three-fold increase in processing power, a six-fold increase in graphic performance, and a dramatic increase in memory capacity, giving processors access to bigger banks of memory. In economic terms, this law translates into a simple fact - everything using digital technology will get faster, smaller and cheaper.

The second law is Metcalfe's law named after Bob Metcalfe, the inventor of Ethernet. This states that while the cost of a network expands linearly with increases in network size, the value of a network increases exponentially. The implications of this law are just as profound as that of Moore's law. As networks expand towards infinity, they become dramatically more useful and cost effective. In practical terms, this means that Web sites, databases, and on-line services can attain success and capture a market, even though the cost to service these networks decreases to virtually zero. This then is the challenge before all of us.

D) Impact of the Web - “The Three Masses”

The Web will have a major impact in three critical business areas - critical mass, mass customisation, and mass communication.

a) Critical Mass

Software and information are the driving technological forces on the web, and they have one essential aspect in common. Whatever it costs to make the first copy, be it one dollar or one billion dollars, the cost of the second copy is virtually nothing. The average cost of bit based products falls exponentially with volume, and eventually it falls to naught. The value of networks go up rapidly with volume, but the average costs of software on the network falls steadily. This gap between costs and value symbolises the scope of our opportunities.

The Internet scale economies can therefore generate virtually infinite returns, which means that the sheer size of an enterprise will tend to mean less in the cyberspace world, than at present where economies of scale require increased size. By undermining to a large extent the advantages of scale for commodities (e.g. sugar), tomorrow’s cyberworld Davids may rise to threaten the hegemony of today’s industrial Goliaths.

We, in the sugar industry, will have to continue our R&D efforts, with the realisation that we can no longer hold onto past developments and innovations for too long. Unlike the pharmaceutical industry (except perhaps in the area of cane seeds), it will be much more difficult for the sugar cane industry to rely only on patent protection to retain its competitive edge and meet customer needs.

This issue of critical mass, is one of the main reasons why internet stocks are quoted at such extremely high price earning multiples on all stock exchanges. A simple fact illustrates this point. Once your web site is built, the marginal cost of serving additional users is almost zero. This is unlike any traditional sales, marketing or customer service experience. To repeat this crucial point, the effect of critical mass will reinforce a Web-based business dynamic in which the strong will only become stronger.
b) Mass Customisation

It was generally assumed that customers need to pay a premium, often a high one, for any customised feature or service. This is the dominant perception in most manufacturing industries including the sugar industry. Again, this model no longer holds good. There is now a change in relationship between customisation and volume. This relationship is being steadily inverted, and database technology has drastically reduced the costs of customisation. Contrary to our existing pattern, customisation is now information based, and therefore becomes easier with increasing volumes. Industries are using customisation for increasing demand and providing stability to their earnings stream.

With critical mass, we witnessed the blending of the concepts of initial network cost and product replication. With mass customisation, two formerly contradictory concepts - those of cutting cost and increasing customisation, are being fused into a more powerful business model. We must apply this to the sugar industry, satisfying the ever changing requirements of our bulk (soft drink, pharmaceutical) and general customers.

c) Mass Communication

In the pre-infodustrial society, there was a trade off between the amount of information provided, and the costs of physically distributing it. Once again, in the new web-based paradigm, these two attributes have come together, and we would now have the capability to provide both maximum communication depth, and maximum volume. The marginal cost of storing and transmitting information is effectively negligible, and so we do not have to worry about a trade-off. Here we have a positive feedback cycle. The more depth provided, the greater the volume of use, and with this volume, the need for more depth. In fact, we will have to be careful about information overload. How do you sieve through all the information available, in a reasonable time frame, and get only the information you want. In this Information Age, with every company becoming an Information Provider in some form, companies will no longer need to worry about cost and time implications while using the traditional mediums like telephone, postage, printing etc., and instead, will be free to focus on all the information that their customers really need.

E) Technology Innovation

Some representative areas of future Technology Innovation are presented below in the Hardware, Software and Communication sectors.

