4-1-2004

Revving the Innovation Engine in China, Japan, and the United States

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EXECTUTIVE SUMMARY

In the early 1980s when IBM launched the Personal Computer, senior executives of many multinational corporations (MNCs) demonstrated little initial interest in reaping the returns on investments promised by budding technology pundits. Corporate adoption of subsequent advances in Information and Communications Technology (ICT) have since promulgated worldwide. Today, MNC managers have come to regard ICT as a key differentiator of their competitive advantage. Drawing from metrics produced by the World Economic Forum, this paper comparatively assesses the viability of Chinese, Japanese, and U.S. firms as they increasingly compete for global market share, relying on technology as a critical success factor.

KEY WORDS

ICT Innovation, ICT Metrics, ICT Globalization, ICT Competition, ICT Marketing

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INTRODUCTION

Notwithstanding the initial reticence to embrace ICT during its genesis, the efficiency gains that were assured as technology matured often never seemed to materialize (David, 1999). This was witnessed in the late 1990s when an explosion of interest in ecommerce came into focus when corporate America viewed the Internet as a promising and exciting new channel for global marketers. Ecommerce, the technology-mediated exchange between parties (individuals, organizations, or both) is not a new concept either in theory or in implementation (Rayport & Jawarski, 2001). In fact, it merely extends *existing* ICT advances such as electronic data interchange (EDI) that began in the 1980s. Despite massive inflows of cash to deliver ecommerce projects, the vast majority of ecommerce initiatives failed and caused a mass migration of investor money away from technology stocks.

Other advances, such as the development of the Internet for commercial enterprise, had its genesis in 1994 when the Clinton-Gore Administration took steps to make its vision of the National Information Infrastructure (NII) a reality. A catalyst to promote technological innovation and new applications, this government-funded effort channeled billions of dollars toward helping the private sector develop and deploy relevant applications and implement the technologies that would maximize value to end-users. To date however, the overall acceptance by the general public of ecommerce has been uninspiring. In fact, rather than providing a bridge between individual consumers and the retail channel, the Internet has instead been adopted more as a logistical aid in business-to-business (B2B) ecommerce than business-to-consumer (B2C) ecommerce.

The less-than-enthusiastic success of initiatives by corporations to deploy ICT was examined in a recent report by Commerce Net, which posits that the seamless flow of information between global firms and widely geographically distributed end-users is not easily implemented because of problems stemming from 1) security and encryption, 2) trust and risk, 3) lack of qualified personnel, 4) lack of business models, 5) culture, 6) user authentication and lack of public key infrastructure, 7) organization, 8) fraud and risk of loss, 9) internet/web access and throughput, and 10) legal issues.

ECONOMIC GROWTH AND ICT

Economists have long identified three inter-related variables that serve as mechanisms driving economic growth. The first is the efficient allocation of resources, based on market competition and the division of labor first studied by Adam Smith in 1776, the second is capital accumulation, when national savings are converted into increasing capital per worker, and output per worker hypothetically rises. The third mechanism in economic growth is technological advance.

Improvements in technology – such as new product development - can be achieved by either creating new technologies and/or by adapting technology that has already been developed for use in the manufacturing process. When applied to ICT, the first option is called technological innovation; the second, technological diffusion. All three mechanisms - division of labor, capital accumulation, and technological advance - are important, but technological advance is most assuredly the most sought after mechanism by MNCs. Without technological advance, the benefits of the other two mechanisms are muted; so while they push the standard of living higher, they do not necessarily prolong the associated effects as improvements in ICT would. Advances in ICT have often been self-perpetuating and sometimes trigger new technological innovation, leading to positive downstream benefits in a kind of chain reaction that fuels long-term economic growth. This is precisely the result that MNCs hope to achieve by leveraging their ICT investment while simultaneously providing sustainable maximum efficiency gains (Acemoglu, 1998; Goldin et al, 1999; Krueger, 1993).

QUADRAPARTITE FORCES AFFECTING BUSINESS

Like the multifaceted aspects in which technological advancements occur, international business activity is similarly affected by multidimensional forces. Many nations striving to advance their economic growth via international trade and in doing so face a volatile environment within which business activity is impacted by four factors. These factors can be described as 1) social, manifested as people and their behavioral consuming patterns, trends, public interest, public awareness, religious background, ethnicity and beliefs; 2) political, determined by political influence of government standards including legal requirements, global relations, international influences and other political influences; 3) technical, originating from advancement in technologies, innovations, requirements, and the needs of end-users; and 4) economic, which include domestic productivity, interest rates, capital markets, tariffs, and other economic influences.

