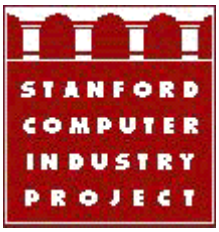

Software Entrepreneurism in Korea

Final Report
December 30, 1999

Avron Barr and Shirley Tessler
Stanford Computer Industry Project

Funded by a grant to Stanford University
from the Chong-Moon Lee Foundation

The Stanford Computer Industry Project

Since 1994, the authors have been directing a study of the worldwide software industry at the Stanford Computer Industry Project (SCIP). Initiated with a grant from the Alfred P. Sloan Foundation, SCIP has sponsored a broad range of research activities at the School of Engineering, the School of Humanities and Sciences, the Graduate School of Business, and the Institute for International Studies. SCIP's Software Industry Study has systematically identified and analyzed the issues that will shape the commercial use of software, including piracy, patents, antitrust, project management, the Internet, globalization, litigation, software quality, project failures, systems and device failures, the global talent supply, and the education of software professionals. Most recently, the study has focused on the globalization of the software industry, the worldwide shortage of talented software people, and changes in the financing of software R&D.

The authors would like to thank the Alfred P. Sloan Foundation and SCIP's Corporate Partners for their support.

Special thanks go to the Chong-Moon Lee Foundation, which supported SCIP's study of software entrepreneurism in Korea through a grant to the Asia/Pacific Research Center at Stanford University's Institute for International Studies.

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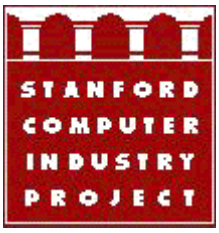

Software Entrepreneurism in Korea

Avron Barr and Shirley Tessler
Stanford Computer Industry Project[1]
December 1999

1 Executive Summary

Our study of software entrepreneurism in Korea began in February 1999, as part of the Stanford-Korea IT Project, initiated by President Kim Dae Jung and funded by the Chong-Moon Lee Foundation.[2] The overall goal of this research is to understand Korea's software industry in a comparative context with the software industries of several other countries, and in particular, to find ways to further encourage and support software entrepreneurism in Korea.

To most people, the software industry is synonymous with software publishing and firms like Microsoft and Oracle. In our five-year study at Stanford, we have come to view the software industry much more broadly (see Section 1.2). After examining the variety of ways that software produces wealth, we consider possible strategic alternatives for what kind of software industry might evolve in Korea. The report investigates how the government might encourage entrepreneurism in those areas and what kinds of support might be provided to small software companies to increase their likelihood of success. We've looked at all aspects of the industry: software education, financial institutions, new business creation, startup habitat, the domestic market, and global strategies.

Korea, like many countries, began several years ago to focus on its software industry as an area for targeted development. It has become clear to many that software is a potential key to economic development (jobs, export revenue, etc.). In addition, software requires no investment in manufacturing plants and no raw materials, so it seems like an inexpensive industry to get started – two young entrepreneurs with a PC can start the next Microsoft or Yahoo! But more importantly, software is key to participating in the new "knowledge economy." Innovation and entrepreneurism were explicit elements of Korea's efforts to build its software industry.

Korea brings some clear strengths and strategic advantages to its efforts to become a global player in the software industry. Most important of these is a highly educated

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1. Prof. William F. Miller, Director of the Stanford Computer Industry Project, supervised this research. All papers are available on the authors' website at: http://www.aldo.com/papers/

2. Our research was funded during 1999 as part of a major grant from the Chong-Moon Lee Foundation to Stanford's Institute for International Studies, which also funded an executive education program and a forthcoming book on Silicon Valley, to be published by the Stanford Press in 2000.

workforce and a tradition of higher education, especially engineering education. The status of engineering is boosted by the presence of major global players in other high-tech industries, in particular, semiconductors, telecommunications and consumer electronics. Another relative strength that will be an advantage in developing the software industry is the state of the telecommunications infrastructure and the relatively low price for domestic bandwidth.

The most critical advantage that we have seen in our short study is the willingness of the Korean government to be proactive, to learn from the experiences of other countries, and to think creatively about ways to promote the software industry. In a small country, the need to coordinate efforts on many fronts, to maximize the impact of limited resources, and to overcome inertia in existing institutions requires direct and decisive government action across a variety of agencies. In a few years, as the private sector and market dynamics become effective forces on their own, government action will become less of an industry driver. For the time being, it is most important that action across government agencies be coordinated based on an informed understanding of the software industry and of the various possible strategic alternatives.

In recent years, the Korean government has written or revised over a hundred laws and regulations in education, finance, and intellectual property protection, in order to facilitate software industry growth. Government agencies have implemented a wide variety of policies and programs, spending many millions in a variety of efforts. As a result, many new high tech venture firms have been started and a NASDAQ-like public equity market is thriving. It appears that Korea has been particularly effective at motivating thousands of young high-tech entrepreneurs to strike out on their own and at creating a flow of capital to support them.

It is too early to evaluate completely the impact of these programs and regulatory changes. Development of a software industry and of a fast-moving, entrepreneurial economy in Korea is a complicated problem of many dimensions. Failure in any one dimension (finance, education, corporate governance, global marketing, etc.) might preclude overall success.

1.1 Key Recommendations

Our goal is to clarify the issues, broaden understanding of the possibilities, and help decision makers in government and private industry make more informed decisions. Developing Korea’s software industry and promoting software entrepreneurism are complex tasks, and the situation in Korea has been changing rapidly during the short time we’ve been studying it. We have come to an understanding of the situation, however, that might be illuminating.

There are two conflicting constraints shaping Korea’s path forward. On the one hand, coordination and focus are important for marshaling of the resources of a small country. On the other hand, flexible market mechanisms and diversity of approach are key to success in the fast-moving software industry. Korea must search for an effective balance.

We have listed dozens of recommendations in the body of the report. These suggestions address specific aspects of the effort, or offer corrections to potential problems we see developing. (Appendix 1 is a complete list of our recommendations and suggestions.) However, from our outsider's, Silicon Valley perspective, there are some larger issues that still seem problematic. We list them here for emphasis. Each is discussed in greater detail in the report.

1. **Venture capital.** Despite a variety of government efforts to promote fluid financing of high-tech startups, much early-stage financing is still based on debt. Venture capitalists in Korea, with a few exceptions, have not yet shed their conventional finance backgrounds – they are still focused on securing their investments with collateral and insuring a reasonable return on each investment. Recent government efforts to put a value on patents (or even on Internet domain names) held by the startups, in order to rationalize a startup's valuation, have supported this debt-based financing mindset.

   Debt-based financing does not allow the kind of risk taking required for *innovation-based success* in the software industry. While some types of software companies may be started with traditional financing, the ventures that will have a chance to introduce leading-edge technology and products on a global basis must involve substantial risk sharing between entrepreneurs and financiers. It is the nature of this high-risk game that most individual ventures must fail – otherwise they are not taking the kinds of risks required to become a huge success. Successful investment involves managing a portfolio of startups and hoping for a big winner in one of ten portfolio companies.

   The key recommendation in this area is to allow venture capitalists to learn to deal with high-risk investments. Government efforts to lower the perceived risks will not help. Laws that narrowly define venture capital and venture firms will become counterproductive. Government plans for supporting venture investments should include a timetable for withdrawal of direct government involvement.

2. **Domestic demand.** The current state of information systems in Korea's biggest companies and government agencies is seriously out-of-date, again with a few exceptions. Without a domestic market that demands state-of-the-art information systems, Korea's software industry development is limited to PC titles and software games. The much larger market for "enterprise software" is almost impossible to approach without domestic customers. Major areas of the industry, like software services and corporate "in-house" applications development, cannot grow and, in turn, can't become breeding grounds for the next generation of software entrepreneurs.

   We recommend that the government encourage corporations to update their information systems and that it also invest heavily in innovative government systems. To the extent possible, this work should be outsourced to independent software services firms and some of the work should be "set aside" for small software firms.

3. **Education.** The software faculty in Korea's universities is highly qualified. However, in Korea, as in Computer Science departments everywhere, faculty who specialize in software are few in number and are struggling to maintain the quality of their graduates

as demand for software classes increases. They do not have the resources to offer so many students adequate practical experience in significant software projects or to develop new curriculum to keep up with this rapidly changing field. Korean Computer Science departments are completely dominated by electrical engineering and hardware systems faculty, who, as in other countries, are unappreciative of the value of software. The rate of growth of software faculty is zero, or possibly negative. Since a dramatic increase in the number of first-rate software engineers is prerequisite to significant growth of Korea's software industry, this problem must be addressed immediately, since it takes so many years to increase the number and quality of software graduates.

We recommend, at least for the next ten years, focusing on software education separately from traditional computer and systems engineering. Software education must go beyond programming languages, data structures and algorithms. State-of-the-art technology and methods must be incorporated in undergraduate programs. Practical issues like project management, quality assurance, product management, etc., can be taught by visiting professionals to complement faculty offerings.

4. **Government vs. market-driven activity.** Government agencies charged with promoting the software industry's development have addressed all aspects of the problem with great energy and insightfulness. One area of concern, however, is that, by directly offering support services to Korea's software startups, these agencies may be precluding the development of the secondary support industry, what we call the "habitat" for software startups. In the end, government programs can't be flexible enough to support the dynamics of a rapidly changing industry like software. Development of independent, private-sector marketing firms, strategy consultants, PR firms, HR firms, etc. must be supported.

   We recommend that the work currently being done by government agencies to support software startups be gradually outsourced to private consultants and support firms. Over the years, this would build expertise in the habitat about how to meet the special needs of software startups. Software marketing, in particular, is quite different from traditional industries and must be learned from experience (see Section 7.2).

5. **A long-term, expensive effort.** It is important to think about the program to bring Korea to the forefront of the global software industry as a long-term effort of ten to twenty years. Systematic data collection should be put in place to help evaluate government policies and programs and guide incremental improvements over the years (see Section 2.4). Furthermore, the high rate of failure of software startups with truly advanced ideas makes the overall effort to establish the industry quite expensive. This failure rate is also uncomfortable for government agencies and financial institutions that can be criticized for their failures, even if their overall portfolio is quite successful. An informal joint industry-government effort like the Software Industry Promotion Committee is useful to independently monitor the impact of policies and programs and to sustain momentum through the inevitable changes in government administrators.

1.2 Alternate National Software Industry Strategies

During our five-year study of the worldwide software industry at SCIP, we have come to define the industry to include not just software publishing, but the full range of software-related business activities. As shown in Figure 1, a nation's total software output capacity must be divided among a variety of different economic development alternatives.

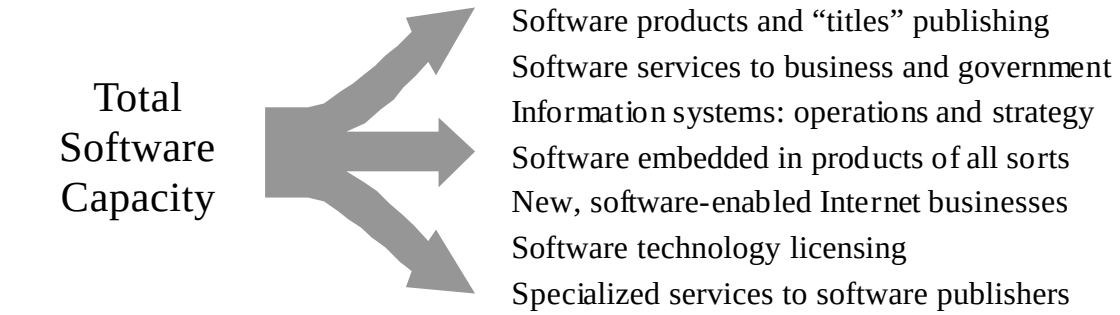

Figure 1. Software teams produce wealth in a variety of ways.

Software publishing includes productivity, games and education titles, as well as the much larger set of tools and "enterprise products" sold to businesses and government. In total, publishing was a $135B industry worldwide in 1998. Software services, like consulting and systems integration, was a $280B industry last year. Business information systems, like supply chain management and e-commerce, are also critical to global competitiveness in "traditional" industries. Products from toys to automobiles are increasingly defined by the software they contain. Internet companies like Yahoo! and eBay, whose service is essentially a software system, are what we call software-enabled businesses. Finally, there are growing markets for software technology and for specialized services like localization and technical support in the software publishers and other larger technology, communications, and media firms.

We feel that this inclusive view of software is important when looking at national development strategies. In countries where the total potential software production capacity is small, because the total population of software engineers is small, allocating that resource across possible avenues of development must be considered strategically.

Our study has investigated software entrepreneurism in several other countries to help identify issues and strategic alternatives for Korea. Figure 2 shows the four countries besides the US that have significant software exports at this time. A remarkable variation is apparent: each country has found, either intentionally or by trial and error, that a unique type of software industry works for them at this early stage in their development. (Of course, we are simplifying the issue – there are all types of software activities in each country – but one particular type has come to dominate each country's global software presence.)

Country	Software Industry Focus	Strategy	Size ($B)	Exports ($B)
India	Export software services	Utilize existing human resources	3.9	2.7
Ireland	Services to SW publishers	Knowledge transfer	6.6	5.9
Israel	Export technology	Military high-tech spin-offs	1.5	.7
Japan	Game titles	"New Hard"	2.9	1.3

Figure 2. National software industries, in retrospect. All figures are for 1998, except Japan, where 1997 are the latest available. India's numbers are for the fiscal year ending 3/31/99. Ireland's numbers include total revenue for software that is localized in Ireland for the European market. Sources: India's NASSCOM, Ireland's Minister of Public Enterprise, the Israeli Association of Software Houses, and the Japan Information Service Industry Association.

Since the software industry is changing so rapidly, strategies must aim at opportunities that are just emerging or about to emerge. Our first question, then, is to ask what types of software industry make the most sense for Korea, strategically, and what are the emerging opportunities. We do not want to suggest that the Korean government should pick one area of software and concentrate all efforts – entrepreneurs looking realistically at their markets make these decisions best. Or more precisely, the markets select among the ideas that entrepreneurs have explored – only a diversity of ideas can reduce overall risk of failure. By understanding the alternatives, however, public policy can be more flexible as the industry begins to evolve. We return to the issue of strategic alternatives in Section 2.

1.3 Human Resources

In the software industry, there is only one natural resource, the teams of software professionals who create all of the different types of software. Software development and maintenance is now some of the most demanding engineering activity in the world. In whatever way software is used, success requires not only creative new ideas but also teams of very bright engineers and technical managers to execute those ideas. Since software technology is changing rapidly, those engineers must not only be trained to the cutting edge, but must be kept up-to-date for their entire careers.

Korea's current population of state-of-the-art software professionals, including engineers and software-savvy managers and financiers, is very small. While Korea has a highly educated population, it does not have a highly developed system of software education, especially at the most advanced levels. The faculty at Korean universities who are trained in software theory and practice is a small fraction of the Computer Science (CS) and Electrical Engineering (EE) faculty. These professors are already overwhelmed satisfying the growing demand for the most basic programming classes, in addition to their required research and publishing activities. As a result, many Korean students, like students in most countries, do not enter the workforce with deep, cutting-edge knowledge and experience on significant software development projects.

Beyond the technical aspects of software development, there are other human resource issues. First, the ability to come up with ideas that have great market potential requires contact with the current state-of-the-art in a particular market area: internet games,

manufacturing scheduling, on-line banking, or whatever. Most often, it is engineers who've worked in a particular area who come up with these new ideas. Korean graduates of US computer science schools who get a chance to stay for a while after graduation and work in cutting-edge software jobs may get valuable insight and experience that will help inspire innovative ideas later in their careers.

There are also business issues that require training and, of course, these are different in each sector of the software industry. We have addressed several in the sections that follow: encouraging entrepreneurism among inventors and innovators, managing software startups, corporate use of IT in existing firms, and global software marketing. One more educational issue that is obvious but should be mentioned is the value of English language competence in almost all areas of the software industry.

1.4 Encouraging Entrepreneurism and New Business Creation

In the rapidly changing software industry, startup companies are a critical source of new ideas and innovations, often opening major new markets that remain invisible to larger firms for many years. While the role of startups is well understood in Silicon Valley high-tech generally, the situation in the software industry is exaggerated because of the huge number of new ideas and variations that can be explored with a relatively small total investment. The fact that software companies can be started with a significantly smaller investment than manufacturing companies has generated great interest in the software industry among countries around the world looking for ways to get into the high-tech boom as part of their economic development strategy.

Few countries, however, have been successful at encouraging the kind of high-risk entrepreneurism that characterizes high-tech startups. Taiwan, Israel and maybe India come to mind. Even in the United States, the level of high-risk activity in Silicon Valley is many times that of any other region. Over the last 20 years, both institutional and attitudinal change in Silicon Valley have contributed to its phenomenal level of new high-tech business creation.

The most important institutions are, of course, financial institutions. Venture capital comes to mind when one thinks about Silicon Valley. Venture capital, however, must be considered in the context of other financial institutions: private/angel investors, investment banks, corporate investment and acquisition funds, and public equity markets. Nowadays, few startups in Silicon Valley get their initial, "seed" financing from institutional venture capitalists. (Figure 13 in Section 4.4 shows that only 5% of US seed financing came from institutional venture capital in 1997.) What is most important to keep in mind is the goal of encouraging and facilitating new business creation.

Naturally, not all new business will lead to development of a high-tech industry and the envisioned impact on the national economy: export revenues, job creation, increased competitiveness in traditional industries, national prestige, etc. The natural reaction is to focus public policy on the financing of "venture" businesses. This tendency must be balanced against three other factors: the difficulty of defining "high-tech ventures," the

need to encourage respect for entrepreneurism in the population generally, and the need to create the "habitat," that will support startups during their lifecycle.

An individual's decision to go off and start his or her own business is shaped by the attitudes of family and friends as well as the perceived risks and rewards. The general attitude towards entrepreneurism in society must be positive before large numbers of new businesses will be created. Policies that define "venture businesses" too narrowly may fail to address this attitudinal issue. Narrowly defined policies also run the risk of missing important emerging sectors, as technology and markets continue to evolve. Targeted policies also do not support business creation of non-high-tech support firms, e.g., marketing, business consulting, human resource, and public relations, which are critical to the success of high-tech startups.

As for perceived risks and rewards, each entrepreneur weighs a complex array of issues: other career alternatives, effort required, likelihood of success, ownership and control, and the consequences of failure and bankruptcy. Bankruptcy is particularly problematic in high-tech, since the nature of the industry is so risky. Diversity of approach is key to the nation's overall high-tech strategy. As a natural consequence of taking multiple parallel approaches, many startups will inevitably fail. In most cases this will not reflect mistakes or incompetence on the part of the startups' business and technical teams. In Silicon Valley, entrepreneurs who have failed in previous attempts, and learned from their failures, start many new companies. In Section 4, we discuss institutional environments to support new business creation, as well as encouraging potential entrepreneurs to start out on their own.

