

The New Software Exporting Nations: Success Factors

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ABSTRACT

Many nations are attempting to craft successful software exporting industries to emulate the remarkable success of India in this area.. What are these success factors? We introduce the “Oval model” that incorporates eight factors that lead software industries to export success. The eight factors are: 1) Government vision and policies, including funding and tax benefits. 2) Human capital, including national orientation and traditions, quantity, composition, language skills, and managerial skills. 3) Wages. 4) Quality of life, since talented professionals tend to concentrate in desirable locations. 5) Linkages, which emerge between individuals, between work groups, between firms, and between nations due to geographic, cultural, linguistic, or ethnic connections. 6) Technological infrastructure. 7) Capital, which can come from domestic and foreign sources. 8) Industry characteristics, including: clustering effects, the number of firms, their size, the associations which organize the industry’s firms, the industry’s degree of common vision and branding, and the standards that the firms aspire to.

1. INTRODUCTION

With the remarkable success of India’s software industry, policy makers and industry leaders in scores of nations are attempting to craft their own success cases in their software exporting industries. We label the many nations that have embarked in this direction, the “new software exporting nations” (classified into four tiers¹ in Carmel, 2003a, this volume). We synthesize and summarize the factors that lead nations to software export success. This synthesis is captured into a model that we label the “Oval model”. The model is useful in order to look back and explain the success of those nations that have already succeeded in this industry, namely Israel, India, and Ireland. But, more importantly, the model is useful as a framework for prescriptive policies and strategies to be taken by other nations in order to improve their national well-being (Carmel, 2003b, this volume).

2. LITERATURE ON SUCCESS FACTORS FOR NEW SOFTWARE EXPORTING NATIONS

Researchers and policy makers have had a long fascination with the question of why a certain national industry succeeds: what led to success, what factors will keep it successful, and what prescriptive factors can be gleaned for other nations (surveyed in Porter (1990)). Traditionally, economists have explained an industry’s success in macro-economic terms, interest rates, exchanges rates, cheap labor, abundant natural resources, government policy

¹ Carmel, (2003a, this volume) establishes a taxonomy of nations, that we use for a discussion of industry success factors in this article. Nations are divided into four tiers, depending on their industry success. Briefly, Tier 1 nations have mature software exporting industries, and include the US, Britain, Germany, and the recent success cases of India, Israel, and Ireland. Tier 2, are two transition nations, China and Russia, in which the software industry is rapidly moving to maturity and size equal to the Tier 1 nations. Tier 3 are mostly emerging nations, sometimes exporting hundreds of millions of dollars in software, with as many as one hundred firms engaged in exporting software. Tier 4 are infant stage software exporting nations, sometimes exporting for just a few years. Finally, many smaller, least developed nations do not significantly compete in the global software markets.

and intervention in the marketplace, or by national advantages in management practices and labor-management relations. An important milestone in this regard was Michael Porter's model (1990) of competitive advantage of nations that posits four critical factors for a national industry not only to be able to export, but to achieve global leadership over an extended time period.

While traditional national focus was on manufacturing, success in high technology, specifically, is of more recent interest. Thus, Porter et al. (2001), in a series of studies begun in the late 1980s, developed the High Tech Indicators model which includes four factors that influence technological standing and the technology mix in a country's exports: technological infrastructure, production capacity, socioeconomic factors, and national orientation.

Still more recent is the focus on success models for nations' software exports. A World Bank report (Garry, 1999) categorized important new software nations according to four criteria (with the respective nations in parentheses): cost (China), English-speaking ability (Singapore, Ireland), ease of doing business (Ireland, Israel, India, Singapore), and segment expertise (India). Perhaps the most comprehensive model, to this point, for evaluating national software industries, is the Software Export Success model proposed by Heeks & Nicholson (2002). This model has already been applied to a number of new software exporting nations (Nicholson and Sahay, 2003, this volume; Gengler, 2003, this volume; Bruell, 2003, this volume). The authors developed the model from success factors of India, Ireland, and Israel, the success cases of the 1990's. The model consists of five major factors, some of which have important subcategories. The five factors are: demand (for software); national software vision and strategy; international linkages and trust; national software industry characteristics; and national software-related infrastructure. A number of common factors appear in these sources: for example, human capital factors (phrased differently), appear in all three sources; infrastructure appears in two of these sources.

