

Korea and the Global Software Industry

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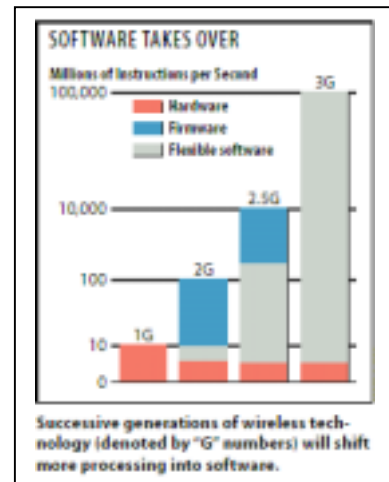
1. Korean Software: What's at Stake?

In half a century, the Republic of Korea has transformed itself from an agrarian economy to an industrial nation of the first order. In economic growth, standard of living, national literacy, and democratic governance, the ROK is a model for other countries. And in technology too, Korea has established itself as a world leader in semiconductors, telecommunications, and consumer electronics and is investing heavily in emerging technology areas like biotechnology and nanotechnology.

So, why all this concern about software? Is it really necessary that Korea be a world leader in software technology and a major player in the global software industry? In our opinion, software is not optional – Korea must strive to attain a dominant position in this industry. There are four reasons that make continued attention to the growth of Korea's software industry critical:

1. Software in the form of information systems is a primary competitive weapon in all industries (finance, retail, transportation, entertainment). Cost reduction, supply chain management, customer data mining – all modern business strategies are enabled by modern information systems. Companies and government agencies cannot function effectively without software – better software means better work.
2. Software is an increasingly dominant engineering component in products ranging from automobiles to toys. It impacts R&D, design, engineering, manufacturing, and even service and support.
3. Software itself is a major global industry. Combined annual software products and services revenues have reached \$600B worldwide – four times the size of the semiconductor industry. Digital content, including video games and animation, adds another \$100M. Furthermore, new markets for software will continue to emerge, including major new platforms – platforms that create enormous markets for new software, like the PC in the 1980s and the Internet in the 1990s. New markets and the fortunes they represent are created by a confluence of factors: new technology, plummeting costs of computing equipment, regional economic development, and innovative ideas about how IT can impact people's lives.
4. Software is the key to the knowledge economy. Korea cannot continue to enhance its position and prestige in the world economy without establishing itself as a serious player in the global software industry – becoming a provider (and consumer) of advanced software technology, products, and services.

To illustrate the increasing importance of software to Korea's economic future, consider the illustration to the right. It shows the increased percentage of software-based product functionality (vs. special purpose chips and



firmware) as mobile phone technology matures. Eventually, handset features and functionality will be changed as easily as ring tones, by downloading software on the fly.¹

Industry executives, government policy makers, academics, financial analysts, and even electrical engineers often overlook software in their thinking about “information technology” and high tech. Besides the usual difficulty of seeing a small industry emerge amidst large successful industries like telecommunications and consumer electronics, software’s visibility is handicapped by its being an intangible product and an immature engineering discipline. It is critical for Korea’s strategic planners, educators, and industrialists to have a better understanding of software and its economic importance. Eventually, the very best students must come to think of software as a prestigious career – achieving that goal will be the measure of the effectiveness of Korea’s software industry strategy.

1.1. Analytic Framework and Research Methodology

This Report presents the findings of a six-month study of the Korean software industry conducted in the summer of 2002. The study was commissioned by the Korean IT Industry Promotion Agency (KIPA, a division of the Ministry of Information and Communication) as an update to the authors’ 1999 Stanford University study entitled *Software Entrepreneurism in Korea*.² The earlier study, funded by the Chong-Moon Lee Foundation, examined the Korean software venture community and its habitat, with the goal of recommending strategies for expanding Korea’s software industry. It was conducted after the “IMF crisis” and at the peak of the high-tech boom. It focused on Korea’s policies and programs aimed at stimulating entrepreneurial business activity and venture investment in software.

Over the last three years, Korea has made significant progress in the growth of its software industry. At the same time, there have been dramatic changes in the global software industry. The objective of the current study is to make new and specific recommendations to KIPA in support of its continuing mission to promote the Korean software export industry and establish Korea as a major supplier of software technology to the world.

Our research approach is based on the analytic framework originally developed at the Stanford project. During that six-year study of the global software industry, we examined the entire range of economic activity related to software. We studied the three countries that had made great strides in the previous decade as software industry powerhouses, India, Ireland, and Israel, and the factors that had contributed to their success. We also

¹ From Deborah Shapely, “The Universal Cell Phone.” *MIT Technology Review*, April 2001, 58-62.

² Barr, Tessler and Miller. “Software Entrepreneurism in Korea.” Stanford University Asia/Pacific Research Center, December, 1999. The Stanford Computer Industry Project was funded by the Alfred P. Sloan Foundation, the Chong-Moon Lee Foundation, and two dozen corporate sponsors from around the world. Prof. William F. Miller was Director of the Stanford project. He and Prof. Edward A. Feigenbaum directed the software industry study. Many of the papers are now posted at www.aldo.com/papers.

studied the problems encountered by a number of other countries that had undertaken to transition their nations into a knowledge economy. As **Table 1** illustrates, the successful national software strategies all evolved in different ways, depending on the circumstances of the country and the global opportunities at the time. Some were more strategic in their approach than others, but all three have had success. Several other countries that have set their sites on software exports, including Malaysia, China, Russia and Singapore, are still struggling to crack the export industry.³

	India (started in late 1980s)	Ireland (early 1970s)	Israel (early 1980s)
Resources	Tens of thousands of highly trained, underemployed, English-speaking engineers.	English speaking workforce; European location; relatively cheap telecom.	State-of-the-art technology developed in military R&D projects.
Strategic Goal	Create export industry for job creation, foreign exchange earnings, technology self-reliance.	Create jobs in Ireland at all levels. Learn the software industry (low capitalization and environmentally friendly vs. manufacturing jobs).	Commercialize military technology; create export industry; employ tens of thousands of Russian immigrant programmers.
Opportunity	Shortage in US & Europe of low-level programmers created by demand for ERP installation, Y2K preparations, and e-commerce conversion.	Flow of US and Asian technology into the EU. Localization and support difficulties of MNCs in dealing with multi-lingual market. High telecom costs on European continent.	Increasing demand for software technology, especially advanced security technology, in the US as networking became commonplace.
Key Measures	Combine on-site labor with offshore outsourcing facilities; invest in telecom & computing infrastructure, and quality reputation to establish credibility.	Offer tax & other incentives to software MNCs to set up shop in Ireland.	Create Yozma and other industry investment programs; BIRD-type alliance programs; technology parks.
2001 Export Revenue	\$ 7.5B, almost entirely software services	\$ 8B ⁴ , almost entirely software products	\$ 3B, products and technology licensing

Table 1. National Software Strategies. The result of the variation in their circumstances and goals, and of the opportunities presented at the time, is that each country has a different type of software industry. Export revenue represents both product and services sales. Sources: NASSCOM, Enterprise Ireland, and the Israeli Association of Software Houses.

³ Barriers to significant growth in software exports include: high piracy rates at home, small talent pool, lack of engineering innovation, language barriers, and difficult business & regulatory environments. If its regulatory barriers continue to decline, China is likely to become the next \$B software exporter because of its enormous workforce and investment in education.

⁴ This figure includes flow through from multinational software companies that have located in Ireland. Indigenous companies alone exported \$1.3B of software in 2001.

The framework that evolved from our research takes into consideration all of the dimensions of the software industry:

- Different types of software business activity: shrink-wrapped products, enterprise products, software services, embedded systems, software built in-house, and software-based e-services (like e-Bay and interactive games).
- Software technology, tools and platforms, and the software development process.
- The different kinds of talent and skill that make up software teams in different parts of the industry. Software is still almost entirely handcrafted. Both software development methodology and software education are immature engineering disciplines.
- The key role of innovative startup companies in the industry, the importance of entrepreneurship, high-risk capital, the developmental stages of a software startup, and the supportive habitat supplied in industrial clusters like Silicon Valley.
- Domestic use of advanced software and a favorable general business and regulatory environment as important contributors to software industry success.

Based on this framework, we have developed the following methodology for evaluating the health of a nation's software industry, the impact of government policies and regulations, and the effectiveness of government support programs – assessing the state of progress, identifying problem areas, and recommending options:

1. Examine published data and reports from the government, industry analysts, research firms, and other governments. In Korea's case, there is now a very large amount of data and analysis available.
2. Review and monitor the local trade and business press for current thinking, known issues, and strategic directions. In addition, we track the global software industry for market trends and new technical developments.
3. Interview the entire range of local practitioners and observers: entrepreneurs, financiers, educators at all levels, government administrators, programmers, CIO's from large firms, analysts, consultants, incubator managers, and academic and industry researchers. We also consult with industry experts in the US and elsewhere on specific technical, market and policy issues. (Our list of interviewees is included as Appendix I.)
4. From these interviews, we get initial insights into the specific areas of the industry that are problematic. We present our preliminary findings to knowledgeable people as early in the project as possible. The feedback about these early ideas often gives us great insight into the nature of the problems we see and especially into appropriate ways of describing and addressing those problems.

1.2. Summary of Observations and Recommendations

The Republic of Korea has excellent resources to pursue a variety of opportunities in today's global software industry in areas like software services export, innovative electronics products, digital content, and mobile business applications. New opportunities will continue to emerge. In the past three years, the Ministry of Information and Communication (MIC) and other government organizations have made tremendous strides in reorienting business thinking about software. Their focus and greatest success has been the stimulation of small entrepreneurial venture startups – the business form that so often is best suited for the task of bringing innovative software to market. The rise in entrepreneurship among young engineers, who in the past would have pursued careers in the big chaebols, is a dramatic, important, and surprising change over just three years or so.

Of course, entrepreneurship itself is not enough to create a global software industry. We summarize here our findings, based on interviews and secondary research. We also present briefly our suggested actions in each area (➤).

Guidance and Governance of Venture Firms

While a surprisingly large number of talented Koreans, including many young people, have indeed left their traditional career paths to pursue entrepreneurial ventures, relatively few of these software startups have evolved into moneymaking companies. We believe this situation can be improved, but one should keep in mind that only a very few software startups, in any country, are destined for global success. The experience and knowledge gained by the Korean software community in establishing and nurturing these companies are invaluable (even if many do not succeed), and in time will contribute to the development of a large and vibrant software export industry.

Seed financing and incubation are readily available to new software ventures through both government programs and private sources. Unfortunately, there is still a relative lack of involvement and guidance for software startups from specialized support firms and advisors, early investors, and especially from the private venture capital community. Korean venture firms need hands-on investors and habitat support firms in order to make an effective transition from startup to real business with export potential. Government cannot do the entire job itself.

Most Korean software entrepreneurs and investors envision a traditional path of company growth through sales of products and services. But this model is not appropriate for some software technologies, products and companies, depending on the concept, technology, maturity of the market, competition, company capitalization, etc. Many software companies create value for investors in other ways: for example, technology licensing, combined hardware/software products, web-based services (like e-Bay and interactive games), and company acquisition.

As a result of the lack of ongoing guidance, many Korean software entrepreneurs told us they have no ambition to produce global companies that lead a market sector. They tend

not to study their market during the product conception and definition phase and do not seek advice from people who know about software marketing. Instead, they remain focused on their technology and on product development until too late. In Silicon Valley, it is the role of the angel investors, VCs, and other business advisors, to educate first-time entrepreneurs on how software companies make money, and to eliminate the non-starters early.

- **It is important to continue government funding of venture capital companies and direct grants to select venture firms.** It is equally important to grow a cadre of knowledgeable private investors and advisors who can discriminate among business proposals to identify those with high potential and can help manage the development of firms started by novice entrepreneurs. We recommend training for VC's and other advisors who can work with software startups (as coaches, directors, business planning consultants, entrepreneurs-in-residence, new venture CEOs, etc.). All investors should be encouraged to take an expanded role in shaping their portfolio companies and in experiential learning about the workings of the global software industry. We also recommend overseas experience for VCs as well as for government analysts and decision makers.
- **Marketing** is an important area where Korean entrepreneurs need education and guidance. World-class innovation must be combined with world-class marketing.⁵ We recommend that part of any government monies invested in venture firms be specifically earmarked for marketing. Marketing should involve actual contact with potential customers in the target market, including overseas markets for firms with global ambitions.
- **Corporate governance** is the other key problem area for Korean venture companies. Business practices at many Korean venture firms reduce the interest of potential foreign investors, acquirers and alliance partners.⁶ Requiring quarterly Board of Directors meetings, with an experienced businessperson on the Board, will help first-time entrepreneurs understand what's required. Education about the life cycle of software startup companies, the various ways of realizing value from software inventions, and the importance of mergers and acquisitions in the industry is also recommended for all entrepreneurs and investors.

⁵ First time, techno-entrepreneurs often think of marketing in terms of "I built it – now you go sell it!" In software, product conception and definition must involve input from the market at every phase – specific, clear insight into what customers need and what they've already got. For example: "Which software architectures and dominant infrastructure vendors must be supported by a new collaboration tool for insurance companies and healthcare services providers?"

⁶ Among the areas of concern: control of the company; corporate governance including financial, legal and audit practices; qualifications of advisors; experience of management team; lack of first-hand knowledge of market; poor corporate communications and website; no product and project management experience; weak Board of Directors.

Marketing Korean Software in the US (And Other Markets)

Korea's success at stimulating software entrepreneurship has been remarkable. Total software exports have grown from \$50 million in 1999 to \$290 million in 2001.⁷ One area of noticeable progress is the software services sector (consulting, systems integration, and outsourced development). The large systems integrators have begun to win significant business in Southeast Asia, South America and elsewhere. However, software revenues remain small in absolute terms.⁸ Foreign investment in Korean software startups is also lagging.

Of course, since 2000, the global software industry has been in a serious two-year slump. Cutbacks in enterprise IT expenditures for new initiatives have influenced almost every sector of the industry.⁹ The simultaneous "dotcom bust" was a second serious blow to the industry, which resulted in venture capital investment in US software startups to retreat to their 1998 level. Korea has certainly felt the impact of the global downturn in software, especially as regards sales of enterprise software to the US.

The most important development in Korea's global marketing efforts involves the iParks, originally created as offshore "incubators" in the US and other countries. These outposts have been reorganized as trade missions with the primary function of helping high-tech venture firms enter important foreign markets. By bringing in experienced local management, they have also become learning and training centers for startups and entrepreneurs who are prepared to face the reality of doing business abroad.

- **Focus efforts to support software exports solely on those firms that are properly prepared** and financed to sell into foreign markets. Target additional investment, support, and promotion programs for high-potential software venture firms. (We discuss the characteristics of firms with global potential and offer suggestions for how to identify and support them in Section 3.2.) Attend to the needs of firms at various stages of development.

- **Expand marketing support programs** like the new iPark "market enabler" program. Supplement iPark educational programs like the Venture Boot Camp with training programs in software product management and corporate governance, as these areas are also problematic for Korean software startups. General programs on "plugging into the global software community" would also be helpful.¹⁰

⁷ KIPA website, Overview of the Korean Software Industry, 2002

⁸ In 2001, software services exports were \$125 million; products \$108M, digital contents \$56M. From "Software export surges 86.4% last year," Korea Herald, March 11, 2002

⁹ Of course, some areas of the industry are thriving despite the downturn: security, enterprise application integration, mobile applications, information retrieval, bio-informatics, etc.

¹⁰ Techniques for improving awareness about software markets might include following the trade press and market analysts, effective participation in tradeshows, conferences, and web seminars, etc.

- **Encourage more foreign acquisition of and investment** in Korean software technology, products, talent, and companies. Not only will this help identify those firms with global potential, but it will also allow the business networking via investors and Board members which is important for software startups, especially in foreign markets. Participation in transnational software startups (defined in Section 2.2), as investors, technology contributors, software developers, or principal market (e.g. for broadband or mobile applications) would also be an excellent way to get involved with the global VC community.
- **Continuously monitor the perceived quality of Korean software** offerings in target markets by retaining the services of local customer satisfaction research firms. Software quality and customer satisfaction (in both products and services) are essential to putting Korea on the world's software map.
- **Focus additional efforts to penetrate the global enterprise software sector.** Concentrating on the consumer products and games markets is tempting because enterprise software is a difficult segment to penetrate; it is by far the biggest and most complex sector of the software products industry, the most technically sophisticated, and has the most demanding customers. It is also uniquely prestigious. It is important for Korean products to become well known in this sector. Opportunities will present themselves in emerging niches like mobile enterprise applications and e-government software.

A Supportive Habitat For Software Startups

Silicon Valley is not just about money. It's about vision – “changing the world.” Software entrepreneurs in Silicon Valley, like their predecessors in earlier eras, are driven by the promise of making an impact. This vision drives the teams of dozens of people in each of the thousands of software startups in Silicon Valley. But it's the venture capitalists who decide which of those visions get a chance. Almost all of the VC's decisions are based on market potential. These industry-savvy investors attend Board meetings to make sure their money is spent well. And at any juncture a key investor can “pull the plug” on future investment and end that particular vision of changing the world.

As soon as a startup gets its first seed financing in Silicon Valley, a host of specialized experts and support firms are at hand to help with everything a startup might need, from product positioning to preparing a press release. This nexus of industry-savvy specialists, including the experienced venture capitalists, is what we call the habitat.

Except for government programs and incubators, there is still little in the way of advisory and specialized operational support for Korean entrepreneurs and small companies. Like the venture capital community, this corps of seasoned advisors and professionals will take some time to develop. A community of private habitat support firms is also not emerging, in part because Korean entrepreneurs don't yet include business activities like market research, collateral development, or business development in their budgets at an early enough point.

- **Ensure that funds are available for second and subsequent funding rounds** for a small group of firms with global potential. Consider making funding contingent upon having experienced business expertise involved in running the company.
- **Encourage the growth of private sector expertise in the habitat**, e.g., by creating a fifth category of venture firm, the “venture support firm,” to promote the establishment of a variety of outsource and consulting services. To promote the use of their services by venture firms, earmark part of government venture funding programs for marketing budgets of the funded companies and not R&D.

Domestic Market And Systems Integrators

The domestic market for advanced enterprise software products is growing. Since 1999, there has been a dramatic increase in the number of major chaebols and banks (and increasingly mid-size firms) that have installed industry-standard architectures and applications, like ERP, CRM, and SCM.¹¹ Because of the wider use of these modern enterprise software architectures, Korean innovators will be able to deploy and demonstrate their solutions locally, on standard enterprise platforms. This growth in the availability of local test beds will prove vital to the growth of the Korean software export business.

- **Review, revise and expand incentives** (e.g. tax incentives and other programs) to firms of all sizes to implement standard enterprise software infrastructure and, where appropriate, encourage experimentation and adoption of cutting-edge technologies. These measures will not only stimulate the domestic software industry and create opportunities for software startups, but it will help ensure that Korean firms remain internationally competitive. Similar systems deployment should be encouraged in government and military organizations.
- **Create a domestic “iPark”** to develop domestic marketing channels for small technology startups’ solutions into projects at chaebols, systems integrators, telecommunications firms, banks and government and military projects.

Education and other Human Resource Issues

Software is a talent-based industry. Korea’s capacity to become a player in the global software industry depends on the development and management of software talent. In recent years, the MIC has initiated a number of programs to support software research and education. Educational institutions will respond to this critical need, in their own time. Our greatest concern is the decrease in the number of bright young students

¹¹ Enterprise Resource Planning (like SAP and Oracle), Customer Relationship Management (like Siebel and Oracle), and Supply Chain Management. This class of software has been installed in most major global corporations, along with middleware to link them all together from companies like IBM and BEA. The result is a standard operational environment and data architecture in those business automation areas where custom-built solutions don’t offer competitive advantage.

choosing to study software – a reflection of the general trend in Korea away from engineering careers (as is also the case with students in the US).

- **Move Korea towards a leadership position in software education.** Experiment with new ways to meet industry requirements for talent. Foster autonomy and competition among institutions, to facilitate responsiveness to industry needs. Introduce competition in the form of new, professional software schools, centers of excellence, magnet schools, international accreditations, and foreign university campuses and partnership degree programs in Korea.
- **Initiate an independent, third-party assessment of software education** at Korean universities to identify shortfalls in curriculum, faculty training, and graduation requirements.
- **Undertake a long-term study of labor issues specifically focused on the software industry**, examining areas such as performance-based compensation and promotion systems, career tracks for software professionals, employee mobility, attractiveness of the profession to young people, and so on, in order to accelerate change and ensure that software export firms can employ globally competitive labor practices.

1.3. Korea's Path Forward

The future of the Korean software industry will be shaped by Korea's inherent strengths and advantages, of course, and by the changing shape of the software industry. We count its proactive and enlightened government agencies as one of the country's strengths, but there are others:

- Korea's proximity to major markets like Japan, China, and South East Asia could be major factors in the ultimate shape of Korea's software industry.
- The domestic penetration of broadband and advanced wireless technologies might make Korea a center for tools and applications in important new software niches. The technology behind interactive games, for example, might have important applications in corporate training, collaboration, and knowledge management.
- Korea's world-class electronics industry may be the place where the most money is made from Korean software over the next decade. While trying to capture global markets for software technology, products and services, Korea must also use software to push its electronics industry forward. The world will soon be filled with an array of special purpose, radio networked, easy to use, computing devices, all depending on software to provide advanced, flexible, simplifying features. Again because of Korea's adoption of advanced broadband and wireless technologies, the electronics-manufacturing sector is positioned to become a global leader in major new markets, as it has become in the mobile handset market.
- Korea's other advanced industries, like auto manufacture, steel, and finance, as well as government organizations, are another advantage. Information systems departments in large organizations are the market for some of the biggest sectors of

the software industry. They serve as a test bed for innovative ideas from startup companies. They are also the source of future entrepreneurs who know at least a little about their market. Korean enterprise customers look increasingly like the users of cutting-edge enterprise IT all over the world.