1.5 Developing a Supportive Habitat for Software Startups

Professor Miller has named the special business environment that supports high-tech startups in Silicon Valley the "habitat." In this report, we've divided the issues he addresses into new business creation and support for small startups during their lifecycle. To understand the nature of this support, one must understand the nature of the software startup lifecycle.

Very few software companies achieve dominance in a sector. Microsoft, Oracle, SAP, Adobe, Computer Associates, Electronic Arts, and Autodesk are the exceptions, not the rule. Most software startups fail, of course, and most of the rest are either acquired by larger technology companies or spend their life supporting a small niche. (Many boutique software services firms fall in this latter category, for instance.) To return value to investors who are taking extraordinary risks, software startups must capture a significant share of a potentially very large market before a liquidity event for the investors (IPO or acquisition). Since technology and markets change very quickly, this enormous growth must be achieved in just a few years. It is rapid growth that requires high-risk investment – commitments must be made years before technology and markets mature. And for startups in very small markets, like Korea's current domestic market, that growth must be international from the beginning.

Global software companies are not the only type of software startup and not the only strategic alternative for developing a software industry. Firms that service the domestic market with products and services are important to national development, can be bootstrapped without high-risk investment, and require less in the way of a supportive habitat to get started. We discuss the importance of the domestic market below, in Section 1.6, but for now we'll look at the needs of software startups that intend to be global players.

Telecommunications, transportation, and financial infrastructure, as well as political stability, are critical to industrial development, but they are not enough for rapid movement in high-tech. The habitat for high-tech startups includes the physical, legal and social mechanisms that promote speed in product development and in cross-firm learning. The habitat includes a variety of services providers and consultants tuned to the needs of small companies. They supply specialized functions not available in a small firm and they do it in a way that lowers the hurdles and speeds growth of the business. Since much of the expertise that results is external to the startups themselves, the habitat firms become a repository of knowledge about technology, markets, and international competition.

However, the specialized support firms, lawyers, accountants, recruiting, market research, public relations, etc., are not enough to make the habitat work either. In software, as in much of the rest of high-tech, there is too much to learn about technology, markets and competition. The software startup simply doesn't have the time to learn everything it needs to know. Social institutions and attitudes, including the open exchange of non-proprietary knowledge with competitors and a mobile workforce, are critical to rapid growth in these small companies.

It is worth mentioning here that the role of government agencies in developing the habitat must be considered carefully. Low-cost government services, for instance, might preclude market-driven development of provider firms. And government agencies are not generally rapid movers or risk takers. Also, because bureaucrats move naturally from job to job, government agencies are not very good at becoming a repository of knowledge. This being said, without the government's initial involvement in countries like Korea, the habitat might develop too slowly, if at all. We return to habitat development in Section 5.

1.6 Stimulating Domestic Demand for Software

In our opinion, there is no more pressing issue for the Korean software industry than increasing the domestic demand for cutting-edge software products and services. Current efforts addressing piracy in corporate and government institutions, and putting computers in the schools and in the hands of consumers, are important, but only address the market for published software products, mostly PC products. The world of software is much bigger. Corporate and government information systems, in fact, account for 70-80% of the demand for software worldwide. It is in this area that Korea must find an effective strategy for development.

There are two reasons why the corporate and government demand for software is critical to Korea. First, these systems are increasingly important to global competitiveness in

traditional industries. Korea's semiconductor, consumer electronics and automobile industries are already globally competitive, but will have increasing problems in areas like e-commerce and supply chain management if there is not enough serious investment in new information systems. Other industries, like financial services and tourism, for example, require state of the art systems to enter the global arena. The major Korean firms appear to be behind in this type of automation. Their mechanism for procuring advanced information systems, namely captive systems integration (SI) houses, does not always work well, as has been demonstrated in Japan. (See Section 6 for a more complete discussion of captive SI firms.)

The second reason that domestic demand is such an important issue is more subtle: without local corporate and government customers, Korean software startups are at a tremendous disadvantage. Business and government are, as we said, by far the biggest market for software products and services. It is not likely that Korea will develop a global software industry based on computer games and PC titles alone. Business customers are particularly important in the early adoption of new technologies. And as we said in Section 1.1, it is in these segments that new opportunities will appear.

It is critical to develop this part of the domestic market – cutting-edge systems for business and government. A thriving corporate/government IT market will stimulate an independent software services sector. It not only creates demand for innovative software products, but also helps startup companies by providing local customers, and most importantly, local beta and reference sites. Prestigious customers give credibility to startups and legitimacy to software entrepreneurs, and it is much easier to service beta sites locally. In fact, the interaction and co-invention that takes place between software startup and beta customer is almost impossible to achieve across the Pacific. Also, nowadays, big firms invest in and eventually acquire many of these startups before they reach a wide market – it is important that Korean firms acquire some of this technology. Finally, the *users* of technology in big firms are historically a training ground for new entrepreneurs with a better idea.

One important note: it is tempting to spur the growth of the domestic market by interfering with the sales of software by foreign firms, e.g. by restricting imports or by giving some regulatory advantage to domestic firms. This strategy doesn't work. In fact, it leaves domestic software companies and their customers with less-than-cutting-edge technology. The only way to create a global software industry is to compete technically with the existing players. Publishers and services firms must work with customers who have the most current technology in the world, in order to generate new, advanced ideas.

1.7 Facilitating Global Marketing Efforts

Almost all of the software firms that operate globally are US firms. The exceptions are few: Indian software services firms, SAP, Israeli software technology licensers, etc. Certainly this situation is due in part to the enormous market for software products and services in the US, but that is only half the story.

Software marketing is different. In fact, the term “marketing” is misleading because it brings to mind the traditional marketing activities in manufacturing industries, like building market awareness, lead generation, and sales support. Because there is no manufacturing phase in the software industry, there is no separation of market analysis, requirements specification, product development, sales, and customer support. They blend together, and marketing takes on a broad, cross-functional role supporting not just sales but all parts of the product’s evolution. A deep knowledge of software technologies, as well as the dynamics of specific market segments, is often required. In Section 7, we discuss the unique nature of software marketing in more detail in order to better explain its importance to Korea’s growing software industry.

2 National Software Industry Strategies

Our goal with this report is to offer an academic perspective from Silicon Valley on the economic development of the software resource in the Republic of Korea. Significant research and public policy activity in this area is already underway in Korea, as part of a national focus on economic development of the IT industry. Many regulatory changes aimed at spurring development have been proposed and enacted in recent years. We hope that Stanford's experience studying the global software industry will bring a useful new perspective.

This report is based on:

- Our comparative investigation of the software industries of several other countries that have or might soon have significant software exports: India, Israel, Ireland, Japan, Taiwan, and the US.
- Several dozen interviews in Seoul, Taejon, and Pohang during visits in January, February, and July, 1999.
- Interviews with Korean entrepreneurs and visitors here in Silicon Valley, including several at the Korean Software Incubator in San Jose.
- Extensive secondary research on the situation in Korea and how it compares with other countries, based on a framework of issues we developed to study a country's software industry and entrepreneurial environment.
- A preliminary investigation of software education in Korea, in comparison with local schools in Silicon Valley, conducted with our research assistant from Stanford's School of Education, Vaibhavi Vishanji Gala, and a visiting graduate student from Yonsei University, Saerona Hong.
- A study of bankruptcy law in all of the countries mentioned above, conducted with our research assistant Aswan Augustus Morgan.
- An in-depth study of venture capital in all of the countries, conducted with our research assistant Kin Sing Leung.
- Our on-going study of the changing shape of the software industry and of trends in the financing and management of software startups.

2.1 Misconceptions About The Software Industry

At the Stanford Computer Industry Project, we have been studying software as an industry since 1993. We've looked at software activity as a creator of economic value in all industries around the world. In fact, we started in 1993 with Professor Edward Feigenbaum comparing Japan's software industry to the United States'. Our conclusion was that, contrary to popular opinion at the time, Japan was not positioned to become a

major competitor in software. The reasons were as much about attitudes in Japan about software and about entrepreneurism as they were about economics or business.[3]

During the ensuing five-year study of software industries in many countries, we have become convinced that out-of-date views about software remain major stumbling blocks to effective policies and successful change. Countering misconceptions about software, software people, and the software industry include the following points:

- Software has real value, even though it is not tangible.
- Packaged software is not the biggest part of the software industry. Custom software systems for businesses and government are a much larger economic activity, and the software that is embedded in everything from automobiles to toys is much larger still, and growing faster. Even within packaged software, shrink-wrapped “titles” like games and desktop software account for a small fraction of total sales, compared to the “enterprise” software products, like databases, e-commerce tools and ERP systems, which are sold to companies and government agencies.
- Programming is no longer a clerical activity, as it was often viewed in the 60’s and 70’s. Some software systems rank among the most complex engineering tasks ever undertaken. Software development, the tools, systems environments, and new functionality requirements, all get increasingly complex every year.
- Big companies, like Microsoft and IBM, are mostly not responsible for the enormous rate of innovation in the software world – almost all innovations come from the thousands of small startup companies. Entrepreneurism is critical to succeed in the rapidly changing software industry.
- The Indian software industry, widely recognized as a model for economic development in this area, was enabled by a surplus of many tens of thousands of well-trained engineers selected from the top 5% of high-school graduates. Also, the Indian software industry is still, after 10 years of phenomenal growth, strictly limited to software services export, not products. It accounts for less that 1% of the worldwide software industry.
- Highly talented software people are not created by the universities, they are born that way. For the rest of us, we can learn to play the instrument, but we’ll never make music! There is a serious, worldwide shortage of these talented people and the work that only they can do. Software professionals deserve a very high level of prestige in society. In Silicon Valley, they have achieved that status.

For more on misconceptions and for a general overview of the trends and issues in the global software industry, please refer to the authors’ website.[4] We discuss these perceptions of the software industry here because widely held, preconceived notions are the most difficult things to change. We urge policy makers to use this opportunity to take

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[3] Feigenbaum, Edward A. "Japanese Software Industry: Where's the Walkman?" In *The Future of Software*, ed. D. Leebaert. Cambridge: The MIT Press, 1995.

[4] All of our SCIP papers are available at http://www.aldo.com/papers/

a fresh look at the software industry. An up-to-date understanding will lead to policies that will position Korea well in this rapidly changing industry.

2.2 Software As An Engine Of Economic Growth

When an automobile manufacturer wants to institute supply-chain management or when a bank wants to offer home banking on the Internet, they must make major investments in new software systems. These systems are built, installed and maintained by the very same teams of software professionals who might otherwise be writing a new Sega game, starting an Internet company, or creating embedded functionality in a new cellular telephone.

Publishing: Products for Businesses and Consumers	Software publishers are the most familiar type of software company, including Microsoft, Oracle, SAP, etc. This category includes publishers of business software, as well as games and educational "titles." This was a $135B business, worldwide, in 1998.
Services to Corporations and Governments	Software services firms offer consulting, custom systems development, systems integration, and other services to big companies and government agencies. The results are cost savings (e.g., manufacturing automation or supply chain management) or other types of competitive advantage (like product quality assurance or customer loyalty via a frequent flyer program). Services totaled $280B in 1998.
Information Systems in Traditional Firms	Most of the software developed for businesses and governments worldwide is not outsourced to services firms, but is designed, developed and maintained by their own employees.
Software-Enabled Internet Businesses	When a company like Yahoo or E-Bay starts, the first task is to build a new piece of software. Software-enabled businesses are a tremendous growth area, as the Internet becomes a center of commerce.
Embedded Systems	Software is an increasingly important part of products of all sorts: automobiles, cars, airplanes, phones, electronics, toys, etc.
Technology Licensing	Many software companies never sell their software or their services. Instead, they market the technology they've developed to larger software companies or to major firms in the computer, telecommunications, media or other industries. Sometimes this transaction takes the form of an acquisition of the small firm. This form of software company is dominant in the Israeli software industry, for example, and is currently experiencing a boom in Silicon Valley.
Services to Software Publishers	Software publishers require some services that are increasingly supplied by software teams in supplier firms. These services include localization of their products for international markets, software testing, and customer support call centers.

Figure 3. Software teams create economic value in a variety of ways. Viewing them all as part of the software industry helps policy makers understand priorities and tradeoffs.

2.3 National Development Strategies

Among all the nations of the world, only the US has been able to developed business forms in all of the areas mentioned above. Its large market and large base of technical and business talent is certainly part of its successful coverage of the breadth of possibilities. Other countries have focused, by plan or by chance, on just one of these software business forms:

- India, of course, has built a $3B export industry primarily selling services and talent-for-hire to businesses of all sorts in the US, Japan and Europe.

- Ireland has focused on selling services like localization and tech support call centers to software publishing firms. They not only get foreign direct investment and foreign exchange, but they have the strategic intention of having individual workers learn the workings of the software industry well enough to start their own companies.
- Israel has built its software industry on technology licensing, partnering primarily with US software publishers who then sell the products globally.
- Japan, while it has a large domestic software industry, is successful internationally only in the computer games segment, on the platforms of Nintendo, Sega and Sony. This combined platform/title strategy reflects the thinking in Japan that the real money is in the hardware embodiment of software technology, which they call the "New Hard."

Except for Japan, these countries have small domestic information technology (IT) markets coupled with high piracy rates. As a result, they have very small domestic software markets and have turned primarily to international strategies. This focus puts them at a disadvantage, of course, because they are competing on foreign turf with the local players. Yet, each country found a very different business form on which to concentrate its efforts, based on its own respective business strengths. They offer an obvious but important lesson to Korea – that although Korea must explore the potential in all of these business forms, its initial participation in the global software industry might well be focused on only a subset of the possibilities.

We should also point out a strategy that none of the other countries has taken, namely, competing globally in mature software market segments. While this may seem appealing, especially in the domestic market given the possibility of tariff protection and import substitution, the fundamental economics of software publishing works against this strategy. There are no manufacturing costs in software. Therefore, given the initial costs in product development, profitability is based solely on market share. Established players with a large market share can always undercut the price of competitors who try a low price strategy in new markets. And users' resistance to change creates a large barrier in established markets.

This is not to say that software companies focused on the domestic market are not important. They are in fact critical in the synergistic interplay between companies of various sorts, as mentioned above. But they are not likely to become global players and venture capitalists are not likely to be interested in their limited growth potential. The role of institutional venture capital, as compared to other sources of funding, is to share the risk with entrepreneurs whose ideas have a chance to take a significant share of billion-dollar markets. Most of these ideas fail to materialize, but the VC's portfolio can be very profitable if just one succeeds. Less risky ventures get their money from banks.

The good news is that almost all markets for software of all types are growing 10-15% per year, and much faster than supply in most areas. Furthermore, new markets for software are periodically created by new platforms that arise because of leaps forward in another technology, like semiconductors or networking. Sometimes these are really big markets, like PC software, Internet software, or ".com" companies. The only strategy that makes

sense for building a major software export industry in Korea is to look for new opportunities in emerging markets.

2.4 Some Ideas for Consideration

The list of opportunities is as long as the human imagination. It is very important to keep in mind that every opportunity is very risky – lots of things can go wrong with technology, market evolution, competitors, etc. And each emerging market can be approached in a dozen very different ways. We feel strongly that it is the entrepreneurs and their financial backers who are best able to identify the opportunities. While focused government efforts to create high-tech industrial sectors have been successful in some countries in the past, like semiconductors in Korea, these approaches are not likely to be successful in software today. There are too many possibilities and things change too fast. More importantly, since software is an personal expression of ideas, it is very important that startups are free to work in areas of the industry that have personal meaning to the team members.

Here are some examples of currently hot niches, and a few that are possibilities in the near future:

- Web portal features and web-based services
- Toys with "behavior": Tickle-Me-Elmo, Tamagotchi, Furby, …
- E-commerce products and services, e.g., application service providers
- Portable, wearable and home computing; wireless internet
- Information appliances, applications for less-than-$100, non-Windows PCs
- Animation, entertainment and education
- Government services over the Internet
- Rapidly growing markets in China, Japan, and East Asia generally

Some additional general principles and ideas:

- As a general rule, since marketing abroad is such a challenge for software startups, software title publishing, e.g., games or educational titles, is a slightly easier marketing challenge than enterprise software, where the sales cycle is very long and cooperation with other technology vendors and with beta customers is critical. (See Section 7.2.)
- Technology licensing, since it involves only one or at most a few sales, is an even more attractive way to get started as far as the marketing effort is concerned. Here, the biggest challenge is identifying cutting-edge technology for which there will be a need and getting it ready for adoption by licensees before they can build it themselves or buy it elsewhere.
- Software products and services in industries where Korea already has an international presence should be given high priority. A new e-commerce idea for auto companies or a knowledge management solution for semiconductor manufacturers can be developed to the point of credibility with partners in Korea, who might even be of help in marketing it to their competitors in other countries.
- Software services, either sending people abroad or contracting off-shore work to be done in Korea, is a segment that should not be overlooked. Although it does not have

the revenue per employee of publishing or technology licensing, and might not attract venture capital as a result, it is an excellent environment for developing software technologies and future entrepreneurs.

- Software-enabled Internet services businesses, already a growing segment in Korea, have tremendous global potential. Internet-based services to large companies, including application service providers, seems a natural opportunity. Internet-based services delivered over wireless computing devices is another area with a huge potential that is just emerging.
- Focused segment incubators: putting together several startups with complementary products and services aimed at the same geographic, industry, or technology niche could be mutually supportive.
- As researchers, we find government data collection in every country to be less than optimal for our purposes. In the software industry, however, the rapid pace of change and the constant emergence of new categories and new markets aggravate the issue. Since so many regulations and government programs will be at least somewhat experimental, it is important that various agencies collect the data necessary to monitor and adjust them and that the data be consistent across agencies.

  Some of this data is already being collected: total software industry sales, exports, etcetera. Additional data might be important indicators to monitor in the future. For example:

  - Number of software graduates at various levels of proficiency
  - Locus of employment of software professionals, especially recent graduates
  - Software spending of major corporations, including domestic spending
  - Number of new software startups
  - Total investment from all sources in software startups
  - Number of jobs created by new software businesses
  - Total domestic and foreign sales of software and software companies

Whatever the market opportunity, whatever the form of the business, there is only one industrial input for a software industry, one natural resource – the skills and talents of the software professionals and software-savvy business people who create the programs and services.

3 Developing and Managing the Human Resource

There are several different types of skills and talents essential to software development. Each of the different forms of software activity (publishers, services firms, .com companies, etc.) required these skills in different degrees. We believe that software success comes from software teams with the full range of skills shown in Figure 4 in appropriate proportions. The weakest link can spoil the best efforts of the others. Human resource development must address people with each of the needed skills, from their education throughout their careers.