3. THE OVAL MODEL

In this section we introduce the "Oval model" of national software export success factors. The model is labeled *oval* because of the oval shape of the national boundaries that are depicted in Figure 1. The model includes eight factors that are synthesized from the literature and from our own research². In particular, we adapt and enhance the Heeks & Nicholson (2002) model. We go beyond that model in a number of important respects: we apply the factors to 3rd and 4th Tier software exporting nations; we emphasize certain factors, such as human capital, which are not prominent in their model; we de-emphasize some secondary factors, such as piracy (trust, in their parlance); we add certain factors, such as Quality of Life.

It is important to note that not all Oval model factors need be present for success in software exports. Furthermore, some factors, in practice, are somewhat contradictory, e.g., wages and Quality of Life. The Oval model graphic of Figure 1 suggests some factors which overlap somewhat (the overlapping ovals) and some which are inter-related (those connected by arrows). We now explain and discuss each of the factors of the Oval model in detail.

² This model is an extension of Carmel, forthcoming.

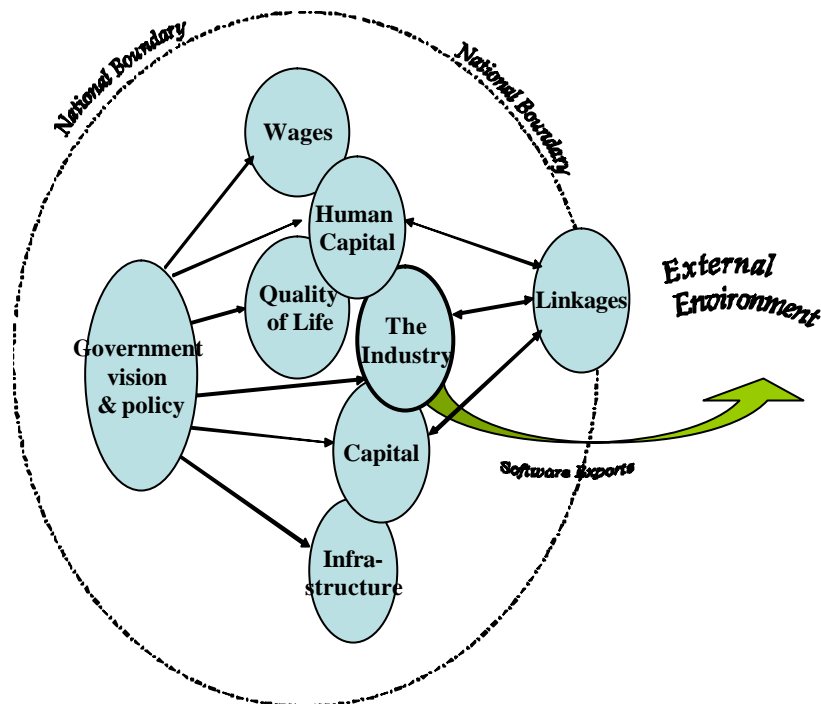


Figure 1: The “Oval model” depicting national software export success factors

3.1 Government Vision and Policy

Many of the new software exporting nations succeeded because their government took active steps to encourage the high-tech sector in general or the software industry in particular. Such policies have been given many labels: industrial policy, science and technology policy, and innovation policy (Salmenkaita and Salo, 2002). Basically, these policies channel national resources into sectors that the government views as important to future economic growth. There is considerable debate about how the government chooses which sectors to support. In our case, we will not delve into how governments choose software specifically. But, as discussed in Carmel (2003b, this volume) and Tessler et al. (2003, this volume), the intent of such a policy is to spur broad economic growth.

Government can play a proactive or facilitating role in every one of the factors discussed in the Oval model as can be seen by the centrality of its placement as depicted in Figure 1. The government can influence/facilitate the development of telecommunications infrastructure, the availability of capital, including risk capital, the vibrancy of the industry, human capital (through investment in education), quality of life, and wage levels. Brazil’s policy epitomizes the change in policy philosophy vis-à-vis high technology. In the 1980s the country acted to protect its computer industry through high tariffs (Duarte, 2002). This changed with a policy of liberalization in the 1990s (Tigre and Botelho, 2001) and industry-government partnership, supplanted, for example, by a program to encourage PhDs in IT (Duarte, 2002). Other recent examples of various government policy levers include: in China, the government created a specific planning document to spur the software industry, titled “Policy Document 18”, in 2000 and it has created Special Economic Zones for software; in Romania the government eliminated income tax for the employees of software firms in 2001.