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<th>Hardware</th>
<th>Software</th>
<th>Communications</th>
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<td>Affinity Identification</td>
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<td>Disks Digital Versatile</td>
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Source: Enterprise.com by Jeff Papows

The Digitalisation revolution shall lead to near universal networks. There would be a technology convergence of the 4 ‘Cs’ - communication, computer, consumer electronics and content, and this would be mainly directed at the mass consumer sector. Hardware shall reflect the convergence of PCs and consumer electronics; communication will reflect the convergence of voice and data; and content will reflect the merger of multiple media - text, image, audio and video. Eventually, the full scale integration of sensors, cameras, and communication capabilities in the products we use everyday, will transform the marketplace. Product mobility through Personal Digital Assistants, Smart Cards and phones etc. will be steadily increasing. Fully functional handheld devices will handle most communication needs. In the future, we will have low cost hardware devices (whether they are PCs or something else) selling for under US$ 100, and these would be far less complex to use. Voice rather than keyboard operation would increasingly come into being.
Over the next few decades, the cost of telecommunication shall drop to the point that it becomes a virtually free commodity. Large scale usage of fibre optics and wireless communication, along with newer compression techniques, will practically eliminate bandwidth constraints. This will make large scale transfer of data much faster and cheaper. The rapidly falling costs for multimedia and videoconferencing would make these facilities an integral part of our new web based business environment (implications for Congress nine years hence!). The volume of network traffic will probably double each year for the foreseeable future. A consequence of this phenomena will be a shift in the nature of communications from Circuit-Switched voice to Package-Switched data. In 1990, 90-95% of all communication was voice. This will drop to around 10% by 2000/2001 and then go down even further. We need communication channels that are designed for data but have the flexibility for voice, rather than what we have today, which is the other way round.

This new economics of the network, has replaced the old economics of silicon chips, as the principal driver of not merely the IT industry, but all industries. This plenary session is really about networks and networking - from the internationalisation of sugar industry R&D, to the usage of IT, to our response to the new global regime.

F) Organisation Transformation

In the future, the historic internal focus of most information systems, will shift towards a more external or market oriented system. Very soon, the current era of competition on the Internet, which represents a battle for traffic, will give way to a new era, where the defining battle will be for customer profiles, and that too online. All that has been mentioned so far will bring with it a cultural change in our organisations. Adaptability and flexibility are likely to replace restructuring, and a new era of trust, security and openness, especially with respect to sharing intellectual property, will come. Individual companies will be forced to develop a global information infrastructure, and Knowledge Management may incentive information sharing and even penalize information hoarding. The paper on Internationalisation of R&D is most appropriate. We need to imbibe a new culture of effective Knowledge Management, and change to a more appropriate corporate culture.

IT is deeply imbedded in all business. In many areas, such as telecommunications, automobiles, airlines, and financial services, market leadership has been established by a few focused companies that have invested aggressively in the network economy, and I cannot see why the cane sugar industry should be an exception. We must, therefore, take this as a technological challenge, and devote far more resources to these efforts than what we have done in the past. With rapid technological change, comes the drive for innovation, and this must also be our forte, as it is generally perceived as being synonymous with profitability and industry leadership.

Communication technology is also radically changing the enterprise. Both voice mail and e-mail provide asynchronous communication. This is a quantum jump over the fax machine, and allows effective direct connectivity over the world’s time zones. Mobility allows messages to be received and answered from anywhere, and the embedded broadcast capabilities allow for rapid information dissemination. With the advancement in communications technology, many companies are being forced to move away from a country focus, to a more global product line approach.

Collaborative software solutions are redefining traditional corporate boundaries. Groupware, a term used for these team efforts, in the current network-centric era is subtly shifting the status and relationship of people within our companies at almost all levels. The relevance of these phenomena for individual sugar technologists, and for sugar enterprises, are extremely important and critical. Those of us who are able to make a paradigm shift in both understanding and using these new technologies quickly, will be the winners, and this is just as relevant in a commodity driven industry such as ours, as in a hightech industry.

There are an estimated 150 million computers connected to the Net today. This is expected to increase to 300 million by the next Congress, and to one Billion over the next 6/8 years. The CEO of Intel, Craig Barrett says that by 2002 at least US$ 500 Billion worth of business will be transacted via the Net. However he adds, that his only problem is that each time he looks at his forecast, the figures tend to increase by 30%. By the way,
others have estimated the e-commerce potential as high as US$ 1 Trillion by 2002. With the possibility of 1 Billion connected computers, the real issue is the impact of these connections on the way we do business, and how we can remain competitive in this new environment. Six years from now is not too long - it is just two Congresses away. Will we be ready for it?

The coming two decades shall witness an economic transformation unprecedented in the annals of history for the speed at which it will take place. In the words of Intel’s Andy Grove “the world now runs on Internet time” and the two M laws shall accelerate the pace of innovation and unleash near-perfect competition. Individuals and enterprises will know precisely what is going on at a certain moment in time, and in a certain place anywhere in the world, and will have the ability to turn this information into actionable knowledge. The economic fulcrum will continue to tilt in favour of enterprises built on ideas, innovations, and intellectual assets. Indeed knowledge and information are destined to constitute a more important production factor than labour, raw material or capital.