Team Member	**Responsible for Understanding and Mastery of …**
Marketing, Product Manager, Systems Analyst	Users' needs, technological possibilities, alternative solutions, requirements specification, constraints, feature and bug list prioritization, etc.
Architect	Alternative technologies, tools and components, installed systems, systems design constraints, design alternatives, testability, maintainability
UI Designer	User interface, user environment
Programmer	Development tools and environment, development process, diagnosis/debugging, code documentation, structure of existing code and interfacing systems
QA Technician	Functional requirements, performance requirements, testing design, testing tools, structure of the system
Documentation writer, Trainer, Support Tech.	Explanation of software operation and features, understanding problems and potential problems
Project Manager	Hiring engineers with the right skills, planning and scheduling, monitoring progress, coordination with other business functions, solving problems as they come up

Figure 4. Software development requires a number of different skills.

If software startups are a key to software industry success in Korea, as they have been in other countries, then there is another set of human resource requirements that must be addressed. The people who make startup software companies successful include the entrepreneur(s), innovators, and start-up savvy managers and business people. The habitat for supporting software startups requires a wide range of professionals, as well as regulations and attitudes that support knowledge sharing and workforce mobility, for example. We will discuss the motivation of the startup team in Section 4, and the personnel issues related to the habitat in Section 5. In this section, we'll discuss issues relevant to developing the software talent itself. You can have all the entrepreneurs,

hotshot marketing people, and software-savvy venture capitalists, but without the technical talent, you have nothing.

We should spend a moment talking about the innovator. Certainly coming up with at new idea that might have significant market potential, and realizing its value, is a key element of all parts of the software industry. Sometimes the innovator is an architect-level engineer who sees the need for a new tool or sees a way to do a common task more efficiently or elegantly. Sometimes the innovator is a user of technology who sees a way to meet a familiar need by combining some pieces of technology already available. The innovator may be the entrepreneur, or may team with an entrepreneur who has a better sense of how to create a moneymaking business out of the inventor's idea. While the innovator needs to understand at least the use of technology, a deep understanding of technology or business may not be necessary if he or she can form the right team. Silicon Valley is all about making this team formation and new business creation easier.

3.1 Some Initial Comments On Developing The Software Workforce

Many nations around the world have an educated workforce. And good software professionals can be found everywhere. The workforce issue isn't simply about headcount or average level of educational attainment. Other issues relevant to developing the software workforce include identifying talent, modern software curriculum at all grade levels, cutting-edge faculty and state-of-the-art technology in the schools, prestige of software careers, workforce mobility, and lifetime retraining. Some general comments first:

1. It takes time to develop a competent software workforce. Singapore has been training its IT workforce for close to 20 years. With a long-term strategy in hand, they instituted a series of initiatives to train a workforce that could help attract the high-tech manufacturing business and support the important financial services sector. Similarly, it has been close to two decades since Ireland created a suite of programs and agencies to lure foreign high-tech investment as its vehicle for educating a more professional software workforce. Now both countries have a competent and fully deployed mid-level workforce, with salaries rising and good people in demand.

2. Special circumstances can change the pace or direction of development. India, for example, started training large numbers of engineers in the mid-1960's for defense purposes. By the 1980's the country had a large population of underemployed engineers that could not be utilized by the domestic economy. When high-tech trade barriers were relaxed, India was well positioned to quickly deploy this entire pre-trained group into the software services outsourcing industry.

   In Israel, Russian-trained scientists who have been allowed to leave the USSR over the past 25 years added substantially to the indigenous engineering community, giving Israel one of the highest per capita engineering populations. That special circumstance, coupled with Israel's well-funded military research activities and strong ties to the US, allowed a strong technology sales industry to develop in the last two decades.

Another factor that has influenced the positive development of the software industries of India, Israel and Ireland has been English language fluency. Moreover, all of these countries plus Taiwan have benefited from the large number of students that were sent to study abroad. Whether they came home after graduation with new skills and perspectives, or stayed abroad and helped build a strong expatriate network, these graduates contributed to the pace of their country's development.

3. Creativity is not a cultural trait. Some Asian business people believe that their cultures or educational systems do not encourage creativity and independent thinking, which in turn has a negative impact on the kind of innovative thinking that is central to the development of the software industry. We see, on the contrary, an enormous amount of resolve and energy, as well as a certain entrepreneurial spirit in Korea, Japan, and elsewhere, towards the development of whole new high-tech companies and industries that are competitive global players in areas ranging from electronic games to semiconductors to consumer electronics. Many Silicon Valley startups were formed by people who were educated in the same schools in Asia before settling in the Valley – they display tremendous creativity and initiative in an environment where such behavior is encouraged.

   Note the lesson of the Russian high-tech workers, who have not been able to create significant entrepreneurial activity in Russia, nor launch any kind of software industry there. Yet this same population has proved to be very entrepreneurial when transported to Israel or to the US. In the US, Russian entrepreneurs are said to start more businesses than any other ethnic group. (We have not found data to support this assertion yet.) It would appear that it is the environment, not necessarily cultural background or style of the education system, that allows entrepreneurs to flourish or not. It is a long process to change a business or educational environment, but it is not an absolute deterrent.

3.2 Software Education in Korea

Of course, the key issue is education. Educating an adequate pool of effective software engineers is not as easy as it might seem. Even here in Silicon Valley, most professionals will concur that on-the-job experience is more important than their formal software education. (And that native intelligence and talent is more important than either!) Even at the best schools, the amount of actual experience in building substantial software systems and working on realistic software projects is small. And in this field, because industry practice is often so far ahead of academic research, only at the best schools are teachers and students at the "cutting edge" in software. With the allure of the software industry at an all-time high, many top faculty and would-be young faculty don't go into teaching at all, deciding instead to seek their fortunes in industry, at the cutting edge of the technology they love.

We have undertaken an informal study of the software-related education at four of Korea's major universities, the Korea Advanced Institute for Science and Technology (KAIST), Seoul National University (SNU), Pohang Institute of Science and Technology (Postech), and Yonsei University. These schools were picked because we had access to

faculty members and because we felt they were representative of the situation. SNU and KAIST are public schools; Postech and Yonsei are private. SNU is much bigger than all of the other schools – five times bigger than KAIST, for example. We interviewed faculty at all of these schools and collected some data from published sources.

We looked at the four biggest schools in Silicon Valley for comparison: Stanford University, the University of California at Berkeley, Santa Clara University, and San Jose State University. Stanford and Santa Clara are private schools; Berkeley and San Jose are California state institutions. Our results are not meant to be definitive, only indicative of the issues faced in educating the software workforce.

Figure 5 shows the various degrees awarded by the eight universities that have some concentration in software, both undergraduate and graduate. While the Korean schools all offer degrees at all levels, BS, MS and PhD, they do not offer the range of engineering and computer science concentrations offered by the Silicon Valley schools. Also note that the Silicon Valley universities (except Berkeley) differentiate between computer science and electrical or computer engineering degrees, while these Korean universities do not. The Korean universities we looked at typically offer either the computer science degree or the computer engineering degree at both undergraduate and graduate levels. At the graduate level, the M.S.-Ph.D. option is typically for students oriented toward research and academia; the engineering degree programs are professionally oriented and centered around design, development, and management.

Stanford	**Berkeley**	**San Jose State**	**Santa Clara**	**KAIST**	**SNU**	**Postech**	**Yonsei**
BS, CSE BS, CS BS, EE, CS major BS, Symbolic Sys.	BS, EECS BA, CS	BS, CE BS, CS BS, IT	BS, CS BS, CE	BS, CS	BS, CE	BS, CSE	BS, CS
MS, CS PhD, CS MS, EE in SW Systems MS, Eng. & PhD in Scientific Comp.	MS, CS PhD, CS M.Eng. D.Eng.	MS, CS MS, CE	MS, SE MS, CE Eng, CE PhD, CE	MS, CS PhD, CS	MS, CE PhD, CE	MS, CSE PhD, CSE	MS, CS PhD, CS

Figure 5. Undergraduate & graduate degrees awarded for software professionals.

In 1997, Berkeley undertook a substantial revision of its lower division curriculum; the motivation was to be a department of electrical engineering *and* computer sciences, as opposed to being a department of electrical engineering *or* computer sciences. They mention, “Students studying computer science at Berkeley should receive a grounding in larger systems issues that go beyond software. Likewise, students studying electrical engineering should receive grounding in the most pervasive and important use of electronics – the execution of software… We feel strongly that the proposed curriculum is

an opportunity to improve our undergraduates' education, by capitalizing on our strengths as an EECS Department."[5]

A similar move has been proposed in Korea as part of the Brain Korea 21 initiative. This change is motivated in part by the quota allocation of students to departments, and the increased demand by students who want to study software in Computer Science. Note, however, as shown in Figure 6, that there are 71 CS faculty in the EECS department at Berkeley, and only 51 EE faculty. In Korea, where the CS faculty is very small compared to the EE faculty, and software faculty is only a fraction of the total CS faculty, combining departments may be very problematic for software education. In fact, unless something is done, the quality of software education is likely to deteriorate as the number of students who want to learn programming goes up.

School	Dept.	Emeriti	Full	Assoc.	Asst.	Lecturer	Other	Total
Stanford	CS	6	18	11	10	6	34	86
Berkeley	EE+CS	2 + 21	32 + 37	6 + 9	9 + 2	2 + 0	0 + 2	51 + 71
San Jose State	CIS		5	4	4		37	50
	Math & CS		43	5	2	24	1	75
Santa Clara	CE		2	5	2		48	57
	Math & CS	2	3	7	3	7		22
KAIST	CS		17	5	7			29
SNU	CE	1	6	5	3	1		16
Postech	CSE		6	7	3		1	17
Yonsei	CS		5	5				10

Figure 6. Faculty in software-related departments.

Another fact apparent from Figure 6, is that Silicon Valley universities have a large number of 'other' faculty, compared to their Korean counterparts. This title includes consulting and courtesy professors and other adjunct or part-time faculty, many of whom are from industry. The use of adjunct, visiting and consulting faculty not only increases the number of faculty available to the students, but also helps bring a more practical orientation to the lectures and brings cutting-edge knowledge from industry to the students and other faculty.

The CS faculty we interviewed in Korea expressed concern that they were unable to meet the demands placed on them. In addition to ever-rising teaching demands, as students see software as an important career skill, the faculty have research, publication, curriculum development and industry relations goals that are very difficult to meet. Publication requirements for Korean faculty in general are particularly onerous on software researchers, because the international academic literature in this field is very small,

[5] Source: http://www.eecs.berkeley.edu:80/Faculty/Curricprop/

compared to areas of Electrical Engineering, for instance, and because interesting practical problems in industry are often far removed from academic research areas. The faculty we talked to said they had no time for developing new courses, consulting with industry, or even teaching additional "project" courses, which demand much more time that lecture-oriented theory courses.

Figure 7 shows the numbers of students enrolled in related degree programs at the eight schools, and the number of graduates last year. It is clear that in proportion to their numbers, the CS faculty at the Korean schools are producing a lot of graduates. The question, of course, is how well the graduates are trained for their roles in the software industry?

University	**Dept.**	**Student Enrollment**			**Number of degrees awarded (1997-1998)**	
		Undergraduate	**Graduate**	**Total**	**Degree**	**#**
Stanford University	CS	175	394	569	BS, CS MS, CS PhD, CS	79 147 22
UC Berkeley	EECS	1,213	471	1,684	BS, CS BA, CS MS, CS PhD, CS	128 144 28 24
San Jose State University	CIS	873 (Fall 1997-CE majors only)	116 (Fall '97-CE majors only)	989	BS, CE MS, CE	58 31
	Math & CS	1,035 (Fall 1997-CS majors only)	97 (Fall 1997-CS only)	1,132	BS, CS MS, CS	109 9
Santa Clara University	CE	225	375	600	BS, CE MS, CE	23 173
	Math & CS	100 (CS majors only)	0	100	BS, CS	15
KAIST	CS	171	397	568	BS, CS MS, CS PhD, CS	62 66 30
SNU	CE	406	137	543	BS, CS MS, CE PhD, CE	68 37 12
Postech	CS&E	158	99	250	BS, CS&E MS, CS&E PhD, CS	36 29 5
Yonsei	EE/ME	190	115	305	BS, CS MS, CS PhD, CS	47 27 5

Figure 7. Student enrollment and degrees awarded. We have tried to estimate the number of CS students, but this is especially hard in Korea, since the departments

are combining and the number of actual CS majors is often not known until close to graduation.

Figure 8 shows the required courses in CS and software as a percentage of the total graduation requirements for undergraduates at each of the eight schools. With the caveat that we are comparing only a part of the education establishment in the two groups, we note some possibly significant differences.

First, the Korean CS students are required to take much less basic science and math. This difference may, of course, reflect a much better fundamental education at the secondary school level in Korea. On the other hand, in the US, science and math courses are often used to cull the ranks of engineering students – discouraging less qualified students from pursuing an engineering degree. At least in computer science, this does not appear as likely in Korea.

University	Degree	Math & Science	Computer Science					
			Total	Theory	SW	HW	Project	Electives
Stanford	B.S., CSE	34.3	51.4	7.6	17.2	21.9	8.6	5.7
	B.S., CS	36.3	52.4	11.8	24.5	8.8	2.9	5.9
Berkeley	B.S., EECS	28.3	42.5	0	6.7	9.2	3.3	23.3
San Jose State	B.S., CE	22.1	45.8	0	13.0	23.7	0	9.2
	B.S., CS	25.0	39.8	8.6	9.4	4.7	0	17.2
Santa Clara	B.S., CE	24.7	43.4	6.6	11.1	7.0	7.0	8.1
	B.S., CS	25.1	23.4	10.3	6.3	0	0	6.9
KAIST	B.S., CS	2.3	36.2	4.6	7.7	5.4	2.3	16.2
SNU	B.S., CE	4.6	34.6	6.9	0	4.6	4.6	23.1
Postech	B.S., CS&E	2.1	40.4	2.8	9.9	7.1	5.7	14.9
Yonsei	B.S., CS	15.0	25.7	4.3	0	0	0	21.4

Figure 8. Course requirements in undergraduate Computer Science and software courses as a percentage of total graduation requirements. Computer Science courses include: theory/fundamentals, software, hardware, projects, and CS electives. Assignment of courses to a category was by our best judgment.

Another comment from industry folk in Korea was that students got a good education in theoretical topics, but graduated from Korean schools without even the most basic software skills developed to a useful level, and had to be trained on the job for a substantial time. This observation is borne out by the preliminary data in Figure 8. While there is a significant variation among the Korean schools, the required number of computer science courses, and especially software courses, is quite a bit lower on average.

In Silicon Valley, where most schools offer separate CS and CE degrees, the CS programs require more software courses than hardware courses, and vice versa for the computer

engineering programs. This difference might be something to keep in mind as the curriculum in Korean schools evolves.

3.3 Some Ideas for Consideration

Korea's human resources development strategy will be shaped by its overall strategy for developing its software industry and the priority it places on the various forms of software businesses. A corporate software services strategy would require different types of training than games publishing or an embedded systems emphasis. Here are some thoughts and ideas worth discussing about human resources related issues in general:

1. Korea has just started the process of adjusting the national mindset about software. In the long-term, national attitudes will self-adjust, the way the example of Bill Gates has changed some attitudes about the viability of a career in software in the US. The Korean government, its agencies, and affiliated organizations have been using public relations for several years to reward and encourage software entrepreneurs. This is a good effort that will bear fruit in the long-term. Encouragement of entrepreneurs must be complemented by other public relations efforts to raise awareness of software as valuable intellectual property and to encourage students to consider careers in software-related fields. All educational efforts are useless unless some of Korea's brightest students decide to undertake software careers.

2. Universities should be encouraged and funded to train as many software people as they can accommodate, to aggressively recruit good software professors, and to encourage all types of interactions between academia and the fledgling software industry (consulting, summer internships, joint research projects, training partnerships, university spinouts, and so on). The exchange should go both ways – software practitioners from industry should be encouraged to lecture at the university and to develop practical curricula. Perhaps some forms of industrial activity, like software patents or spinout companies might substitute for traditional faculty publishing requirements in a given year. K-12 education should also evolve to train teachers extensively on how to teach about technology.

3. Professional software schools and trade schools focused on software might be considered. In India, the brilliant graduates of the India Institute of Technology were supplemented by several times as many software engineers who took vocational training from NIIT and similar commercial institutions after graduation from college. This attention to all levels of software professionals is important.

   We think that Korea might leapfrog other countries in software education, and avoid some of the problems inherent in introducing new requirements on existing institutions, by starting professional post-graduate schools for software, modeled after schools of medicine and architecture. Practical skills besides programming, like project management and software quality assurance, could be taught by working professionals.

   Along the same lines of professional education, life-long learning for software professionals is critical. The technology is vast and it changes very quickly. Software

people sometimes move between segments of the industry where very different skills are required. Efforts to motivate individuals and companies to invest in post-graduate software education will pay off. In Silicon Valley this need is partly met via university extension programs.

4. Education in management and entrepreneurship is also critical for the startup-centric economy. While we did not study management education extensively, we do know from our interviews that the management schools in Korea are actively exploring way to teach entrepreneurism, because there is student demand, but again their resources are barely enough to keep up with requirements, and developing innovative management programs takes a great deal of time.

5. Because so much of software technology, process, and business is learned on the job rather than in school, policies that bring Korean students studying abroad home right after graduation might be reconsidered.

6. Our informal study of software education in Korea was just a beginning. We recommend that a more formal, and on-going monitoring of the software education situation be undertaken by one of the research institutes. A national test or certification program might also be a metric of progress in this area.

Of course, even with a well-trained software workforce, software startups will not occur unless individuals feel free to start out on their own, get the right encouragement from family and friends, and find the resources need to get a company started, especially money.

4 Encouraging Entrepreneurism and New Business Creation

Why do we not look to the very large technology companies to develop the software industry in Korea and elsewhere? The reason is that, while startups may not be essential for developing all types of industries, they are extremely important in software. For many reasons, industrial structures that support the activity of small, innovative firms have a great advantage in periods of rapid change in technology and markets.

4.1 Why Startup Companies Are So Important To The Software Industry

There are three areas in which startups have an advantage over larger firms in the software industry:

1. **Risk and Reward.** Change is what creates new business opportunities: new competitors, emerging markets, or technological innovation. And anticipating change involves risking failure. To do business in periods of rapid change, a company cannot wait until it knows the right course of action with certainty. It can take its best shot or, in order to reduce overall risk, it can explore several alternative strategies for a while. While most of these alternative strategies will not succeed, the chances of total failure is reduced by this diverse, multi-strategy approach.

   Most large organizations are not oriented toward managing these kinds of risky technology projects internally. Nor are they adept at pursuing multiple risky alternatives, knowing that most will fail. What happens to the managers of the failed alternatives, for instance? For this reason, larger companies need to turn to more entrepreneurial software firms who are prepared to take higher risk in return for higher rewards than is possible within the larger firm.

   We will return to the subject of rewards in Section 4.2, but what does an innovative engineer in a large company expect as a reward? He or she is a salaried employee, just like all the other employees. An innovator who comes up with a billion dollar idea is typically rewarded with a small bonus, and maybe a plaque. A Silicon Valley innovator, on the other hand, expects a piece of the action. Since innovation is the key to the knowledge economy, finding a new way to reward innovators is as important innovation itself.