In addition, the government may be active in facilitating, funding, encouraging, and successfully politicking³ the success of the high-tech (or software-specific) industry.

³ There is intense competition between national governments for foreign investment in technology. To illustrate, in 2003 the Israeli Finance Minister declared, in response to the competition between Ireland and Israel for FDI:

Successes in this are noted for Ireland by the Industrial Development Authority, in Israel by the Ministry of Industry and Commerce's "Office of the Chief Scientist", in Finland by Tekes, and so on. In Costa Rica, a Tier 3 nation, the government set a national vision (Digital Opportunity Initiative, 2001) and successfully lobbied for a massive investment by US-based Intel to open a plant in San Jose. This was a milestone that spurred the domestic IT industry in general and software specifically. In Jordan, a Tier 4 nation, King Abdullah was personally involved in the 1999 launching of national plans for its software industry.

Heeks and Nicholson (2002) point to the difference in national policy between the *initial* strategy and the *succeeding* strategy, or in our words, the *sustaining* strategy. The sustaining strategy for India has been climbing the value chain, for Ireland, diversification, and for Israel innovation and differentiation.

In a minority of cases the government had little to do with setting a vision for the software export industry, but the industry succeeded anyway. The case of India may be such a case, though there are conflicting opinions about the deliberateness of the government policies. Clearly, India's economic liberalization in 1991 was a turning point.

3.2 Human Capital

The software sector's *Human Capital* encompasses the collective characteristics and abilities of its software professionals: national orientation and traditions, quantity, composition, language skills, and managerial skills. We discuss each of these in turn.

The strength of a nation's human capital stems from a multi-generational tradition of science and engineering that has its roots in strong universities, polytechnics, and vocational schools. Thus, the recent success cases in this area - India, Israel, and Ireland, all benefited from a strong national emphasis on advanced technical education that dates back at least one or two generations. Strong human capital in software cannot emerge within a few years. Competitive human capital, perhaps more than other factor in the Oval model, emerges only after many years of national investment. And human capital advantages persist for idiosyncratic reasons. For example, in Russia the national focus on degrees in engineering and sciences persists today, in part due to the ability to avoid military conscription (Malkov, 2002)

The quantity of specific human capital is important as well. A critical mass of educated human capital is vital to the software industry. China is currently graduating about 50,000 new computer graduates per year (Liu, 2002) while 465,000 (Einhorn, 2002) are graduating in all science and engineering (some of which will also end up in software positions). The estimates for Russia are 25,000 new computer graduates per year (Terekhov, 2001). Furthermore, there are tens of thousands of Russian engineers and scientists from the old Soviet scientific establishment who can contribute to the software industry. The numbers of annual graduates in computer disciplines in some other representative countries: 3,000 in Bangladesh (Tjia, 2003, this volume) 2,500 in Vietnam (Chidamber, 2003, this volume), 5,000 in Indonesia (Bruell, 2003, this volume), 7,000 in Ukraine (Gengler, 2003, this volume).

A nation's software labor pool composition is not homogenous. At the higher end of the labor spectrum are very capable individuals, referred to in industry parlance as "talent", while at the lower end of the spectrum are those with "skills". Barr and Tessler (1998) define the difference between the two in practical terms. Skill is something that can be learned in a few months or a few years (e.g., becoming a Microsoft Certified Engineer); while "talent" is

"If corporate tax in Ireland is 12.5% [we will beat them and] ours will be [just] 10%." (Haaretz Daily www.haaretzdaily.com April 4, 2003).

the ability to see a complex systems problem. It is a cognitive gift, like musical talent: anybody can play an instrument, but only some can make music. While empirical evidence is not conclusive, industry insiders claim to see national differences in this regard.

English language ability has been critical to this point in national software success. English skills appear on consultants' checklists as a key criterion used to decide on the capabilities of software firms and software nations. English language skills stem from either some historical connection to England or from national investments in language education beginning in early school years. We return to this topic of language in the *Linkages* discussion further below.

Finally, management skills are needed in order to manage successful firms. Such skills tend to be taught in business schools. So, it is the professionalization of management that is necessary in order to build national software exporting industries. The growth in business training around the world in the 1990s has hastened building this component of human capital.