Korea's ability to take advantage of the opportunities that present themselves will depend on the experience of the people making decisions – on-the-ground experience in major target market niches. These decisions must be put in the hands of people who have worked in the industry, and preferably worked in the specific markets of interest. It will take time to build a cadre of investors, advisors, and specialists with the experience required, and some failures will likely be involved. Programs must anticipate the time and investment required. Metrics for institutional learning in the private-sector habitat should be established and policy directed at improving performance on an ongoing basis.

1.4. Organization of this Report

This Report is intended to give an objective perspective on progress and problems in bringing Korea to the forefront of the global software industry. Our subsequent remarks are divided into 4 sections:

2. **Marketing Korean Software Globally.** We discuss the range of ways to create value with software: through technology licensing, product licensing, service offerings, and company M&A. We also present a framework for what's required to market into the US, an analysis of important trends in the global software industry, and SWOT analyses for Korean software in important market niches.
3. **Entrepreneurship, venture capital and habitat.** In the software industry, innovation is key, and most innovation comes from startup companies. We examine the issues having to do with the identification, initial financing, and early-stage guidance of startups that have the potential to take innovative software technology to global markets. We focus on the importance of venture investors and support firms as advisors and gatekeepers, in the habitat. The domestic market for cutting-edge software is also discussed as a key element of the habitat.
4. **Education and other Human Resource Issues.** Finally, we look to the source of all value creation in the software industry, the talent. We consider the education of software industry professionals, and other issues that might impact the availability and quality of Korea's software workforce.
5. **Final Thoughts.** We include some ideas about realistic milestones for Korea's software industry in 5, 10 and 20-year timeframes. Like other countries' software industries, Korea's will evolve in a distinctive way, shaped by the resources available, the opportunities presented by world markets, national strengths in other industries, and the unique characteristics of Korean culture and psychology.

We include as Appendix I the list of people we interviewed, to whom we are thankful. These interviews once again proved a rich source of understanding about the Korean

software industry from a range of perspectives, and they repeatedly challenged our thinking.

Appendix II is an extensive bibliography of the published and on-line sources we've used. In this context, we'd like to thank our research assistants, Sabina Lee, Sungrim Kim, and John Song, who worked tirelessly to find gems of data in the Korean literature.

2. Marketing Korean Software Globally

Many of the industry participants that we interviewed expressed the opinion that “the problem is marketing.” They see that Korea’s policies and programs to stimulate growth of the Korean software industry have been quite successful, despite the downturn in the global software industry. They believe that it is only the inability of these small firms to market abroad, especially in the US, which is holding back export revenues and deserved recognition for Korean software technology.

We believe that selling software internationally is hard, and that selling into the US enterprise software market is especially complicated. (See Section 2.4.) The idea that small startups should sell into the global marketplace should be examined critically. Currently, few of the 5000 Korean software venture firms are at all prepared to enter the US market, in terms of corporate structure, available resources (including capital), marketing expertise, market knowledge, or product readiness. Historically, software firms from other countries have had the same experience. The good news is that there are alternatives.

2.1. Alternative Ways to Create Value for Software

Many foreign software companies, and many US startups, follow one of several alternative routes to realizing the value of their software invention, product, or solution: licensing the technology, licensing a product for distribution, being acquired by a US company, moving the company closer to the target market, creating a differentiated service offering, or creating a web service based on their software. We review each of these alternative, emphasizing the enabling circumstances for each and the implication for the structure and management of Korean software startups.

Technology Licensing. Software technology is relatively inexpensive to invent. In contrast, the costs of productizing, testing, demonstrating, integrating with installed systems, and marketing can run into the tens of millions of dollars. The risks of failing to find a market or being replaced by another technology in the meantime are very high. For some technologies, there are so many possible products that starting a company around just one is not the best strategy to maximize returns. The obvious route for many software inventions is to license the technology to larger firms, or to do joint development on the technology with a big company, possibly a strategic investor, and then share in subsequent product revenues.

Case in Point: Trifork Technologies

Technology licensing (OEM) vs. product development.

Trifork Technologies is a small, mostly self-financed, Danish spinout from a 5-year old Java consultancy. The first Trifork product was a J2EE 1.2-compliant application server introduced in 2000. Its customer base was small and located primarily in Europe. The product struggled to compete in a highly competitive and unusual bifurcated market segment in which free and nearly free open source application servers such as Apache competed with expensive, full-featured, enterprise-ready offerings from large players such as IBM and BEA.

Trifork was unable to attract the venture capital it required to develop and implement a global marketing strategy. When Sun released the new J2EE specifications (v1.3), Trifork decided to develop its new version 1.3-compliant application server specifically for the US OEM market. In 2002, as one of the first few developers in the world to be fully compliant with the new J2EE specifications, Trifork was able to secure several OEM deals, including a multimillion-dollar contract with a large Silicon Valley software company. The company is currently in the planning process for a US headquarters office.

Product Licensing. Most software startups begin with a product idea and then a prototype – still, a relatively inexpensive stage. Some then proceed to market the product domestically. Rather than attempt to build a global company and sell their software directly to customers in the US, for example, they may license their software product to a US company that can sell it, e.g., as part of a larger product line. This method takes advantage of the existing, expensive sales and marketing organization of the larger company. Note the contrast in product licensing strategies of the following two companies: Seagull Software and BoldSoft.

Case in Point: Seagull Software

Product licensing strategy leads to HQ move and IPO.

Founded in 1990 in the Netherlands, Seagull Software began as an ERP implementation services provider to Europe. In 1994 it developed a Windows GUI application for IBM mainframes and licensed the solution to IBM. Seagull used this significant product licensing deal with a major US company as its entry vehicle to the US market. The next year the company established headquarters in the US to be close to its licensing partner, and hired a US President and US VP of marketing. The new US executives transitioned the company to a direct sales model that was more suitable for the US market at that time. US revenues grew to over 65% of total corporate revenues. In 1999 Seagull made a successful IPO on the Amsterdam exchange, and subsequently used the funds to acquire two US companies. As of 2001 the US President became the worldwide CEO, having lead the company to a size of \$40 million and a leadership position in the US as a legacy solutions software vendor.

Case in Point: BoldSoft

Product licensing alone leads to acquisition.

BoldSoft, established in Sweden in 1997, was a vendor of UML-based modeling tools. That same year it licensed its flagship product to Borland as a branded add-on bundled with the latter's high-end software development environment products. In contrast to Seagull, BoldSoft kept all of its operations in its home country, spent minimally on US marketing, and focused its development capacity on improving and porting its one product. As late as the spring of 2002, BoldSoft was still looking for venture capital to expand its business activities, but was unsuccessful, in spite of the fact that it had won an award from an American developer community for high quality. In October 2002, it sold its operation to Borland in an all cash transaction, and its five-person technology team joined Borland's Copenhagen office.

Case in Point: Brokat Technologies

Entering the US market via cross-border M&A.

Major decisions made before thorough market analysis.

Brokat Technologies, founded in 1994, was a German company that sold financial software into the European market. It received substantial venture capital and made a successful IPO in Germany in 1998. It then expanded rapidly into mobile commerce and e-banking in Europe.

In early 2000, Brokat acquired two US companies. Based on its experience with mobile financial applications in Europe, management believed that it could enter the highly competitive American application server market with a new secure mobile application server offering. With mobile financial services in little demand in the US, Brokat "spent a great deal of money [after it made the acquisitions] trying to figure out what it should be selling and to whom."¹² After a year of examining various marketing alternatives while it accumulated significant losses, Brokat was forced to sell off its two US acquisitions at a fraction of their original purchase price. The US failure precipitated a restructuring of the rest of the company and further asset sales, finally culminating in bankruptcy at the end of 2001.

Postscript: In early 2002 the former management of Brokat purchased the remaining corporate assets and renamed the company Cambista. The new company has decided to focus on financial software and services for the Northern Europe and Middle Eastern markets. Cambista has already obtained venture capital financing.

Strategic Acquisition. Many small software companies get acquired by a larger company that has the marketing power to sell the product. Large companies extend their product lines or update their technology through acquisition, because it is faster than internal development. Mostly, they look to acquire companies that already have a released product, reference accounts, and some presence in the marketplace, although

¹² Mathew Downward. "Brokat Sells Off Units on the Cheap." the451.com, August 17, 2001.

pure technology acquisitions are not unheard of. Historically, about ten times as many venture-funded companies in the US are acquired as reach IPO.¹³ (These acquisitions of successful, operating companies are to be distinguished from “fire sales”, where the assets, including IP, of a defunct startup are sold off.)

Case in Point: RelQ

A global growth strategy -- acquisitions and alliances.

RelQ is a Bangalore-based software validation and verification company. It originally focused on software testing for real-time embedded systems and for banking and financial applications. Its marketing strategy was to offer dedicated testing teams to large customers such as Intel, Citibank and Hitachi. In recent years the company identified and targeted two markets that it believed was high growth and would trend towards outsourcing quality assurance: the aerospace industry, and game software.

In order to implement its strategy of entering the \$3 billion dollar global game software testing market, RelQ obtained first round funding from a US venture capital firm. It used the funds to expand its testing operations into Europe (Ireland, Belgium) and Asia-Pacific (Singapore, Australia), as well as to acquire a small French gaming software testing company. The French acquisition brought RelQ a significant European customer base. In 2002 it sought to obtain second-round financing and to acquire additional small game testing firms in the US and Japan.

Apart from its expansion activities, RelQ has focused on entering into alliances with tool vendors. These strategic marketing relationships call for the tool vendors to market RelQ testing services along with their tools. The company has also initiated a channel partner program. With its new acquisition, continued technical improvements, and focused marketing strategies, RelQ anticipates doubling its revenues from \$10 million to over \$20 million by 2003.

Move Corporate HQ. Adequately funded small startups from other countries often start a company in the US and then move their headquarters there. This allows HQ decisions to be made near the principal market and usually makes US venture capitalists more interested in investing. Experienced local management is normally brought in to run the US company, or at least the US marketing. The firm then looks like any other US startup, except, perhaps, for an R&D or software development facility in the country of origin. (See also the discussion of “transnational software startup” below.)

Differentiated Service Offering. Immature or incomplete enterprise solutions can often be the core of a differentiated service offering. While building a services business around a “pre-fab” product in this manner is not typically of great interest to venture investors, it is very common in the US and may be an appropriate strategy for some small Korean software companies who are prepared to field a services organization in the US. (However, as we will discuss in the Software Services section, there are other global markets in which Korean software services may be at an advantage.)

¹³ See, for example, the statistics published by Venture Economics, National Venture Capital Association, May, 2002. The dotcom boom temporarily increased the percentage of liquidity events that were IPO's, which rose to a peak of 44% in 4Q2000.

Web Service Offering. While dotcom businesses are widely discredited in this post-bubble period, some software startups' proprietary software may best be brought to market as an online service. Amazon and eBay are examples of pieces of software that have been used to achieve great success in on-line consumer services. We anticipate tremendous growth in new on-line services that are designed to be used not by people directly, but by other programs and "intelligent agents". We discuss these web services as well as the Semantic Web in Section 2.7.

2.2. M&A in Korean Software Venture Companies

Only a few Korean software venture companies are inclined or prepared to take advantage of any of the alternatives mentioned in the previous section, especially if merger or acquisition is involved. (In our interviews, we got informal estimates that in all of 2001 there were less than 20 M&As of software firms in Korea, and all were fire sales.) The reasons for this dearth of strategic acquisitions include the following:

1. The entrepreneurs do not want to give up control of their company in an acquisition. Even more importantly, due to the tradition of tightly held and family-controlled businesses in Korea, both entrepreneurs and investors often consider M&A to be a failure mode. In software, it is not a failure mode – it is just another strategy for realizing the value of an invention or product.
2. Potential acquiring companies don't value small software companies highly (e.g., based on IP and overall impact on their business vs. current revenues of the acquired firm). Also, many large companies generate their own innovations and have no mechanism or tradition of acquiring innovation from outside.
3. The startups are not "acquirable." Reasons include clouded equity ownership or IP rights, or muddled financial situations.
4. The products are not ready for market (e.g., to be licensed by a US software company). Korean startups are typically financed only for software development, and are not prepared to enter the marketplace with a "whole product" solution, market intelligence, sales collateral, analyst connections, reference customers, etc. And they usually don't have enough money to start and grow a parent software company in the US.
5. The market does not exist, or their product is not competitive, of inferior quality, incomplete, or in some other way inadequate or inappropriate for the US market.

M&A is particularly important to the software industry, in part because of how customers use software technology. Enterprise customers, who account for 80% of the world's software sales, cannot easily adopt a point solution. Instead, they want a full-service solution that will integrate with all of the other technologies and processes that are already in place in their organizations. They typically want a proven solution, a whole product that comes ready to deploy, and one that is recognized by market analysts and the trade press as a segment



leader. A small software venture is limited in the number of technology, product, channel, and services partners it can work with to bring to market the kinds of solutions and support enterprise customers demand. Large software companies find that acquisition of point solutions or technology, to add functionality or transition to a new platform or standard, is a faster way to keep up with rapid change.

The alternative to M&A for a small software venture that prefers a more independent route into the enterprise is to grow an expensive sales and support organization very quickly. This hurdle is so high that only a handful of new ventures, even in the US, can obtain enough funding for this option (see Section 2.3). Finally, the software industry is unusually dynamic. In a number of cases, the only practical way for entrepreneurs and investors to see any return from their investment at all is to liquidate through an acquisition before the appeal of the company's value proposition declines in the marketplace.

Few small Korean startups (or their US counterparts) are ever adequately capitalized for effective marketing in the US. (As discussed in the Section 1, most Korean startups in 2002 are getting on the order of \$1M in a single round of funding – not enough money to do even domestic marketing – and they are having difficulty finding a Series B investor. (See also Table 2). Instead, most Korean venture software companies spend their initial financing on technology development. Their hope is to find a “partner” who will handle the problem of marketing into the US market.

Unfortunately, this partner model is unrealistic. In the software industry, product marketing starts with product conception. Marketing drives the entire product design and development process.¹⁴ In enterprise software, for example, through a process of “co-invention,” early customers often have a major impact on the ultimate shape of a software product. Technical decisions about architecture, platforms, interfaces, user interface, and even technology components are all market driven. Finally, without a complete, proven solution and a clear idea of its market positioning and value proposition, it is unlikely that an appropriate partner would be interested. Korean software venture firms tend not to hire a marketing professional or retain a marketing consulting firm until too late in the evolution of their product.

In the current down market, partnering has become even more problematic. Many larger companies that traditionally partnered with smaller product vendors to add functionality to their product line have turned to M&A or internal development instead. These same companies are also adding to their in-house services organization to reduce dependence on implementation partners.¹⁵

¹⁴ It is quite understandable that an inventor who has dreamt up or even built a new gizmo would have a “product push” vs. “market pull” orientation towards his business. In Silicon Valley, this is one of the many misconceptions that venture capitalists and other advisors must typically address in coaching entrepreneurs.

¹⁵ US Bancorp Piper Jaffrey. “As the Pie Shrinks, the Fight to Get a Decent Slice Intensifies.” *The Software Field Guide*, October 2002, Volume 1, Number 33.

The notion of a transnational software startup is very important. This phenomenon, pioneered by Israeli and Taiwanese high-tech entrepreneurs and financiers, involves forming an international startup business from resources located in several countries with facilities located in the globally optimal location. For example, suppose an Irish software R&D lab invents a LAN security algorithm. They might partner with a Singaporean device manufacturer to design and build a portable LAN security testing device. They might get financing in both Singapore and New York, then move their headquarters to Washington, D.C., their first regional target. This goes well beyond technology licensing or reverse merger. We see this sophisticated arrangement as a major trend in the global software industry, but one that Korean venture firms might be slow to embrace until a more mature model of software entrepreneurship is widely adopted.

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Case in Point: Interwise

A transnational software company.

Interwise started as a "web-based live learning" software platform company, founded in Israel in 1994. After it completed its first commercial product and had several customers, the company obtained \$3 million in first round venture capital financing in 1998 from Yozma and another Israeli venture firm. It used these funds, in part, to establish US headquarters in Silicon Valley. The company kept its R&D center in Israel. This headquarters move allowed it to hire senior US marketing executives to reposition the company appropriately for the US market. The next year, Interwise launched a new business model focused on corporate e-learning, published its first advertisement, and attended its first US trade show. As a result of its better market exposure, it won accolades from a trade group and a major industry analyst, GartnerGroup.

The company also managed to attract a well-known American in the software business, former Lotus CEO, Jim Manzi, who became an investor and Chairman, and helped bring in significant additional venture capital to finance the company's global expansion and first acquisition. The company's two rounds of financing totaled approximately \$70 million from an international group of investors, including large customers from Japan and Germany; venture capitalists from Belgium and the UK; and solution delivery partners in the US.

In 2001 Interwise appointed another prominent American software figure to its Board, business development expert John Landry. Currently, it has positioned itself as a provider of "real-time enterprise communications" and appears to have the global customer base and financial resources to go forward until an IPO is possible.

Our recommendations regarding strategic alternatives for realizing value from software innovation are the following:

- In addition to traditional approaches involving company growth and global sales channels, also consider encouraging technology licensing, product licensing, and M&A as appropriate ways of realizing value in some stages of concept development. The pursuit of opportunities that leverage proprietary software technology through combined hardware/software product strategies, software-based e-services, and semi-custom solutions development should also be promoted.

- Business practices at many Korean venture firms reduce the interest of potential foreign investors, acquirers and alliance partners (e.g. control of the company; corporate governance including financial, legal and audit practices; qualifications of advisors; inexperienced management team; lack of first-hand knowledge of market; poor corporate communications and website; no product and project management experience; weak Board of Directors). Solutions to these problems may take some time and involve changing attitudes about entrepreneurship, company control, foreign ownership, partnerships, accounting standards, and about software generally. Some of these attitude changes, such as better governance practices, can be helped along by making them prerequisites of receiving government financial support, or by regulation, if necessary.

2.3. *Marketing Software in the US (and Other Markets)*

Clearly, we believe that many Korean startups that achieve success in the US market in the *near term* will do so by licensing their technology or product to a US company or by being acquired outright. The reason is the cost and difficulty of marketing software in the US. Most of the Korean entrepreneurs we've interviewed continue to focus primarily on technical innovation, with little appreciation for the creativity and innovation required in non-technical parts of the software product development: product management, marketing strategy, market research, product positioning, beta program management, marketing communications, partnering, release management, etc. (And, as we discuss in Section 3.3, they are currently not obliged to attend to these issues by advisors or investors.)

In order to understand the complexity of the US software market, and thus our view that only the most prepared foreign software firms have success in the US, we need to look separately at three different classes of software: software titles (including packaged software and games), OEM software, and enterprise software sold to businesses, government agencies, and other large organizations. Software services, developing custom systems, is a separate category that will be addressed later in this section.

Software Titles. The software titles business is very much like the movie or music recording business. Many titles get created, few get distributed, and one in one thousand become hits – only hits are profitable. The product is distributed as is, has no integration or upgrade issues, and relatively fewer support requirements. It is clear that Korea has great strength in the games sector, and is a world leader in the development and consumer acceptance of interactive games including wireless games. To penetrate the US market further, these companies will likely partner with US and Japanese games publishers and console manufacturers, and US Internet service providers, mobile telecommunications carriers, etc.

Case in Point: NCsoft Corp

Re-thinking their products for the US market.

NCsoft, a leading Korean game developer, has recently formed a joint venture with seasoned US game experts. The goal, however, is not to sell Lineage, the world's most popular on-line computer game, into the US. In fact, NCsoft tried and failed to introduce Lineage to US gamers in 1999. The new joint venture (with industry veterans Richard and Robert Garriott, legendary game developers themselves) is based in Austin Texas. It will develop new Internet game offerings that are specific to the US market and will publish third-party games on their network. The need for even established software companies to create new offerings specifically for the US market is an important lesson for software startups.

OEM software. OEM companies develop systems that will be embedded in automobiles, consumer electronics, telephone handsets, airplanes, or another software product. This usually simplifies the marketing problem to a certain extent, since there are a small number of possible customers in the world (e.g., mobile phone manufacturers). Purchasing decisions are often made by engineering departments, which means that technical entrepreneurs are at less of a disadvantage when making sales presentations.

On the other hand, extensive marketing effort is still required. There are four reasons that a small OEM software publisher might have trouble selling its product:

1. There is no market for this product
2. The product is not competitive, of poor quality, or incomplete
3. The company is not seen as a reliable provider of technology and support
4. The pitch is not being made to the right people.

Technical entrepreneurs are often inclined to assume the world will want their product (i.e., that the market exists) and to think they know the customers' requirements (without actually investigating their full requirements). They typically neglect the other market research required to effectively target customers, position products, sell against competition, and find appropriate business partners who can lend credibility and facilitate "getting a foot in the door" of potential customers.

In the end, embedded software publishing is a co-engineering process, driven more by technical issues than by other market demands. There is, in each industry, specialist expertise available to help well-prepared software companies find their way into the right engineering groups. It is our impression that the new management at iPark Silicon Valley has a clear idea of how to involve market specialists in the process, as well as how to identify appropriate Korean vendors.

- Focus efforts to support software exports solely on those firms that are properly prepared and financed to sell into foreign markets. Target additional investment, support, and promotion programs for high-potential software venture firms. (We discuss the characteristics of firms with global potential and offer suggestions for how to identify and support them in Section 3.2.)