2. **Speed and Flexibility.** Speed is important in software because market opportunities appear and disappear rapidly, and the first entry has a tremendous advantage (See Section 7.1). It is hard to innovate this fast in traditional firms. Existing products and relationships, bureaucratic decision-making processes, complicated labor relations, and conservative approaches to business problems all conspire to slow down change.

   Another area where small firms excel is in the flexibility of their business and technical strategies. It is more common than not that a Silicon Valley startup, after being funded based on a detailed business plan describing technical direction, market assumptions and revenue model, will change all three, some more than once, during its first year in

business. It is hard to imagine a division of a big corporation with that kind of flexibility.

3. **R&D and "Co-invention."** Most product ideas in traditional industries (autos, consumer electronics, etc.) originate in the corporate lab, emerge through product development, and then are released to the customer. In contrast, software industry customers are intimately involved in the definition and development of new products – we call this process "co-invention." There are too many technical alternatives and complexities in the systems environment, and too much change over time, for any vendor to create their products entirely internally. In other words, the very nature of R&D and new product development in software startup firms is different than in traditional firms.

Entrepreneurial firms are a key source of new technology and business innovation. Their willingness to experiment and take risks, their openness to co-invention with customers and alliance partners, and their lack of inhibitory corporate structures or installed base, all combine to make software startups important contributors of innovation in the high-tech industry. One final point: even big opportunities start out very small, often too small to be taken seriously by established multi-billion dollar companies. Who would have invested in Bill Gates when he was a twenty-year-old Harvard dropout battling IBM?

There are three ingredients required for high-tech startups to get started: entrepreneurs, innovative ideas, and seed financing. We'll deal with each in turn. In Section 5, we'll discuss the requirements for nurturing startups once they are underway.

4.2 Encouraging High-Tech Entrepreneurs

Special laws targeted at new high-tech companies tend to convey the message that traditional business practices and attitudes are satisfactory for all other industries except high-tech. Entrepreneurs and their high-risk activities often do not receive the highest level of respect in many parts of the traditional business world. In the knowledge economy, however, firms in an increasing number of traditional industries, such as banking, securities, newspapers, retail entertainment, and autos, are being forced to innovate like high-tech startups do, in order to compete with each other and with new competitors. (Ask any newspaper executive in the US about the company's competition, and he or she will mention Microsoft.) In the knowledge economy, constant innovation is required. Therefore, entrepreneurial, risk-taking attitudes are needed in all industries, not just high-tech.

The stated rationale for the special high-tech laws in Japan, Korea and India, for example, is that other types of new businesses, such as the traditional corner grocery store, are not useful contributors to the new economy that the governments wish to develop. Thus, regulations define very specifically which startup companies are included and which are excluded from receiving any incentives or benefits. By doing so, these laws can potentially exclude, or slow the development of, startups in two important groups:

1. High-tech support businesses, which may not be themselves high-tech but are vital to the success of the high-tech industries they serve, and

2. True high-tech companies that don't, for one reason or another, meet the regulatory specifications.

The actual goal of these special high-tech laws is to encourage true risk-taking entrepreneurs and exclude the class of business people that merely want to be self-employed. This latter group has very different motivations and risk profiles. Those who want to be self-employed for the purpose of self-determination and control may also want a low-risk business endeavor, and are willing to accept a significantly lower return for their work as a result. In contrast, the entrepreneurs who are key to developing the knowledge economy, regardless of their industry, aim for new, untried business areas, which are by definition high-risk, high-return ventures. Silicon Valley-type venture capitalists support only these high-risk, high-return activities; otherwise they would put their monies into more traditional investments. Thus, laws which encourage high-risk business creation broadly, rather than just high-tech, exclude automatically the majority of startups that do not contribute substantially to creating a knowledge economy and yet include *all* high-risk efforts to explore promising business opportunities in every industry.

Laws that encourage broader entrepreneurial efforts may also have a beneficial long-term impact on society's attitudes towards entrepreneurs. Social attitudes factor into every entrepreneur's decisions – even if it is just to ask himself, "what will my parents think if I start my own company?" Traditional conservative attitudes about risk-taking and new business startups are also reflected in every business regulation, from incorporation to bankruptcy, and in a wide variety of other laws and policies. It is harder to change social attitudes about entrepreneurism as an acceptable business activity if government encourages entrepreneurism in only certain business areas. Instead, by focusing more broadly on high-risk business creation generally, all institutions, academia, industry and government, eventually come into alignment to both encourage this type of entrepreneurial activity and raise society's esteem for those involved.

4.3 Innovation

Besides well-motivated entrepreneurs, the two biggest needs of software startups are innovative ideas and money. In the US, software innovators come from one of three places: engineers in the software industry itself; users of technology, mostly in big firms, who come up with a new idea; or researchers from university labs. For the time being, the first two sources of software innovators are limited in Korea, since the software industry is very small and since strategic uses of software in big Korean firms are not yet widespread (see Section 6). This leaves the university labs, which in Korea probably also includes government research institutions like ETRI.

In the US, large long-term government grants from various agencies are distributed by peer-review decisions. There is no national research plan and each agency focuses its research program(s) on issues it sees as relevant and promising to its own mission. By contrast, Japanese & European top-down national research programs often result in too

much commitment to technologies that do not prove to be the winning approach. In general, governments are too slow moving to direct the course of research in software. Since in all countries the government must be the primary funders of research, there is always a tension about who determines the direction of the research. The trick, again, is to allow diversity in approach, driven by the researchers themselves. Linking laboratory innovation with market needs, however, requires additional input, but not from the government.

In Silicon Valley, traditional university research is usually the end of government involvement, but only just the beginning of the innovation process. A great deal of creativity is involved after fundamental principles are discovered and breakthrough technologies are invented. Porous relationships between the university and high-tech companies, and between high-tech companies and their customers and competitors have been critical in ensuring the rapid pace of innovation.

For example, high-tech firms, large and small, hire university researchers as consultants; professors and students sometimes start their own companies; and industrial technologists often come back to the university as guest lecturers or visiting faculty. (See Section 3.2.) This constant exchange not only results in better transfer of technology from the university labs to industry, but also in better software engineering graduates who are familiar with cutting-edge ideas. In software, the leading edge in some segments has been in industry, not in the university, but the porous relationships work the same way, regardless of where the technology first originated.

A final point: innovation in software is not always about technology. It is often about new products or new business models that are enabled by new technologies, like computers and networks. While the innovator/entrepreneur must be familiar with the capabilities and limitations of the technology, he or she may not be a technologist. In India the innovation has been much more about how to put buyers and sellers of software services together, how to overcome barriers of geography and time zones, and how to coordinate development project members. Companies like E-Bay and Amazon are truly software companies because they require a lot of innovative software, which is in turn what differentiates them from their brick-and-mortar competitors. Their innovation, however, goes well beyond their software.

4.4 Capital for New Ventures

In Silicon Valley these days, capital for new startups comes from different places at different stages of the startup company's development, as illustrated in Figure 9. "Seed money," used to flesh out the idea, recruit the management and technical team, and come up with a business plan, often comes from family and friends or from private, "angel" investors. The latter are often successful entrepreneurs themselves. There are a few venture funds and corporate "seed" funds that also work with brand new startups, but that's no longer typical.

Substantial financing for product development, marketing and first-product launch come from venture capital partnerships or corporate venture funds. Subsequent funding for a

software startup can come from sales, from additional rounds of venture capital financing, from the public capital markets (an IPO), or from joint venture partnerships with larger firms in all industries. In recent years, larger technology companies have been acquiring small software startups in large numbers, often before they reach this growth funding stage (see Section 4.6).

The decision at each stage to continue financing, or to let the company fail, is an important function of the investment community. Most startups must fail, and the earlier they fail, the more efficiently resources, both human and capital, can be routed to the firms who will make it. Silicon Valley venture capitalists feel that these go/no-go decisions are their most important contribution to the success of the habitat. They require intimate knowledge of the company's progress, a constant monitoring of technological and market developments, and an understanding between entrepreneur and financier about the nature of the game. Many general partners in VC firms are, after all, former high-tech executives or even entrepreneurs. In this sense, the shape of the evolving industry is as much based on the vision of the venture capitalists as it is on the vision of the entrepreneurs and technical gurus.

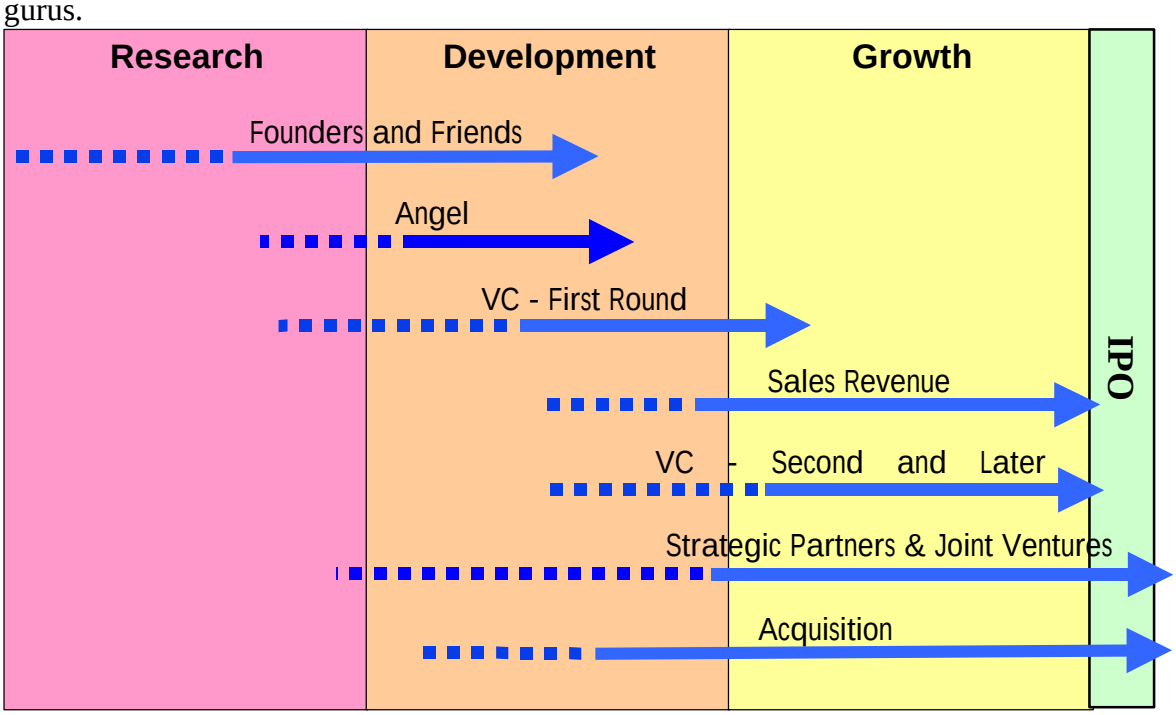

Figure 9. The early stages of development of a company and the available sources of capital. This figure is meant as an illustration only – the starting and ending points of all arrows are debatable.

One key question about the financing of software startups is why they need millions of dollars of capital. After all, as some might point out, product development involves at most a couple dozen person-years of programming and can't possibly cost that much. It is the need for speed that drives up the costs. Buying component technology rather than building it, maintaining close contact with the market including beta programs, accelerating sales to capture market share, and reaching a global market to get maximum return on product development costs, are all very expensive. (As we discuss in Section

7.2, software is a market-share driven business – the firm with the biggest market share has the lowest unit costs and the most leverage.) It is market share, not product development, which costs millions of dollars to achieve.

The speed of the software industry creates a constraint on the sources of capital. Whatever organizational structures evolve in Korea to supply the capital required at each stage of a software startup, they must not slow down the startup's activity. Bank bureaucracies or government approvals could hamper progress by defocusing the efforts of the startup's overburdened management or by slowing down company activities. This need for speed is unique for high-tech startups and is not well understood by traditional venture capitalists and bankers.

Our question in this Section of the report is focused on how to encourage the establishment of new software startups, so only seed financing is at issue. However, since the financial institutions that support the various stages of a startup's growth must evolve together, we will deal with the entire life-cycle's financing here, including later-stage financing which would more properly be a function of the supportive habitat discussed in Section 5.

4.4.1 The Impact of Debt Financing on Venture Capital Firms

The US venture capital industry is built around the principal of risk sharing. This approach stands in sharp contrast to just about any country's banking industry, and most of the world's venture capital industries too, where risk minimization and preservation of capital is paramount. Risk sharing implies, among other things, that both fund investors and entrepreneurs act under a pure profit motive. In many business contexts, other motivations take the forefront and make a US-style venture capital industry very difficult to achieve.

In both Japan and Korea, for example, approximately ¾of venture firms are affiliated with banks, securities firms, or insurance companies, or have some type of government involvement. The majority of these organizations have additional goals other than ROI, such as finding complementary technologies or products, portfolio diversification or public policy goals such as the stimulation of a particular business sector.

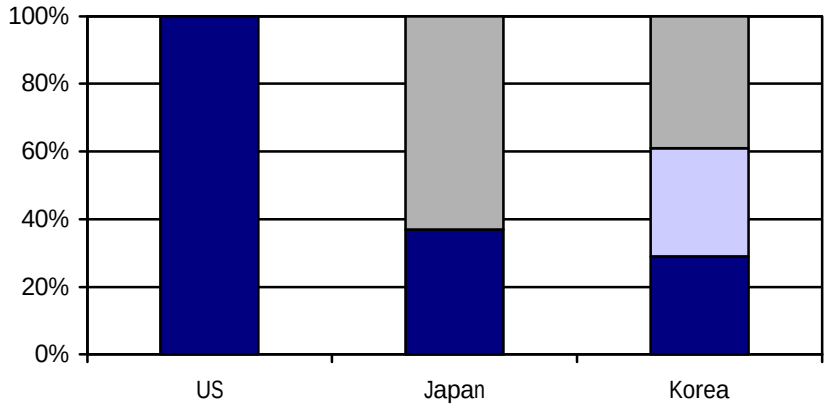

Figure 10. Sources of venture capital funds in the US, Japan and Korea are funded by partner investments (darkest shading), by paid-in capital, i.e., profits from previous

investments (lightest shading), or by debt. Note: Japanese figure (medium shading) is debt plus paid in capital. Source: Asia Venture Capital Journal.

Even in venture capital firms that identify profit as their primary goal, the structure of their firms and investment practices influenced by their parent companies inhibit their investment choices. For example, these traditional parent companies provide a significant portion of the venture capital firms' funds in the form of debt. While this practice is slowly declining, its impact is still very much in evidence (see Figure 10). Venture capital firms whose funds are loans must, in order to service the loans, offer loans or other debt instruments to startup firms (as shown in Figure 11). These loans to the startups also require debt service. The impact on both venture capital firms and their portfolio companies is significant.

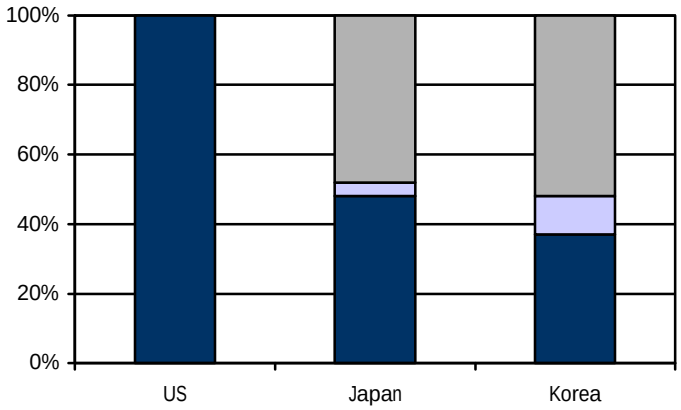

Figure 11. Investments by VC firms in the US, Japan and Korea are either equity investments (darkest shading) or debt financing, including loans (medium shading) and convertible bonds (lightest shading.) Source: Asia Venture Capital Journal.

Venture capital firms that loan money to startups (debt financing) have traditionally required collateral of both company assets and personal assets. Unlike manufacturing or retailing, a software startup company has few tangible assets. Even a patent may have limited value as an asset. Up until now, the relative lack of security in software companies has discouraged investment in software in both Japan and Korea, even by those venture capital firms which have a high-tech focus.[6]

The need to repay the debt to their parent company might lead venture capital firms to choose lower risk investments. Not only is a software startup a very risky enterprise to begin with, but it often also requires technical or market familiarity that is beyond the experience of the traditional venture capitalist, so it appears even riskier. If that venture capitalist is also a salaried employee who will spend only a few years in the venture firm

[6] Recently, Korea has instituted a new scheme to help companies value their software patents in order to use them as collateral or as part of a company's valuation. A new startup in the seed financing stage is not likely to even have a patent in any case.

before going back to the parent organization, his incentive system is overwhelmingly skewed towards risk minimization. Thus, of all the high-tech startups, software companies have enjoyed in the past the least interest from the venture capital community (even in Silicon Valley), until fairly recently (see Figure 12).

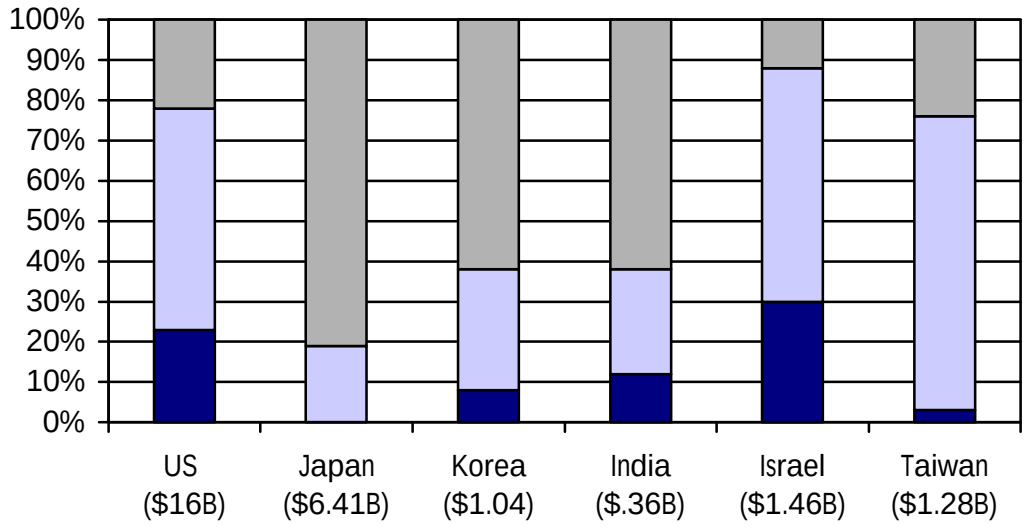

Figure 12. The percentage of venture capital funds invested in software in 1997 (darkest shading), other high-tech (lightest shading), and non-high-tech companies. The total funds invested are shown under the country names. (No data available for Japanese venture capital investment in software, and the amount of Korean venture capital to software companies is an estimate.) Source: Venture One and Asia Venture Capital Journal.