In this context, the most radical change in marketing - and hence the ability for nations to compete - is the shift in power from the producer to the merchant to the consumer. Such a radical shift is supported by the widespread reach of the Internet, whose extent is virtually limitless, yet whose current usage by consumers is abysmal because of the reasons previously cited. Nevertheless, the Internet presents global businesses with an entirely new medium for connecting to consumers never before reachable. It offers the promise of delivering products and services directly to the customer in a one-on one real-time relationship. This truly global reach by producers frees users from pervasive marketing, advertising, and sales intermediaries that heretofore controlled and channeled information, acting on behalf of manufacturers and other third parties (Bresnahan & Goldstein, 1998; Spulber 1998).

THE NEW, ENLARGED ROLE OF THE MARKETER

As the expansion of the marketspace is no longer limited to a particular geographic area or consumer segment, the role of global marketers is widening in scope and deepening in complexity (Rayport and Jawarski 2001). Catering to such a diverse customer base becomes increasingly complicated as marketers face the need to bridge the social and cultural gap to effectively reach out to consumers spread out around the world. The associated increase in global competitiveness resulting from increased numbers of firms vying for the same pool of consumers causes marketers to change their business strategy.

As a greater number of consumers are becoming price sensitized and the smaller-sized retailers, previously able to charge higher prices for the same products, are forced to rethink the way they conduct business, consolidation among retailers is inevitable. Not only are customers chasing lower prices for the goods and services that they consume, they are also more knowledgeable than ever before. The explosion of information available on the World Wide Web is providing the customer with a yardstick to measure and compare similar goods and services online, an ability they lacked prior to opening the Internet up for commercial endeavors. As such, the Internet and its associated ecommerce activity has become the ultimate leveraging device for many consumers. Marketers are therefore faced with the need to increase product awareness and decrease consumer prices just to maintain the same customer base they commanded for years while simultaneously exploiting the Internet's inherent global reach to attract more customers and compensate for shrinking profits.

CHINA – THE NEXT ICT POWERHOUSE

China's push to joining the global economy after gaining admission to the World Trade Organization (WTO) is seen in how it is pursuing its own ICT agenda. The nation's leaders in Beijing have decided that the fastest way to share the spoils of globalization is to immerse itself into the high-tech world of ICT and enjoy the gains in efficiency and effectiveness these technologies promise. Further, its domestic industries, seeking to reach as wide a market as possible and interconnect with their respective supply chains, are determined to use as high a level of technical sophistication as the national ICT infrastructure might enable. The country's agenda to meet this challenge has been preempted however, by its requirement to build up its telecommunications infrastructure, an initiative that is being met with impressive results.

Electricity blackouts and a technology-starved telecommunications network have always constrained Chinese economic growth. Clearly, the nation's ability to provide the vast sums necessary to build its ICT infrastructure in order to compete effectively in international markets depends in large part on its ability to attract foreign direct investment (FDI) to finance key projects. Even the nation's ability to generate enough electricity to power the country's push into the digital realm is almost unobtainable without capital inflows to fund the myriad technological projects currently under construction. Inflows from FDI helped China's economic development in 1998, for example, were in excess of $25 billion. Concomitant problems with inflation, reaching as high as 24% at the end of 1998 for example, caused the government to loose confidence in its ability to control an overheated economy. To partially solve this dilemma, senior leaders felt that by linking the country together via ICT, the resulting cohesion of far-flung provinces with the central government would provide the nation's leaders with the ability to speak with one voice to the people. Further, the fact that foreign firms operating in China would need high quality telephony to conduct business both domestically and internationally gave cause for the nation's leaders to face the reality that the basic telephony infrastructure was extremely poor and needed a massive overhaul. Obviously,

business could not be expected to flourish until an efficient infrastructure was built. Realizing that there is a fundamental link between information and economic development, China's leadership also decided to provide more attention and provide more capital investment to data lines rather than voices lines to spur the flow of information that is the lifeline for many firms operating in the country. Finally, by interlinking much of the nation's production centers, China stood to reap the benefits of an improved communications channel among domestic industries.