- Encourage more foreign acquisition and investment in Korean software technology, products, talent, and companies. The cross-fertilization of ideas and learning that results will stimulate the overall software industry.
- Consider a Malaysia-style PR program for branding Korean software. In order to promote Malaysia as a high-tech center, senior public officials (including Prime Minister Mahathir himself) travel widely to speak to business leaders and other market influencers and decision makers about the country's high-tech capabilities. Dr. Mahathir has also organized an international Advisory Board. He attends every meeting himself, which motivates top industry leaders to participate. Not only does he get the best advice, but he also gets an unequalled opportunity to promote Malaysia's high-tech vision.

2.4. *Marketing Enterprise Software*

Enterprise software is by far the biggest and most complex category – about 80% of software sales in the US. Here too, the use of specialists market intermediaries may be key to Korean firms' success, and that is a cornerstone of iPark Silicon Valley's strategy.

The US software market is very large and is commonly broken down in terms of a multi-dimensional sectors, for example:

- Geographical, e.g., Northeast, Mid Atlantic, Midwest, South, and West.
- Product category: infrastructure, tools, applications, services
- Industry verticals: Financial services, telecommunications, auto, other manufacturing, government (federal, state, local), software companies, ...
- Customer size: managed account, enterprise, SME, SOHO
- Application categories: Database, ERP, CRM, e-commerce, middleware, tools, ...
- Hardware platform: mainframe, servers, PCs, handhelds, ...
- Software platform, e.g. application servers, Websphere, Weblogic, Apache, Sun, ...
- Operating system platform, e.g., Linux, Windows NT, Solaris, ...

While it may seem unnecessarily complicated for a small startup to approach the market with this fine-grain perspective, in fact, it is necessary. The resources are often specialized, e.g., consultants who know the East Coast telecommunications carriers' CRM groups or a Midwest wireless technology tradeshow for small financial services firms sponsored by BEA. Progress in the US enterprise software market is expensive and requires hard work and assistance from marketing specialists familiar with the firms, technologies, channels and market influencers.¹⁶

¹⁶ See, for example, Sally Goodsell, *The Role of Analysts in Your US Marketing Campaign*, www.international-marketing.co.uk.

Table 2 illustrates the shared understanding of Silicon Valley investors and entrepreneurs about the stages of growth and incremental investment in enterprise-oriented US startups. It also shows some of the main marketing tasks at each stage.

Financing Stage	Requirements Before Moving to Next Stage	Principal Marketing Activities	Survivors
Entrepreneur with an idea and a second mortgage	Business plan summary, IP protection strategy, initial prototype, investor strategy	Value proposition, elevator pitch, initial product description, market size estimates, competitor identification, investor presentation	~1000
\$1M seed money from friends and angels	Executive team, revenue model, Advisory Board, patent applications, beta installations, complete business plan	Whole product definition, market strategy, product MRD, market and competitive analysis, positioning, pricing, sales presentations, technology and marketing partner strategy, beta site program	~100
Series A: \$5M from institutional or strategic investors	Sales team, development team, whole product, analysts' upper right quadrant, good press, paying customers, hardened product, Board of Directors, reference sites	Lead generation and qualification, marketing collateral, demos, product launch, analyst & press tours, partner programs, customer relations, user group, sales support, product line plan, release schedule	~10
Series B: \$10-20M	Many happy customers, sustained growth, cover story in Business Week, first tier alliances, top 3 in market share.		~5
Series C, or company acquisition	Sustained profitability, loyal customers		~2 or 3
IPO			~1

Table 2. Hurdles that Silicon Valley software startups must jump at each phase of venture financing, typical marketing tasks at each stage, and a general approximation of the number of startups that survive.

Our recommendation:

- Concentrate extra effort to penetrate the global enterprise software sector. Focusing on consumer products and games is tempting, because enterprise software is a difficult segment of software to penetrate. Enterprise software is by far the biggest and most complex sector of the software products industry, the most technically sophisticated, and has the most demanding customers. It is also uniquely prestigious. It is important for Korean products to become well known in this sector. Opportunities will present themselves in emerging niches like wireless devices, mobile applications, and web services.

2.5. Software Product Management

The Marketing Requirements Document (MRD) mentioned in Table 2 is a “living document” created by the product manager early in the software product life cycle. Good product managers spend considerable time keeping all members of the team focused on the marketing requirements and goals via this document. Typically, the MRD specifies:¹⁷

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- Business and marketing goals
- Customer needs, market segment(s), users’ view of product functionality
- Product requirements (whole product): features, performance, integration, components, standards, footprint, quality, usability, installation, DB interfaces, documentation, training, user support, etc.
- Technology issues and trends: platforms, standards, installed base, ...
- Release timing, competition, strengths/weaknesses, future competition
- Product segmentation, adoption cycle, lifecycle, roadmap
- Market size, market share, growth strategy and forecast
- Product positioning: value proposition, elevators pitch, feature/benefit list, sales points, packaging/configuration, release dates, ...
- Marketing plan: distribution strategy, collateral checklist, pricing, case studies (reference sites), white papers, press/analyst relations, advertising, direct marketing, promotions, e-marketing, trade shows, ...
- Risks, open questions, and issues that need to be followed for future decisions

The MRD illustrates the issues and the effort involved in bringing out a software product in the US Market. Korean entrepreneurs and investors are not prepared for this level of complexity or for the level of investment required.¹⁸ Bringing software products to the US market without this level of marketing expertise does not make sense. Software is a winner-take-all business, where only the top market-share holders survive.¹⁹ Furthermore, market knowledge can’t be bolted onto the product as an afterthought.

¹⁷ See, for example, Merrill R. Chapman, The Product Marketing Handbook for Software, Third Edition, Aegis Resources, Killingsworth, CT., 2000. We also thank the folks at ShipShapeSolutions.com for specific expertise on software product management.

¹⁸ See, for example, survey data published by the Korean Software Industry Association, March 23, 2001. static.sw.or.kr/stanic_detail. Often too, Korean entrepreneurs are satisfied enough with the business potential they see in the Korean and Japanese markets, and maybe in China – entering the US market seems like an overwhelming and uncomfortable proposition.

¹⁹ Mark Blumling, Kevin A. Frick, and William F. Meehan III. “A hard turnaround for software.” McKinsey Quarterly, 2002 Number 3: “Software is a winner-takes-all business in which three factors—the need for compatible technology in networked environments, high switching costs, and increasing returns to scale - unite to ensure that only a small number of players in most market segments survive in the long run.”

In software, marketing starts with product conception. Understanding the opportunity, customer requirements, market dynamics, technology standards and constraints, partnering possibilities and so on is as important as designing solid code and attractive user interfaces. Typically in enterprise software, early beta customers and systems integration (SI) partners have a huge impact on the shape of the final product. And, of course, this product design process is over-constrained – there are tradeoffs and they change over time.

The software product manager drives the decision-making process of product implementation. Since decisions must be made quickly, often on the spot with clients and partners, the product manager has to have the authority to make decisions that may have financial and technical implications. He or she prepares the Marketing Requirements Document, which is maintained as the “document of record” for the product’s life.

Because the Korean software market is less complex, and marketing in Korea is often relationship based, very few Korean software venture companies come to the US with a product manager prepared for this job. In fact, some interviewees suggested that experienced product managers and senior software project managers are rare in Korean software companies, and that many firms are still not employing standard product management methodologies and tools (requirements management, QA and bug list management, version control, code reviews, beta programs, release management, etc.) The value of these methodologies is not apparent until the project is quite mature and complex, for example, when a software product has gone through several releases and hundreds of customers need features and fixes of all sorts.

One reason, we were told, for the lack of appreciation of software product management is that most Korean programmers are relatively young in the software publishing companies. Older Korean programmers, we gather, move into management, or out of software all together. It is not until you have experience with how things can go wrong that you develop an appreciation for methodologies – they do, after all, add overhead to what seems like a simple, straightforward programming project. We feel that the career path for programmers of various sorts is a key labor issue (see Section 4.3).

Finally, a word about software quality, mentioned above. Every market has different expectations along several dimensions of software quality. While it is not possible for us to study the quality of Korean software in depth, some interviewees suggested that typically venture companies do not attend to quality assurance, usability, documentation, and so on at the level expected in most US markets. This is an area of great concern, because it is important to position Korea as a supplier of quality software. (It took India ten years to achieve this reputation starting from the “low cost” positioning.) We therefore make the following two recommendations:

- Undertake a study of the level of practice in Korean software firms in the area of software product management. Support private training and consulting services to help firms improve in this area.

- Continuously monitor the perceived quality of Korean software offerings in target markets by retaining the services of local customer satisfaction research firms.

2.6. Software Services

In recent years, Korean systems integrators have won some business in markets like Latin America and Southeast Asia. These firms have used their experience on major projects in Korea to develop “pre-fabricated” solutions that they can then offer as part of services contracts. This expertise, combined with the ability to deliver solutions at lower cost than the big US consultancies, creates many interesting market opportunities. With some strategic attention to market and technology strategy, offshore services and outsourcing could be a significant business. It will be limited, eventually, by the availability of talented programmers.

We make the following recommendations regarding the software services business:

- Undertake marketing communications programs in specific foreign markets to increase awareness of the Korean software industry as a quality provider. Consider retaining the services of local market communications firms in those markets that have some experience with software branding to develop a plan for approaching market influencers. Increase informational and other support to embassy and trade missions on behalf of the software industry.
- Consider “productizing” the Korean approach to ICT-based economic development and selling it into developing economies, perhaps with donor organization support.²⁰ Host summits on ICT for economies in transition to establish Korea as a global leader on the impact of ICT on economic development.
- Focus special attention on helping small Korean software firms deal with the complexities of conducting business in China, since this is such an important but difficult market. Make sure that the small companies selling into China have adequate business and legal support in key cities – beyond the promotional efforts that iParks generally supply. While China is a hard market for chaebols to penetrate, they at least have the resources. Software SMEs and startups need government support on the ground in China.

One caveat regarding software services export: software services (consulting, systems integration, and outsourced software development) are relatively labor intensive. If you look at the software industry in terms of leveraging software talent, services are at the low end of the scale. (The revenue per employee at a software product publisher is twice

²⁰ The Indian state of Andhra Pradesh has expressed plans to market its approach to ICT development to other third world countries. The “Andhra Pradesh Inc” offering is expected to focus on e-government for poverty-level economies, and schemes for maximizing efficiencies of minimal physical infrastructures. The Korean approach could, for example, focus on strong telecommunications infrastructure development and government policies and programs designed to develop an entire knowledge economy over a longer term.

that of the typical systems integrator, and four times that of a contract programming shop.²¹) Korea must continue to increase the number of talented and trained software professionals available to the services export sector, or its growth will be constrained by (or will constrain the growth of) the publishing and embedded software sectors.

While we feel there are threats to the software services business in the future (see the competitive analysis in Section 2.8), we nevertheless think that there is a good chance that additional regional and vertical markets will open to this business, for example:

- Falling hardware costs, pre-fabricated solutions, and open source software infrastructure technologies like Linux will dramatically reduce the costs of automation for organizations that previously could not afford database, ERP and e-commerce/e-government systems.
- Specialized expertise could lead Korean SI's into high-end systems consulting work in, for example, the international telecommunications industry, the "Windowless enterprise" market, cyber security for Chinese corporations, or e-government for SE Asian governments. Of course, ICT development for economies in transition, mentioned above, is another specialization with considerable potential.
- Specialized niche solutions, (e.g., in mobile data/telecom systems for hospitals, trading, or other) could open the some of the most lucrative systems integration and strategic consulting markets.

In Section 3.5, we discuss other SI-related issues and present recommendations about how to use the growing services sector to help along the enterprise software publishing companies that are trying to introduce innovative technology into Korean companies.

2.7. The Changing Shape of the Global Software Industry

During the last two years, the worldwide software industry has gone from its all-time peak of activity and value into a serious slump. Software startups have been particularly hard hit. The reasons for this retraction are three-fold:

1. The speculative investment in dotcom software businesses and the consequent bursting of their stock market valuation bubble has created in its wake a reluctance to invest in new software companies. (In fact, VC investment in software companies in Silicon Valley has retrenched to its 1998 levels, and much of this money has been invested in existing portfolio companies that were unable to make planned public offerings on schedule.)
2. The depressed economy in the US, the sorry state of the public stock markets, and the resultant dearth of initial public offerings, combined with retrenchment by

²¹ Rule of thumb estimates for annual revenue per employee are \$200K for software publishers, \$100K for typical systems integrators, \$50K for contract programming shops in India, and \$10K for Indian call centers. See Software Magazine's Annual Software 500 (October 2002), and Shyam Malhotra. "The Pottery of the Indian IT Supermarket." [Dataquest India](#), August 5, 2002.

large enterprise technology companies, particularly as regards acquisitions, has almost completely eliminated liquidity options for venture investors.

3. Corporate IT expenditures have been cut back dramatically, partly because of the general business slowdown. CEOs also argue that years of investment in Y2K overhauls, ERP deployment, and e-business infrastructure have left them with a lot of software technology that they are not fully utilizing. With some exceptions (see below) their new technology purchases focus on better use of technology they already have.

The recovery will be even slower for the software industry than it will be for the economy at large. The US software industry may be approaching a critical juncture. As one Silicon Valley product management consultant put it, “maybe this prolonged downturn will force our industry to grow up.” Software is still a young engineering discipline. Product quality and project completion statistics are unacceptably bad across a broad range of market segments. Everyone agrees. But the pace of the industry for the last 15 years has been unrelenting, and there has been little time in most organizations to attend to software development methodology, re-tooling, or even workforce skills development. The pace has slowed down, at least for a few years. And this presents an unprecedented opportunity for countries like Korea to find a central role in a reconfigured global software industry.

The pace of innovation. The primary opportunity is a direct result of the slower pace of change. As the world’s largest companies slow their rate of purchase of IT products and services, and Silicon Valley VCs respond by slowing their rate of investment in innovative software startups, the technological future becomes a bit easier to predict.

Silicon Valley’s primary advantage as an industrial cluster stems from its ability to precipitate and manage a rapid rate of technical innovation. If the pace continues to slow down in the technology sector, the Valley’s unique methods for creating market value from innovation in the software industry may become less advantageous. Product and market risks may be reduced earlier in the product development process. As a result, alternative (lower cost) ways of funding innovation and market entry may be possible for the software venture firms. And perhaps the slow and bureaucratic R&D organizations found at many of the larger technology companies may now be fast enough to bring new software products successfully to international markets. Finally, a slower pace of technology adoption offers opportunities to compete based on quality and service in some mature segments.

New Opportunities. New markets for software applications, tools, and infrastructure will emerge, even if at a somewhat slower pace, and specific opportunities are always identifiable. Some of them are big opportunities. New platforms, new technologies, and the resulting new markets create new opportunities for software developers every year.

A new computing platform is a blank slate. Old applications have to be ported to run on the platform and new applications need to be created. As the cost of computing power continues to decrease, new applications can be brought to market that either required

more computing power than was widely available, or required equipment that was too expensive before. We see some very interesting new opportunities emerging in the next few years:

- The area we feel most closely leverages Korea's current situation is mobile enterprise applications, as we've mentioned above. Tools that enable workers in various industries to do their work better, possibly involving special purpose hardware (e.g. handhelds), could be the area that brings Korean software into the global spotlight. Cooperation of the telecommunications carriers and, most importantly, of Korean chaebols and government agencies, which have to co-invent these applications, is essential.
- Linux-based enterprise applications and infrastructure software (complementing the open source and Windowless enterprise SI opportunities mentioned above).
- Very low-cost wireless computing applications, for example, for education in undeveloped rural areas. Naturally, there are potential device/software synergies.
- Connected computing generally – devices will get smarter and be able to link to the network. One can imagine all kinds of special purpose and extremely easy to use consumer and enterprise tools, building on Korea's strengths in consumer electronics and mobile telecommunications. Embedded software is the key to functionality, flexibility, usability, interoperability, and security. Korea has well-developed expertise in embedded software which can be exploited much more extensively.
- Web services. The migration to Internet-based enterprise software architecture has begun. As this technology becomes widespread, and vendors like Microsoft, Sun and IBM deal with security issues, major new opportunities will emerge for software systems that take advantage of inter-company linkages. On-line services, like Salesforce.com's hosted CRM system, will combine elements of e-commerce, ASP's and Internet gaming, with complete data integration and end-to-end security.²²
- Security will be an increasingly important part of computing. Korea's expertise in network security and in mobile communications infrastructure could imaginably be leveraged into important enterprise or personal solutions.
- Finally, there are opportunities in some of the oldest parts of the software industry. Re-thinking business mainstays, like information retrieval or desktop productivity, in the light of modern hardware technology, software architecture, communications trends, security, quality, and market economics may lead to major innovations in the way existing and new markets automate these traditional tasks. The natural tendency to try to undercut Oracle or Microsoft products on price alone does not work – there is too much flexibility in their pricing and tens of thousands of person

²² We should mention in this context important advances in artificial intelligence software enabling the Semantic Web, as it is called. Cf. Barr, Tessler & Kresge. "Towards a Knowledge-Level Software Platform." International Semantic Web Workshop, Stanford University, July 2001.

years invested in their technology. But they have weaknesses, like portability and quality, which could be exploited by innovative latecomers.

The slowdown in the global software industry presents one more opportunity of a different nature. For the last ten years, the worldwide market for talented software engineers and experienced software industry professionals has been extremely tight. With careful planning, we think that it is now possible to utilize some of the best and brightest people in the industry in creative ways to help expand Korea's software export industry. We will return to this point, with some recommendations, in Section 4.4.

2.8. *Korea's Competitiveness in Segments of Interest*

As we have discussed, there are many opportunities in the software industry today that seem approachable by Korean venture firms. We present here SWOT analyses for Korean firms in six software industry segments:

1. Mobile infrastructure software for the US telecommunications market;
2. Mobile applications for businesses and consumers (besides games);
3. Multimedia content technology;
4. Software services export;
5. Packaged software; and
6. Embedded software

Note: The elements in all of the following SWOT's are derived from our research on global technology trends, interviews with Korean software venture entrepreneurs about their product and services offerings, and discussions with segment experts familiar with Korea's technology strengths and weaknesses.

1. **Mobile infrastructure software for the US telecommunications market.** By infrastructure, we mean tools and technology used to support wireless services as well as the business operations of carriers and service providers. Examples are GPS-based location technology and mobile payment infrastructure.

Strengths	Weaknesses
<p>Korean technology is in the forefront in mobile infrastructure innovation.²³</p> <p>Leading global equipment manufacturers are located in Korea.</p> <p>Korean software vendors have unique opportunities for getting experience, since carriers, handset manufacturers, services providers, and consumers are already using advanced technology.²⁴</p>	<p>Korean telecommunications software vendors have no established reputation or credibility in major markets like the US (although the equipment manufacturers are well represented).</p> <p>While CDMA technology is finding broader acceptance in the US, some Korean technology may not be compatible with US customers' systems.</p> <p>No Korean software company has any experience as a global platform vendor, supporting other software developers.</p>
Opportunities	Threats
<p>Because Korean technology is ahead of the market, there is time to find appropriate sales channels and establish a presence in the US.</p> <p>Working with international vendors like Qualcomm, Samsung, or LG, Korean venture firms could establish themselves as leaders in mobile infrastructure technology.</p> <p>Korea's technology has the potential for being a major element of future wireless applications development environments.</p> <p>It may be possible for an adequately funded joint venture to buy a troubled US carrier and become a leader in introducing wireless services in the US.</p> <p>A new and large market will emerge for communications solutions for the home, office, building, and campus that integrate LAN, telephone, wireless, 802.11b, and Bluetooth mobile devices.</p>	<p>The rate of technology adoption (and product innovation) in the US market continues to be very slow.</p> <p>US telecommunications companies are weak and most are in difficult financial straits, further slowing their acquisition of new technology.</p> <p>Microsoft sees itself as the eventual owner of all platforms. Qualcomm, Nokia, Motorola, Sun are also vying for position.</p>

²³ Korea leads the world in the deployment of cutting-edge mobile technology. It is also recognized as a center for innovation in some underlying technologies, e.g., mobile Java and CDMA 1x- EVDO.

²⁴ Japanese vendors are also looking to Korea as a technology test bed. See Ki-hong Kim. "Korea a Testing Ground for Japanese Tech." *The Chosun Ilbo*, October 2002.

2. **Mobile applications for businesses and consumers (besides games).** The US market is wide open for innovative applications of wireless technology, like location-dependent services, sales force automation, and retail transaction services.

<p style="text-align: center;">Strengths</p> <p>The advanced state of Korea’s wireless telecommunications industry means that the infrastructure and market are ready for deployment of new, innovative mobile services.²⁵</p> <p>Foreign venture capital firms are establishing offices in Korea not only to look for investment opportunities in Korean startups, but also explicitly to find markets and partners for their portfolio companies in the mobile technology space.²⁶</p>	<p style="text-align: center;">Weaknesses</p> <p>Korean firms (banks, chaebols, government agencies) are not yet using mobile enterprise apps broadly, despite Korea’s technical and market lead in this sector.</p>
<p style="text-align: center;">Opportunities</p> <p>Mobile carriers and service providers want to identify new applications that will increase the use of their infrastructure.</p> <p>We are particularly excited about the possibility of very-low-cost mobile devices, like the Encore’s Simputer and MediaSolv’s VillagePDA, for mass markets in developing countries. These are wide-open platforms for software infrastructure, tools and content.</p> <p>Web services architecture, now beginning to be deployed broadly in the US, creates a new platform for enterprise application integration. New platforms mean new opportunities.</p>	<p style="text-align: center;">Threats</p> <p>Mobile services in the US are still quite expensive, and kilobit-based 3G rates are not likely to make it easy to introduce high data rate applications.</p> <p>Despite years of anticipation, there is very little use of mobile technology for non-voice applications in the US. Some banks are stopping their mobile banking services due to lack of interest.²⁷</p>

²⁵ Andrew Weber. “Korea as Wireless Leader? This American Believes.” *The Korea Herald*, March 24, 2001.