Another way that venture capitalists have reduced risk exposure in high-tech investment is to invest in companies at a later stage in their development, when their long-term success is less in question. Japanese venture capitalists, in particular, have traditionally taken this route of investing in mezzanine or later stages (see Figure 13). Unfortunately, the pace of activity in the software industry is so rapid and the benefits of reaching a global market quickly are so great, that software startups require significant funding early in their lifecycle, before their product or business strategy is proven. Once again, the traditional conservative sources of capital and loan-based funding model of the traditional venture capital community are at odds with the requirements of the vitally important software segment of high-tech.

Financing Stage	***US***	***Korea***	***India***	***Israel***	***Japan***	***Taiwan***	***Ireland***
Seed	5	10	9	10	2	8	1
Startup/Early Stage	20	20	46	35	11	16	7
Expansion	56	46	38	30	51	50	35
Mezzanine/Later Stage	See Other	15	5	7	35	24	50
Buyout/Buy in	10	3	0	4		1	
Turnaround	See Other	6	0	9	1	1	8
Other	9		1	5			
TOTAL	100	100	100	100	100	100	100

Figure 13. Percent of institutional venture capital fund disbursements by financing stage in 1997. (US numbers are for 1998.) Data from Asia Venture Capital Journal and Venture Economics.

While government-affiliated venture capital firms may concentrate on goals other than profit, like job creation or economic development, they often end up being just as conservative as other traditional investors. For a government administrator or any employee of a large organization, who hopes some day to move to a higher-level job, it is very difficult to explain why nine investment failures and one investment success is overall a great success. Yet, that is the nature of high-tech venture funding: if investors are not taking risks at this level, they're likely to miss the biggest opportunities.

4.4.2 The Impact of Debt Financing on Software Startups

From our interviews with a number of software entrepreneurs, we have observed the impact of loans and related instruments on the decision-making processes of the startup companies. First, startups will tend to minimize borrowings by bootstrapping their businesses over a longer-term. This admirable desire to avoid debt has the unintended effect of slowing down the startup's market entry and market-share growth. As we mentioned earlier, the software industry is fast-paced: a company that takes five years to develop a product instead of two, simply cannot compete in a global market that changes every six months. The only markets where such companies can survive are protected ones where innovation is artificially slowed down.

These bootstrapping software startups also tend to economize on technical talent and other important resources. Unfortunately, the competition is very stiff for the top software talent, and it takes money to acquire the best talent. The consequences for a company that does not have enough money to spend on people, from the software architects to the senior executives, is that it will not be cutting edge, and therefore not competitive in the global marketplace.

Underfunded startups also tend to look for niches in already established markets, since they do not have the extensive financial resources to create a new market. In Korea these niche markets tend to be small, domestically focused, and not at the cutting edge (e.g., substitution for well-established imports with a low-priced alternative). Thus, while the company might become a modest success eventually, it has very little potential to become a big success, or a global success, or to provide an adequate return to high-risk investors.

The impact on startups from debt-related financing is the same regardless of the source of debt funding; i.e., venture capital, loans from banks, government agencies, etc. It is the need to pay interest and repay principal, combined with the fear of a business bankruptcy, that influences how startups develop their business strategy.

4.4.3 Ownership and Control

Debt financing is not the only reason that startups are conservative in their use of funds. Many shun equity investments also, even as these funds become more readily available. Creating a company that can be passed on to the children is a common motivation for starting a company, which requires the entrepreneur to keep the ownership in his company. Even entrepreneurs who are focused on more immediate financial objectives may not want to lose control of their company. Equity investors, especially in the US, want to have some say in the future of the company, either through a seat on the Board or through other means. This desire for shared control is the direct result of the shared risk that venture capitalists assume when they take equity in a company. They want to be able to do what is necessary to achieve a high return on their equity investment, including changing the management.

Accepting conditions of shared ownership and control is particularly unnatural for first-time entrepreneurs. New entrepreneurs, especially those with technical backgrounds, don't understand why they even need all the money that venture capitalists offer them – the technical and business problems always seem straightforward! Nevertheless, through the agency of their attorneys and advisors, Silicon Valley entrepreneurs eventually come to understand how the game is played, why they need the capital, and why it makes sense to own only a fraction of "their company." The risks are smaller and the potential rewards are greater in the venture-funded startup model. This transition to a shared-risk high-return model is now underway in Korea, and to a lesser extent, in Japan and India as well.

Another issue that is quite problematic, in Japan especially, is the issue of "sweat equity." Japanese entrepreneurs get no special benefit from their ideas or hours of unpaid labor since they must buy into their company at the same price per share as every other investor. In contrast, US entrepreneurs receive founders stock at a much lower, nominal price. The absence of sweat equity is another factor that has tended to dampen enthusiasm for entrepreneurial ventures in Japan, and has shifted the burden of risk-taking back towards the entrepreneur. It is unclear what the impact of the sweat equity issue will be in Korea as venture capitalists increase their proportion of equity investments, but it is an issue that will need to be addressed.

On a related subject, key employees in Silicon Valley software startups also receive considerable stock options as part of their compensation. These options are worth nothing if the company fails, but can be worth a great deal if the company is successful. Investors often express concern that their ownership is "diluted" by the employees' shares, but they continue giving the stock options because they know that top-notch employees, both technical and managerial, are key to success in the software industry. This equity ownership by the founders and employees represents a modification to traditional capitalism – a revision of how the pie is divided – that reflects the importance of

knowledge workers in the knowledge economy. They are not replaceable parts. So far, this model has been very beneficial to Silicon Valley companies and workers.

4.4.4 Angel Investors

Every year angel investors play a bigger role in the nurturing of software startups in Silicon Valley. They fill a financing niche that the institutional venture capital firms cannot easily address: small, seed investments at the very early stages of company formation (in the range of several hundred thousand up to about two million dollars). Often, a group of angels will band together to provide an appropriate level of startup financing for a new venture. Local venture capitalists are currently flush with funds and are limited by the number of companies they can manage in their portfolio, so each of their investments has to be quite large (typically over five million dollars per startup).

Another important characteristic of Silicon Valley angels is that they are often people who achieved their wealth through a successful entrepreneurial effort, sometimes quite recently. They therefore can offer their invaluable experience and their personal business networks to the new startups they invest in. In some cases their support goes well beyond advice, as all parties might find it beneficial for them to provide services or even formally participate in management temporarily.

At present, Korean software startups need the experience that angels provide as much or more than they need funds. Korea is fortunate that it has an incredible wealth of retired (or restless!) high-tech executives that might be tapped for their experience and business network. One area where their experience might be especially valuable is in the global marketing of software (see Section 7). While it is true that other high-tech businesses are quite different than software, successful electronics and semiconductor entrepreneurs in Silicon Valley learned how to make the transition to the software industry over the last decade and Korean high-tech executives can make that same transition.

Korea has an interesting and unique phenomenon emerging in the form of angel clubs. In such a club, investors who are not necessarily high-net-worth individuals or knowledgeable about the software industry, are given an opportunity to evaluate a particular startup and take a fairly small equity position in it. The club's managers locate, select and present worthy startup opportunities to the investors, and follow the portfolio on their behalf. (Valuations are determined by direct negotiation between the investors and the entrepreneurs.)

In contrast to the Silicon Valley-style angel, the investors of the club are much less likely to be entrepreneurs themselves or have a thorough understanding of what it means to undertake an entrepreneurial venture. These clubs are so new that few if any funded companies have had an exit event (either successful IPO or acquisition, or an unsuccessful exit such as a bankruptcy). At some point there will be a failure. Actually, there will multiple failures, since that is the nature of high-risk investment. The reality of failure will be an important test for small investors and government regulators to maintain a market-driven path.

Government regulations are often about protecting the parties to a business transaction. In the context of venture capital and startups, an inherently high-risk situation, regulations to protect the parties are problematic. Often regulations affect adversely the startups' ability to grow or compete. For example, Korean entrepreneurs we interviewed made reference to a government reporting rule that required the startup to have a certain cash position as of the annual reporting date. Some companies have borrowed the required amount of money for one day at a very high rate of interest. This regulation was costly and distracting for them, and did not lead to the greater level of company stability that the regulation may have wanted to foster.

Parties to high-risk transactions may be better served by general business regulations that promote transparency and disclosure for all parties. This concept is one that has been discussed extensively in Korea in the context of the international business relationships of Korea's multinational enterprises (MNE's), but it is very relevant to these small high-risk interactions also. Venture capitalists, angel investors, entrepreneurs and creditors will, in effect, shoulder more responsibility for entering into business transactions, but transparency should offer all parties more knowledge and more flexibility.

4.5 Government Involvement in the Venture Capital Industry

The government has a two-pronged impact on the effectiveness of the venture capital industry in starting and supporting software startups: regulation and allocation of funds.

4.5.1 Regulation

In many countries, government involvement in the development, funding and regulation of the venture capital industry is a mixed blessing for high-tech and software startups. Government involvement often reinforces a low-risk, low-return model that is not well suited to the needs of the software industry. Governments generally have a low tolerance for failure, preferring instead results that are stable, predictable, and less open to criticism. In order to achieve these results, governments need to set guidelines, monitor participants for compliance, and measure results. All of these activities are useful and reasonable, but almost inevitably slow down the activities of software startups.

The situation gets more complicated when multiple government agencies regulate various activities or players in the same industry. In India, for example, regulations from four different government groups, some of them inconsistent with each other, come into play in the venture industry. This complex and restrictive regulatory environment is one of the key factors that have held back the domestic venture capital industry in a period when a vibrant software services outsourcing industry has produced many potential entrepreneurs and world-class ideas. Instead, the overall amount of venture capital available in India remains small, and more than half of the total comes from foreign sources.

One of the more serious impediments to the venture capital industry come from regulatory environments that do not provide venture capitalists with limited liability. Much of the success of the US and Israeli venture capital community comes from their long-established use of limited liability organizational structures. While Taiwan does not have limited

liability partnerships (LLP's), they have been able to create a viable workaround using separate incorporation of each fund and fund management to achieve the same effect. India still does not allow LLP's, and its trust-related organizational mechanisms are only a partial solution. Thus, just as in Japan, which has only recently authorized the use of limited liability organizations, India has not been able to take advantage of pension funds and other large sources of capital to create a stronger venture capital industry. In the past two years Korea has lifted or reduced restrictions that had previously constrained financial institutions and pension funds from investing in LLP's. The impact of these changes on the growth and direction of the venture capital industry is still very much in the future, awaiting a serious investment commitment from these institutional sources.

While India has just this year formed a committee to discuss the harmonization and liberalization of its laws related to venture capital, other countries, like Taiwan and Korea, are farther along in that process. In 1996, Taiwan reduced restrictions on venture investments abroad, as well as removed restrictions on the industries or types of businesses that Taiwanese venture capitalists may invest in. Korea has recently lifted most of the restrictions related to foreign investment, instituted favorable tax legislation, and relaxed restrictions on pension funds and insurance company investments in venture capital. Still in place in Korea are regulations relating to the establishment and capitalization of venture capital firms, as well as a number of regulations that limit their investment activity by industry, by specific company characteristics, and by percent of capital.

The current body of regulations in Korea appears to aim for the purposes of both promoting a high-tech industry and protecting all parties involved, including investors, entrepreneurs, and government stakeholders. This dual goal is a difficult one to accomplish. In any case, many of these regulations are too new to determine the impact they will have on Korea's venture industry. The important point is that Korea has made a commitment to nurture its high-tech industry. If these regulations are considered to be experiments open to refinement or elimination, then eventually the country will find the right balance between regulation and a market-driven model.

4.5.2 Government Funding of New Ventures

Direct government funding of ventures and government involvement in venture funds has had a significant impact on the venture capital industries of many countries. In the US, the Small Business Investment Corporation (SBIC) program, which was started in 1959, provided easy-to-obtain risk-sharing funds to venture investors. That program was instrumental to the development of a formal venture capital industry. However, by the late '60's, the US venture capital industry was stronger and more mature, and no longer needed to tolerate the regulatory constraints of the SBIC program. Amendments to the Employee Retirement Income Security Act (ERISA) opened the doors to pension fund investment in venture capital funds, strengthening the industry further. The SBIC program now exists primarily to help more traditional financial institutions fund very small startup companies with minimal financing needs, often in non-high-growth industries.

Israel started a similar program to the SBIC, the Yozma Fund, that is also structured to share the risk with venture capitalists in their investment in startup companies. The Yozma program includes specific mechanisms for a graceful exit from participation in venture funds, as those funds strengthen and gain experience. This successful program went through a number of funding experiments before finding approaches that both produced increased investment activity and encouraged eventual independence from this self-same program. (Among the programs that didn't work well for Yozma were extensions of guarantees to venture capital firms and direct investments in technology startups.)

Korea is still at an early stage in the process of encouraging the development of a strong venture capital industry. It has created a number of programs that either aid startups directly or participate in venture funds. Like Yozma, the Small and Medium Business Administration (SMBA) and other Korean government agencies may find that some of their funding experiments will work better than others. The important features of both the SBIC program and the Yozma Fund that should be noted, however, are that both were designed to share risk rather than assume it entirely, and both provide encouragement, either directly or indirectly, to venture capitalists to eventually eschew their use in favor of private funding sources.

One further note is that the SMBA recently announced that it was setting up the Korea Venture Fund with one of the partner organizations being the Yozma Fund. This arrangement should allow a useful direct transfer of the knowledge that Israel has gained from developing its own, highly successful venture capital industry.

4.6 Exit Opportunities for High-Tech Investors

Investing is not really what venture capitalists are most interested in, of course. Their main goal is selling off their investments. All investors must consider their "exit strategy" before making an investment. For software startups, in addition to the traditional public offering of stock, acquisition by a larger software, technology, Internet or media company has become a common form of exit.

4.6.1 Public Equity Markets

In recent years, Japan, Taiwan and Korea have created new stock exchanges modeled after the American NASDAQ, and have made listing easier for smaller companies. Still a very small and new exchange, the most significant impact so far of Korea's KOSDAQ may well be as a symbol of growing public support for entrepreneurial activity. We believe that the growth of the KOSDAQ will progress in step with the growth of Korea's venture capital industry. As venture capitalists move towards greater holdings of equity of higher-risk companies, they will be highly motivated to explore and expand all possible liquidity options, including encouraging their portfolio companies to go public more rapidly.

Another possible scenario might follow the Taiwanese experience, in which a large amount of new venture activity was inspired by a few substantial early successes with Taiwanese-owned US companies that went public on the NASDAQ. Admittedly, these early successes in the US started a substantial outflow of venture capital to startups

abroad (mostly US). Much more importantly, however, these successes also inspired a great deal of domestic activity, including the formation of many new independent venture capital firms, the creation of a NASDAQ-like registered stock trading system, and greater interest among entrepreneurs in going to the public markets earlier. Moreover, that first round of successfully liquidated US investments financed a host of expanded funding opportunities for new startups in Taiwan.

Note: This year Korea Technology Banking and Korea Technology Investment achieved four very large successes for portfolio companies that listed on the NASDAQ. Also this year, for the first time, several private venture capital-backed Korean companies have applied to list on the NASDAQ. These offshore activities may well inspire – and help fund – a similar venture capital boom within Korea.

4.6.2 Mergers and Acquisitions

In the last few years, there has been an interesting development in liquidity options for startups in the US, namely an explosion of acquisitions of very-early-stage acquisitions, as shown in Figure 14. In 1998, 13 times more venture-backed companies were acquired than went public. Startups achieve faster liquidity from M&A, with similar valuations to what they might have received in an IPO. While the growth of the Internet has spurred the demand for new innovation, the M&A phenomenon is not limited to Internet technology companies. The acquiring firms are from many industries, notably software, computing, networking, semiconductors, media, telecommunications, consumer electronics, and toys. We believe that this new M&A activity reflects again the importance of innovation and innovators in the knowledge economy. It is a way of outsourcing R&D so that it's done better and faster while allowing entrepreneurs and key technical people to retain a bigger portion of the value.

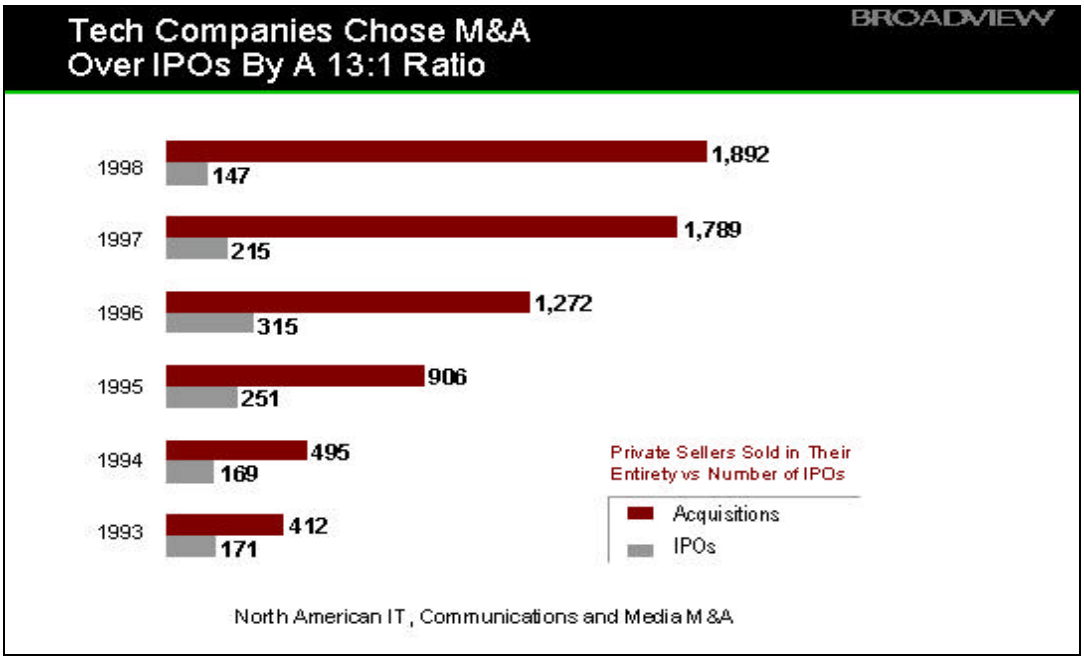

Figure 14. Data from Broadview tracking the enormous growth in acquisitions of high-tech startups, relative to the number that go public.

For the acquirers of high-tech startups, these purchases bring in new products more quickly (and perhaps no more expensively) than if they were developed in-house. While most venture capitalists still maintain that they only invest in companies that they believe will go public, all admit that the growing M&A phenomenon has been a very favorable development for them too. It means that a higher proportion of their portfolios will make a reasonable return. It also means quicker returns both because an acquisition can occur years before an IPO is possible, and because investors can cash out of their positions immediately, instead of dealing with a post-IPO stock lock-in period.