While domestic human capital is vital, interestingly, some nations have attempted to bypass the need for home-grown human capital. Barbados in the Caribbean was the base of a (briefly) successful IT services firm that imported software professionals (mostly from India) to work on projects for large US customers. Similarly, in 2002, in Panama, in former US-Army bases, a new technology park began to emerge with plans to emulate this model by importing hundreds of software professional from outside Panama. Time will tell if this is a sustainable national model.

3.3 Quality of Life

Why do multinational software firms establish higher-end software R&D in certain nations? (Higher-end R&D investment is a form of FDI - Foreign Direct Investment). These firms, such as Microsoft, seek innovative software human capital, or as we labeled it above - "talent" - and not just skills. This talent is not scattered at random in nations but resides in clusters typified by higher *Quality of Life* standards. That is, talented professionals tend to concentrate in desirable locations (Florida, 2000). Florida found that this higher-end human capital is attracted to live in locations in which there is: quality of place (natural, recreational, and lifestyle amenities); a "thick labor market; and high levels of environmental quality." This is evident in some US locations such as Austin and Seattle. It is also evident in centers of science around the world: such as the sophisticated metropolises of Stockholm, Tel Aviv, or Moscow. In India, the temperate, less hectic, metropolis of Bangalore has been able to attract talent for this reason. In contrast, many developing and emerging nations have not developed the quality of place in their cities and have seen some of their top talent leave.

3.4 Wages

In marked contrast to the Quality of Life factor is the wage factor. Managers buying so-called offshore outsourcing services tend to shop for the lowest-cost supplier. These costs are driven by the wages of software labor: from the junior programmers to the seasoned project managers. For example, variations on Table 1 have appeared frequently in the IT business press. The differences in wage rates are striking and very tempting for managers who are under cost pressures. In recent years, wages in India were bid up and India is no longer the lowest cost software nation. Instead, firms are turning to China, Vietnam, and others, where wages may be lower.

USA	63000
Japan	44000
Russia	7500
Philippines	6500-10000
India	5000-8000
China	5000-9000
Indonesia	5000
Ukraine	5000 median for software engineer
Vietnam	1400-6000

Table 1: Wages for software professionals. Annual, in USD.⁴

This is the “race to the bottom” of software exports in services. There is relatively little that nations can do to compete in this cycle in which foreign investment and interest quickly shift to lower wage nations. Of course, it is instructive to recall that this dynamic is not unique to software. In the post-war period, industrial manufacturing began shifting to Japan, which then became too expensive, and then it shifted to Korea and Taiwan which then became too expensive, and then it shifted to China, Thailand and elsewhere. Sawhney and Ariav⁵ define this phenomenon in purely financial terms, placing offshore software outsourcing in the context of what they label *global technology arbitrage*, which they define: “Sourcing labor and capital where it is cheapest and selling to where it is most profitable. National borders do not matter”.

3.5 The Industry

It is only now that we arrive at the particular characteristics of the industry itself. Do the software firms that make up the software exporting industry have the right characteristics to succeed globally? We describe the many characteristics that interact here: the clustering effects, the number of firms, their size, the associations which organize the industry’s firms, the industry’s degree of common vision and branding, and the standards that the firms aspire to.

The first several characteristics are essentially those of industry *cluster* effects (Tessler et al. (2003) this volume, refer to this as *habitat*). The best known high-tech cluster is Silicon Valley. High tech clusters are numerous in nations of Tier 1 and Tier 2. In Tier 3 nations the clustering effects are less striking (and in Tier 4 are often absent). In general, in these nations, the software industries are clustered around the large metropolitan business areas, or in technology parks.

A cluster represents a critical mass of firms in geographic proximity. Technology clusters are often deliberate government policy initiatives such as the Science Park in western Singapore near the major universities. Cluster effects confer a positive benefit on an individual firm in the cluster, independent of other firm characteristics. Cluster effects arise in an environment of both competition and cooperation among the firms. Competition spurs innovation. Cooperation spurs growth. Cluster effects also arise from professional networks

⁴ Sources for wages include Field, 2002; Overby , 2002; Chidamber, 2003, this volume; Bruell, 2003, this volume; Gngler, 2003, this volume; as well as author’s notes. Wage data vary considerably from various sources - by as much as 50%. Wages have significant local dependencies: what kind of firm?; the top firms in the nation?; in an expensive city? Thus, national software wage data at this point need to be used for rough comparisons only.