²⁶ “Nokia Venture Partners Opens Korean Office and Makes First Investment in Market.” Press release, June 10, 2002; and Barr and Tessler, Interview Notes, July 2002.

²⁷ Troy Wolverton. “Wells Fargo to Shutter Mobile Service.” *CNet*, August 20, 2002.

3. **Multimedia content technology.** This segment includes tools, applications, and services in segments like internet games and other on-line entertainment, wireless games, PC games, e-learning, e-publishing, website design, and digital animation.

Strengths	Weaknesses
<p>Korean technology and applications in this area are among the world’s leaders.</p> <p>Koreans are active consumers of this technology, creating a unique test bed for new innovations.</p> <p>Korean tool and infrastructure vendors have targeted markets like Japan and China with growing success.</p>	<p>Cultural dependency of applications requires serious market research before export product development. For example, “PC baangs” and interactive game rooms don’t exist in the US.</p> <p>Marketing into the entertainment, publishing, and ISP sectors in all countries requires special expertise. The marketing of tools to creative people requires even more specialized expertise.</p>
Opportunities	Threats
<p>A significant share of the digital design market, world over, is on the Apple platform. New offerings on Apple’s OS/X, a less crowded market, might help create awareness of Korean technology and establish a leadership position in this sector.</p> <p>Free browser plug-ins for new technology or new platforms (wireless browsers?) could open new markets and establish de facto standards (like Adobe PDF).</p> <p>New Internet platforms, like Nintendo’s recent GameCube announcement,²⁸ require new embedded technology as well as applications that drive sales and, preferably, differentiate the platform.</p> <p>Convergence of Internet, wireless, content and handset/PDA should create a sweet spot for Korean electronics firms, especially with breakthrough embedded, infrastructure and applications software.</p> <p>E-learning markets, for devices, tools and content, are expected to grow rapidly (e.g., US corporate, worldwide education, etc.). Other corporate market crossover products, including collaboration, collaborative design, knowledge management also have potential.</p>	<p>Low cost services providers (e.g., digital animation shops in India or China) may limit growth in services, although they may at the same time be a market for tools.</p> <p>Hollywood and its technology providers are well positioned to dominate many parts of this sector.</p> <p>Adobe, Macromedia and other software powerhouses may also be looking for low-hanging fruit in this wide-open sector. (However, like Apple, they are also potential partners for global plays in this technology.)</p>

²⁸ “Nintendo will sell Web Game Adapter.” *New York Times*, August 23, 2002. Also, Anthony Brexnican. “Sony Unveils Online Game Service.” *APonline*, August 28, 2002.

4. **Software services export**, e.g., e-government, financial and manufacturing systems in Latin American and Southeast Asian markets.

<p style="text-align: center;">Strengths</p> <p>Korean SI's have experience, technology, and some recent success stories abroad.</p>	<p style="text-align: center;">Weaknesses</p> <p>No long-term track record, reputation, credibility. This will take some time to build.</p> <p>Limited exportable experience with cutting-edge solutions. Relatively limited experience working with Korean firms outside of own chaebols and few Korean SI's are working offshore now. Limited exposure to foreign bidding practices, project pricing, multi-vendor project management, alternative solutions, vendor partnerships, etc.</p> <p>No established reputation in Linux-based solutions.</p> <p>Growth may be constrained by availability of software labor.</p> <p>No differentiation of Korean offerings. In particular, Korean software labor is not low priced compared to India, China,</p>
<p style="text-align: center;">Opportunities</p> <p>As a recent entry, the Korean SI's can establish an image of Korea as a premier provider.</p> <p>Lower-cost software infrastructure (Linux, etc.) reduces the overall cost of solutions developed by SI's, and thus opens markets that cannot afford solutions from big US consultancies. The "Windowless enterprise" movement may also create opportunities for Linux-based solutions.</p> <p>E-government is in big demand, especially in emerging economies.</p> <p>While to date only a limited number of projects have been won,²⁹ there are a number of large markets that Korean SI's could target, e.g. telecommunications, manufacturing, in emerging economies.</p> <p>Integrating hardware and consulting with software services (perhaps via partnerships) would position Korean offerings as solutions vs. contract labor – higher in the food chain and less vulnerable to low-cost competition.</p>	<p style="text-align: center;">Threats</p> <p>India and other low-cost software services providers are desperately looking for new markets. India in particular has 170,000 skilled programmers,³⁰ global connections and operations, quality reputation, and very low wages.</p> <p>Local offices of major international consulting/SI firms are also looking for business in new markets. They have credibility, experience, technology, and inside connections via consulting.</p> <p>Local services providers in target regions may get preferences for some types of contracts.</p>

²⁹ IT Industry Outlook of Korea 2002, KISDI, from KIPA data.

³⁰ Per the Nasscom website, 2002, in addition to the "almost 170,000 are working in the IT software and services export industry, nearly 106,000 are working in the IT-enabled services segment and over 220,000 in user organizations."

5. **Packaged software**, generally.

<p style="text-align: center;">Strengths</p> <p>Some stable mature packages popular in Korea like Haansoft HWP and Dr. Ahn's Virus software.</p> <p>Expertise in Unicode & Asian localization</p>	<p style="text-align: center;">Weaknesses</p> <p>Few products established outside of Korea</p> <p>No country brand recognition</p> <p>Foreign companies will have difficulty competing in the US in established segments</p> <p>Both SI's and small startups have great difficulty turning solutions into robust products</p> <p>Very limited software product management experience</p> <p>Not enough venture capital & other support for high-risk global plays</p>
<p style="text-align: center;">Opportunities</p> <p>Expand foreign language capabilities and go into other regions with non-Latin alphabets (e.g., Asia and the Middle East).</p> <p>ASP model – turning software into a service, e.g., Salesforce.com</p> <p>SW tools for telecommunications-related activities like transmission line planning, manufacturing automation, electronics designing & testing – niches where Korean firms may have an easier time establishing their credentials.</p>	<p style="text-align: center;">Threats</p> <p>Substantial US competition</p> <p>Competition from local companies in target countries</p>

6. Embedded software for consumer electronics and automobile manufacturers.

We believe that software technology sourcing is likely to undergo dramatic changes in these markets – manufacturers will OEM an increasing amount of software developed by other firms.

<p style="text-align: center;">Strengths</p> <p>Korea consumer electronics and auto manufacturers use world class technology and therefore offer the kind of test-bed environments that venture firms need to develop globally competitive technology.</p> <p>Entrepreneurs with good ideas for new software tools and OEM technology often are likely to come out of jobs in these advanced industries.</p> <p>Korea has a track record for OEM technology in consumer electronics, especially mobile handsets.</p>	<p style="text-align: center;">Weaknesses</p> <p>Lack of cooperation of large Korean manufacturers with venture firms in the development and marketing of software technology.</p>
<p style="text-align: center;">Opportunities</p> <p>For a variety of reasons, including costs savings, product development speed, and global sourcing programs, manufacturers in these sectors, including world leaders like Sony and GM, will increasingly buy software technology embedded in their products rather than developing it themselves.</p> <p>Cooperation between Korean electronics firms and software venture firms in identifying and pursuing opportunities for special-purpose wireless devices and solutions could take Korea into a leadership position.</p>	<p style="text-align: center;">Threats</p> <p>For both consumer electronics and automobile manufacturing industries, large software OEM supplier infrastructures exist in the US, Europe and Japan.</p> <p>Indian software firms have started to penetrate this market (e.g., MP3 decoder software sale to Sony). It is time for India to move up the software food chain, and markets like this are very attractive.</p>

3. Entrepreneurship, Venture Capital, and Habitat

The key message of the previous section is that many of the problems Korean software venture firms are having in their effort to market products into the US stem from decisions made early in company formation and product conception.

In this section, we will examine software company formation, financing, and habitat support in Korea. Government efforts over the last several years have achieved a remarkable success in terms of changing the career ambitions of young engineers towards entrepreneurship and of what we would call “seed financing” of startup venture firms. Korea’s extensive incubation system and several government educational and promotional programs supply some of the nourishment needed by these seed-stage startups. However, private sector habitat support is still at a very low level, and neither the incubators nor the venture investment community has matured to the point where they can effectively turn these innovative startups into real businesses, much less into risk-taking, global ventures.

We will make recommendations about government programs, venture capital, incubation, and the domestic market for advanced software. First, we define the goal – identifying and supporting software firms with important innovations and global potential.

3.1. *Entrepreneurship and Risk*

All entrepreneurs take risks in going out on their own, whether they are starting a grocery store or a software company. Different models of entrepreneurship are appropriate, depending on their company’s potential, the resources they have versus those they require from outside, the rate of change of their market, and the risks they face.

Not all software startups aspire to be global enterprises. But those entrepreneurs whose vision involves reaching the top of some new software category, like enterprise security or wireless transactions, must be well capitalized, fast moving, well managed, and global from the outset. This usually requires outside investors, marketing and management expertise (as well as technical innovation), cluster-based networking, and very high risk in order to get to market quickly with a new idea.

For the past several years, the Korean government has used a statutory definition of the “venture firm” to distinguish a subset of the many small businesses that are started every year in a wide variety of industries. The legal definition of a venture firm contemplates high-risk: that the firm will be funded with venture capital and/or that it will engage in the (high-risk) creation or exploitation of intellectual property in a technology area. There are other expectations (communicated through support programs and other means) that these high-tech venture firms will also undertake the additional risk of exporting their products and services abroad.

In the current business climate, however, risk aversion appears to be the distinguishing behavioral characteristic of many Korean entrepreneurs and investors. Minimizing risk

by moving slowly and cautiously is a reasonable business strategy in many contexts, especially in an economic downturn. Unfortunately, while software technology markets may have temporarily slowed down, they have historically changed very fast. This requires entrepreneurs and investors to commit years before the eventual outcome is clear. In short, it requires high-risk business and finance strategies. Slow-moving software development, gradual penetration of new markets, and self-funded business growth will not produce companies that can introduce major new software innovations into global markets.

Ironically, the Korean government currently exhibits the most entrepreneurial attitude of all stakeholders: it fundamentally recognizes the high-risk, high-reward nature of the software business by steadfastly continuing to offer a broad range of supportive programs and policies to promote venture firm activities. Of course, there are a small number of venture firms and venture capitalists that are going forward in developing their businesses at a globally competitive pace. It behooves the government to better understand and identify those venture participants who accept risk, who know how to manage it, and who are committed to doing international business.

3.2. Identifying Software Firms With Global Potential

In Silicon Valley there are neither government guidelines nor formal mechanisms for identifying and supporting new companies with global potential. As we all have come to understand, in functioning technology clusters, the “certification process” consists of exploiting the informal habitat network to validate business ideas, develop technical innovations into competitive products, and eliminate the non-starters. In order to determine whether their new business is a viable one, the founders will seek expertise of every kind, both formally and informally.

The quest for advice is one of the key processes of early stage Silicon Valley companies. Entrepreneurs will spend countless hours talking to the experts they need to establish the validity of their ideas, technologies, and business strategies (angel investors, venture capitalists, high-tech lawyers, consultants, marketing agencies, potential partners and customers, and prospective team members). Through this informal process, they may also locate critical resources like key employees, specialists and, of course, initial financing (which may be seed financing – enough to develop their concept into a real business plan). By the time the entrepreneur has described his ideas to 50 people, or 100, in various business specialties, he will have gathered together the knowledge, referrals, and funding that he needs to go forward (or he will find out that his idea is not viable and will not proceed).

**Best
Practice**

We consider this approach to be a best practice for several reasons:

- Entrepreneurs can validate and refine their business ideas quickly and cheaply. In the process they begin to form an Advisory Board, should they go forward;
- Inexperienced entrepreneurs become familiar with the tradeoffs involved in high-risk ventures and with the rules of the game;

- Entrepreneurs become better acquainted with the area's support firms and their particular expertise, so that they can call upon the right people as their company develops;
- Investors and support firms strengthen their network with each other; and
- All parties in the cluster (entrepreneurs and advisors) stay up-to-date on where the cutting edge is in terms of technologies, markets, and business innovation.

This last point, about the institutional learning that arises out of this informal business validation activity, is one of the most important advantages of Silicon Valley. It is not the process so much as the knowledge of the various participants (about technology, market trends, entrepreneurship, and about the habitat itself) that makes the habitat work.

Korean business people do significant networking of their own, of course. Yet, Korean entrepreneurs and venture capitalists have told us repeatedly that Korean entrepreneurs tend to seek out less advice, and to utilize less of the advice that they do get. Furthermore, tech-savvy investors, experienced entrepreneurs, and specialized software industry consultants are very hard to find in Korea, especially since the dotcom downturn. As Korea grows as a software exporter, this relative lack of use of expertise will hamper success. The reason is clear: a Korean company of say 10 engineers, operating in relative isolation, must compete against a Silicon Valley company that may appear to be of a similar size, but actually has a "virtual army" of dozens of experts available to it, helping it with every facet of its operations and strategy. This is the power of the habitat.

By contrast, Korean software entrepreneurs might gather a rather limited amount of advice during the process of applying for government certification, residing at an incubator, or seeking institutional venture capital. Otherwise, they have much fewer opportunities to interact with industry-savvy people about their product concept and market realities, about forming and running a business, and about the tradeoffs they will need to consider as high-risk entrepreneurs. Perhaps the majority of Korean entrepreneurs have no ambition to build a \$50M global business, much less become a billion-dollar household name. But for those who do, the lack of competent feedback during all stages of company formation and product conceptualization is a serious handicap.

High-potential software startups have the technology, talent, and organizational will to introduce important innovations to a global market. These entrepreneurs and their investors must understand and be prepared to address the different types of tradeoffs inherent in the software industry:

- **Resources/Ownership.** Software markets are very fast moving. Products can be too early to the market or, more often, too late. The window between when the market materializes and when it becomes crowded can be short. Large equity investments by venture capitalists allows small companies with no assets to staff up in engineering and marketing quickly, get to market early, and win global market share. Entrepreneurs in firms with global potential trade off ownership, and sometimes control, of the company, in order to get the necessary financing to time a successful market entry.

- **Vision/Flexibility.** Many entrepreneurs are driven by a vision how their technology is going to change the world. They usually have a very specific vision, which is, as often as not, wrong. As they interact with advisors and customers during product development and trial deployments, they recognize the need to modify or abandon all or part of their initial vision due to the realities of the marketplace.
- **Quality/Speed.** Engineers have a natural tendency to want to get things right. Exactly right. Since the market imperative is speed, successful products usually involve some amount of compromise about features and quality in order to get to market in time to be competitive. Problems can be fixed and important features added in subsequent releases.
- **Global/Niche.** It is not easy or cheap for a small company to play in global markets, but in some software segments there is little choice. Firms that decide to stay local trade off some short-term dangers and expenditures, but may later end up battling for their domestic market with the foreign firms they avoided competing with earlier. It may seem like native language interfaces or lower prices are adequate differentiators in the local market, but if the local market is of significant size, a global player generally has the resources to take it away by localizing its product, undercutting prices, bundling, partnering, etc.
- **Control/Team.** Most entrepreneurs envision themselves at the helm of their enterprise, even if they have no experience (and really don't like) business activities like management, finance, sales, and marketing. Having an unskilled entrepreneur in charge of a high-potential company is unrealistic, and many first-time Silicon Valley entrepreneurs find themselves moved to the CTO or Dir. of Engineer position. By working with a team of experienced executives, they can learn how to run their second startup, or how to become venture capitalists if their first company happens to succeed.
- **Risk/Failure.** The risks involved in a high-potential startup include the technology, the market, the company's execution, etc. The safe course hardly ever achieves global success in the software industry. Entrepreneurs, investors, executives and employees must be willing to take risks and must be prepared for failure, which is the most likely outcome. Entrepreneurs must understand the nature of the risks the investors are taking, and the consequent relationship they will have.

It is very common for technical entrepreneurs, in Silicon Valley, Korea and everywhere, to be focused on the importance of technical innovation. Many believe, wrongly, (1) that the technology is the product; and (2) that the world will beat a path to their door to get it. In Korea, much of the venture support system has tended to reinforce the beliefs of these firms that technology is the key component for venture firm success. The truly high-potential firms recognize, however, that what counts is sales, and that true creativity and innovation are required for every step along the way to making a sale: business strategy, product positioning, branding, packaging, promotion, pricing, distribution, partnering, and customer support, to name a few. They know that they are competing on the basis of a "whole product," not just on its technical innovation: every member of the team is an important contributor.

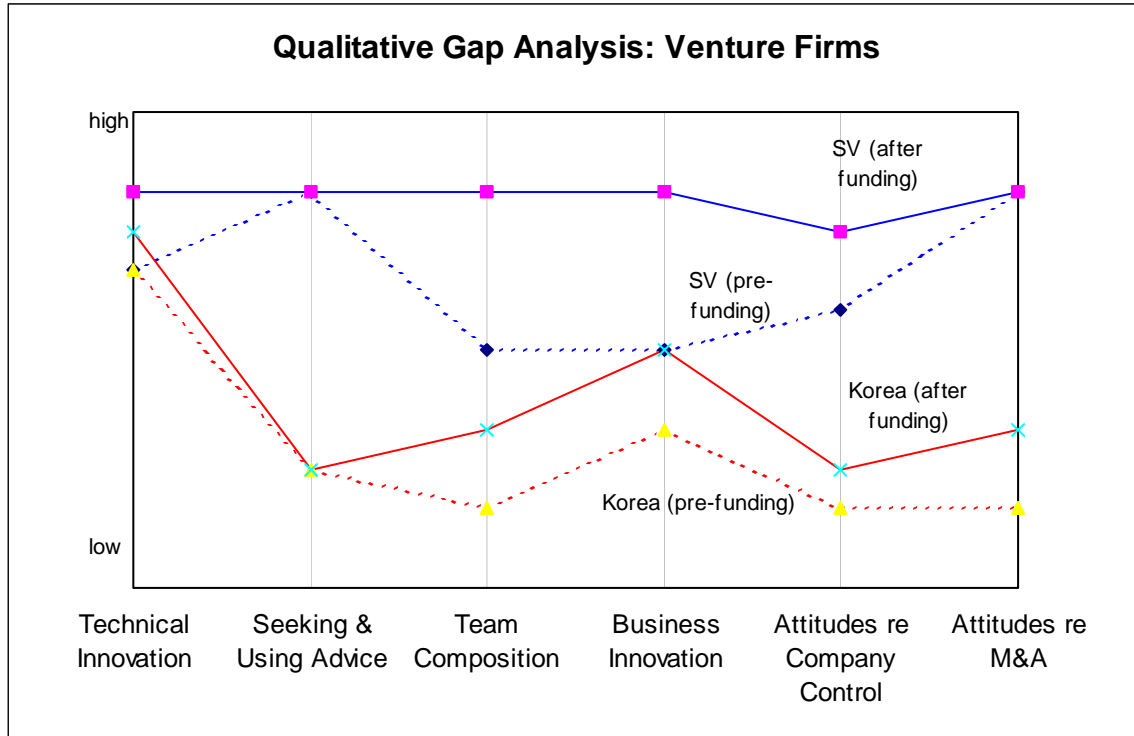


Figure 1. **The Value of Advice.** Both Silicon Valley software ventures and Korean GSI venture firms have technology with global potential. Both groups are likely to start out with serious deficiencies in team composition and business knowledge. By the time Silicon Valley firms have acquired first round funding, however, they have typically addressed some portion of their business problems. They are much more likely than their Korean counterparts to have sought out constructive advice, added experienced business people to the team, developed a business strategy, and adopted more practical attitudes towards company control and liquidity events. In other words, Korean and SV venture firms are not so different before funding in terms of technology, team expertise or even business innovation. However, the influence of advisors, especially VC's, is profound and positive on Silicon Valley firms, making them more likely to succeed.

In terms of both market knowledge and product innovation, entrepreneurs in high-potential firms know that they do not have all the answers, that they must enlist experts and get advice in many areas of the business at every stage of its development. Chairman Chong-Moon Lee calls this kind of entrepreneur a “coachable” entrepreneur. He believes that in the end, this open-mindedness and willingness to take advice may be the one quality that counts most in achieving success in high tech.

We believe that the relevant experts for helping software venture startups are available in Korea in small numbers. Their numbers and expertise will grow as the demand for their knowledge grows.

Case in Point: Free-ceos.com

Seasoned veterans coaching early-stage software startups.

Free-ceos.com is a Korean consultancy, founded in 2000 in Seoul, and focused primarily on high-tech venture firms. It provides “consultations to support and help companies to go worldwide in the global market.” It is comprised of three executive partners and 20 general partners, who are all seasoned business people with diverse backgrounds and experience in areas such as international business, venture financing, marketing research and strategy, sales strategy and alliances, and human resources management.

The firm will only accept clients that it believes have good potential to be successful in the global market. Potential clients are screened and evaluated in the same manner as they are in Silicon Valley. In some cases, the firm will offer seed financing or similar help. To keep costs down for the clients they accept, Free-ceos.com consultants offer much of their advising and coaching services over the Internet or telephone.

Free-ceos.com is an example of a fundamental resource for any robust software industry: it identifies and supports high potential venture firms; brings its clients into the global network; and functions as a vital locus of industry knowledge for the habitat as a whole.