The impact on entrepreneurs of this M&A boom is noticeable. Many more US entrepreneurs are beginning to create companies with the specific intention of selling them within a relatively short period of time (say, within two years). More interestingly, startup entrepreneurs elsewhere in the world are also thinking differently about their exit strategies. For example, M&A has traditionally not been an attractive alternative for most business owners in Korea. Apart from potential differences in the return from this route compared to IPO, there is also a feeling that M&A is intrinsically a less successful outcome. This year, however, we find that many more Korean entrepreneurs are willing, or even eager, to consider an acquisition of their companies. Some already have their next company in mind! This attitude change is profound, and a positive indicator for Korean entrepreneurism.

4.6.3 Failure and Bankruptcy

As we point out several times, the software industry is changing so rapidly that it is impossible for a business to forecast even 18 months ahead which technologies or market approaches will be the right ones. Taking the level of risk required for successful early

entry means that three out of four venture-funded startups will fail outright. Thus, business failures are an integral part of the software industry.

In many countries around the world, there is a significant stigma attached to bankruptcy, with the implicit assumption that bad management is usually the cause of the trouble. Since a startup in the software industry is more like an experiment than a company, and there is a high likelihood of its not succeeding, the negative attitudes towards failure embodied in bankruptcy laws inhibit at least some worthy startup efforts. While entrepreneurs tend to be a very optimistic group as a whole, the consequences of a possible business failure can influence their decision-making in everything from whether they start up a business to begin with, to whether they take outside financing, expand their business, or attempt a risky global strategy.

Bankruptcy laws differ from country to country based on social attitudes about business failure and on which parties are perceived to require protection. In Western Europe, bankruptcy laws are oriented towards creditors, with liquidation seen as the best way to provide some value to those creditors while eliminating marginal firms. US law also provides a liquidation option (a "Chapter 7" bankruptcy), but it is more neutral in its protection of all the parties, including equity shareholders. Another option under US law, a "Chapter 11" bankruptcy, is oriented towards rehabilitation (restructuring of debt, reorganization, debt-equity swaps, etc.) to preserve troubled companies as on-going concerns. In either type of bankruptcy proceedings, management is usually left in control. India's bankruptcy system is strongly oriented towards preservation of businesses also, but court inefficiencies and other problems leave non-functioning firms in limbo for years, tying up assets and people who could be utilized more efficiently elsewhere.

In contrast to the West, there is a long tradition of informal workouts in Japan and elsewhere in Asia. At its best, workout lets all parties agree on a satisfactory course of action without court administration. At its worst, ailing companies end up limping along indefinitely, often with creditors putting in additional monies that will eventually be lost also. Large creditors especially prefer workout when court involvement would force them to write off or flag their troubled loans. Workout approaches also usually leave existing management in place, whereas control might have to be relinquished under formal bankruptcy proceedings.

Korea has recently made a number of changes to its bankruptcy system and small business support infrastructure. By far the most important one is the decriminalization of bankruptcy, which had troubled entrepreneurs and reinforced very negative social attitudes towards entrepreneurism. Additional useful recent changes have been aimed at harmonizing bankruptcy-related laws, providing more rehabilitation and rescue support for small and medium firms, and offering government loan guarantees. All of these changes will be key in helping to reorient business attitudes towards more risk-taking and entrepreneurship.

4.7 Some Ideas for Consideration

The Korean government is very active in the area of encouraging high-tech entrepreneurism and the financing of high-tech startups. Of all the areas covered in this report, this is the one in which we've had most trouble keeping up with Korea's rapid progress. Our intention here is to give some outside perspective on what we see happening.

4.7.1 Encouraging Entrepreneurism

- While it may seem counterintuitive, the software industry in Korea, and the knowledge economy generally, might develop more efficiently in the absence of special treatment for high-tech companies. Instead, a broader emphasis on new business creation might provide a more supportive environment for all entrepreneurial business ventures, including high-tech startups and their support firms. From this perspective, current rules covering venture capital firms and their portfolio companies -- already liberalized significantly in the past two years, might be moved even further towards a market model. An additional benefit of increased regulatory flexibility is that the environment for high-risk ventures would be more readily adaptive to industry changes. Thus, in response to the constant and rapid change in the software industry, venture capitalists would be able to respond immediately and easily with novel deal structures, new alliance models, and new ways to raise capital.
- Encourage truly independent entrepreneurial spinouts from chaebol companies, particularly software spinouts. This approach would allow the rapid development of the many new ideas that big companies create and then cannot implement quickly enough. It would also help develop an entrepreneurial mindset in a new group of people. Of course, independence from the control of the parent company would be key here, in order for these new startups to compete most effectively within the industry.
- Facilitate the use of founder's sweat equity and stock options to motivate entrepreneurs, their employees, and their external support firms, to take the risks inherent in software startups.
- Reorient public opinion about bankruptcy towards an understanding of failure as an integral part of high-risk endeavors, especially in high-tech. While moving public opinion and traditional attitudes takes a long time, the effort is worthwhile and may serve to encourage a few more would-be entrepreneurs. Eventually, the success of many entrepreneurs will change this negative perception, and may serve to inspire a new generation of young people to consider starting their own companies.

4.7.2 Innovation

- Expand university funding for software R&D, not only to help the schools and faculty deal with the increasing demand for a software education, but also to give software faculty and students more opportunities to explore cutting-edge software research areas.

- Encourage all manner of interactions between university faculty and students and companies who are selling and using high-tech. Most new ideas for marketable products come from people who are already deeply involved in technology use or development.

4.7.3 Financial Industries' Roles in Supporting Entrepreneurism

- Experiment with different models of government high-risk investment funding to discover which approaches not only nurture more startups but which also foster experience building and independence within the venture capital community. The SBIC in the US and Israel's Yozma Fund are good models of programs that promote balanced risk-sharing and timely exit for government involvement.
- Move towards transparency and comprehensive disclosure as the primary means of protecting all parties in a high-risk venture. This approach has some drawbacks when dealing with inexperienced investors, especially those who are not high-net-worth individuals. Korea has seen an increasing number of new, small investors making very speculative investments, come into the market this year. Separate measures might be considered to make sure that new investors understand the true level of risk they are assuming.
- Permit and encourage venture capitalists and other business advisors to become more involved in advisory roles for startups, for example, by participation on the Board of Directors. Involvement is the most effective way for investors to really learn the software industry. Moreover, since many high-tech entrepreneurs are inexperienced in business, advice from their outside directors may prove to be critical to their success. Eventually, there will be a number of successful software entrepreneurs who will become angels or venture capitalists and will be able to provide even more comprehensive advice and help.

4.7.4 Foreign Investment

- Facilitate participation of Silicon Valley venture capitalists in Korean startups, possibly by offering risk-sharing funds or other incentives. Deep participation, including board membership, would be particularly beneficial for startups aiming to penetrate the US market effectively.
- Encourage private venture capital firms to establish a presence in Silicon Valley, to gain first-hand knowledge of US-style high-risk investment, create a US-Korea VC network, and undertake joint participation in investment activities both in Korea and in the US.

5 Developing a Supportive Habitat for Software Startups

Once a new company gets started by an entrepreneur with a new idea, an initial team of talented people, and enough capital to prove the concept, its subsequent growth is determined in part by its ability to get the other resources it needs. Software and other high-tech startups do not do well in normal business environments. Not only must they compete with larger firms for resources of all sorts, people, capital, services, etcetera, but they also need many types of support that big companies don't need in their environment. Startups are by definition very small and don't have the staff to perform all necessary business functions (and they don't have time or money for hiring in qualified people). Some types of support that both large and small companies need, like personnel search firms or public relations firms, must be packaged quite differently for small startup companies than for well-established firms. This supportive environment for high-tech startups is what Prof. William Miller calls the "habitat."

In recent years, a number of countries around the world have resolved to become "knowledge economies" and to focus substantial resources on developing their domestic software industries. This public policy resolve is frequently manifested in some initial development actions, including the building of infrastructure, such as technology parks and telecommunications networks. In a few of these countries, there is an underlying belief that the physical infrastructure *is* the habitat or that it will at least facilitate the development of one. The majority of governments, however, recognize that the habitat has much more to do with people and their interactions, not buildings or equipment.

The habitat for software startups is composed of

- A mobile workforce with specialized expertise and extensive personal networks;
- A supportive business and regulatory environment and appropriate attitudes toward entrepreneurism, risk taking, job mobility, failure, openness, etc.; and
- A wide variety of support firms and consultants who fill in temporarily to perform a function that would be routinely done by a department in a larger firm.

All of these players are expert at doing business with software startups, where things change very quickly, cash flow is tight, and mistakes can mean failure to get their product to the market in time and, consequently, business failure. The various players work for many different startups over the years (different technologies, different markets, different business situations, etcetera). They learn a great deal that makes them more and more effective in helping the next startup.

5.1 Knowledge Sharing in the Habitat

The habitat is, in a sense, a repository of knowledge that can be tapped by all startups. Some governments have come to understand that the habitat is all about specialized expertise, expertise about startup companies and about the software industry, and so have started government programs to provide those services, in order to nurture the development of their software industries. These programs may well be useful as temporary

measures. Unfortunately, it is extremely difficult for government organizations to offer the full range of professional, cutting-edge business services that startups need to compete effectively in the global marketplace. Governments are typically not good at servicing small businesses' needs, nor are they known for speed or for speeding up business processes. Also, the normal tour of duty in government agencies is often not long enough for individuals to become expert and then share that expertise with startups over several years.

More importantly, government programs, though done well, may inhibit the growth of viable habitat firms and professionals in the private sector. By providing low-cost business services to startup companies, government in effect competes with private efforts to offer those services, thereby constraining the long-term development of expertise in the habitat. In the paragraphs that follow, we discuss the key components of the habitat in more depth, including government participation.

Silicon Valley is a habitat well known for the openness of its business relationships – people talking with their competitors, even entering into alliances with them; employees moving from company to company, working with friends in every company; entrepreneurs talking to 20 venture capitalists about a new idea for a business. The underlying belief is that exchanging knowledge can be a win-win situation. Only rarely does knowledge have more value if it is kept secret. These small startup companies also recognize that they cannot do everything alone – to be fast and effective enough to compete globally they must utilize the network of the habitat.

Sharing knowledge is how individuals, firms and the region as a whole keep up with rapid change in technology, markets, competitors, standards, and so on. Again, any individual or firm could eventually learn how to position a new product, identify good beta customers, influence industry analysts, recruit key employees, test out new ideas, find business partners, evaluate the competition, finance business growth, staff a booth at a trade show, coordinate a product launch, etcetera. But without this knowledge readily available in the habitat, these decisions and activities would be too slow, even slower than in a big company. The role of the habitat as a knowledge repository is critical to all of the small companies that must make hundreds of business decisions very quickly without experienced staff on board in all areas.

Some of this knowledge sharing happens within a formal framework, by hiring a consultant or a public relations firm. But most of the exchange occurs informally. Informal knowledge sharing happens, for example, when workers change jobs, discuss work at a social gathering, or participate in a civic or professional activity with colleagues and neighbors. The network, and the knowledge sharing processes that go on, is essential to the success of the habitat. Knowledge that stays within one firm may be valuable to the firm, but knowledge that is shared enhances the overall competitiveness of the region, and the chances of success for all firms.

In many parts of the world (including much of the US) the local business culture is not as open to knowledge sharing as it has become in Silicon Valley. Changes of business tradition and practices are very difficult to effect and impossible to legislate. There may be

a few laws, like labor laws (transferable insurance coverage, non-complete covenants, etc.) that make it more convenient for workers to change jobs voluntarily, which could help certain aspects of the knowledge sharing process. For the most part, however, the participants in Korea's software industry will have to figure out for themselves how sharing knowledge is in their mutual best interests.

5.2 Habitat Participants

As Professor William F. Miller of Stanford has defined it, the habitat includes a variety of local businesses and individuals who offer services specific to the needs of software startups. While observers of Silicon Valley often focus on software publishing startups, it is worthwhile keeping other sectors of the industry in mind when examining this issue of the startup habitat. In particular, boutique software services firms for enterprise systems or embedded systems, or firms that service multi-national publishers, each need their own support infrastructure. Figure 15 illustrates the kinds of firms, individuals, agencies and organizations that are typically associated with the habitat for high-tech startups.

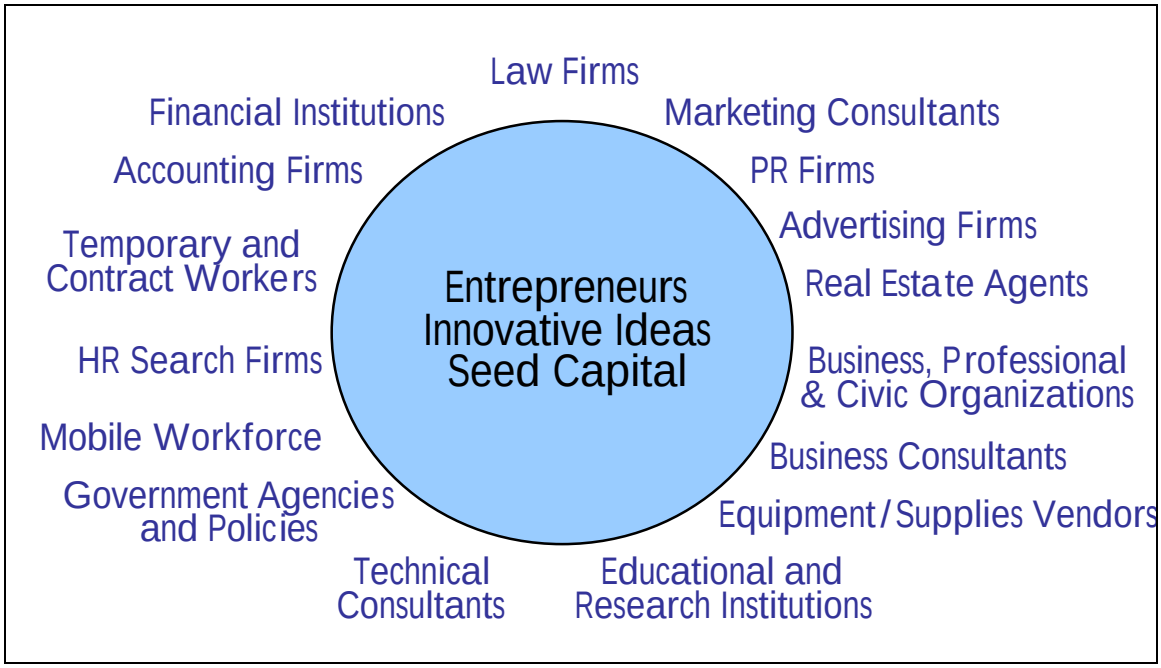

Figure 15. The High-Tech Habitat, as described by Prof. William F. Miller. All participants, firms, institutions and individuals, are specialized in serving the needs of fast-moving, high-tech startups. Business practices are correspondingly aligned to help startups avoid delays in getting product to market. Social attitudes and business culture are also part of the habitat.

In the software publishing and Internet sectors, for instance, marketing and speed are basic needs that the habitat can facilitate. Specialized firms that quickly locate key elements of the management or engineering team, put together a product launch plan, or conduct project post mortems are resources that can be shared across a number of fledgling software startups. There are dozens of different types of specialty firms, not to mention independent consultants and contractors, who make up a large part of the workforce in

Silicon Valley.

One important example of the specialized professionals in Silicon Valley is the lawyers. Because they see more startups, perhaps 500 in the career of an attorney who has specialized in high-tech startups, they understand the alternatives, accepted practice, and possible variations better than venture capitalists, who typically invest in only a couple dozen startups. Lawyers here are connected with private investors and venture firms and with other specialists who help startups take off. They often serve as coaches, preparing entrepreneurs to meet the people they are introduced to. The attorney's activities in this specialized sector are numerous, covering a variety of areas of the law: startup formation, mergers and acquisitions, securities, IP protection, software licensing, bankruptcy, IPO, and employee stock plans and compensation, to name a few. They also attend Board meetings and often serve as a business advisor.

In Silicon Valley dozens of specialties have evolved in similar ways to fit the very specific needs of the high-tech startups they serve. The role of the support firms goes well beyond that of supply chain participants – these firms shape their clients' businesses and the software industry as a whole. They package their products and services in ways that work for startups at various stages. Many are even willing to share the entrepreneur's risk by taking equity instead of cash, or by delaying their invoice until the startup is in a better cash position, in the hopes of getting the next E-Bay or Amazon.com as a long-term client. By creating an environment that supports the unique requirements of small startup companies, Silicon Valley's habitat has remained incredibly effective, as the region transitioned from semiconductors to computers in the 1980s, and from computers to software in the 1990s.

5.3 Big Multinationals vs. Indigenous Companies

Professor Miller lists eleven factors that differentiate the resources and strategies of the many regions around the world that have attempted to become centers of innovation and high-tech business:

	Community collaboration
Knowledge intensity	
Quality of work force	Developed venture capital
Mobile work force	University interactionQuality of life
Rewards for risk taking	Government involvement
Open business environment	Indigenous companies

In this report, we have discussed all of these to a greater or lesser extent, except the last, the role of indigenous companies that grow from startups vs. existing multinationals with comparatively vast resources. This does not appear to be a major issue in Korea at the present time, but for completeness we will discuss the pros and cons of these two strategies.

Many regions around the world have invited in the big multinationals as a first step to jump-starting a high-tech industry, though with very different long-term goals. Ireland, for example, encouraged the development of hardware assembly and manufacturing

businesses, software localization, and later, software products technical support, for mostly US high-tech companies. Their stated long-term strategy, however, was to develop their high-tech workforce, and to then encourage them to start their own businesses as complements and competitors to the multinationals. In contrast, Singapore developed an elaborate plan to attract large MNE's, especially in financial services and hardware assembly, as an end unto itself.

Gifu Prefecture's approach was to attract large companies from Tokyo and elsewhere, so the companies were Japanese, but not indigenous to the area. Austin Texas and some other US high-tech regions have employed similar strategies. The problem with non-local companies is that they can leave just as easily as they came. With no special ties to the community, they may not have the desire to train people for longer-term or higher-level jobs, build long-term infrastructure, or otherwise contribute to the local community. They also come already equipped with a national or international support network, suppliers, etcetera, so they don't necessarily have to develop those kinds of resources locally. Finally, with regard particularly to the software industry, the larger established companies are probably not going to be the ones to create the high-growth innovations, as we discussed in an earlier section. In other words, they are not well positioned or well motivated to participate in the development of the local habitat.

The good points for attracting MNE's to a region is that these companies often bring in new ideas, illuminate global standards of technology and business, develop/train some portion of the local workforce, perhaps stimulate local competition, perhaps embed/export/distribute local goods and services to a wider customer base, and bring in foreign exchange. If their presence is exploited effectively, several software business forms can be developed in the local economy, as is being done in Ireland.

Indigenous, homegrown companies, on the other hand, carry the entire community upward. There are opportunities for employment and training, development of both entrepreneurs and their support networks, and physical infrastructure development. They are the key contributors to the development of the habitat. There is also more interest from these local businesses in enhancing the quality of life, such as schools. Taiwan, for example, succeeded in nurturing homegrown companies at Hsinchu Technology Park, in part through its recognition of the importance of quality of life issues to its high-tech workers.