⁵ Unpublished teaching notes used in Kellogg’s Technology Industry Management Program. .

and specialists that diffuse information -- which otherwise is more expensive to acquire outside the cluster.

A successful software exporting industry requires a critical mass of firms, with at least some of significant size. For example, Arora et al. (2001) point to the large Indian firms that act as a nucleus around which other smaller software firms develop. The numbers and sizes vary as we move across the tiers. In Tier 3 nations, a substantial software firm is of size greater than 100 employees. For example, both Romania and Bulgaria (both Tier 3 nations) each have 5-15 medium-sized firms.

Success is aided by the software firms' ability to pool some resources into a national association or consortia that serve to promote the nation's industry abroad and provide services back to its member firms. Such a case is the prominent Indian association, NASSCOM, which helped the *branding* (in the marketing sense) of the Indian software industry. In contrast, the inability of the Russians (until recently) or the Mexicans, to build strong associations may have inhibited their success. The industry can also collaborate beneficially in other ways: several firms can pool their resources to market their services abroad. This strategy has been conducted with some success by firms in at least three eastern European clusters: St. Petersburg, Russia (called Fort Ross); Novosibirsk, Russia (called SibIT); and Bulgaria (called Bulsoft). We will likely see more of these consortia in Tier 3 and Tier 4 nations.

Ultimately, in order to succeed *as an industry*, firms need to specialize in the same domain/niche: in specific services or products. This specialization enhances the cluster effects of information diffusion and facilitates national branding efforts. For example, Ireland has specialized into services projects and into niche product markets, while Israel specialized in software products, particularly in data communications and information security. Now that there are dozens of national industries competing in the global marketplace, differentiation is even more critical for Tier 3 and Tier 4 nations. Those national industries that have not specialized are less likely to succeed, since they cannot compete simultaneously on all fronts.

Heeks and Nicholson (2002) posit that the national industry success is driven by the coherence of the industry's (and to some extent the government's) vision and strategy in defining the industry's focus. Malaysia set its vision early on "multimedia" and built the "multimedia corridor" between Kuala Lumpur and the airport. The coherence of the national vision is also defined by a national "branding" such as a recent promotion by a Philippines IT agency (Department of Trade and Industry, 2001) which advocates doing business with the Philippines by stating: "Me, the Filipino: Think American, feel Spanish, act Asian; Strong English language capability; Value education highly; Naturally hospitable, naturally caring; Peaceful; Patient temperament".

Finally, the success of the Indian software industry has demonstrated that attaining internationally-recognized standards of quality is an important component of the industry focus. These standards address the following problem: purchasing software from a distant, exotic foreign supplier is a risky proposition. The Indian industry understood this predicament early by embracing the Capability Maturity Model (CMM⁶). Now that Indian firms have acquired the highest international quality standards and practice these standards with greater success than do most US organizations, India is seen as a safe (or even desirable) destination in this regard. Arora and Asundi (2001) found evidence that adherence to quality certification enhances revenues for a given size. Other nations have emulated India on the quality certification arena: Russia, a Tier 2 nation, in 2002 had one CMM Level 5 firm (the Motorola subsidiary) and 2 CMM Level 4 organizations. In Bangladesh, a Tier 4 nation,

⁶ The CMM standard rates organizations at 5 levels of maturity where the highest attainable level is level 5. Most of the world's firms are judged to fall into Level 1 and 2.

Grameen Software was the first in that nation to receive the ISO9001 certification and others have followed (Tjia, 2003, this volume).

3.6 Capital

A software industry must acquire capital to grow. While some national industries, such as the Indian software industry, has been able to grow predominantly from working capital (internally funded), this is unlikely to be sufficient now that the global software industry has become more competitive. Capital sources for software firms can be any combination of domestic and foreign. Domestic sources include: government funds, venture capital, investment capital, and equity offerings. Foreign sources include: foreign loans, venture capital, investment capital (FDI), foreign equity offerings, and foreign aid.

Tier 1 nations have sufficient capital from a number of these sources. Of particular note were the new entrants to Tier 1, Ireland and Israel. Ireland's Industrial Development Agency (IDA) has been very effective in luring FDI to Ireland. Israel's Office of the Chief Scientist (within the Ministry of Industry and Trade) has been seeding high tech startups with very generous loans.