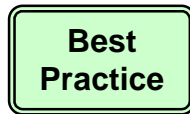
Government programs cannot force an entrepreneur to take advice, give up control, or aspire to global business objectives. However, they can provide a supportive environment for venture firms – an environment in which informed risk-taking, creativity and innovation (both technical and business) are encouraged. The following are our recommendations in this area:

- At all touch points where entrepreneurs interact with the government (grants, certification, tax filings, etc.), seek to identify the high-potential firms so that appropriate intensive support can be offered. Some differentiating criteria are qualitative, and are related to the aspirations and attitude of the entrepreneur, such as self-employment goals versus risk-taking entrepreneurship; attitude toward failure; openness to advice; and interest in doing business abroad. Other differentiators are the existence of a realistic and well-informed business plan, showing some knowledge of the global market; an understanding of the implications of venture capital investment; and a willingness and ability to adhere to minimum business standards, such as financial reporting requirements. Include experienced software industry people in government committees, reviews, training and consulting to help identify these high-potential firms.
- Consider breaking venture firm financial support into separate R&D and business development components. Marketing activities would then not take money away from product development. Moreover, money spent on private-sector business advisors will help develop the habitat in the long run. Finally, this approach would help communicate the importance of marketing to new entrepreneurs.
- Focus on expanding national research and development activities in software technology areas in which Korea has strength and could develop a global reputation, including mobile infrastructure and especially, mobile enterprise applications.

- Rationalize the current suite of government programs and policies related to the venture industry so that all programs contribute to smooth forward progress. Since the various initiatives were adopted at different times with very different goals in mind, a rethinking of the priorities and goals with an eye towards streamlining would be timely.³¹ Consider implementing a policy of regularly scheduled reviews of venture-related policies and programs, as Malaysia has done, in order to avoid future conflicts in goals and to continuously refine and improve initiatives to keep pace with the dynamically changing software industry.
- Consider a program for analysts from government agencies involved in software export to get first-hand experience in the global industry, since the government is such an important player in the current habitat. Such a program might be implemented as a tour of duty for key analysts and decision makers to go to an established software industry cluster, such as Boston or Silicon Valley, to get a first hand perspective of the local situation and to develop relationships with local expert counterparts. Perhaps even consider internships in VC firms or specialized marketing consultancies for analysts without previous business or educational experiences abroad.

3.3. Venture Capital for High-Potential Startups

Perhaps the most problematic area for both new software company formation and subsequent habitat support in Korea is venture capital. In addition to cash, Silicon Valley VC's offer most, if not all, of the following contributions:



- The ability to select companies with investment potential, based on experience in evaluating software technology, product concepts, market risks, and team members;
- A deep understanding of software technology trends and of the target market and/or vertical industry, preferably based on personal managerial experience;
- Some experience with directing a software startup, often through a successful IPO;
- A willingness to take appropriate risks, with his or her skin in the game, and the courage to pull the plug on ideas whose time has passed. This usually involves phased funding with periodic go/no-go decision points;
- A network of resources, e.g., temporary CEOs, industry insiders, professional services firms, personal contacts at potential partners and customers all over the

³¹ The possibly conflicting goals included facilitating technology transfer, nurturing venture firms, developing the VC industry, creating a robust software export industry, protecting investors from fraud and mismanaged venture firms, and protecting venture firms from unethical VC's or too much interference from VC's. An historical example: the regulation which prohibited venture capitalists from interfering with the management of portfolio companies protected venture firms from uninformed venture capitalists, but precluded VC's from protecting or enhancing the value of their investments, and inhibited the formation of valuable institutional learning about emerging industries.

world, and additional investors. They should also have an enthusiastic willingness to talk up portfolio companies to just about anyone; and

- The time to be involved, at least attending periodic Board meetings, and the patience and skill needed to coach the entrepreneur as needed about all of these things and more.

The Korean VC industry is still not well positioned to help software venture firms in this manner. While there are many more VC's active in Korea than there were in 1999, with generally larger funds, they are taking fewer risks. They require, for example, that potential portfolio companies already have some revenues or revenue possibilities in the very short-term. To minimize risk, they are making small first round investments in the software venture firms, and are not making larger, second round investments. In 2000, the average investment was about \$1.1 million dollars in software venture firms.³² This state of affairs makes it quite difficult for any high-potential firm to get the attention and significantly larger funding it would need for a fair chance in any global emerging software segment.

The lack of expertise about the software industry among Korean VC's continues to be a problem. Studies confirm the conventional wisdom of the US VC industry that one of the key activities of venture capitalists is to separate the wheat from the chaff; i.e. to identify and support only the most innovative new companies.³³ While VC's undertake this winnowing process to ensure their own returns, they also have a highly solicitous impact on the industries they finance, since available funds are focused on more promising innovations and not wasted on endeavors whose hopes have faded. Without experienced people in-house to evaluate software venture firms, VC's might look for evaluation expertise outside the company. Unfortunately, we understand that few VC firms turn to specialized experts to undertake a proper software venture due diligence. The lack of in-house expertise, the high risk associated with software ventures, and the global downturn in the software industry have resulted in proportionately fewer investments in software.

Almost all Korean venture capital investments in software are in domestic companies. There are two consequences of so little foreign investment by Korean VC's for the Korean software industry. First, not enough Korean investors are developing the international experience and connections they need to help their portfolio companies. Taiwanese VC's say that their experiences in partnering with Silicon Valley VC's and sitting on the board of a high-quality startup are extremely valuable contributors to their success.³⁴

³² Asia Venture Capital Journal, 2001

³³ Mani & Bartzokas, Institutional Support for Investment in New Technologies: the Role of Venture Capital Institutions in Developing Countries, UN University, 2002; and Thomas Hellmann. Venture Capital: the Coaches of Silicon Valley, in Lee, et al, The Silicon Valley Edge, 2001

³⁴ Kenney, Hana & Tanaka, "Scattering Geese: The Venture Capital Industries of East Asia," World bank Report, April 2002.

Second, a predominantly domestic software portfolio means that any particular VC is probably not investing in any firms with global potential, since there are simply not that many domestic high-potential ventures yet in software. Thus they are unlikely to experience the very high returns that a successful investment in this sector can bring. Big wins in software, even if the ventures were foreign, would bring increased confidence, experience, and the returns to reinvest, perhaps next time in domestic firms. Unfortunately, having been largely absent from Silicon Valley to date, the Korean VC's who do come to investigate investment opportunities will have to be persistent in networking into the deal flow.³⁵

In general, Korean VC's still appear to have little involvement in their portfolio companies. Most continue to do traditional hands-off investing. Some tell us that the venture owner doesn't want their advice so they don't try to impose it. Others point out that their share of the firms is too small to warrant the time or effort involved in offering any substantive help. Some give lip service to Silicon Valley style active involvement, but the actual effort appears to be minimal.³⁶

Researchers have good evidence that, at least in the US, the VC's hands-on involvement improves a venture's chances for success.³⁷ There are a few venture capital firms in Korea that appear to have both the motivation and the expertise to support their portfolio companies in a substantive manner.³⁸ Most of these "Silicon Valley" style venture capital firms are less than three years old, have small funds, few portfolio companies, and therefore cannot have a large number of noteworthy successes yet. We anticipate, however, a success path for software similar to that experienced in Taiwan in hardware, where a handful of forward-thinking venture capital firms achieve early successes that inspire a significant wave of investment activity into that segment, creating the momentum to move the entire venture capital industry to a new level of expertise and investment.

Looking around the world, we see that a viable domestic venture capital industry appears to be essential to the development of a indigenous software products industry. Ireland had primarily an MNC-based services export industry until Enterprise Ireland took steps in 1993 to develop a private venture capital capability. (It now has 12 venture capital firms and 900 indigenous software companies producing \$3 billion a year in software.)³⁹ Israel too has benefited enormously in the last 10 years from the establishment of the Yozma program in 1993. That program, which was privatized in 1997, has now spawned a

³⁵ Interview notes, Silicon Valley VC's on the subject of Korean VC industry, 2002

³⁶ Interview notes with venture-capital funded Korean entrepreneurs, 2002

³⁷ Hellmann, op cit.

³⁸ These firms do more due diligence than their more traditional peers. They have substantial involvement in all facets of the portfolio company's business. They may even set up full incubators to maximize the efficiency of their support. At least some of senior people were trained abroad or worked for US VC's.

³⁹ Enterprise Ireland: Annual Report and Accounts, 2001.

community of 85 VC firms supporting an industry of more than 400 software houses with combined revenues of \$4.2 billion.⁴⁰

In contrast, the Indian software industry has had difficulties moving away from its services-based roots, in part because of its lack of a meaningful domestic VC industry.⁴¹ (While there are some foreign VC's in India, they are not inclined to fund ventures that will not be directed immediately to the export market.) Japan is another country whose VC industry has little expertise or interest in the software industry. As a result, all of the Japanese software services firm expertise has yet to be marshaled towards a viable software export industry.⁴²

Korea's software industry has progressed well so far with the help of significant ongoing support from government programs and in addition, much government involvement in the venture capital industry. The establishment of new public venture capital firms in recent years, such as Korea Venture Fund and Dasan Venture, have certainly been helpful for high-tech startups under three years old. It might seem reasonable then to believe that the software industry can continue to grow long-term without a better-developed private VC industry.

As a practical matter, however, government programs or even government-backed venture firms cannot do the whole job. A government agency, for example, would be hard-pressed to develop the depths of expertise or the breadth of international relationships that a private venture capital firm can, and therefore it cannot hope to give the required specialized attention to each individual promising venture startup. On the flip side, the government can rarely shut down the non-performers to preserve finite financial resources with the same pragmatic efficiency as a private investor. Effort must continue to be focused on developing the private VC industry as a key driver for the long-term growth of the software industry.

Our recommendations:

- Make government funding programs to venture capital firms contingent on performance. Reorient incentives and programs for the venture capital community to encourage them to take an expanded role in shaping their portfolio companies and in experiential learning about the workings of the global software industry. Growing a cadre of knowledgeable private investors/advisors will take some time, but it is critical to the long-term development of the software export industry.
- Ensure that there are funds available to provide second and subsequent rounds of equity financing to firms with high potential but that need more investment before

⁴⁰ Israeli Association of Software Houses, <http://www.iash.org.il/Content/SoftwareInds/SoftwareInds.asp>, October 2002

⁴¹ Rafiq Dossani and Martin Kenney. "Creating an Environment for Venture Capital in India." *World Development*, Vol. 30, No. 2, 2002.

⁴² Kenney, Hana & Tanaka, op cit.

achieving profitability. Much of the current VC interest in and funding of software venture firms is focused on seed or first-round investments, potentially leaving a number of worthy firms unable to progress after their initial funding.

- For startups that apply for government support beyond the seed-financing stage, consider making further funding (especially for technical entrepreneurs and new graduates) contingent upon obtaining substantive and on-going business expertise such as business experts in senior management or business advisory boards. The management team should have experience in business generally, and better yet, in the software industry, in the specific vertical industry they're targeting, and possibly in the US (or their target geographical market).
- Give incentives and training on proper corporate governance practices to VC's and other advisors who can work with software startups (as coaches, directors, business planning consultants, entrepreneurs-in-residence, new venture CEOs, etc.).
- For any ventures receiving government-funded grants, loans, or investments, require regular Board of Director meetings and quarterly status reviews by investors. Financial reporting is an important tool for management as well as a mechanism for building trust in the industry. The Board should have outside Directors – people with expertise and experience – and be responsible for keeping management focused on the business plan, or understanding why it needs to be revised. There is no intention here to burden small companies with paperwork or useless administrative overhead, but rather to be in a better position to get help from interested stakeholders.
- Encourage more Korean VC's to participate in Silicon Valley and other high-tech clusters, to learn from VC's with more experience in the global software industry. Industry expertise and interaction with the international VC community have proven crucial to the successful development of the venture capital industries of Taiwan and Israel. To encourage the Korean VC community to develop its international network as well as to enhance Korean expertise and knowledge of cutting-edge venture capital investment strategies, develop targeted matching-funds investment programs or incentive programs for investing in foreign ventures that would benefit Korea in the broadest sense. Review venture capital-related regulation to ensure that there are no administrative, tax, or other impediments that might discourage Korean VC's from investing abroad or foreign VCs from investing in Korea.
- Review current tax incentives to both venture fund investors and the venture capital industry to ensure that they motivate the desired investment behavior. For example, it would be useful to examine the impact of the current approach of providing a significant tax break up-front to fund investors, who enjoy this benefit even if the receiving venture fund avoids risk by investing little or none of these monies.

3.4. Habitat Support for High-Potential Software Venture Firms

Habitat support for software venture startups is not completely absent from the Korean business landscape. Over the last few years, Korean business incubators have grown substantially in number and in the range of services they offer. At the present time there are more than 300 incubators in Korea, plus about 150 industrial complexes that are also providing incubation space and services. This makes Korea's system of incubators one of the most extensive in the world and more than adequate to handle the number of venture firms (currently around 10,000).

Incubators, however, do not meet all the needs of Korea's venture firms. They are not a substitute for a thriving private sector habitat. Not all startups go into an incubator, and the ones that do are allowed a maximum stay of only two or so years. More importantly, almost all incubators focus on technical and logistical support (office space, PCs, Internet bandwidth, etc.) and not on the broad business support that is so desperately needed.

A 1999 Science and Technology Policy Institute (STEPI) study reported that Korean business incubators at that time provided little more than office space to tenant companies. The most often offered additional support was technical.⁴³ A National Business Incubator Association report from about the same time period showed that successful US incubators provided a large array of support services ranging from management to legal.⁴⁴ While we understand that Korean incubators are now offering a broader array of services, particularly marketing help, the task now is to refine the service offerings and focus particularly on the venture firms with high potential.

The majority of Korean incubators are particularly challenged because their management has little incubation or even business experience. Many are professors, researchers or government employees. This observation is especially true for the not-for-profit incubators. It is quite difficult for these managers to find and tap into a powerful network of support for their tenants, or to help with the full range of business needs.

While no definitive studies have been done on how incubators might improve the success rates of high-tech startups, some recent studies of technology incubators in the US and Europe can offer a list of practices that have a high probability of success in creating companies that can survive and obtain funding for further growth.⁴⁵ These likely success factors are also what most Silicon Valley incubator managers would agree were best practices:⁴⁶



⁴³ Cited in Zong-Tae Bae, Business Incubation in Korea, slides, SPRIE Incubation Research Workshop, Feb 2002.

⁴⁴ National Business Incubator Association, Impacts of Incubator Investments, 1997

⁴⁵ Albert & Gaynor, Incubators -- Growing Up, Moving Out: A Review of the Literature, 2001; and Lewis, David, Does Technology Incubation Work? A Critical Review, Rutgers University, 2001

⁴⁶ UN-ECE, Conclusions and Recommendations of the Expert Meeting on Best Practice in Business Incubation, Geneva, 1999.

- Positive relationships with the local “technology generators” i.e. universities, research labs, and dynamic companies;
- Full-time, experienced, entrepreneurial incubator management;
- High-quality tenants;
- Broad range of business support services, such as accounting, legal and marketing;
- Access to a strong business network, including specialized business support, potential customers and partners;
- Good physical infrastructure and equipment.

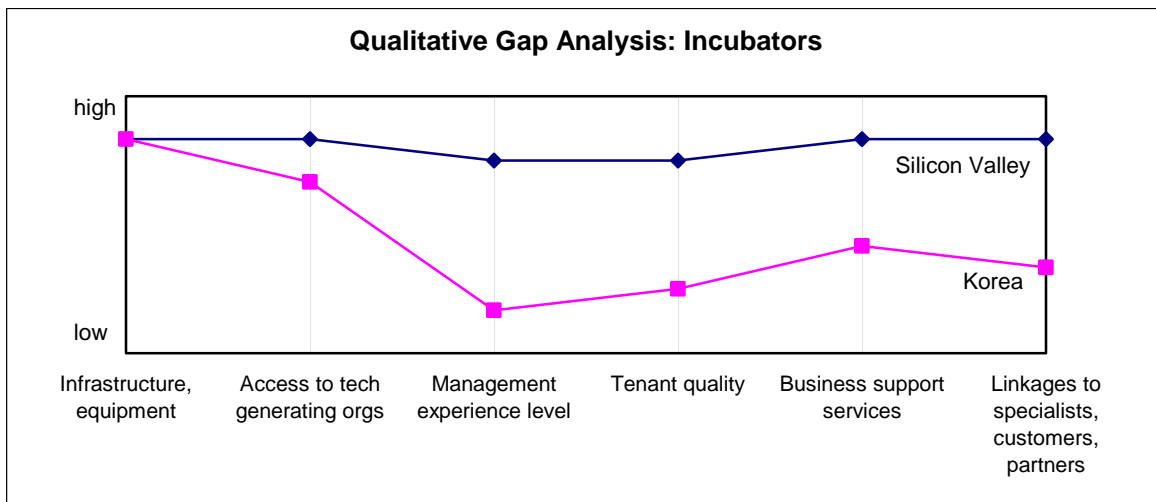


Figure 2. A qualitative comparison of Korean and Silicon Valley incubators based on interviews and available data. The comparison is across six important best practices areas articulated by experts of the US National Incubator Association and the United Nations. In terms of physical facilities and proximity to technology generating organizations, such as universities, research labs, and companies, both Korean and Silicon Valley incubators are roughly comparable, although the latter has access to considerably more technology generators. Regarding tenant quality, many Silicon Valley for-profit incubators have closed down, and the remaining incubators are increasingly selective in their choice of tenant companies. In contrast, the substantial increase in the number of Korean incubators and incubation facilities in industrial complexes in proportion to the number of venture firms cannot help but keep entry standards modest, leading to a somewhat lower tenant quality. Business support services in Korean incubators have improved considerably since 1999, but there are still noticeable gaps in the range of services that the majority can offer either in-house or brought in from outside. Networking opportunities and linkages to important potential business partners, beta customers, and so on, have been slow to improve in Korean incubators, which may be partially the result of the general business downturn.

In addition to providing some useful support for venture firms, the current Korean incubator system offers additional business and social benefits, including facilitating and increasing the amount of market-oriented R&D available for business exploitation; stimulating regional/local economic development; education; technology transfer; and export-oriented business development. Government programs that fund incubators should have clarity about the various goals, since they will sometimes conflict, and about what constitutes successful outcomes for each type of incubator. For example, government programs that fund university incubators would aim to enhance advanced technology

education and facilitate technology transfer, but would not expect to spawn a significant number of firms with global potential. Similarly, the performance of the majority of non-university, not-for-profit incubators is measured on the basis of contribution to local economic development (diversify industries, generate tax revenue, and employ people).

While many Korean incubators do have as their primary goal the development of venture firms with export potential, very few incubators are currently *optimized* to nurture the high-potential types of firms. Incubators most able to support firms with global potential, whether they are for-profit incubators or not, are likely to be very entrepreneurial and are run more like businesses.

Case in Point: The Enterprise Network (TEN)

A famous and successful Silicon Valley incubator.

The Enterprise Network (TEN) is a Silicon Valley high-tech incubator founded in 1993 and currently serving 38 companies. It is a general-purpose incubator committed to employing best practices.

One key TEN incubator best practice has been its constant drive to expand its network in the local habitat. It maintains regular contacts with the dozens of technology-generating organizations in the area (university, government labs, and high-tech companies), in order keep up-to-date on the cutting-edge of innovation, as well as to obtain the highest quality tenants.

A second key best practice is the incubator's steady focus on creating viable businesses, rather than on technology. The six full-time TEN staff consists of a powerful combination of three seasoned entrepreneurs and three experienced business people from the community, (including one technical person). A Board of Directors and a large, well-connected Advisory Board support their efforts. The 16-member Board of Directors includes a former TEN executive director, the dean of a local business school, a marketing consultant, three venture law specialists, two accounting experts, two venture capitalists, three successful entrepreneurs, and an executive search professional. The 15-member Advisory Board includes specialists with specific expertise in areas ranging from international business development to startup marketing to business strategy. Many of the Boards' members are non-US-natives who can also offer contacts and focused advice for doing business abroad. The staff and Boards of the incubator are additionally supported by 25 sponsors and partners: the three technology partners are joined by 22 service providers in venture finance, law and marketing.

In the past five years, TEN has graduated approximately 80 companies, including several that were successfully acquired by companies such as Intel, and at least one big successful public company, eBay.

Incubators continue to play an important role in the very early developmental stages of Korea's software venture firms. However, they can only be a part of the habitat, and cannot substitute for a thriving open market of independent advisors, consultants and services firms whose business is supporting startup ventures at every stage:

- Like the incubators, the habitat makes knowledge and services available to very small firms who need different kinds of expert help from time to time (usually on short notice), but can't justify hiring full-time people with the required know-how.

- Entrepreneurs can get exactly the support they need from an open-market habitat (market research, business strategy, collateral development, UI design, product documentation, etc.). Paying for these services, once they are finally convinced they need them, may make first-time entrepreneurs more likely to appreciate the value of those contributions.
- An open-market habitat is a very efficient way to utilize expertise that is in short supply. On the one hand, scarce expertise can demand high fees, meaning that only the most serious firms will want their services. On the other hand, the habitat experts themselves only take on the firms that they believe have good potential. Thus, just like the venture capitalists, they act as a filter, expending energy on only the most promising new startups.
- An open-market habitat is also an efficient way to train new talent for highly specialized support firms. The better services firms hire more employees, who learn the business and eventually spin off their own services firms. Mobility of talent is a key feature of effective technology clusters. (Hollywood film production comes to mind as another cluster where highly specialized talent is brought together for each specific project.)
- The rapid institutional learning about new technology, new markets, and new ideas that is shared in the open-market habitat is a result of the business motivation of the individual participants who are rewarded based on their effectiveness and reputation. The habitat is a cooperative environment – everyone has a stake in the companies and industry they serves.
- The open-market structure can more easily support the transnational software startup (described in Section 2.1), since resources are available generally to any part of the transnational firm that happens to be located locally.

Our recommendations for improving the effectiveness of the incubators and building additional habitat support capabilities, especially for post-incubation and GSI startup firms:

- Adhere to performance-based funding principles for existing public and private business incubators, recognizing the possibility that some of the operations will not survive. Expand incubator performance measures, especially with regard to high potential software ventures, to include acceptable progress in transitioning to the next stage of business development (but not necessarily generating revenues), such as obtaining beta customers; entering into joint development arrangements or marketing alliances; or obtaining private venture capital.
- Offer an increased level of funding for business services and advice in the supported incubators. For example, creating a pool of experienced advisors who are available to the incubators (for committees, proposal reviews, and/or periodic visits) might be a way to increase the speed of learning about entrepreneurship and about the software industry.