Part of the strength of Silicon Valley lies in the fact that the majority of companies there were started in the region. There were no attempts to bring in big companies like IBM, although IBM and many other companies now have facilities in the Valley. During the last economic downturn these indigenous companies came together, raised money and developed plans and programs to revitalize both the business environment and the quality of life. (When the CEO of the company lives locally, a whole additional set of personal interests in the community exists!) Similarly, the majority of the top 20 Indian software services outsourcing companies originated in India.

5.4 The Role of Government in Developing the Habitat

The US federal government contributed to the success of Silicon Valley generally by ensuring a supportive environment for all US companies, including startups, by funding basic research and, of course, by buying a lot of technology. But no special federal attention was given to the Valley, different from other regions of the country. Silicon Valley did the rest by itself, with business and civic organizations taking the lead. The Valley enjoyed an extraordinary preponderance of elements that came together to make it a successful software habitat: many educational institutions including two major research institutions; a large technical workforce already employed by the computer hardware, electronics and defense industries; a mature venture capital industry with high-tech expertise; and a location in the world's biggest market for technology, the United States. (There are those who say that the fact that Silicon Valley succeeded where other regional centers in the US haven't yet was due, in large part, to the fact the Valley is several thousand miles away from Washington and New York, which allowed a unique industrial system to evolve here, but there is no data to support this hypothesis!)

Most other countries and regions (including other regional centers in the US) have felt the need to be more proactive in creating their own software industries. For example, standing as a counterpoint to Silicon Valley is Cyberjaya in Malaysia. It is a top-down effort to create a Silicon Valley-like region by building massive physical infrastructure. In further contrast to Silicon Valley, the workers come from other areas, and include a huge contingent of government people. Most of the companies will not be indigenous to the area either – they will be primarily foreign MNE's given substantial tax incentives to come. In our view, the long-term success of Cyberjaya may be limited by this approach.

Singapore was also a top-down effort. However, it was a broad development plan executed over two decades, and included infrastructure development and massive training of technical professionals. It had in some ways more modest aspirations, attracting MNE's in the manufacturing sector, at which it has succeeded.

Korea's many programs and policies aimed at creating software habitats are still too new to forecast the results. One program that has some promising elements is the proposed Software Town. In contrast to the large construction effort going on in Media Valley, Software Town proposes to encourage habitat development in Kangnam-ku and Seochu-ku, two areas of Seoul already populated with numerous high-tech companies, including many indigenous software startups. The relatively low commitment to building physical infrastructure will allow the Korea Institute of Multimedia Contents & Software (KOMS) and other involved government groups to concentrate their funds on the more important incubator services to these companies.

After more than a year of running the Korea Software Incubator (KSI) in Silicon Valley, KOMS now has valuable experience and perspective on how to select companies with a high likelihood of success, prepare them before they move to into their markets, set expectations for cost and potential problems, and provide the right services to startup companies to help position them to compete globally. One of the lessons that the KSI has learned in Silicon Valley is the importance of specialized support firms, and how to utilize

them effectively to develop their incubator companies. We anticipate that Software Town will also now try to introduce programs that will bring in private startup support companies, and help develop their expertise, so that these private support companies can eventually take the lead in creating the Software Town habitat.

5.5 Some Ideas for Consideration

5.5.1 Encouraging Private-Sector Habitat Firms

- Extend "venture" status and benefits to the small specialized habitat firms: the startup firms in marketing and PR, management consultants, executive and professional search firms, technical training firms and all other companies vital to the development of the habitat and the success of software startups.
- Ensure that there are no regulatory barriers to these business support firms' receiving equity, options, or otherwise sharing the risks and rewards with their startup clients.
- Government agencies involved in supplying support services to software startups might consider outsourcing a significant portion of their work to private habitat firms and independent professionals. Close cooperation in this area would benefit all parties.
- Encourage Korean support firms to participate in Silicon Valley and especially in KSI activities. Support firms from the habitat have as much to learn about the global software business as the startups themselves.

5.5.2 Encouraging Worker Mobility

- Facilitate movement of people between firms: insurance coverage, labor law, non-compete covenants, etc. Since there is such a powerful tradition of lifetime employment in a single company, visible government efforts to encourage the worker mobility that is important to the knowledge economy could help change people's attitudes more quickly. For example, mobile retirement accounts that workers retain when they change companies could be an important contributor to this goal.

5.5.3 Encouraging Knowledge-Sharing

- Facilitate forums for "cooperative learning" among entrepreneurs and technical innovators. Perhaps older startups can participate in activities aimed at helping newer firms move more quickly. These forums are best if self-managed, so as to be quick and flexible in meeting participants' needs.
- Subsidize low-cost gathering places (for both formal and informal meetings) for technical and business people in Software Town and other software centers.
- Sponsor seminars and discussions on getting ahead of the curve in the software industry, inviting visionary speakers from around the world and attracting visionary participants from all sectors of Korean industry.

6 Expanding the Domestic Demand for Modern Software

In our opinion, there is no more urgent avenue for development of Korea's software industry than increasing domestic demand for state-of-the-art software. Fortunately, this is an area where the government may be very effective in influencing private-sector behavior to everyone's advantage.

The Korean government has already taken steps that will dramatically increase the market for PC software, especially games, educational software, and consumer-oriented Internet companies. These efforts include stricter enforcement of piracy laws, investing in Korea's Internet infrastructure, and making low-cost PCs available to schools and to consumers. However, software for these markets, while an important and growing segment, remains a relatively small part of the overall software industry. The real money is in software for business and government organizations, including enterprise software products, software services and system integration, embedded systems, business-to-business e-commerce, and software-enabled businesses. Without being competitive in this "enterprise software" arena, Korea will be excluding at least 80% of the potential software industry market.

Even more importantly, Korea's other industries need state-of-the-art information systems to continue to be globally competitive. For a variety of reasons, it appears that the state of IT in some of Korea's large manufacturing companies is several years behind, due to inadequate investment over a prolonged period. (This may also be true in smaller companies and in other industries, like financial services, but we have not had time to investigate beyond a cursory look at a small number of the chaebol companies.) So long as manufacturing companies compete based primarily on price for their products, and labor costs are low, IT-based efficiency is not that critical. But labor costs in Korea are no longer low compared to other nations in the region, and the playing field for competition in automobiles, consumer electronics and even semiconductors has shifted. Modern business strategies, like supply chain management, customer relationship management, knowledge management and e-commerce, depend on state-of-the-art software systems. Serious investment in this area is now needed at Korea's biggest companies.

6.1 How Domestic Demand Impacts the Software Industry

Since part of the motivation for developing the software industry is to increase foreign trade, the issue of domestic demand may not seem paramount. However, the demand by the largest firms and by the government for innovative software influences the growth of the software industry in many ways:

- Enterprise software services to big business and government (consulting, software development, systems integration) is twice as big an industry, globally, as all of software publishing. These service providers supply cutting-edge systems using the most current technology. They train a great number of software professionals too.
- Prestigious customers give credibility to startups and legitimacy to entrepreneurs. A small startup that has a company like Samsung or LG as a client, for instance, has instant credibility in Korea and abroad. The credibility of the startup firms reflects on

the legitimacy of the whole entrepreneurial software industry and on the entrepreneurs and employees personally.

- Small enterprise software publishers need market feedback about their products, their business conduct, and their strategy. Rapid market feedback is best – local customers to test and refine their software (beta sites) and to help them integrate their fledgling offerings with other vendors' software from around the world. Language and logistic barriers make this normal "co-invention" process between publisher and customer much more difficult if it must be done primarily in foreign markets.

  Note that to be effective beta sites, the large firms must be buying the latest and greatest software from all the world's top vendors, not just from Korean firms. Startups need feedback on innovative features, marketing, packaging, pricing, time to market, platforms, etcetera, from customers who are free to chose from the global marketplace and who have state-of-the art systems in place.

  Finally, going global first is a high barrier for startups. The costs of going global with a product untested in the domestic market present a greater risk. Major Korean customers could give local startups the "reference sites" that are critical to broader market acceptance.

- A functional local marketplace gives investors early feedback about how startups are progressing. Small companies that have received a first-round venture investment but then fail to get a beta site may not get a second investment round. It is important to cut non-performing startups early, so that people and capital can be redeployed.

- In many instances, larger firms, acting as alliance partners, market the new products and technologies developed in startups. These relationships take many forms. In recent years, acquisition of startups by larger firms, to expand their product line or acquire a new technology, has become very common. If the chaebol firms began making these kinds of acquisitions, it would stimulate the software startup sector and venture investment by creating an important exit strategy. Of course, the challenge for the chaebols would be to integrate and use these acquired companies effectively. These acquisitions would in effect be "outsourced R&D" since, as we mentioned in Section 4, it is very difficult for large firms to do cutting-edge software R&D internally.

- Technology consumers and services providers are important breeding grounds for technology innovation and software business ideas. Very often, it is from the software innovators within a big company that new entrepreneurs and their teams emerge: an industry-specific product idea that has applicability across many firms around the world is spun out into a new software venture. Sometimes big corporations even invest in these spin offs. Similarly, when a startup fails, technical employees can be hired by beta-site customers with whom they've worked closely for months.

6.2 Barriers to Increased Domestic Demand for State-of-the-Art Software

Large companies face serious obstacles in updating the level of their information systems to be better positioned for future IT-based global competition as well as for effective partnerships with the new software startups. Not the least of which is that the growth of a

software publishing and software-enabled Internet companies in Korea will draw top talent away from the larger firms. The booming software services export industry in India, for example, has consumed software talent to such an extent that there are serious shortages of software people in many other sectors.

Perhaps the best way to look at the problem is in terms of resource allocation, where software talent or software production capacity is the resource being managed. In the short term, a strategy that uses software to significantly increase a major manufacturer's market share in consumer electronics, for example, may be a bigger immediate economic boost than the entire software-publishing sector. However this strategy may consume talent that is needed to seed future capacity in new software companies. This balancing act will likely continue for a very long time.

Another barrier to increasing the IT sophistication of the big companies is their current IT organizational structure. As in Japan, large Korean firms rely on captive systems integration (SI) houses for their access to new technology. These captive organizations are driven by demand from the parent firm and are not in a position to suggest, much less instigate, major re-automation efforts. But the biggest problem with captive SI firms is that they inhibit crossover learning about new technologies between firms. An independent services provider is more motivated to learn about a new kind of information system, since it hopes to sell that kind of system to many different clients. Competitive bidding between independent services firms should be based on vision and track record as well as price.

The biggest barrier to IT advancement in large corporations worldwide is sometimes just lack of vision and understanding at the highest levels of management, resulting in inadequate investment. It characterizes many traditionally run firms – firms that are systematically being put out of business by more IT-aggressive competitors. It is important to directly address the demand for state-of-the-art software technology among executives and government leaders, in addition to developing the software suppliers.

Many business executives all over the world have seriously outdated ideas about the purpose of IT investment. After all, information systems were first introduced into companies as a cost-saving technology, mostly reducing labor costs, eliminating clerical jobs and later manufacturing jobs. However, this "productivity" perspective is no longer the right way to think about information systems. Leading-edge executives view IT as a competitive weapon, an investment to gain market share vs. an investment to save on operating costs. (Think of an airline's frequent flyer program, which costs millions but saves nothing.)

The government's own information systems are, of course, a very big part of the domestic market and a great opportunity to initiate a variety of changes. Korea's government computerization program is already underway, aiming at state-of-the-art systems for many government agencies. Continuing this effort, with the additional goals of nurturing the existing systems integration providers as well as the fledgling software industry, could have a very positive impact.

6.3 Some Ideas for Consideration

6.3.1 Continue efforts to change attitudes about software as a product with inherent value and about software careers and software professionals.

- Continue working with software trade organizations to reduce piracy, enforce IP laws, and change folks' minds about the value of software.
- Work with hardware companies to unbundle software in the enterprise sector.

6.3.2 Continue government programs to put computers into homes and schools

- No matter how slow they start, programs that stimulate the spread of computers in homes and schools will increase the demand for software in those sectors and create opportunities for domestic software publishers. They will also increase the familiarity of young people with computers and may influence their career choices.
- It is also important to train teachers and to support the use of computers in non-business environments. This might mean encouraging small business solutions that will supply training and support services for schools and consumers all over the country. The cost of the original equipment is a fraction of the actual cost of getting value from these programs.
- There are $100 network computers on the horizon, and a plethora of wireless Internet devices. Think about creating demand for this equipment by supporting products and services that will appeal to a wide segment of the population.

6.3.3 Government systems and procurement

- Whether it's high school computing, information security, or Korean tourism, government expenditures on state-of-the-art, innovative systems will dramatically impact, directly and indirectly, the domestic market for services and for new products. In some ways, it does not matter what projects the government funds, only that they are truly innovative in the technology they use.
- Planning and sourcing of these projects should be done cooperatively with large domestic software firms and startups and even foreign vendors. A set-aside to assure a role for startups in these projects might be an effective tool, but it is just as important that state-of-the-art technology from cutting-edge vendors – regardless of their nationality, be employed. These projects are for learning and skill development as much as for ROI.
- Fair procurement policies must include quality requirements, not just lowest price. Services suppliers should have the opportunity to provide quality services and still make a profit. Also, to help small companies, the paperwork required to bid for these projects and comply with oversight agencies should be minimized.
- Expect some failures. This is a learning process as well as investment in cutting-edge, relatively risky systems. In the US, it is common for 40% or more of these systems efforts to fail. The government's natural risk aversion should be tempered. Clear public statements from the onset about the expectations of some failures and stressing

the larger developmental goals may help. Vendors should be graded by their success, but not severely punished for just one failure.

6.3.4 Government-sponsored research projects and standards efforts

- Emerging markets, like e-commerce, wireless computing, application service providers, etcetera, are the fertile grounds for software startups serving the enterprise. Government funded research projects in these areas have a higher chance of spawning relevant business ideas. It is important that researchers are personally committed to their research goals, so they must generate the ideas. Perhaps joint funding from government and industry, like Europe's Esprit Program, might be a way to find good research projects.
- The difficult experience of Japan in their Fifth Generation program is a good example of why government would want to avoid top-down control of R&D. A more beneficial approach is to set a goal, source the systems fairly, include some startup software product and services companies, and then let the chosen organizations figure out how to build the systems.
- Supporting industry and academic involvement in the full range of international standards efforts seems like a wise investment as well. Early commitment to a standard, however, while focusing the countries limited resources, also carries a significant risk and should be considered with caution.

6.3.5 Stimulating strategic innovation in major industrial and financial firms

- Consider additional tax breaks for corporate R&D expenditures on strategic software systems (i.e., not traditional back office systems)
- Offer forums for top managers from the big companies on new ways to think about technology and its use in business strategy.
    - Effective software strategies, the role of the CIO, differences between consumer electronics and software business models, resource utilization, sourcing business systems, …
    - Managing outsourcing: How to work with software services firms and small software publishers
    - Perhaps a lecture series by heads of first-tier companies from around the world about the importance of strategic information systems.
- It is key that both industry and government view their efforts to develop Korea's software industry as a sustained program, one that needs to be monitored and fine-tuned for many years. The Software Industry Promotion Committee's model of annual revisions of a rolling five-year plan was a good approach and an effort of this type should be continued through the next decade. Constant monitoring of the impact of regulatory changes and the success of programs, investment funds, and vendors is important. Having industry and government leaders together involved in this sustained effort will be vital to the future development of the software industry.

We view domestic market development as a critical issue for Korea's economy in general as well as for the growth of the software industry and software entrepreneurism. But Korea's software industry will not meet its objectives unless it can be an effective player in the global marketplace too.

7 Facilitating Global Marketing of Software Products and Services

In our discussions with Korean software entrepreneurs, both in Seoul and in the Korean Software Incubator in San Jose, it was clear that reaching a global market was seen as a desirable but rarely attainable goal. Lack of marketing expertise, language barriers, and better opportunities in the domestic market were all given as reasons that global strategies were not a top priority. While we did meet a few entrepreneurs who were selling or planning to sell software in Japan, China and the US, even their ambitions were small and their plans were mostly quite tentative.

In fact, there are very few examples of companies besides the US software publishers who have a large global business. SAP from Germany, Baan from Holland, Japanese games publishers, and the India software services firms are frequently mentioned examples. There are few others of any size. Even Israeli software companies have so far tended to distribute their products through US publishers in some sort of technology licensing arrangement. Selling software in the US market in particular requires state-of-the-art technology, extensive integration expenditures, technical support, and, most importantly, a lot of marketing money and know-how.

Different types of software businesses have different global opportunities and need different types of support in their efforts at reaching global markets. Software services exporters need contacts with enterprise information systems groups, as well as the technical skill base and telecommunications infrastructure to allow their work to seamlessly mesh with the client's application development activities. Software publishers need market intelligence and local sales and service presence, and partners to get their products accepted in the foreign market. And, of course, the US market may be a special case compared to Asian and European markets.

7.1 Why Global Marketing is Important in the Software Publishing Industry

Software publishers have a very different business structure from traditional manufacturing companies, including high-tech manufacturing in semiconductors and electronics, for example. As we mentioned in Section 2.3, software publishers' costs are all in the R&D and sales cycle – there are essentially no manufacturing costs (tooling, materials, or labor). The R&D costs can be quite high, but are very similar across publishers, as are the costs per sale. Furthermore, in many types of software publishing, especially enterprise and small business software, recurring revenues from existing customers (service, support, upgrades, add-on products) are an extremely important part of the business model, since costs of sale are so much lower for existing customers.

The bottom line for software publishers is that market share is everything. Their strategy is to capture market share early, sometimes by announcing products long before they are ready for rollout, thereby slowing a competitor's market entry. Because of the enormous costs and inconvenience of changing the systems employees use every day, companies are quite reluctant to change from one enterprise product to a competitors', which makes dramatic turnarounds in market share unlikely. In overseas markets, US publishers can

incrementally increase market share using any strategy necessary, including price manipulation.

So in software publishing, traditional factors like capital and labor costs do not play a very big role. The critical industrial input is skilled labor, which, since there is a severe global shortage, will be priced at market value within a few years. The critical business capability is not manufacturing technology and skill, but marketing.

7.2 Software Marketing – Managing the New

In all types of software, there is a premium for offering new products and new features before anyone else. In many types of software, new capabilities are far more important than cost, or even, to a certain extent, quality. (It is one of Microsoft's great insights that, since incremental increases in quality will delay product release by months or even years, publishers must have an clear understanding of what the market will bear in terms of bugs, and they will release the product as soon as it reaches the minimum. Continued improvement in quality over the product's lifetime is another Microsoft strength.) Innovation in computing platforms and new ideas about useful features and interfaces, along with compatibility with other vendors' innovations, creates a constant demand for new products and new releases of old products.

In a software publisher, it is the function of the marketing group to "manage the new."