As China's propensity to open itself to outside investment for the purpose of obtaining massive amounts of capital and knowledge transfer from Western firms continues unabated, firms such as Motorola are helping China to leap into the cellular age by providing critical money and technical knowledge. Holding fast to the strong belief that the country cannot get wired fast enough to provide adequate service for business growth and the likelihood that the nation will adopt cellular telephony more quickly than land-based telephony, Motorola claims it is the biggest foreign company in China in terms of revenue. It recently announced plans to supplement its numerous manufacturing facilities with a state-of-the-art $1.9 billion semiconductor plant in the northern coastal city of Tianjin that will produce eight-inch semiconductor wafers using 0.18-micron technology, relatively advanced technology for semiconductor plants in China.

The ongoing state-sponsored "Golden Projects" agenda, began in 1997, represents the future for a networked China to continue to pursue its efforts to join the ICT-enabled global society. Cumulative figures for total spending on these projects vary as data sources conflict, but it is estimated that they range between $1 billion to nearly $3.5 billion through the year 2000, then subsequently tapered off to a lowered maintenance figure in excess of $100 million per year, according to a Commerce Department report. These projects represent significant opportunities for foreign companies seeking entry to China's market and are described as follows:

- Project ***Golden Card*** enables electronic payments. This project enables countrywide banking and credit card usage. Its goal is to use telecom networks to replace cash transactions with suitable electronic systems for savings, withdrawals, and payments. The plan will deliver 300 million credit/cash cards to 300 million people in 400 urban areas by 2005.

- Project ***Golden Bridge*** is China's version of the information superhighway. The network will be constructed across China and will ultimately incorporate all of China's information systems via a backbone that interconnects space satellite and ground fiber optic networks linked to a domestic private network. Apart from Internet access, the system will allow email, electronic data interchange, online database services, and applications service systems.

- Project ***Golden Customs*** will connect foreign trade companies with banks and China's customs and tax offices. The project aims to create paperless trading by automating customs checks and eliminate cash transactions for international trade. It will feature email, electronic data interchange (EDI), and an electronic post office.

- Project ***Golden Tax***, cosponsored by the Ministry of Finance and the People's Bank of China, plans to spend more than $1.2 billion to computerize the tax collection system. According to the Commerce Department, the government has already finished the first phase which built and linked the Beijing main audit center to 795 local tax offices in 50 large cities via a satellite network. The system will be expanded to include 400 cities in 4000 districts and counties.

THE UNITED STATES: INNOVATOR AND ICT DEPENDENT

While the dramatic economic growth of the U.S. economy during the 1990s caused much international amazement, business and political leaders await the effects of the slow down that has pervaded the nation in the new millennium, especially post 9-11, for insight into the nation's economic prospects in the coming few years. The United States is in a slowdown now related to the end of a huge investment in ICT capital stock. There are three reasons for the slowdown. First, after an enormous building period of information technology, companies are taking a breather in their ICT investments. They have no justification for building their ICT infrastructure at the same pace as the 1990s. Second, the rollout of high bandwidth technologies and associated applications is proceeding more slowly as curtailment of ICT investments hinder rapid deployment and current business conditions certainly do not warrant stepped-up rates of ICT enlargement. Third, the U.S. experienced a financial bubble when public sentiment pushed technology stocks up in value as promises of new and more rapid economic growth driven by ICT permeated the world's investment community.

The optimism about the ICT revolution that was taking place in the 1990s led to a euphoric overpricing of stocks traded in the technology sector. Despite the radical deflation of stock prices since 2000, the comparative lead in ICT usage by

U.S. firms continues to inspire further adoption among corporate America. According to the Global Competitiveness Report for 2001 – 2002 (*see* **Figure 1**), the World Economic Forum declares the U.S. ranks *first*, for example, in technological sophistication, firm-level innovation, quality of scientific institutions, utility patents (number granted per million), average total years of schooling among population aged 15 and above, *second* in speed and cost of internet access (behind Finland), high-skilled IT job market (behind Netherlands), and *third* in company spending on research and development (behind Japan), quality of competition in telecommunications sector (behind Finland and Sweden), IT training and education (behind Finland and Netherlands).

JAPAN: SIGNIFICANT ICT PARTICPANT

As Japan anxiously waits for its domestic economy to improve, the strengthening of the Japanese Yen continues to plague that nation's export sector as products marketed to the U.S. and the rest of the world become more expensive. With the increased weight of the Yen, Japan's leaders must turn to new revenue-producing sources to keep the nation's rising currency from thwarting expansionary efforts by recent policy changes instituted by the government. Recently, important efforts to stimulate new economic growth in Japan hinge partly on the progress of advancing the ICT revolution currently underway. Although several downside risks remain for the Japanese economy, namely large public debt and the "three excesses" (excess capacity, labor, and liability), the Japanese government has declared its intention to regard the progress of the ICT revolution as a strategic national issue with the highest priority. Government leaders feel that this will enable the Japanese economy to regain its economic dynamism and to secure new pathways toward new economic growth.