- Expand marketing support programs like the new iPark “market enabler” program. Supplement iPark educational programs like the Venture Boot Camp with training programs in software product management and corporate governance, as these areas are also problematic for Korean software startups (see Section 2.5). General programs on "plugging into the global software community" would also be helpful. (Techniques for improving awareness about software markets might include following the trade press and market analysts, effective participation in tradeshows, conferences, and web seminars, etc.)
- Attend to the needs of firms at various stages of development. In particular, increased focus is needed on post-incubation firms that have several million dollars of post-seed investment, a dozen or more employees, and international business activities.
- Encourage the growth of private sector expertise in the habitat by creating a fifth category of venture firm, the “venture support firm,” to promote the establishment of a variety of outsource and consulting services. Venture support firms would be eligible for some of the same incentives available to the software startups they serve (such as tax breaks in the early years). Examples: private QA service centers; specialized temporary staffing firms; software market research and strategy consultancies; private incubators; specialized ad agencies and PR firms; documentation and tech writing services; tech support call center outsourcing; specialized law firms; and technology licensing and commercialization firms.
- To encourage the use of habitat services by venture firms, differentiate R&D funds from business development funds in government venture funding programs. This will stimulate both the hiring of marketing professionals by venture companies and flow-through of money to specialists in the open-market habitat.
- Continue to evolve the mission of the recently organized national QA lab. It is expanding its role currently as a testing and certification service center for software companies. We believe that private testing firms should eventually take over this role and that the government lab should develop programs for encouraging and supporting private testing labs (as a certifier of private labs, establisher of standards, certifier for government procurement, and investigator of different countries’ standards). Private outsourcers (or in-house departments of larger software companies) will be in a better position to test software products to the level of detail necessary to compete abroad: test on all hardware platforms, on all versions of operating systems, interfacing to the database, ERP, and middleware products from major vendors, and so on. Private firms would also be able to test more dimensions of quality, including functionality, reliability, usability, installation, performance, and documentation.⁴⁷

⁴⁷ While one might suppose that a government “seal of approval” for Korean software products would be beneficial, we think that it is too early for that step and that there would be risks of compromising the

3.5. *Stimulating Domestic Demand*

One final dimension of the habitat we need to address is the domestic market for advanced software technology. As we have pointed out earlier, there has been dramatic improvement in the use of software technology by Korea's largest manufacturing firms and financial institutions. This is a very positive development for Korea generally.⁴⁸ However, there is still insufficient use of *advanced* software technology. The environments where innovations can be tried are beginning to appear in the large firms: standard ERP databases, e-commerce, wireless applications, etc. But Korean firms are not yet to the point of innovating on these platform and using cutting-edge products from startup companies. Software startups, in turn, still do not have a domestic market. This situation puts these firms at a disadvantage in terms of: product requirements evolution, product testing in operational environments, and, most importantly, the credibility that comes from having major firms as customers and references.

Some suggestions:

- Stimulate domestic demand for innovative software solutions with global potential, built on standard enterprise architectures. In particular, create a domestic "iPark" to develop domestic marketing channels for technology startups' solutions into projects at chaebols, systems integrators, telecommunications firms, government projects, and banks.
- Review, revise and expand incentives (e.g. tax incentives and other programs) to firms of all sizes to implement standard enterprise software infrastructure and, where appropriate, encourage experimentation and adoption of cutting-edge technologies. These measures will not only stimulate the domestic software industry and create opportunities for software startups, but it will help ensure that Korean firms remain internationally competitive.
- Encourage all government agencies, including the military, to continue to update systems for record keeping, operations, and services (e-government) using world-class software infrastructure components (SAP, Oracle, Microsoft, Linux, IBM, BEA, Java, and others). Conduct high-level workshops for top government officials and corporate executives to enable them to be leaders in introducing innovative IT in their organizations. Encourage development of advanced projects using state-of-the-art technology, including cutting-edge Korean technology (e.g., mobile enterprise applications) that meet international standards of quality. Include projects that can be re-sold by systems integrators into target markets (SE

"Korea" brand. We recommend that certification be done by independent, private organizations to the satisfaction of the software publishers, and that the Korea brand be established separately.

⁴⁸ "No nation can be strong industrially without strength in software." – William F. Miller, Stanford University, 2002.

Asia, China, Japan, Latin America, Europe), using the Korean government's system as a reference site. Encourage cross-fertilization of knowledge among SI's, e.g., through consortia projects.

- Continue education and enforcement programs regarding software piracy. Persistence will offer further benefits for the consumer software industry as public attitudes towards software gradually change.

In addition, there is a problematic issue in the Korean software services sector that stems from its historical origin and the overall structure of Korean industry. All of the large systems integration firms are captive to a chaebol. While they can get some useful domestic experience from government projects and from work within their own conglomerate, their experience with other firms is limited and the cross-fertilization of knowledge about installed technology is low compared to their international competitors. Resistance to outsourcing by in-house software groups and labor unions at banks and other non-chaebol institutions, along with customer preferences for foreign SI firms vs. those from competing chaebols, further reduces the exposure of Korea's big systems integrators to needed experience and state-of-the-art technology.

- The government should encourage the cross-fertilization of knowledge among the SIs by, for example, continuing to require that multiple SI's form consortia to take on major government projects. Perhaps this model could be extended to smaller projects and some non-government projects.
- Educate in-house software teams and IT labor unions about the tremendously positive impact that outsourcing has had on similar professionals in the US to create a more positive attitude toward software services outsourcing.

4. Education and other Human Resource Issues

Value creation in the software industry, in all sectors, is dependent on the talent and skills of a variety of software professionals. Korea has instituted many programs over the years to increase the quantity and quality of graduates prepared for software careers. In our 1999 report, we took a close look at Korea's software education resources, policies, and practices. The major issue at that time, besides overall capacity to produce qualified graduates, was a troubling trend towards merging Computer Science departments into the larger and more dominant Electrical and Mechanical Engineering programs in order to qualify for Brain Korea 21 funds. These changes occurred at a time when software studies needed more attention, funding and autonomy, rather than less.

Although tangible forward progress has been slow, we believe that both momentum and support for improved software training has increased substantially as a result of several educational initiatives. A number of interesting programs have been funded and are in the first years of implementation, including:

- New program to train graduate-level engineers abroad in CMU's certificate program at NASA Ames
- Initiative to recruit lecturers from industry to teach entry-level programming
- Foreign visiting faculty programs
- Programs to promote applied research for industry needs
- New university initiatives emphasizing software studies

In addition, there are some signs of progress and good directions going forward:

- Many creative proposals put forth for interdisciplinary programs in software and management, or in MIS and industrial engineering, for example
- Management courses under development for engineers (KAIST)
- Creative ideas for a professional software school as well as for a media laboratory modeled after the MIT Media Lab (KAIST and ICU)
- Budgets for more software-focused Computer Science faculty
- Demand from foreign students, especially from China, to study Computer Science in Korea

We believe that these programs and trends will eventually contribute to substantial improvements in software education in Korea. Some problem areas have emerged, however. First, Computer Science enrollments are down. The consensus opinion regarding the decline is that, in a growing economy, students have good opportunities in a variety of professional fields. Since students believe that the training and the work is harder in software than in other disciplines, they are choosing other majors. A temporary decline in the rate of demand for software professionals, caused by the transition of people who had been working for dotcom startups and by the general slowdown in the

global software industry, may also be decreasing the perceived value of a software degree.⁴⁹

The second problem area is that the pace of change in software education continues to be very slow. Some schools have created separate software programs in name, but have so far not been able to implement substantive improvements in their curricula or faculty composition. We first address this general issue of software education and the university system, and then focus on improving the quality of graduates from current programs. The global supply of software talent and other non-education HR issues are addressed in the subsequent sections.

4.1. Software Education at Korean Universities

Universities are slowly changing institutions. Thoughtful academics consider the university's "disengaged" stance and deliberate pace to be a feature. However, this institutional inertia sometimes makes it difficult to meet society's educational needs, especially in situations where needs and knowledge are changing rapidly.

There is also an inherent conflict in the universities in Korea, and in all countries, about how to train software professionals. We would like our schools to produce all of the following in adequate numbers:

- The next generation of teachers of all software-related subjects at all levels
- Cutting edge-researchers who know the most recent theoretical developments, technologies and tools, at least in some sub-discipline of Computer Science (some innovative business ideas come from this group, as do many software architects)
- Programmers of all sorts, filling industry's need for trained technical professionals. For most software projects, a few top software architects and designers drive the work of a much larger number of journeyman and novice programmers. These top programmers are typically Computer Science graduates. At the other end of the spectrum might be testers and QA technicians, positions often filled by trainees.⁵⁰
- Software managers (project managers, product managers, and program managers). Next to top-flight software architects, people who combine technical skills (who understand tradeoffs and complexities), people skills, and business sensibilities are the most hard-to-find class of talent, and key to success in all major projects.

⁴⁹ While Korean employment in the software and computer services sector grew an average of 16.1% per year from 1996-2000, it appears to have not increased appreciably by 2Q2001, the last quarter for which data is available. [Source: Korea Association of Information and Telecommunication, 2002].

⁵⁰ It is important to keep in mind that the difference in top programmers and average programmers is significant. Top programmers have natural talent, in addition to their CS training and extensive experience with various tools and technologies. Education and training alone cannot create top programmers.

- Software-savvy graduates from engineering, humanities, and business departments, who will support the use of IT their own fields. (Again, an important source of innovation and entrepreneurs.)

Different universities around the world have taken different approaches to meeting these divergent societal needs. Some have introduced a variety of degree programs at baccalaureate, masters and Ph.D. levels, some have specialized, and some have kept their heads in the sand. In the end, policy makers have to work with the existing institutions and understand their limitations.

Alternatively, they can try to shake things up! The degree to which radical change is required in order to move Korea towards a leadership position in software education must be determined by government and academic planners. We offer here some recommendations for instigating radical change in the way that Korea educates software professionals:

- Move forward with proposals to set up post-graduate professional software schools. The reorganization of software education to be more like the training of doctors and architects is a radical idea which has not yet been implemented anywhere in the world. Some Korean academics have recently proposed similar ideas for independent, software-focused academic organizations that incorporate practical training and hire faculty with industry experience in addition to world-class researchers.⁵¹ Since we first proposed this idea in our 1999 report, we have elaborated some of the details, which are available in a short paper.⁵²
- Establish centers of excellence or magnet schools in software education. There are many types of software magnet programs that could be located at existing institutions (possibly partnered with foreign degree-granting institutions):
 - Theoretical programs aimed at researchers and future professors;
 - Intensive IIT-style programs that expose future software architects and super-programmers to the range of modern technologies and tools;
 - Classic CS curriculum coupled with extended programming labs or work-study projects to give entry level programmers more exposure to practical issues like methodology and project management; and
 - Bridge training for university graduates with other degrees.
- Promote competition among the major universities to create software education offerings of high quality. This is another radical approach requiring that existing institutions be made more autonomous and, at the same time, be given the resources necessary to create the programs needed by the software industry.

⁵¹ Kim, Jin Hyung, Report on Research on Computer/Software Training in Higher Education, 2002.

⁵² See Barr and Tessler, Professional Software School. 2002. www.aldo.com/papers.

Approaches to spurring innovation in the educational institutions might include, for example:

- Facilitate autonomy of Computer Science departments (with regard to student selection, scholarships, number of students, faculty hiring and promotion, research grants, endowments and fund raising, foreign students, and so on) by moving towards more general-purpose funding mechanisms.
 - Invite (maybe using incentives such as a land grant or facility donation) one or more private foreign institutions, like IIT, CMU, U. Mich., to create a private technical university in Korea.
 - Consider a voucher system⁵³ where, instead of establishing admission quotas and annual budgets for each institution, education grants are given directly to students for use at the institution of their choice (if accepted for admission).
- Separate the training of researchers and the training of professionals. Short of starting a professional software school, it might be possible for existing institutions to look at their graduate education programs differently. Most are oriented towards training researchers and future professors, although few graduates actually pursue these careers. A professional masters degree, for example, might be introduced, or a second track for Computer Science Ph.D.'s who will work in industry as software architects and innovators. At the same time, training of future professors should not be ignored – growth in the number of academic researchers and teachers is necessary to increase Korea's capacity to train top software professionals.

4.2. The Quality of Software Graduates

Our interviews with industry, academic and government people showed a great disparity in opinions about the quality of software graduates. Senior technical executives at a number of large systems integration firms indicated that intelligence and motivation were more important than a Computer Science degree.

The nature of the work of systems integrators requires fewer top-level programmers per project. Once someone has learned to configure an SAP installation each subsequent installation is more-or-less straightforward. (Computer Scientists are still needed for small parts of the project that are never straightforward.) All major SI firms the world over need to have substantial training programs for new employees (of any background) that cover both required technical skills and business practices specific to the company. From our research on US software labor force issues, we observe that the hiring and training practices of Korean and US systems integrators are actually quite similar.⁵⁴

⁵³ See discussion in West, EG. Education Vouchers In Practice And Principle: A World Survey (full report). World Bank, 1996.

⁵⁴ Barr & Tessler, Notes on HR Resource Issues in the Software Industry and Their Implications for Business and Government. Talk presented to the NSTC Presidential Advisory Committee, 1997.

Technical executives of software publishing firms had a quite different view of the quality of new graduates. They require new hires to have significantly more computer science skills and often some specialty knowledge, such as embedded Java programming or web server architecture. These organizations do not have the time or financial resources to train new graduates. They report that they cannot find competent graduates in the numbers they need and are forced to hire primarily experienced professionals; i.e. people with five or more years of industry experience.

In part because of the military service exemption policies, some software venture companies create an R&D lab and hire one or two new graduates a year. These graduates are usually the very top students since they need to have the ability to work productively on cutting-edge projects immediately after graduation. This cream of the crop once took jobs at the chaebols and their SI shops. A similar migration of talent has been seen in the US for many years. The cutting edge software development companies recruit a large percentage of the top graduates, while the big consultancies and SI shops take the next tier of graduates.

The real issue, as far as Korea's software workforce goes, is to match the quantity of students produced at each skill level with the industry demand.⁵⁵ It is important for policy makers to keep in mind that not all programmers are equal, and it's not just a matter of learning the latest computer language. In all programming projects, whether ERP installations or new web infrastructure design, some very highly talented people are required. While non-CS majors can be successfully trained for entry-level systems integration, few develop into high-level software developers.

Furthermore, all software workers need extensive hands-on programming experience with a variety of software tools and environments before they are proficient, much less expert. There are no shortcuts. While this level of training makes for a demanding undergraduate major compared to some others, the fact that non-CS students can get jobs at systems integrators does not mean that this intense level of software training is unnecessary for the industry as whole.

One of the bigger complaints about the training Korean CS graduates receive in school has been that they do not get enough hands-on experience – they are not given enough non-trivial programming projects to do. Some observers believe that the reason stems from class sizes that are too large to allow a professor to grade a large number of complex programming assignments. When we compare student/professor ratios in a small sample of the top tier Korean schools with the larger Silicon Valley schools, we do see moderate differences, although nothing conclusive (See Table 3).⁵⁶

⁵⁵ Industry demand, in turn, depends on how things develop. If the software services export business predominates, then Korea, as has been the case in India, will need several times the number of programmers per export revenue dollar than if technology or software products exports predominate.

⁵⁶ Of course, student/faculty ratios tend to be lower than average class size, but it is a reasonable proxy.

	ROK			Silicon Valley			India
University	KAIST	SNU	Yonsei	UC Berkeley	SJSU	Stanford	IIT-Kanpur
Department	CS	CS	CS & IE	CS & EE	Math & CS	CS	CS
BS Students	350	360	280	1000	1538	430	60
MS+Ph.D	417	205	110	500	292	447	29
<i>Total Students</i>	<i>767</i>	<i>565</i>	<i>390</i>	<i>1500</i>	<i>1830</i>	<i>877</i>	<i>89</i>
<i>Total Faculty</i>	<i>31</i>	<i>26</i>	<i>15</i>	<i>81</i>	<i>83</i>	<i>62</i>	<i>16</i>
Student/Faculty Ratio	25:1	22:1	26:1	19:1	22:1	14:1	6:1

Table 3. Total number of faculty of all ranks (including full-time lecturers) and students (graduate and undergraduate) at some Korean, US, and Indian universities. All statistics are from the schools' websites.

The only really notable result is the student/faculty ratio of IIT-Kanpur, one of the two Indian IIT's that specialize in Computer Science. The school is known for its balance of Computer Science fundamentals and intensive hands-on, team-oriented training in modern programming. All agree that it produces superior graduates, notwithstanding its very poor equipment, texts and network infrastructure. At six to one, its student/professor ratio is approximately half of MIT's (11:1) or Stanford's (14:1), and one quarter of SNU's (22:1). While a low student/professor ratio is probably a significant contributor to the success of the school, clearly other factors play a role and must be investigated further.

From our discussions with educators and industry employers alike, it is clear to us that a disparity does exist in the depth of the training of Computer Science students. Since a high-quality human resource is such a key factor in the development of the software industry. Our recommendations in the area of software education quality follow:

- Initiate an independent, third-party assessment of the relevant departments (Computer Science, Software Engineering, Management Information Systems) of Korean universities and their graduates to identify shortfalls in curriculum, faculty training, and graduation requirements. Improvements based on auditor's recommendations should be funded immediately. Include private sector input from large and small software companies in the audits and the improvement plans.
- Expand incentives for institutions to promote interaction with industry and foreign research labs by students and professors in order to bring cutting-edge, practical software knowledge into curriculum. Several new programs have already been introduced to increase the amount and quality of software instruction at Korean schools, we offer some additional suggestions:
 - Fund continuous professional development activities by faculty (travel, conferences, sabbaticals, ...). Encourage teachers to work in industry during summer breaks and sabbaticals.
 - Encourage part-time or visiting faculty from business to teach courses about practical technical and management issues, as well as programming labs.

- Schools might consider a “capstone project” requirement for graduation, at least as an option. At Stanford, this is a multi-month, team project of significant complexity. More than a few successful startups had their roots in these intensive projects.
 - Consider establishing co-op programs (work-study programs) at some schools. These programs, which are 5-year degrees, include substantial work in industry as part of the degree requirements. Both work-study graduates and corporate sponsors believe that students involved in these programs are better prepared for industrial positions. Temporary tax incentives for industry to employ co-op and summer students may help establish the practice.
 - Generally, any 5-year programs that result in joint CS Bachelors/Masters degree have the advantage of giving students more time to apply what they learn in class to advanced projects and programming work, and to learn more about software (e.g., project management).
 - Encourage cooperative programs for visiting professors to co-teach with Korean professors and do joint research (e.g. Fall in California, Spring in Seoul)
- Expand current programs to supplement existing software faculty with additional faculty, lecturers, and teaching assistants, to bring industrial know-how into curriculum and to staff more hands-on programming projects for students.⁵⁷
 - Integrate software education into other curricula at undergrad and MS level (both engineer and non-engineering majors). Industry needs people who know technology and can be quickly trained for specific programming jobs (e.g., at systems integrators). Also industry needs innovators in other fields who are familiar with computer technology.
 - To counteract falling enrollments in software-related fields, encourage students to choose software as a career and to undertake studies in Computer Science, e.g., with tax deferments, tuition grants/loans, PR campaigns, etc.
 - Support innovative offerings in university business programs in the areas of international marketing, high-tech marketing and entrepreneurship. Consider funding programs to increase their availability and effectiveness.

4.3. The Demand Side of the HR Equation

Not all the burden for improving Korea’s software workforce rests in academia. While we would like to see academia be more responsive to industry’s needs, it is industry’s responsibility to express its needs clearly. The US software industry focuses on the

⁵⁷ Graduate student teaching assistants are particularly valuable in facilitating more hands-on programming projects, at the same time that these opportunities offer an important training experience to the teaching assistants themselves.

following kinds of requirements for graduates of Computer Science and related degree programs:

1. Programming ability;
2. Familiarity with wide range of current commercial software environments, tools, standards, and trends;
3. Familiarity with SW development methodology and some experience with the full cycle of development (requirements, design, build, test, debug, trial, deploy, and maintain);
4. Ability to work with teams, including your own team, other technical teams, and business teams;
5. An ability to understand what users/customers are asking for and focus on their needs rather than just technical issues;
6. Strong written and verbal skills;
7. Enough familiarity with project and product management to co-develop, work with, or comment on technical and marketing requirements;
8. Self-starter, entrepreneurial, requires minimal direction, and solves problems independently. Also desirable is domain knowledge in the employer's field or industry, such as finance, healthcare, or other.

In reality, it is not at all clear that Korean employers are communicating what they want to see in software professionals, either to the professionals themselves or to the educational institutions. We undertook a small survey of software job advertisements in the US and the Republic of Korea. We looked at both job boards and company sites in two categories: software engineer and software programmer, for jobs requiring at least a couple of years' experience. The results, summarized in Table 4, show some interesting differences in the way that US and Korean firms described their needs.

Job Requirements	US	Korea
Knowledge of particular programming languages	+++	+++
Programming experience with commercial software	+++	++
Familiarity with enterprise tools, environments, trends	+++	++
Familiarity with software development methodology	+++	+
Ability to work with teams, (technical and non-technical)	+++	+
Strong customer focus	+++	+
Strong written and verbal skills	+++	
Personal essay		+++
Foreign language ability	+	+++
Co-develop, work with, or comment on technical and marketing requirements	++	+
Self-starter, entrepreneurial, minimal direction	+++	+
Creative problem solver or progressive thinker	+++	+++
Specific degree level (masters versus bachelors)	++	++
Understanding of or experience in quality assurance	++	+
Managerial ability or mentoring of younger programmers	++	+
Experience with employer's software	++	+
Special ability (such as artistic or musical)	+	+
Age range or age limit		+++
Photograph		+++

Table 4. Comparison of job advertisements in the US and Korea. +++ means most ads designate this requirement, ++, some ads, and +, only a few.