G) Impending Changes In The Sugar Industry

The competitive pressures of globalisation have brought with it a renewed focus on flexibility and customer needs, and it is forcing us to be innovative to stay in existence. The benefits of the current Infotech and Communication revolution have not fully percolated down to the Indian cane farmer and the sugar industry. Though various sugar economies such as Australia, are at a different stage of development, I think worldwide there is a tremendous scope to use these present technologies more efficiently.

In India, the area where the returns can be the greatest is on the agricultural side. Unfortunately we have some structural constraints. There are about 7 to 8 million individual cane farmers, and in many cases, their landholding is under one hectare. Rural infrastructure is generally poor, and extension work is carried out in a limited way by government organisations and the sugar factories. As these powerful IT and communication tools are now available in India, we have the opportunity to aggressively try and improve productivity, sucrose content, and ratatooning in cane. The sharing of research and information both nationally and internationally, and its quick dissemination, should help India develop much better new varieties and accelerate their propagation. Satellite tracking will help accurately define varietywise cane areas, yields, incidence of diseases and pests etc., over these vast areas. Advance weather forecasting would help individual farmers do some disaster management, and the usage of remote sensing data could help factories isolate water-logged or drought-prone areas for special treatment. Even though we have a large number of farmers (going as high as 60,000), attached to each factory, the new information gathering and processing techniques, could allow us to introduce the pricing of sugar cane based on sucrose content for all farmers. These efforts would enhance rural prosperity and bring about a better quality of life.

The worldwide advent of Digifarms has already begun. A digital moisture meter tells one when the harvest should start. The farmer rides in a portable office on his tractor, which has onboard computers, a satellite linked GPS, sophisticated sensors, which automatically dispense precise amounts of fertilizer and pesticide, allowing each square foot of tillable land to receive the same measured care as a backyard vegetable patch. At the same time, the farmer is connected to digitised maps, streams of weather data, worldwide commodities markets, his bank, and spreadsheets of his financials.

The usage of Enterprise Resource Planning (ERP) packages allows for the integration of the functional and decision making areas into a more cohesive and efficient structure. Sugar companies, as part of their supply chain management could monitor the inventories of their customers at the retail level online, and thereby take quick decisions about restocking. Usage of the new networks and e-commerce more effectively would cut out some of the traditional intermediaries in the distribution chain. Buyers would have access to more comprehensive real time information through multiple global electronic bulletin boards. As mentioned earlier, we need to discover our customers’ ‘secrets’, customise our product range, and implement quicker engineering and process changes based on these customer needs, without serious cost implications. The knowledge of what is happening in other process industries must become much more vital to us sugar technologists, and we will therefore have
to keep abreast with the speed of technological innovations happening elsewhere. The next generation of "Smart Scada" products would be voice based, self organising, interacting with each other, and through the Net continually accessing large related external databases.

As distance and physical geography means nothing on the Web, all businesses including sugar, will see opportunities to expand beyond their regional boundaries. International business will rapidly increase, resulting in an era of restructuring and consolidation for the industry worldwide. Transnational Sugar Corporations, with units in many countries will dominate, and lead to a concentration in the number of efficient global players. This trend is inevitable. A positive result of these changes, is that we would have cleaner procurement, production and distribution technologies, and would slowly be able to correct the current adverse impact on our environment.

H) The Future's Future

While the Internet revolution is on, a change in computer interaction will also be taking place. We would change the way we use computers, and new software will help pull the computer into our world. For example, we would routinely call a computer, ask for information, and bring it into our conversation. Changes in computer vision, speech recognition capabilities, and more importantly, self organizing abilities, will breed vastly enhanced and different capabilities for computers to understand what is going on in the world, and thereby facilitate this change in interaction.

The next revolution, whenever that might come, is forecast to be biological. DNA cells themselves will be put to do computations. These molecules will not just be information carriers, but structured molecules that are self organising, and have the ability to manipulate. Nanotechnology would give us flexibility in the manufacturing process and cut costs radically. The attempt will be to approach the raw material and energy cost. Molecule manufacturing systems will help build smaller, faster and more powerful computers through artificial materials. As Rodney Brooks, Director, Artificial Intelligence Laboratory at the Massachusetts Institute of Technology has said, in the future, he hopes to have more power in a sugar cube than what exists in the world today.