- Competitive products change rapidly. Marketing is responsible for prioritizing features that go into each release, positioning the product in the marketplace, and feature-by-feature comparisons.
- As the release date approaches, engineering usually realizes that some features are behind schedule and will delay release. In addition, engineering keeps a list of known bugs in the product that have been identified by internal testing as well as by early outside users (alpha and beta releases). It is up to marketing to make the tradeoffs between features, bugs and time to market, and to prioritize the final stages of engineering activity based on knowledge about what customers and competitors are doing.
- Very often, marketing needs rather in-depth knowledge of the industry the software is selling into: automobile manufacturing, loan management, hospital administration, etc., in addition to knowledge about the software and competitive publishers. This knowledge includes the users work environment as well as the existing systems in place in potential customers, with which new products must interface.
- Since customers often have different computing and network platforms, database systems, etcetera, marketing must make decisions about which platforms to build for first, which standards must be followed, etc. To a certain extent, this input is required before engineering selects tools and component technologies. (Software is constructed in layers, and often pieces of several layers are purchased rather than built from scratch, to save time.) Making the wrong decisions about platforms and technologies can delay release and is a common reason that software startups miss the market.

- The situation in enterprise software is so complex, that it is nearly impossible for publishers to get the product to market without the cooperation of some customer firms early in the development process. These "beta sites" allow the pre-release software to be installed, integrated with existing systems, tuned in a real-world environment, and even tested by real users. (Note that this is a big cost for the beta customers, as well as a risk, since they must often install the new software in mission critical environments.) Beta customers typically influence the evolving product profoundly, and it is up to marketing to find the willing partners in "co-invention" and to manage these relationships.
- It is rare that a big company will buy software from a small company before other big companies have done so and are willing to endorse the company and the product. These "reference accounts" sometimes start out as beta sites. They are critical for a startup's credibility. Again, it is the marketing function that must foster and nurture these relationships, often to the point of balancing the call load from prospective customers, industry analysts and the trade press.
- Marketing is also responsible for the long-term relationship with customers and users: packaging appropriate service offerings (installation, technical support, upgrades), and even organizing "users groups" to exchange information and gather market intelligence.
- Marketing's support of sales often goes beyond tradeshow booths, media advertising, direct-mail brochures and other traditional forms of lead generation. Marketing often develops the skeletal sales presentations, makes presentations at conferences, and even helps the sales force complete prospects' requests for proposals (RFPs).
- Another characteristic of enterprise software marketing is the often-complex sales channel. There are often a variety of partners involved: hardware vendors, OS vendors, database vendors, consulting firms and so on. Geography, industry verticals, hardware platform and size of customer often divide the sales territory. It is marketing's responsibility to support each sales process with appropriate knowledge and collateral material.

Marketing departments and marketing budgets at big software publishers reflect the complexity of this part of the business. And small software startups, which cannot develop the internal resource fast enough at any price, need support in the habitat for the various marketing activities. This activity requires deep knowledge of the technologies and the competitors as well as the marketplace, where buyers and users are often quite different groups, both of whom must be sold on the product.

7.3 Some Ideas for Consideration

Our suggestions here try to differentiate across the different types of software businesses and across the different global markets. We have focused on government regulations and programs and on habitat support for global efforts.

7.3.1 Develop sharable forms of expertise about foreign markets

- Gathering intelligence about markets and competition is difficult enough. In order to cover a number of different market segments (geography, industry, technology) this effort must be broad. Perhaps a variety of approaches will be necessary. Experienced software marketing people can make a big difference.
- Since this information changes so quickly, a passive repository approach will not work. In order to share this information effectively, individuals must become knowledgeable and must be available, by phone, email, etc., very quickly as a situation comes up. Publications are generally too slow to answer the hard questions in a timely manner. These knowledgeable individuals must stay up to date and must stay in the software marketing activity for some number of years. Eighteen-month stints in government agencies are not quite enough time to learn and to share effectively.
- Individual consultants or small, specialized consulting firms, who've been involved in selling various types of software in different international markets, might be a good form for this effort to take. Support of these independent habitat entities in their early years would be an appropriate government investment. This might take the form of "outsourcing" of activities from government agencies to habitat services providers.
- Startups already working abroad can be asked to share their knowledge, through survey responses, lecturing or advisory roles.
- Encourage efforts of large technology firms, small startups, and habitat support companies to establish a presence in places like Silicon Valley, or at least to devote more corporate resources to monitoring activities in successful habitats. This approach supports much more effective and up-to-date technical and business intelligence gathering, and would facilitate relationship building, marketing, and sales to a broader market.
- Organize the network of expatriate Koreans:
    - Koreans working in the US, Japan, China and Europe who are inclined to help software startups find customers, partners and employees will be an invaluable resource if organized properly. Informal organizations already exist, like the Korean American Society of Entrepreneurs (KASE). These organizations need an interface to startup companies. They would be an excellent source of connections for software services firms, market intelligence for publishers, and maybe even sales partners. Supporting individuals whose job is to cross-pollinate Korean startups and organizations of Korean expatriates might be an appropriate government role.
    - We made the point when discussing education and HR that it might be a very good idea to encourage early career experience abroad, as well as technical education. One reason for this is networking. It is possible for an entrepreneur in Silicon Valley who has worked in three or four software companies to staff the first dozen positions in his or her new startup with friends and colleagues made in earlier jobs.

7.3.2 Create an active, Israeli-style technology-oriented trade consulate

- Traditional trade consulate activity is not typically focused on technology, and especially not on startup companies who are too small and looking for relatively small deals. Israel's trade consulates in New York and Silicon Valley, staffed with technology-savvy representatives have done an excellent job of gathering business intelligence and finding appropriate alliance partners and investors for software startups in Israel.
- Habitat firms, even individual consultants, who are working with government agencies to support marketing efforts in various software industry segments should be invited to participate in these consular activities. Again, facilitating learning and sharing of knowledge is the main goal here for the next few years.
- The consulate can take over the task of organizing and managing knowledge-gathering programs for government administrators, industry executives, financiers and others who are responsible for developing Korea's software industry. It is important for these players to observe first hand the idiosyncrasies of the software industry and of Silicon Valley, and for some, a multi-month program would be much more helpful than a one-week tour. These educational activities should not be solely the responsibility of the incubators, like the one in Silicon Valley. The incubator managers should focus their efforts on the companies they are trying to incubate.

7.3.3 Continue to evolve the KSI and other incubators

- We have been particularly impressed with the rate of learning at the KSI in San Jose. Staffing this type of incubator with people who will be involved in Korea's software industry for many years will be a very good investment. Staffing with people who have entrepreneurial aspirations of their own would be particularly useful. Overstaffing might be advisable too, both to increase total exposure and to compensate for attrition. (Already more than one KSI manager has left the incubator to start a new company! They will now be part of the vital expatriate business network, along with the companies that graduate from the incubator.)

7.3.4 Focus support of overseas activity

- Early success is very important to the continuation of both financial and government support of the software industry. Some types of companies, technologies and markets have much higher chances for success abroad. A strategy that distributes adequate resources in areas with high chances of success is much better than a strategy that spreads resources too thin. Of course, the broader the diversity that can be supported at an adequate level, the lower the overall risk of failure.
- As we mentioned in Section 2.4, emerging markets are generally easiest to enter, software title publishing is easier than enterprise software, technology licensing is even easier -- as far as marketing is concerned, and products and services in industries where Korea already has international sales activity should be given high priority.

8 Conclusion

To some observers, the type of industrial system we've described, where young technical entrepreneurs take huge risks with other people's money, everyone openly shares their ideas and their experience, workers change jobs every couple of years, and most ventures end up complete failures, seems idiotic and wasteful. Nevertheless, this is the industrial system of the Silicon Valley. Changing one element of the system may require coming up with a completely different system.

This is not to say that every investor will be a winner, or that every entrepreneur will be successful. But over the last 30 years, the phenomenal success of Silicon Valley can't be denied. So long as computer technology continues to evolve at breathtaking speed, the Valley's industrial system works better than any other in the world at creating new products people want to buy. No one invented Silicon Valley, or designed it or planned it or legislated it. And it seems to be hard to duplicate, because so many business practices and social attitudes have changed here. Maybe there is a better way to create wealth from technological innovation, or maybe times will change and technological innovation won't be so valuable. But for the time being, there is no better model for economic development than the Valley's 30-year rise to international dominance.

Duplicating Silicon Valley is not the point – only learning from the Valley's history and unique business style. Whatever path Korea finds into the global software industry, it will have to deal with the same novel aspects of software and rapid technology evolution that have shaped the Valley. Some things will be hard, we expect, including:

- Pulling back on government initiatives once they have served their purpose;
- Getting Korea's big companies to invest in state-of-the-art business systems;
- Educating a large number of cutting-edge software professionals within the existing academic structure;
- Dealing with the inevitable ups and downs of high-risk investment, especially among small investors; and, most importantly,
- Changing people's attitudes about software, software careers, entrepreneurism, and failure.

On the other hand, the opportunities are endless. The Internet and newly emerging platforms, like the PC fifteen years ago, are wide-open territories. It is important to think beyond software publishing for PC markets. New ways of using the Internet to meet a wide variety of market needs are being invented every day. Internet services for consumers, businesses and governments will be hundred billion dollar markets in just a few years. Wireless Internet devices are only just beginning to appear this year – an area of innovation that seems uniquely suited to Korea's consumer electronics and telecommunications strengths.

Korea is well positioned to succeed in time. Early successes by software startups, some of which we expect are already happening, will address many of these difficult issues better

than any government program ever could. We know that Korea will evolve in its own way and develop a software industry structure that uniquely captures the energy and determination of the Korean people. It is our fondest hope that we have helped in our small way, by examining the issue of software entrepreneurism from a Silicon Valley perspective.

Appendices

1 Summary of Suggestions, Recommendations and Ideas for Consideration

We list here for your convenience the ideas and suggestions that are developed more fully in the body of the report:

1.1 General Considerations

- Raise public awareness of the importance of software entrepreneurism by all possible means, such as: taking a leadership role in procuring state-of-the-art systems; buying from small software startups and boutique services firms; educating top management of large firms on the strategic importance of software; reducing software piracy; promoting respect for entrepreneurism generally.
- Continually enhance government understanding of the software industry by bringing in expertise (in the form of experienced high-tech-oriented employees, consultants, and advisors), as well as by developing expertise internally. Ideally, government administrators should spend enough time working in their software industry rotation that they can develop sufficient expertise to become an integral part of the habitat.
- Call upon software-savvy business people and senior engineering professionals to help define, update and refine high-tech policy over a number of years, monitoring what works and what doesn't work in Korea's particular environment. The Software Industry Promotion Committee is an example of a useful advisory model and an invaluable source of industry expertise.
- Focus public policy on major emerging market opportunities. We list some possibilities in Section 2. Also examine vertical niche opportunities in industries where Korea is already strong. For example, consider "New Hard" niches, modeled after the Japanese success in games, capitalizing on Korea's strengths in telecommunications technology and consumer electronics. Internet-based opportunities, like application service providers and wireless computing devices, seem especially promising. Also consider embedded systems in autos, specialized chips, and computing equipment. Japanese manufacturers may prove to be a ripe market for embedded software offerings.
- Orient government activity towards supporting the development of market solutions for the needs of startups, wherever possible. To this end, include habitat support firms, consultants and independent contractors in all thinking about how to support the development of the software industry.
- Encourage forums, including independent industry associations, for more cooperation and alliances among software entrepreneurs, technical innovators, and software industry support firms.

- Take a broad approach to encouraging entrepreneurial thinking and creativity in the schools, government and every industry, in order to facilitate growth of diversity in markets and approaches.

1.2 Finance

- Encourage private venture capital (VC) firms to establish a presence in Silicon Valley, to gain first-hand knowledge of US-style high-risk investment, create a US-Korea VC network, and undertake joint participation in investment activities.
- Ensure that there are no barriers to the use of founders' stock (i.e., sweat equity) in venture capital-funded startups. In general, continue to encourage equity participation in startups by financiers, founders, employees, and startup support firms, through various means, including unrestricted distribution and favorable tax treatment of options. All contributors to the companies' development should be able to share in the companies' upside potential.
- Experiment with different models of government high-risk investment funding to discover which approaches not only nurture more startups but which also foster experience building and independence within the venture capital community. The SBIC in the US and Israel's Yozma Fund are good models of programs that promote balanced risk-sharing and timely exit for government involvement.
- Aim for transparency and disclosure as the chief form of protection for all parties to high-risk ventures, including founders, investors, employees, and creditors.
- Consider the role of bankruptcy within the context of promoting entrepreneurism: reorient thinking about business failure towards the encouragement of a fresh start for entrepreneurs, and as a natural selection process for companies to allow an efficient reallocation of capital, technical expertise, and business skills.
- Continue to move towards a market model for the venture capital industry, aiming for further liberalization of regulations stipulating firm structure, capitalization, investment time frame, and allowed investments (i.e., industry sector, equity ownership percentage, etcetera).

1.3 Education

- Strengthen university-level software education as a separate initiative – separate from existing programs for computer science and electrical engineering departments. The influence of the existing electronics and telecommunications industry in academic politics in Korea is strong, and precludes software evolving as an independent discipline.
- Address the growing shortage of software teachers. It is likely that top graduates, and even some professors, will find irresistible opportunities outside of academia, causing the number of competent teachers to decrease. The simultaneously increasing demand for software education may cause the average graduate to get less and less cutting-edge knowledge.

- Encourage practicing software professionals to teach. We recommend a professional school approach to software education (like a school of medicine or architecture). We feel that other countries will eventually follow this approach.
- Increase support for university efforts to recruit faculty from abroad, especially computer science faculty with a software specialty, who can help students learn to be cutting-edge software professionals.
- Continue to encourage top engineering students to seek education abroad. Additionally, encourage Korean graduate students in US schools to spend a few post-graduate years in the US with their families, working in software companies in the US, since industrial practice is a big part of the education of a software professional. Also, this additional time abroad to work in industry will deepen the expatriate network that can be exploited in software industry development.
- Encourage interaction between industry and university: industry consulting for professors, visiting lecturers from industry, summer internships for students, training partnerships, spin-outs from university labs, etcetera. Perhaps allow an industry spin-out or software patent to substitute for part of the faculty publishing requirement, since some faculty may not have time for industry-related activity even when it's permitted.
- Promote and fund more classes in areas such as high-tech entrepreneurism, international business, and software marketing principles at the undergraduate and post-graduate level of business schools. Some engineering students might also benefit from these courses.
- Promote educational programs in strategic uses of IT, software procurement, and software project management for top managers in big firms. The pilot course at Stanford sponsored by the Chong-Moon Lee Foundation in September 1999 on Software Entrepreneurship and Information Technology is an example of such program possibilities.
- Although English is widely spoken in Korea, continue to encourage even higher levels of English competency, especially among engineering students, since so much of the global software industry, both business and technical interactions, are conducted in English.
- Promote life-long learning among software professionals by giving incentives to corporations to invest in skills development, to universities to develop quality extension programs for software professionals, and to practicing professionals to update their skills. Encourage market solutions to meeting training needs, since the skills change so quickly.
- Continue to expand computer literacy and school computer programs in primary and secondary schools. In particular, teacher training has been shown to be a key element in the successful adoption of computing in the schools.

1.4 Domestic Industry

- Encourage major firms in both the services and manufacturing sectors to acquire state-of-the-art information systems, perhaps with tax incentives for buying or

building strategic software systems. Top management needs input from CIO-type executives who have experience in the strategic use of IT and in the management of software development and procurement.

- Encourage major firms to buy some software products and services from startups and to be beta sites for new products.
- Reduce regulatory obstacles to worker job mobility, where they exist. To the extent that labor policy can influence this issue (health insurance, retirement benefits, non-compete covenants, unemployment insurance, etcetera), job mobility leads to greater cross-firm learning, market pricing of talent, and natural selection among startups.
- Continue energetic public awareness campaigns and enforcement activities to change attitudes about software piracy. Software needs to be perceived as at least as valuable as the computer it runs on. Also, create an understanding that the most important point of piracy enforcement is not about increasing the revenues of foreign software vendors; rather, it is about ensuring the viability of Korea's indigenous software companies: high piracy levels severely inhibit the development of many segments of a country's domestic software industry.
- Increase the prestige of software careers throughout the economy, perhaps by certification of software professionals or by some national competition.
- In addition to promoting respect for all entrepreneurial activities, not just high-tech, it is also important to educate entrepreneurs, business leaders, and the public at large about the distinctive nature of modern software entrepreneurism, including the unique characteristics of software innovation, speed, diversity of ideas, and failure.
- Continue to facilitate the establishment of Korean high-tech firms in Silicon Valley. These offices should not be viewed solely as marketing outposts for sales of Korean-built products, since both business operations and product definition may have to change to be successful in the US market. It is important that both business and technical people actively participate in Valley activities related to their business (trade shows, technical forums, platform and tool vendor interaction, competitive intelligence gathering, face-to-face interactions with prospective customers, supporting and learning from beta sites, etcetera).

1.5 Government Systems and Procurement

- Identify and implement initiatives that will involve state-of-the-art government systems, aiming particularly for those that will also offer recognized high value to Korean citizens and businesses.
- Establish a procurement set-aside for small software publishers and boutique software services firms. Avoid burdensome paperwork and approvals for small and medium firms.
- Review best practices in government software procurement around the world and change policies if necessary.

- Urge agencies to rate the performance of software vendors based on quality, usability, robustness, and maintainability measures, and to use this data to evaluate bids on subsequent projects.

1.6 Software Industry Promotion

- Consider technology licensing and sales, as the Israeli software industry has done, as a way to get some early successes in software startups without facing the global marketing issues.
- Consider the Irish strategy of offering major software publishers localization and tech support services for the regional market, as another way to move beyond the domestic market without taking on significant global marketing challenges.
- Increase and broaden activities in Silicon Valley. An Israeli-style trade consulate could be established to do market intelligence reporting, delegation hosting, and general promotion of Korean software. The Korean Software Incubator (KSI), current charged with these tasks, could then expand their activities focused on the successful development and promotion of the startup firms.
- Exploit the global expatriate network of Korean software professionals for business and educational opportunities.
- Work with international market analysis firms, such as IDC or Gartner Group, to identify market opportunities and promote Korean firms.

1.7 Data Collection

- As researchers, we find government data collection in every country to be less than optimal for our purposes. In the software industry, however, the issue is aggravated by the rapid pace of change and the constant emergence of new categories and new markets. Since so many regulations and government programs will be at least somewhat experimental, it is important that various agencies collect the data necessary to monitor and adjust them and that the data be consistent across agencies.

  Some of this data is already being collected: total software industry sales, exports, etcetera. Additional data might be important indicators to monitor in the future. For example:

  - Number of software graduates and number of active software professionals;
  - Locus of employment of software professionals, especially recent graduates;
  - Software spending of major corporations, including domestic spending;
  - Total investment from all sources in software startups; and
  - Number of jobs created by new software businesses.

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3 Interviewees, Information Providers, and Other Sources

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