While we cannot say this is a definitive study (we looked at some two dozen job posting sites and about 100 ads), some differences stand out. US employers put more emphasis on commercial experience and an understanding of the roles in software teams; on the employer's business and customers; and on independence and job responsibility. US firms also appear to seek out a broader range of ages and experiences and more senior people (no age limit, managerial ability). The implications for both the nature of software careers in Korea and on communication between employers and academia are several.

Software career paths. We note two more related points on the demand side. First, as we mentioned in Section 2.5, some interviewees observed that a significant number of programmers leave the profession in their late 20's or early 30's. If data supports this assertion, then it is a serious waste of knowledge, experience, and talent that needs to be addressed.

Silicon Valley software firms have developed a three-pronged career path for good programmers. Some become engineer team leaders and then engineering managers or transition into general management. A second group consists of the Ph.D.-level computer scientists, who in large software firms become Senior Architects or Fellows. They take on advanced technology projects and focus on keeping the company informed about the newest technical trends and innovations.

The third group consists of the many very good programmers who are neither suited for, nor interested in, management positions. In Silicon Valley firms, these journeyman programmers have a separate career path and salary structure that reflects their talent, experience, know-how, and familiarity with the company's code. These experienced programmers are the key corporate resources who understand and sustain the software development and product management disciplines required in large software companies. The alternate career path can reward achievement appropriately throughout a lengthy career, and radically improve retention of senior technical professionals who would otherwise feel they have "nowhere left to go" in the company.

**Best
Practice**

Other labor issues. The final HR-related issue we'll address is that smaller export-oriented software companies experience a more adverse impact to protective labor laws than other types or sizes of firms. A specific concern is with regard to restrictive hiring and firing regulations, which do not mesh well with the dynamically changing, project-oriented nature of software product development. In US software firms, development teams are formed and reformed regularly to meet competitive pressures in new product development. Though some team restructuring leads to worker dislocation, qualified software professionals can almost always find new positions elsewhere. From the point of view of the habitat, the movement of software people from one company to another is an opportunity for corporate cross-pollination of innovative thinking. While an ongoing data collection and analysis effort regarding these labor issues is beyond the scope of this report, we recommend the following:

- Collect data on the careers of top software professionals in Korea. Encourage new thinking among employers about career alternatives and, generally, the importance of managing this resource.
- Undertake a long-term study focused specifically on software industry labor issues, examining areas such as the impact of IT outsourcing on the software industry; performance-based compensation and promotion systems; impact of labor laws on both team formation and workforce mobility; and life-long learning policies, with the goal of accelerating change and ensuring that software export firms can employ globally competitive labor practices.

4.4. The Global Supply of Software Talent

The current slump in the worldwide software industry, and also the demographics of the software profession (the first pioneers are beginning to retire), means that there are a lot of very talented and experienced people available in the world right now. These people could have a dramatic impact on Korea's professional software education, software startups, VC firms, certification committees, and so on. This is the time to capitalize on the current slow period by engaging software professionals (both Korean and non-Korean) in various initiatives focused on Korean software technology:

- Take advantage of the current availability of talented and experienced software professionals from Korea, the US, India and other countries to participate in new

educational initiatives, as well as innovative programs in Korean venture firm assistance (for example, to be visiting lecturers or as advisors to certification/review committees or incubators).

- Consider the idea of establishing a specialized Silicon Valley in Seoul focused on mobile and wireless technologies where Korea is already a technology leader. As in Silicon Valley, this kind of hub would welcome a wide variety of people and organizations. This might be a particularly good time to attract global software professionals to Seoul. As in Silicon Valley, the longer-term impact of these guest workers would be to expand the entire Korea software industry and its habitat.
- Draw Indian and US programmers to Korean technology, e.g. multimedia programming tools and wireless platforms, by offering free training. It may be easier to attract programmers to Korean technologies via training classes or conferences during this down period in the industry. They will then be primed to use Korean technology as the industry rebounds.

5. Final Thoughts

The recommendations made in the body of this document are quite varied in terms of how costly they are to implement, as well as how long they might take to offer a positive result after implementation. Clearly, Korea must be strategic about what priorities it assigns to various policy changes and program funding, based on a reasonable articulation of its objectives over time. We offer our own vision of the timeline for growth of the industry, in terms of some important milestones.

5-Year Goals

In 5 years, Korea will have joined the Billion Dollar Club, ranking with the US, Japan, India, Israel, Ireland and, by then, China as a major software exporter. In addition, a few Korean firms will have relocated their headquarters to the US or been acquired by US companies, strengthening industry ties between the two countries on a new dimension.

Among the Korean software exporters, we could see one or two widely known Korean brands – market share leaders in important market niches (for example, Linux security software, or mobile transaction processing, or wireless collaboration tools for the healthcare industry). Several additional potential market niche leaders should be identified as high-potential firms and receiving special attention.

Several Korean VC firms should be involved in many more investments in the US (and maybe India, Europe, Japan and China), working with local VCs who are experienced in the software industry. Dozens of Korean software firms get investments from foreign VC firms, as a result of government efforts to encourage better venture firm transparency and governance practices that meet recognized international standards.

Standard enterprise software architectures are commonplace in large and medium size businesses and all government and military departments. Innovative projects using Korean solutions and technology are underway, as a result of to KIPA's Domestic iPark, changes in government procurement policies, and tax incentives for innovative corporate experiments.

10-Year Goals

Korean software exports continue to grow at double-digit rates. Korean systems integrators have established themselves as quality providers in several technology, industry, and geographical market niches (with the help of government PR and quality monitoring programs). Growth in the services sector may now be limited by the availability of talent.

The habitat for software companies in Seoul has become a major local industry in its own right. Separating venture company funding for marketing and for business development, along with increasing the requirements for business planning on the part of the venture firms, has created demand for specialized support firms of all types (now established as a

fifth category of venture firm). A dozen venture capital firms have specialist partners (including successful software entrepreneurs) who understand the software industry and can work closely with their portfolio companies.

A “major win” – a Korean software company will have published an enterprise software product at the top of a major software category (like web browsers or database management). In all likelihood, this market niche, whatever it is, does not exist as of 2002. Several Korean software firms will be trading on the NASDAQ.

As a result of the success of pioneering Korean software entrepreneurs and the rising prestige of the Korean software industry, top students compete to enroll in Computer Science majors and specialized post-graduate software training.

20 -Year Goals

Korean universities are world renowned for innovative methods of software education, attracting students from all over Asia and producing graduates that are in high demand globally.

The mission of KIPA has evolved to one of long-term strategic support and promotion of the software industry, since its tactical programs, such as marketing boot camp, have been supplanted by services from a large and vibrant community of habitat support firms, venture capitalists, and individual advisors. Programs for startup seed funding and regional incubators are limited to venture firms in special circumstances, where private support is not available. There are no statutory distinctions necessary between high-tech venture firms and small startups generally. The software industry is now firmly established, and is a model for countries wishing to transform their nations into a similar knowledge economy.

Korea’s Unique Contribution

Eventually, Korea’s position in the software industry will depend on the development of technology and solutions that the world needs. National software industries, like any other industry, evolve uniquely from the resources and situations of each country. Israel got started through advanced military research, without a domestic market or a large software workforce. Ireland’s advantage was proximity to Europe, and India capitalized on decades of investment in engineering education.

The software industry will grow in radical ways. Major new markets for software, like those created by the PC and by the Internet, will continue to emerge. (The factors that influence new software market creation continue to accelerate: new technology invention, decreasing hardware costs, and regional economic development.) Korea must be prepared to enter new markets as they emerge, in part by being a consumer as well as a producer of advanced technology – new ideas generally come from people and companies that have every-day involvement in the world’s most advanced ideas. Looking forward, beyond what exists, to what computing technology might make possible in the world, is the true key to long-term success in the software industry.

Appendix I. Interviewees, Information Providers & Other Sources

This report is the product of insights we've gleaned from dozens of people who are involved in the Korean software industry and from other experts. We express our sincere thanks for their time and their help to all who helped us in innumerable ways. We list the contributors here, in alphabetical order, with apologies to anyone we've accidentally left out:

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Appendix II. Bibliography

- “Annual Software 500.” Software Magazine, October 2002.
- “Conclusions and Recommendations of the Expert Meeting on Best Practice in Business Incubation.” UN-ECE, Geneva, 1999.
- “IT Industry Outlook of Korea 2002.” Korea Information Society Development Institute, 2002.
- “Nokia Venture Partners Opens Korean Office and Makes First Investment in Market,” Press release, 10 June 2002
- “Software Export Surges 86.4% Last Year.” Korea Herald, 11 March 2002.
- “Software Industry Research & Statistics.” Korean Software Industry Association, 2001.
- “2000 Information and Communications Standardization White Paper.” Telecommunications Technology Association, 2000. (In Korean)
- “2000 Per Country Software Exports Status.” Korea IT Industry Promotion Agency, 2001.
- “2001 Academic Year National Graduate School Master and Doctorate Program Statistics.” Ministry of Education and Human Resources Development, 2002. (In Korean)
- “2001 Adapting Education to the Information Age.” White Paper, Ministry of Education and Human Resources Development. Korea Education and Research Information Service, 2001.
- “2001 Education Informatization White Paper.” Ministry of Education and Human Resources Development and Korea Education and Research Information Service, 2001.
- “2001 Information and Communications White Paper.” Ministry of Information and Communication, 2001. (In Korean)
- “2001 Information Technology Industry Status.” The Federation of Korean Information Industries, 2001. (In Korean)
- “2001 Korea Internet White Paper.” National Computerization Agency, 2001. (In Korean)
- “2001 National Informatization White Paper.” National Computerization Agency, 2001.
- “2002 Academic Year University and Industrial College Student Quota Adjustment Plan.” Ministry of Education and Human Resources Development, 2001. (In Korean)
- “2002 IT Human Resources Business Direction.” Korea Information and Technology Promotion Agency, 2002. <human.software.or.kr/main/introduction/aim.phb> (In Korean)
- “2002 Korea’s Economy.” Korea Economic Institute, 2002.
- “2002 Special 301 Report: South Korea.” International Intellectual Property Alliance, July 2002.
- “2002 Statistical Report.” Korea Association of Information & Telecommunication, July 2002. (In Korean)
- “2002 Statistics of Production of S/W & Computer Related Services.” Korea Association of Information and Telecommunication, 2002.
- “40% of Universities Provide Cyber Education.” IT Research and Consulting, May 2002. <www.iconstant.re.kr/04_plaza/02_news/view.asp?db=news&num=6&pag..>
- “A Research on Computer/Software Training in Higher Education.” Korea IT Industry Promotion Agency, 2001. (In Korean)
- “All About the Incubator Initiative.” InfoDev exchange issue 11, January-March 2002.
- “An Article on Korea Software Provider Award.” Digital Information Bank web site, 2002. <www.dib.net/eng/new/new_sw.asp>

Korea and the Global Software Industry

- “Asia Pacific Venture Investing Drops 61% in 2001, Mirroring Global Trend.” Venture Economics.com, 2002. <www.ventureeconomics.com/vec/news_ve/2002Vepress/Vepress02_13_02a.htm>
- “Asia/Pacific: Tariffs and Other Taxes on Computer Hardware and Software.” *ExportIT*, 26 June 2001. <infoserv2.ita.doc.gov/ocbe/TariffTa.nsf/76fc32623f0cac...>
- “BS Units of Required Courses by Category.” Handbook of Undergraduate, Seoul National University, 2002. <www.comp.snu.ac.kr/haksa/rule_1.html>
- “Capital Raising by Israeli Start-ups.” Israel Venture Association, February 2001. <www.israelventure.com/n2001-02.htm>
- “Comparison of degree requirements – Computer Engineering Degrees.” Stanford School of Engineering undergraduate Handbook, 2002. <www.ughb.stanford.edu/98-99/cse.html> <info.sjsu.edu/web-dbgen/catalog/departments/CISE-section3.html> <www.cse.scu.edu/bsce/bachelor.html>
- “Compilation of IT Human Resources Development Policies Original Documents (I).” Korea IT Industry Promotion Agency, July 2002. (In Korean)
- “Computer Science Engineering Department Curriculum.” POSTECH, 2002. <www.postech.ac.kr/departmen/cse/linus/home_eng/curri_ue.html> (In Korean)
- “Conclusions and Recommendations of the Expert Meeting on Best Practice in Business Incubation.” United Nations Economic Commission for Europe, 3-4 June 1999, Palais des Nations, Geneva.
- “Courses in the Department – Undergraduate Courses.” Department of Computer Science and Engineering, POSTECH, 2002. <www.postech.ac.kr/departmen/cse/linus/home_eng/annual98/cd.html>
- “Department Overview.” Baskin School of Engineering: Department of Computer Science and Computer Engineering, University of California, Santa Cruz, 2002. <www.soe.ucsc.edu/general/atag glance.html>
- “Department Overview.” Department of Computer Science and Engineering, Ewha Womans University, 2002. <cse.ewha.ac.kr/>
- “Department Overview.” Department of Computer Science and Engineering, Korea Advanced Institute of Science Technology, 2002. <cs.kaist.ac.kr>
- “Department Overview.” School of Computer Science and Engineering, Seoul National University, 2002. <cse.snu.ac.kr/English/user/index.html>
- “Department Overview.” School of Computer Science and Industrial Engineering, Yonsei University, 2002. <www.yonsei.ac.kr/YSI/ysi?a=eng.academic.AcademicView&Depth>
- “e-Business Related Majors for 2001 Academic Year.” Ministry of Education and Human Resources Development, 2002. (In Korean)
- “Educational Information – Introduction to Curriculum.” School of Computer Science and Engineering, Seoul National University, 2002. <cse.snu.ac.kr/English/course/introcurri.html>
- “Educational Information – Undergraduate Program.” School of Computer Science and Engineering, Seoul National University, 2002. <cse.snu.ac.kr/English/course/undergraduate.html>
- “Educational Reform Initiatives – Brain Korea 21.” Ministry of Education and Human Resources Development, 2002. <www.moe.go.kr/uw.dispatcher/eng_26/4/4-1.html>
- “Enhanced Contents in Cyber Education Industry.” Digital Valuation Association, May 2002. <www.dva.or.kr/data/view_it.asp?num=249>
- “European Software Industry Analysis Report.” Korea IT Industry Promotion Agency, December 2001. (In Korean, with English Summary)
- “Exploiting Uncertainty: High Performance Changes the Dynamics of Competition.” Andersen Consulting, May 1997.
- “Faculty Directory.” Computer Science Department, Stanford University, 2002. <cs.Stanford.edu/people/faculty.html>

Korea and the Global Software Industry

- “Faculty of CSE Department.” Computer Science and Engineering Department, Indian Institute of Technology Kanpur, 2002. <www.cse.iitk.ac.in/pepeople/faculty.html>
- “Faculty of Science and Technology.” Computer Science Department, Keio University, 2002. <www/cs/keio/ac/jp/DCS/Faculty.html>
- “Foreign Investment in Israel in 2000: a new high peak.” Israel Venture Association, 2000. <www.israelventure.com/fiis2000.htm>
- “Future trends in the global IT industry and implications for Korean companies.” Korea Investment Service Center, 2002. <kisc.org/servlet/KiscCMNKiscMenu01A?0P=102&SITE_ID=M00007...>
- “Global Entrepreneurship Monitor 2001 Executive Report.” Global Entrepreneurship Monitor, 2001.
- “Government Targets Core Technologies for Investment.” Business Korea, April 2002.
- “Government will inject W122.7 Bil. into Software Industry Development.” Electronic Engineer, April 2002. <www.eekorea.com/article_content.php3?article_id=8800220313>
- “Government, Injects W123 Billion into SW Industry.” EETimes Korea, 3 April 2002. <www.eetkorea.com> (In Korean)
- “Gross Domestic Product: The First Quarter of 2002.” Bank of Korea, 2002.
- “Haansoft aiming for W5 Bil. In profit.” The Korea Herald, 5 July 2002.
- “Higher Education in Science and Engineering.” National Science Foundation, 2002. <www.nsf.gov/sbe/srs/seind02/c2/c2s4.htm>
- “How Israeli High-Tech Happened.” Globes Online, 15 August 2000. <globes.co.il/serveen/globes/SPDefault.asp?did=258771&fid=954>
- “Impact-Private Sector Partners: Kookmin Bank Private Sector Investment.” International Finance Corporation, March 2002. <www-wds.worldbank.org/servlet/WDS_Ibank_Servlet?pcont=details&e...>
- “Imports of overseas IT manpower.” ITgoodjob.com, 2002. <job.etimesi.com/do/eti_job.servlet.ej_foreign.ForeignInfo> (In Korean)
- “Incubation Industry Information – Business Incubation Facts.” National Business Incubation Association, 2002. <www.nbia.org/info/facts.html>
- “Industry, Technology and the Global Marketplace.” National Science Foundation, 2002. <www.nsf.gov/sbe/srs/seind02/c6/c6s2.htm>
- “Information and Communications Technology Human Resources Development Project – National Research and Development Industry Survey, Analysis and Evaluation Material.” Ministry of Information and Communication, May 2002. (In Korean)
- “Information Ministry Unveils Action Plans for ‘Hub of Northeast Asia’ Projects.” Korea Investment Service Center Daily News, 2 July 2002.
- “Ireland Software Industry.” Korea IT Industry Promotion Agency, September 2000. (In Korean)
- “IT Export Continues to Increase Since March.” Yonhap News Agency, 21 June 2002.
- “IT Exports Increased 4.4% Reporting W21.1 bil in Profit for the first half of the year.” Korea Information Society Development Institute, July 2002. <www.kisdi.re.kr/itref/view.html?id=13173>
- “IT Imports and Exports Trends of 2001.” Ministry of Information and Communication, 2002. <www.mic.go.kr/jsp/it_export/it_export_r.jsp>
- “IT Industry Outlook of Korea 2002.” Korea Information Society Development Institute, 2002. (In Korean)
- “Korea Advanced Institute Of Science And Technology Graduate School Of Management Curriculum (Master & Ph. D. Program).” Korea Advanced Institute of Science And Technology, 2002.

Korea and the Global Software Industry

- “Korea Goes From Rags to Riches in IT Industry.” The Korea Times, May 2002.
<www.hankooki.com/kt_tech/200205/t2002052018515545110.htm>
- “Korea Has Yet to Embrace Info Revolution.” The Korea Herald, 16 Feb 2000.
- “Korea IT Strategy Report – Capturing Value from IT Investment.” McKinsey and Company, 2001.
- “Korea Taking Global Initiative in Wireless Internet.” The Korea Times, 16 August 2002.
<www.korealink.co.kr/kr_tech/200206/t2002060517354845110.htm>
- “Korea’s GIS Market.” Export America, 2002.
<www.ita.doc.gov/exportamerica/GlobalNewsLine/gnl_0402.html>
- “Korea–Carnegie Mellon Program.” Institutes in Collaboration, 2002.
<www.icu.ac.kr/icu/eng/main06/html/subject02.html>
- “Korean Economic Trends.” Samsung Economic Research Institute, May 25, 2002.
- “Korean Software Firms Positive on 2nd Quarter:Survey.” The Korea Herald, 23 May 2002.
- “Korea–Stanford Program.” Institutes in Collaboration, 2002.
<www.icu.ac.kr/icu/eng/main06/html/subject01.html>
- “KOSDAQ Index: Brief explanation about New Kosdaq’s 38 Indices.” KOSDAQ, January 2002.
- “Kosdaq Transaction Results Increase Trend.” Small and Medium Business Administration, 2001.
- “List of Academic Staff.” Computer Science Department, University of Manchester, 2002.
<www.cs.man.ac.uk/People_suweb/staff-table.php3>
- “Main Activity of Foreign Doctoral Recipients With Plans To Stay In The United States.” National Science Foundation, 2001. <www.nsf.gov/sbe/srs/nsf99304/main.htm>
- “Meeting the Double Challenge: Review of Israeli High-Tech and VC Trends.” Presentation Slides, Israel Venture Association, January 2001.
- “MHP Test Consortium – Testbed.” TTA, 2002.
<www.tta.or.kr/English/certification/mhptest/mhp_testbed.htm>
- “MIC aiming for W51bil. In profit from IT Exports.” Digital Venture Association, May 2002.
<www.dva.or.kr/data/view_it.asp?num=229>
- “Mid and Long Term Education Market Prospect Analysis – Outlook on the Size of 2002-2011 College and University Graduates.” Ministry of Education and Human Resources Development, 2002. (In Korean)
- “Military Exemption Policy.” Pohang University of Science and Technology, 2002.
<www.postech.ac.kr/k/daehak/daehak6-1.html> (In Korean)
- “MOB/WOB Incubator Project - California Incubator Contact List.” University of Southern California, 2002. <ettc.usc.edu/incubator/contact.asp>
- “More Effective IT Investment.” Digital Venture Association, May 2002.
<www.dva.or.kr/data/view_it.asp?num=232>
- “National Center for Educational Statistics – Degrees Earned by Foreign Graduate Students: Fields of Study and Plans After Graduation.” Office of Educational Research and Improvement, U.S. Department of Education, November 1997.
- “New Employment Prospect for 230 Thousand People in IT.” Yonhap News Agency, 15 September 2000.
<IT-Employment.23m.html> (In Korean)
- “Nintendo Will Sell Web Game Adapter,” New York Times, 23 August 2002.
- “Number of required units by category – Computer Engineering Degrees.” Stanford School of Engineering Undergraduate Handbook, 2002. <www.ughb.stanford.edu/98-99/cse.html> <info.sjsu.edu/web-dbgen/catalog/departments/CISE-section3.html> <www.cse.scu.edu/bsce/bachelor.html>