Some nations, such as Russia and Bulgaria, have recently benefited from substantial FDI in their software sectors. An interesting case is Costa Rica, which lured the critical capital and know-how of Intel to its borders. Intel built a semiconductor plant as a result of the Costa Rican government offering a basket-full of incentives: including more airline licenses, building power substations, tax benefits, and lower energy rates (Yee, 2000). Thus, governments can play a critical role through investment, encouragement, and substituting for the venture capitalist.

However, most firms in Tier 3 and Tier 4 nations do not have adequate access to capital, must rely on their working capital, and are hampered in their ability to grow. Thus, some nations have relied on forms of foreign aid that targets high-tech growth. For example, Costa Rica's investment in the software sector and in its human capital (universities) has been aided by the Inter-American Development Bank (Digital Opportunity Initiative, 2001).

3.7 Technological Infrastructure

Technological infrastructure refers to the sophistication and reliability of communication technology. Software firms require abundant, reliable, and cheap telephone and broadband data communication connections. The case of India is instructive. Beginning in the 1980s, Indian firms bypassed the unreliable terrestrial infrastructure by using satellite technology to communicate between top Indian software enterprises and clients abroad. Today, in most developing nations, cell phones bypass the unreliable local telephone system for voice communication.

In cases where this infrastructure is absent on a national basis, "cluster-centered infrastructure" (technology parks or high tech office centers) are the preferred alternatives for software firms. For example, the Philippines is sprinkled with such parks that advertise high connectivity. Clustering also addresses other infrastructure needs: Indian firms usually operate in buildings and technology parks with alternative power generation to compensate for unreliable public sources.

3.8 Linkages

The somewhat fuzzy concept of *linkages* is oft-used but poorly defined, so we define it thus:

Linkages emerge between individuals, between work groups, between firms, and between nations due to geographic, cultural, linguistic, or ethnic

connections; or as a result of one or more liaisons that have created the linkages.

Linkages are essential to business. Managers choose business links that they view as minimizing their perceived costs of doing business (Kogut and Singh, 1988). In many ways linkages are about trust - "without some degree of trust, no trade takes place" (Heeks and Nicholson, 2002). Linkage is a construct that is often examined vis-à-vis national culture. In this context it has been given various labels: psychic distance (Johanson and Vahlne, 1977), cultural distance (Kogut and Singh, 1988), and cultural proximity (Carmel and Agarwal, 2001). Kogut and Singh (1988) confirmed that the choice of entry mode into a foreign country (through acquisitions, green-field, or joint ventures) was affected by cultural closeness.

Linguistic linkages are also powerful. Since English has always been the dominant language of computing and business, English skills tend to be a critical linkage. The success of India is in part attributed to English fluency in this former British colony. Similarly, the relative success of the Philippines stems from such a linkage. Until recently, China was seen as another example of the importance of English as a linkage. China - with poor English language skills - was slow to grow its software industry. The absence of linkages has meant that until quite recently Chinese firms were engaged largely in "culturally independent" software exports. These are software products and services that require relatively little contact and knowledge of their target markets (i.e., embedded software; hardware services; systems software; scientific software). However, since 2000 China's industry expanded due to other factors.

The importance of English is somewhat diminishing. New regional linkages have begun emerging in recent years that weaken the traditional dominance of English. The Chinese have capitalized on their closer linguistic and cultural ties with the Japanese to become a destination for offshore work. The Costa Ricans work with other Spanish-speaking customers in Latin America. Pakistan mines its cultural ties to the wealthy Gulf nations by exporting services to that region.

Diaspora linkages have been a critical success factor. To illustrate: the success of the Indian software industry is due in part to the successful and well-placed diaspora of Indians in US high-tech firms. This generation of Indians came to the US for education, stayed on and rose to influential positions in these firms. We see these diaspora linkages in other countries that have succeeded in high technology - Israel, Taiwan, Korea, China, and Ireland. The "brain drain" has become a "brain gain": in the ties and know-how that have been forged between firms in the home country and the country of the diaspora. These scientists and engineers left their home countries and, sometimes many years later, returned, or invested in, or encouraged acquisition in their home country. In the case of Israel, many of the US technology firms' R&D centers (e.g., Intel, Microsoft) were established as a result of an Israeli expatriate working for the US technology company who wanted to repatriate to the home country. While the diasporas have been critical for Tier 1 nations and are playing a supporting role for Tier 2 nations, they are less likely to play a dominant role in Tier 3 and Tier 4 nations.