To promote the IT Revolution, the government plans to carry out policy making activities based on the following basic principles: 1) emphasize the importance of speed in ICT, 2) reform the private sector to streamline business conduct, 3) promote societal adaptation to an interconnected society, 4) reform the government to ensure maximum social benefits are derived and government behavior improvements occur and lead to solve the dilemma of the digital divide and the mismatch in the labor market, 5) allow commercial use of fiber optic networks developed by the public sector, 6) construct a new market framework suitable for economic transactions in the network society that includes easy access, fast throughput, lowered Internet access costs to consumers, development and active support of mobile terminals and digital broadcasting, and a strengthening of safeguard and security aspects, 7) improve global competitiveness by placing the country in the center of the ICT revolution which is desired for promotion of Japanese technologies and technological systems, to prepare an environment for an increasing number of international enterprises in information and Internet fields to be located in Japan, to contribute toward global governance of the Internet and to standardize IT in cooperation with other countries, and 8) improve the time to distribute services and products by making the most of ICT to promote standardized, seamless, and paperless distribution systems, thereby improving overall distribution efficiency.

SUMMARY

The initial slow, then fast rate of ICT diffusion among MNCs has been a pyrrhic victory for hardware, software, and telecommunication suppliers. This scenario played itself out when the promise of a better life through ICT was put to the test in the late 1990s, resulting in what most ICT practitioners had expected would be a failed outcome, owing principally to the numerous bugs that pervaded the newer architectures and the instability and/or sub optimized corporate ICT infrastructures with which they were supposed to interoperate. As corporations in China, Japan, and the U.S. jockey for supremacy in international trade, the likelihood of success depends not only on their ability to adopt, adapt, deploy, and continually make improvements to ICT technology but also on the ICT suppliers and technological infrastructure that provide the technological means to do so.

Survey Category	Mean	U.S.	Japan	China
Technological Sophistication	5.5	6.8	6.4	3.7
Firm-Level Technology Absorption	5.9	6.5	6.4	4.8
Company Spending on R & D	4.8	6.0	6.0	3.7
Subsidies for Firm-Level R & D	3.8	4.1	3.8	3.6
Tax Credits for Firm-Level R & D	4.1	4.9	4.0	3.6
University/Industry R&D Collaboration	4.7	5.3	4.4	4.2
Speed and Cost of Internet Access	4.9	6.6	4.0	3.3
Public Access to Internet	4.3	5.4	4.1	2.8
Internet Access in Schools	4.7	5.7	3.7	3.2
Quality of Competition in Telecomm	5.4	6.4	5.0	3.4
High Skilled IT Job Market	5.7	6.7	5.9	4.5
IT Training and Education	4.9	6.2	4.4	3.4
Quality of Competition in ISP Sector	5.5	6.7	5.5	3.4
Government Prioritization of ICT	5.4	5.2	5.1	5.3
Government Success in ICT Promotion	4.6	4.5	3.9	4.5
Government On-line Services	4.6	5.4	3.2	3.5
Laws Relating to ICT Use	4.5	5.6	4.2	3.2
Legal Framework for ICT Development	4.9	6.2	4.2	4.2
Overall Infrastructure Quality	5.4	6.6	6.0	2.9
Telephone/Fax Infrastructure Quality	6.4	6.6	6.8	5.4
Electricity Prices	4.3	5.6	2.9	3.9
Intellectual Property Protection	4.9	6.5	5.5	2.9
Local Availability of IT Services	5.4	6.6	5.7	4.3
Nature of Competitive Advantage	5.2	6.2	6.2	3.2
Value Chain Presence	5.4	6.4	5.7	3.9
Capacity for Innovation	4.8	5.9	5.9	4.5
Uniqueness of Product Designs	4.9	5.9	5.9	4.1
Production Process Sophistication	5.6	6.4	6.3	4.3
Extent of Marketing	5.5	6.7	5.8	3.5
Quality of Management Schools	4.8	6.6	4.0	3.6
Internet Effects on Business	4.3	5.0	4.1	3.3

Figure 1: Country ICT Rankings

Source: Porter, Michael, Sachs, Jeffrey et al., "*The Global Competitiveness Report 2001 - 2002*", World Economic Report, New York: Oxford University Press 2002, pp. 341 - 444.

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