Korea and the Global Software Industry

- “Number of Venture Firms Fall Below 10,000.” *Electronic Engineering Times Korea*, 15 July 2002. <new.sw.or.kr/printNews.asp?ID+1832&field=ItNews> (In Korean)
- “OECD Information Technology Outlook.” Organization For Economic Co-operation and Development, 2002.
- “Our Recent Investments.” *BCE Capital* volume 1. Issue 1, June 2000.
- “Over supply among several IT industries.” *Digital Valuation Association*, April 2002. <www.dva.or.kr/data/view_it.asp?num=198>
- “Overall Competitiveness Rankings.” *World Economic Forum*, 2000-2001.
- “Penetrate World Market with SI Orders from Abroad.” *Digital Times*, 5 June 2001. <www.hit.co.kr/ehomepage/about%20hit/eA1_0402.jsp>
- “Per Industry Information and Communications Technology Human Resources.” *National Computerization Agency*, 2002. <stat.nca.or.kr/pageview.php3?pageno=1501> (In Korean)
- “POSDATA Services – Technology Holdings.” *POSDATA*, 2002. <www.posdata.co.kr>
- “Private Equity in Asia.” *Asiaventure.com*, 2001. <www.asiaventure.com/research/Private_Equity_Stat.gif>
- “Problems in IT Exports-per industry & per overseas market.” *Korea Software Industry Association*, 2002. <static.sw.or.kr/static_detail.asp?id=44&category=3&cPage=1>
- “Professional Research Personnel and Industrial and Technical Personnel Management Regulations.” *Military Manpower Administration*, 29 January 2002. <www.mma.go.kr/www_mma3/personnel_1.html> (In Korean)
- “Profit Expectation for Each IT Industries.” *Digital Venture Association*, April 2002. <www.dva.or.kr/data/view_it.asp?num=190>
- “R&D Grants Supported and its Outcome.” *IITA*, 2002. <ita.iita.re.kr/~ita/english/state/intro_4.html>
- “Regional Incubation.” *Pacific Incubation Network*, 2002. <www.pacificincubation.org>
- “Research of Mid-long term Education Market Prospects.” *Ministry of Education*, 2001. (In Korean)
- “Reverse Flow.” *National Science Foundation*, 2002. <www.nsf.gov/sbe/srs/seind02/c2/c2s3.htm>
- “ROK Internet White Paper of 2002.” *Ministry of Information and Communication*, 2002.
- “ROK Placed 23rd in Global Competitiveness.” *Center for International Development at Harvard University*, 2001. <www.cid.harvard.edu/cr/articles/koreatimes_101901.html>
- “Small and Medium Business Administration Selects 105 Colleges for Triangle of Technology Assistance for SMEs.” *Small and Medium Business Administration*, May 2002. <www.smba.go.kr/english/board/u_read.php?bo_type=01ea&ser=7>
- “Small and Medium Enterprises Financial Supporting System.” *Presidential Commission on Small and Medium Enterprises*, 2002. (In Korean)
- “Soft Figures – Worldwide Packaged Software Market: 2000-2002.” *SIIC Journal* Issue No.81, June 2002.
- “Software & Internet Technologies; Internet Access Technologies; Internet Service Providers.” *ExportIT*, August 08, 2001. <exportit.ita.doc.gov/ocbe/USIndust.nsf/806cbc35babba9838525...>
- “Software Benchmarking Test from Government.” *Daum News*, 2002. <news.daum.net/PrintPage/daily/technology/200207/28/inews24/v2886288.html> (In Korean)
- “Software Center Management Evaluation and Public/Private cooperation Model Development.” *Korea IT Industry Promotion Agency*”, 2001. (In Korean)
- “Software Industry.” *Korea Investment Service Center*, 30 July 2000. <kisc.org/servlet/kiscCMNKiscMenu01A?0P> (In Korean)

Korea and the Global Software Industry

- “Software Strong Power 2010.” Presentation Slides, Korea Information and Technology Industry Promotion Agency, May 2002. (In Korean)
- “Software Supporting Center Management Evaluation and Public/Private Cooperation Model Development.” Korea IT Industry Promotion Agency, 2001. (In Korean)
- “South Korea low on domestic mobile phone components supply.” Global Source, 5 March 2002. <www.telecom.globalsources.com/magazine/ts/0205/pmn030501.htm>
- “South Korea: Computer Software – Tariffs.” Export.gov, 2002. <[exportit.ita.doc.gov/ocbe/ExporterInfo.nsf/87b16ee702800...>](http://exportit.ita.doc.gov/ocbe/ExporterInfo.nsf/87b16ee702800...)
- “South Korea: Selling Software via Internet.” Export.gov, 9 February 2002. <[exportit.ita.doc.gov/ocbe/ForeignM.nsf/679c088699b...>](http://exportit.ita.doc.gov/ocbe/ForeignM.nsf/679c088699b...)
- “South Korea: Update on Seoul City Govt’s Digital Media City Project.” Export.gov, 25 August 2001. <[exportit.ita.doc.gov/ocbe/ForeignM.nsf/679c088699b48...>](http://exportit.ita.doc.gov/ocbe/ForeignM.nsf/679c088699b48...)
- “Special Regulations for Venture Firm Development.” Presidential Commission on Small & Medium Enterprises, 2002. <www.pcsme.go.kr/info/law/upload/law_1_21_1_1.htm> (In Korean)
- “Start-up Investment Company and Investment Association Establishment Progress.” Small and Medium Business Administration, 2001.
- “State of the Industry: Report 2000 – 2001.” Interactive Digital Software Association, 2001.
- “Statistical Search - Per Item Import and Export.” Korea International Trade Association, 2002. <www.onlinetrade.or.kr/expimp/jsp/ExpimpltemCountryStat1.jsp>
- “Status on the World’s Main Int’l SW Companies’ Entry into ROK Domestic Market,” Korea IT Industry Promotion Agency, 2001. (In Korean)
- “Strong growth of Korean exports market bodes well for CABSAT 2001.” The Middle East Cable, Broadcast and Satellite Exhibition, November 26, 2000. <www.cabsat.com/2001/news/00nov26.html>
- “Summary Figures by Size of Capital Stock of Industry.” National Statistical Office, 2002. <www.nso.go.kr/cgi-bin/sws_999.cgi>
- “Survey of Software Industry Exports and Business Index.” Korea Software Industry Association, January 2001.
- “SW Competitiveness Enhancement Seminar sponsored by MIC.” GSI815.re.kr, 2002. <www.gis815.re.kr/gisnews/ReadGisNews.asp?IndexNum=3930&PageNum=1> (In Korean)
- “Tax Break for Venture Firms.” Bluechipi.com, 2002. . <www.bluechipi.com/venturedetail.html> (In Korean)
- “Telecom Industry Undergoes Revolutionary Change in Two Decades.” The Korea Times, May 2002. <www.hankooki.com/kt_tech/200205/t2002051018125245110.htm>
- “Ten Things to Consider for Venture Firms’ Overseas Market Entry.” Digital Times Korea, 12 June 2002. <ican.etri.re.kr/Inter/FileData/file_1_51_G-51.htm> (In Korean)
- “The College of Computer, Communications and Commerce.” Division of Computer, Communications and Commerce, Hanyang University, 2002. <www.Hanyang.ac.kr/new_English/e_main.phtml?menu_code=020102>
- “The Israeli High Tech Industry.” Israel Venture Capital Research Center, September 2001.
- “The Rise of Private Business Incubators.” National Commission on Entrepreneurship, 27 January 2000. <www.ncoe.org/newsletter/update/01_27_00.html>
- “The Seventh Informatization Strategy Meeting.” Ministries of Information and Communication, Commerce, Industry and Energy, Construction and Transportation, Agriculture and Forestry and Maritime Affairs and Fisheries, 27 February 2002, Cheong Wa Dae, Seoul, Korea.

Korea and the Global Software Industry

- “The US Software Market Analysis Report.” Korea IT Industry Promotion Agency, Dec.31, 2001. (In Korean, with English Summary)
- “U.S. Software Imports by Region:1997 – June 2001.” ExportIT, 21 September 2002. <<http://exportit.ita.doc.gov/ocbe/USIndust.nsf/806cbc35babba9838525...>>
- “Undergraduate Curriculum.” Division of Computer, Communications and Commerce, Hanyang University, 2002. <http://www.3c.Hanyang.ac.kr/introduction/intro_course.php> (In Korean)
- “Undergraduate Students at CSE Department.” Computer Science and Engineering Department, Indian Institute of Technology Kanpur, 2002. <www.cse.iitk.ac.in/cgi-bin/ug.cgi>
- “University Related Incubators.” Alameda Center for Environmental Technologies, August, 1997.
- “Urgent Need to Enhance Software Industry.” Korean Business Review, February 2002.
- “US Software Market Report.” Korea IT Industry Promotion Agency, 2002.
- “US Software Market Survey Report.” Korea IT Industry Promotion Agency, 2001. (In Korean)
- “Venture Capital Investment Status and National Economic Impact Analysis.” Small and Medium Business Administration, 2002. (In Korean)
- “Venture Capital.” Vcline.com, 2002. <www.vcline.com/cc10.htm>
- “Venture Certification Firm per specified Requisite Composition.” KOSDAQ, 2001.
- “Venture Certification Firm Registration Progress.” Small and Medium Business Administration, 2001.
- “Venture Enterprises Foreign Market-Entry Support Plan.” Small and Medium Business Administration, March 2001. (In Korean)
- “Venture Investment Guarantee System.” Korea Technology Credit Guarantee Fund, 2002. <www.kibo.co.kr/venture/view/view_n_12.asp?left=2> (In Korean)
- “Weekly Survey of Small and Medium Business.” Small and Medium Business Administration, 1-6 July 2002. (In Korean)
- “Year 2000 Korean Export Company’s Status per Country.” Korea Information and Technology Industry Promotion Agency, 2001.
- “Year 2000 Korean Export Status per Country.” Korea Venture Business Association, 2001.
- “Year-end Report on Exports and Imports for 2001.” Ministry of Commerce, Industry and Energy, January 2001
- Aidar, Felipe. et. al. “Lessons for Venture Capitalists.” Kellogg Tech Venture 2001 Anthology, 2001.
- Albert, Ph. & Gaynor, L. “Incubators – Growing Up, Moving Out: A Review of the Literature.” CERAM, 2001.
- Ann, Junmo and Chung, Seungwha. “Survey of Strategy of Growth and Development of Korean Software Venture Companies.” Konkuk University, 1997. (In Korean)
- Ann, Junmo. “Business Incubator Manager Training Program Development Research.” Konkuk University, 2000. (In Korean)
- Auh, Taik-Sup. “Language Divide and Knowledge Gap in Cyberspace: Beyond Digital Divide.” UNESCO, 2001. <[www.unesco.or.kr/cyber lang/auhtaesup.htm](http://www.unesco.or.kr/cyber_lang/auhtaesup.htm)>
- Autler, Gerald H. “Global Networks in High Technology: The Silicon Valley-Israel Connection.” University of California, Berkeley, 2001.
- Bae, Zong-Tae. “Financing for Young Hi-Tech Enterprises in Korea.” Korea Advanced Institute of Science And Technology, 2001.
- Bae, Zong-Tae. “Overview of Entrepreneurship and Startups in Korea and Asia-Pacific Countries.” Korea Advanced Institute Of Science And Technology, August 2001.

Korea and the Global Software Industry

- Bae, Zong-Tae. "SPRIE Incubation Research Workshop. Business Incubation in Korea: Research Framework and Situation Analysis." Korea Advanced Institute Of Science And Technology, February 27, 2002.
- Baijs, Eduard. Gupta, Sandeep. Jaglom, Daniel and Szlapak, Daniel. "Start Me Up! – Business Incubators in the 21st Century." Kellogg TechVenture 2000 Anthology, 2000.
- Barr & Tessler. "Notes on HR Resource Issues in the Software Industry and Their Implications for Business and Government." Talk presented to the NSTC Presidential Advisory Committee, 1997.
- Barr and Tessler. "Professional Software Schools." 2002. <www.aldo.com/papers>
- Barr, Tessler & Kresge. "Towards a Knowledge-Level Software Platform." Semantic Web Workshop, Stanford University, July 2001.
- Barr, Tessler and Miller. "Software Entrepreneurism in Korea." Stanford University Asia/Pacific Research Center, December 1999. <www.aldo.com/papers>
- Blumling, Mark, Frick, Kevin A. , and Meehan, William F. "A hard turnaround for software." McKinsey Quarterly, 2002 Number 3.
- Borrell, Jerry. "Features: Ireland: Turning Green Into Gold." Upside Today, 24 July 2002. <www.upside.com/texis/mvm/print-it?id=3d3f091f5&t=>
- Boyson, Sandor, Gunaratne, Shakuntala and Hanna, Nagy. "The East Asian Miracle and Information Technology." World Bank Discussion Papers, August 1996.
- Bresnahan, Timothy. "Innovation Will Lift Economy -- Be Patient." San Jose Mercury News, October 2002.
- Brexnican, Anthony, "Sony Unveils Online Game Service," APonline, 28 August 2002.
- Burton, Lawrence and Wang, Jack. "How Much Does the U.S. Rely on Immigrant Engineers?" National Science Foundation, 11 February 1999.
- Canham, Janine and Mitchell, Tony. "Bridging the Gap Making Venture Capital Work." Speech given at the Venture Capital Partnership Conference, November 2001.
- Carr, Judith. "Gartner's View on ROK's e-Government plan: A Report from symposium in San Diego, CA." KERIS, April 2002. (In Korean)
- Chapman, Merrill R. The Product Marketing Handbook for Software. Third Edition. 2000, Aegis Resources, Killingsworth, CT.
- Chavali, Satish. "Corporate Incubators – Mother Hen to Fledgling Ideas." ITspace.com, 2001.
- Choi, Keiyoung and et. al. "Market Prospects on Short and Mid Term IT Industry." Korea Information Society Development Institute, 2002. (In Korean)
- Crone, Mike. "A Profile of the Irish Software Industry – 3.10 The Origins of Indigenous Software Firms." Irish Software project 1. Consultation Draft, April 2002.
- Dossani, Rafiq & Kenney, Martin. "Creating an Environment for Venture Capital in India." World Development, Vol 30, No. 2, 2002.
- Downward, Mathew, "Brokat Sells Off Units on the Cheap." the451.com, 17 August 2001.
- Frye, Colleen. "New Economy Goes Back to Basics: Software Magazine 500." Software Magazine, June/July 2001. <www.softwaremaga.com/L.cfm?Doc=archive/2001jun/SW500.html>
- Gonzalez, Marisela and Lucea, Rafael. "The Evolution of Business Incubation." Carnegie Mellon Center for Economic Development, 2002. <www.Heinz.cmu.edu/ced/topics/t3inc1/incub1.html>
- Goodsell, Sally. "The Role of Analysts in Your US Marketing Campaign" <www.international-marketing.co.uk>
- Grossi, Robert. et. al. "Lessons from the Graveyard." Kellogg Tech Venture 2000 Anthology, 2000.

Korea and the Global Software Industry

Hamid, Javed and Wagle, Dileep. "Impact-Private Sector Partners: IFC's Initiative to Assess the Business Environment in East Asia." International Finance Corporation, March 2002.

Hellmann, Thomas. "Venture Capital: the Coaches of Silicon Valley." in Lee, Miller, Hancock & Rowen, The Silicon Valley Edge, 2001.

Kenney, Martin, Han, Keong-Hee and Tanaka, Shoko. "Scattering Geese: The Venture Capital Industries of East Asia" World Bank, March 2002.

Kenney, Martin, Tanaka, Shoko and Han, Kyong-Hee. "Adapting to Strange Environment: Venture Capital in Japan, Korea and Taiwan." Presentation Slides, 2001.

Kenny, Martin and Dalzotto, Cinzia. "History and Location in the Venture Capital Industry." Presentation Slides, 2000.

Kim, Jin Hyung, "Report on Research on Computer/Software Training in Higher Education." Korea IT Industry Promotion Agency, 2002.

Kim, Jinhung, Kim, Taehee, Yang, Youkil and Kim, Miae. "Survey of Software Education in Colleges of Great Britain and Ireland." Korea IT Industry Promotion Agency, 2001.

Kim, Jonginn. "Survey of Intellectual Property Assessment of Software Venture Company Founder." Konkuk University, 1998. (In Korean)

Kim, Ki-hong. "Korea a Testing Ground for Japanese Tech." Chosun Ilbo, October 2002

Kim, W. Chan and Mauborgne, Renee. "Charting Your Company's Future." Harvard Business Review, June 2002.

Kim, Wha-Jin. "Brain Korea 21." Ministry of Education, 1999. <www.bk21.or.kr/datas/English_ver.htm>

Kirkman, Geoffrey S. "Executive Summary of The Global Information Technology Report 2001-2002." Oxford University Press, 2002.

Koh, Jeong-Suk. "Venture Capital & Private Equity Investment." Presentation Slides, Korea Advanced Institute Of Science And Technology, March 2001.

Korea IT Industry Promotion Agency website, Overview of the Korean Software Industry, 2002.

Kozu, Takeshi, Nakayama, Ko, Mineshima, Aiko and Saita, Yumi. "Changes in Japan's Export and Import Structure." Bank of Japan, May 2002.

Kwon, Nam-Hoon. "A Policy Study on Job Turnover and Brain Drain of IT Professionals." Korea Information and Science Development Institute, 2001. (In Korean)

Larkin, John. "Winning the Monster Game." Far Eastern Economic Review, 5 September 2002.

Lee, Se-Min. "SNU Faces Further Drop in Grad Students." Chosun Ilbo, October 2002.

Lewis, David. "Does Technology Incubation Work? A Critical Review." Rutgers University, 2001.

Liu, Mannie Manhong and Chang, Fan. "Venture Capital in China." Presentation Slides, Renmin University, 2001.

Malevich, Maya. "Israeli Startups Migrating To The U.S.: Causes And Implications." Massachusetts Institute of Technology, June 2001.

Malhotra, Shyam. "The Pottery of the Indian IT Supermarket." Dataquest India, 5 August 2002. <www.dqindia.com/content/guest/102080502.asp>

Mani & Bartzokas, "Institutional Support for Investment in New Technologies: the Role of Venture Capital Institutions in Developing Countries." UN University, 2002.

Medved, Jon. "Global strength." Globes Online, May 2002. <globes.co.il/serveen/globes/printWindow.asp?did=587922&fid=980>

Korea and the Global Software Industry

Mulugu, Somasekhar. "Incubator Route to Know-how Development." Business Line Internet Edition, 13 January 1999.

National Business Incubator Association, Impacts of Incubator Investments, 1997.

Nho, Heedo. "Policy of IT Industry." Ministry of Information and Communication, 2000. (In Korean)

Oh, Hae-Jin. "IT Outsourcing Strategy." Digital Times Korea, 28 June 2002.
<ican.etri.re.kr/SuccessVenture/FileData/fiel_1_183_s-183.htm> (In Korean)

Priyadarshini, Rukmini. "RelQ Targets Quality Growth." The Hindu Business Line, 23 October 2001.
<www.bonnet.com/businessline/ew/2001/10/24/stories/0124a2...>

Priyadarshini, Rukmini. "RelQ to Acquire French Co." The Hindu Business Line, 23 January 2002.
<www.blonnet.com/2002/01/23/stories/2002012300710500.htm>

Rosenberg, David. Cloning Silicon Valley, Pearson Education Limited, London, 2002.

See, B.H. "Korean IC Makers Face Brain Drain." The Business Technology Network, 14 April 1999.
<www.techweb.com./wire/story/TWB19990414S0006>

Seong, So-Mi. "Korean Venture: Evaluation and Development Strategy." Presentation Slides, Korea Development Institute, 2001. (In Korean)

Shapely, Deborah, "The Universal Cell Phone. MIT Technology Review." April 2001.

Shin, Hyeon-Sik. "IEEE-ACM Computing Curricula 1999/2001." Presentation Slides, Seoul National University, 27 April 2001. (In Korean)

Stirland, Sarah Lai. "Who Will Incubate the Incubators?" Red Herring Magazine, April 10, 2000.
<www.redherring.com/vc/2000/0410/vc-incubator041000.html>

Tilak, Jandhyala B.G. "Building Human Capital – What Others Can Learn." World Bank Institute Working Papers, 31 January 2001.

US Bancorp Piper Jaffrey. "As the Pie Shrinks, the Fight to Get a Decent Slice Intensifies." The Software Field Guide, October 2002, Volume 1, Number 33.

Weber, Andrew. "Korea as Wireless Leader? This American Believes." The Korea Herald, 24 March 2001

West, E.G. "Education Vouchers In Practice And Principle: A World Survey." (full report), World Bank, 1996.

Wolverton, Troy. "Wells Fargo to shutter mobile service," CNet, 20 August 2002.

Yang, S. "Mobile Communications in Korea; History and Future." Presentation Slides, Ministry of Information and Communication, 2002.

Yoo, Jang-Hee and Moon, Chul-Woo. "Potential for Cooperation in Promoting Knowledge-based Economies in APEC." Journal of APEC Studies, Vol.1 2 No.1, 2000.

Yoo, Jang-Hee. "Real Success, Financial Fall: A Reassessment of the Korean Dynamism." Ewha Womans University Press, 1999.

Yoo, Jang-Hee. "Strategic Alliances by Korean Enterprises." Korea Focus, March-April 2000.

Zacharakis, Andrew L. "Global Entrepreneurship Monitor- National Entrepreneurship Assessment of The United States of America 2000 Executive Report." Global Entrepreneurship Monitor, 2000.