We see other new and interesting linkages in Tier 3 and Tier 4 nations. For example, Mexico takes advantage of a geographic linkage. It advertises itself as a "near-shore" destination for offshore outsourcing. One of the clusters of Mexico's software industry is in Monterrey, an hour's drive from the US border. Others use time-zone linkages. Some Caribbean islands emphasize the time-zone proximity which facilitates communication with customers in the US East Coast. South Africa has the potential to capitalize on same time-zone advantages with EU nations.

In the absence of the pre-existing linkages discussed above, linkages must be created from scratch. In the absence of overwhelming product advantage, when firms from two nations are doing business, the individuals inside these firms need to form some kind of linkage between them. This is the slow relationship building of sales and marketing units. Individual firms generally find this task to be quite difficult (cf. Philips, 1998). This is particularly true of young firms from the new software exporting nations.

3.9 Other Factors

Other factors are mentioned in various sources, but appear to have an isolated or over-emphasized effect on business decision making. The most-oft cited of these issues is a high software piracy rate. Most developing nations (which mostly belong to Tier 3 and Tier 4 software exporting nations) have high software piracy rates. (The common benchmark for national software piracy is the US-based Business Software Alliance⁷ annual piracy estimates which are readily available to researchers). However, IT decision makers see piracy as a nuisance, not a key factor. The growth of software exports from high piracy nations such as Vietnam, China, and Russia, attests to the irrelevance of piracy as a national factor.

We must also deal with the issue of demand. The new software exporting nations are driven by *foreign* demand since, by definition, they are *exporting*. The controversial issue is whether domestic demand is a critical factor for the nation's software export industry – and thus deserving of a small circle in the Oval model of Figure 1 (as argued in Tessler et al., 2003, this volume). Thus, domestic demand can be seen as a catalyst of a healthy national software industry, balancing the risky foreign sales, and providing much needed working capital.

However, most lower-tier software nations, many of which are relatively poor developing nations, have insufficient domestic demand to catalyze a healthy software export industry.⁸ For example, India developed a strong software industry relying on foreign demand in spite of having weak domestic demand for software. It was only in the late 1990s that the domestic economy, whether it be government ministries or Indian businesses, began seeking larger and more sophisticated software systems. The opposite has happened in Mexico and South Africa. Both nations have a solid software industry with potential for exports, but internal domestic demand has been too strong, inhibiting growth of a national export sector even when other success factors are present.

4. ASSESSING THE FUTURE FOR NEW SOFTWARE EXPORTING NATIONS

The many new software exporting nations (those in Tiers 3 and 4) face a difficult challenge: Can they move their national firms beyond selling commodity skills in programming (e.g., experience with platform X or programming language Y), with little national specialization and differentiation? Meanwhile, global software competition continues to broaden and become even more competitive. The top 33 economies are all expected to increase their high tech export capability within the next 15 years⁹ (Porter et al., 2001).

Those nations in the lowest tier (generally from developing nations with few resources) face even more daunting challenge: Can they move their national software export industries beyond that of a “craft industry” or a “cottage industry” in which most of the firms are small, managerial processes are informal, and marketing is immature?

⁷ www.bsa.org

⁸ Furthermore, in these nations, this local demand is usually not sophisticated vis-à-vis global customers—in other words, local demand is not as exacting as that of foreign clients: in terms of quality levels or use of advanced (and expensive) technology.

⁹ with the exception of Germany and UK which are already at high levels

We look to the theory of the firm to inform our understanding of a nation's industry. The resource-based theory of the firm (Wernerfelt, 1984) argues that in order to gain a sustained competitive advantage firms must develop firm-specific resources or capabilities that are: *valuable, rare, or costly to copy*. It is quite unlikely that being the low cost software producer by competing simply on low wages for commodity-type skills is a path to a sustainable position. National software industries that do not add value beyond simply being the low cost producer will soon see their work shift to lower-cost destinations. This is the "race to the bottom" (of the wage scale) that typifies such commodity work. Software work moved first to India because of low wages. But recently, many managers in decision-making positions are looking to nations where wages are even lower. On the other hand, a 4th tier nation need not become the future stars of software. If it can sustain a small exporting industry, it may well see some of the benefits: rise in GDP, more investment in infrastructure, job creation, and positive spillovers to other sectors of the economy.

ACKNOWLEDGEMENTS

I thank Robert Davison, Alberto Espinosa, and Jennifer Oetzel for helpful comments.

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