

## **SOFTWARE INDUSTRY PERFORMANCE IN INDIA AND CHINA**

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## **SOFTWARE INDUSTRY PERFORMANCE IN INDIA AND CHINA**

### **Abstract**

We seek to explain why the Indian software industry has grown rapidly as the world's leading exporter while the Chinese software industry that is equally as large and fast growing is little known outside China. Our empirical analysis depends on new survey data collected by the International Finance Corporation for this purpose. This paper is a summary of main findings from multivariate statistical analyses adapted from an unpublished book manuscript. We suggest that the most important features to explain the performance of Indian software firms compared to Chinese firms are their (1) Greater use of more educated professionals and more experienced managers without incurring higher labor cost, (2) Achievement of quality certifications, (3) Establishment of non-equity strategic alliances with foreign firms, and (4) Direct promotion from government.

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The Indian software industry is the world's leading exporter of software services and among the world's fastest growing software industries. The Chinese software industry is equally as large as the Indian industry – maybe larger – and equally fast growing, but it is mainly oriented to the domestic market. Faced with these similarities and the contrast in industrial development, we ask about the performance of the Indian and Chinese software industries:

- § Why has the Indian software industry achieved such great international success while China's software industry is scarcely noticed outside China? What were the specific conditions that led to India's outpacing the rest of the world in capturing the new software export market?

We explain which features of the Indian and Chinese software industries account for the differences between them and we suggest why the Indian software industry is export-intensive whereas the Chinese industry is not. To accomplish these tasks, we analyze original survey data from firms, and we make use of previous empirical studies and the opinions of experts. Some of our answers accord reassuringly with common beliefs, but only partially.<sup>1</sup> Some of our answers suggest new insights, we believe, into the performance of these two countries' industries.

### **SOFTWARE INDUSTRY FEATURES**

#### **Size and Growth**

Sales revenue of India's widely known software industry is not greater than that of the less internationally prominent Chinese software industry. The Indian industry reached about \$23.4 billion in sales revenue in the Indian fiscal year 2004-05 (NASSCOM 2006). The Chinese industry was \$26.5 billion in 2004 (China Software Industry Association 2005).<sup>2</sup> The worldwide software industry size was \$1,045 billion in 2004 (International Data Corporation 2005).

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<sup>1</sup> For recent expert work, see the chapters about India and China in Arora & Gambardella 2005 and in Commander 2005.

<sup>2</sup> Comparisons between countries must be interpreted with caution. Data sources are national, from government or private sources, and are not harmonized by an international agency. Definitions of industries vary with respect to products or services included.

The number of firms in India was about 3,170 in 2004-05. The size distribution of firms is characterized by a few large firms – the biggest five firms account for 44% of the industry’s revenue – and many smaller firms (NASSCOM 2005). In China, estimates of the number of firms vary widely; 6,282 in 2002 (Tschang & Xue 2005), and more than 8,000 in 2005.

Both countries’ software industries have grown very rapidly, and rapid growth has been sustained over quite a long time period. For the 14-year period beginning in 1990-91, the Indian software industry grew at a compound annual growth rate (CAGR) of 40% up to 2004-05. Over the 1994-2004 time period, the Chinese software industry grew at a CAGR of 38% per year; for the same shorter ten-year time period, the Indian software growth rate was again nearly 40%. The growth rate for the worldwide industry was 15% per year from 1997 to 2004. Both Indian and Chinese software industries are growing from two to three times faster than the world industry overall.

### **Types of Products and Services**

The Indian software industry is predominantly a software services industry while the Chinese software industry is more evenly balanced between products and services. In 2004-05, software packaged products accounted for only 5% of the Indian industry’s revenue, while software services made up 68% of the industry and BPO brought in another 27% (*Dataquest* 2005). Most of the Indian software services consisted of production of customized software from project-based engagements with clients. Much of this work consists of programming, testing, and maintenance, and in total probably more than three-quarters of Indian software services production is at the low end of the knowledge capital continuum.

In China, services accounted for less than half of Chinese software industry revenue according to some sources (NASSCOM 2003, China Center for Information Development 2003), with a share that declined from more than half in 1999 (Saxenian & Quan 2005, Tschang & Xue 2005, whose original sources were China Software Industry Association). Chinese software products consist mostly of systems software, middleware, and applications software.

Any study of Indian compared to Chinese software firms needs to account for the services versus products heterogeneity in the firms’ lines of business. In our multivariate work we explicitly introduce the services versus products business of the firms into the analysis to control for effects that might be unique to each line of business.

### **Exports**

Despite the industries’ similar sizes in total, the two countries’ industries differ radically in their export intensity. The Indian software industry is mainly an export industry, with 78% of its revenues earned from exports in 2003-04 – a figure that had increased over time (it was 58% six years earlier and just over 50% in 1990 at the beginning of the period) and is currently constant (NASSCOM 2005). By far the largest single customer country for Indian software exports is the US, which accounts for 68% of all exports, and Britain is a distant second with 15% of all export sales. The Chinese software industry is mainly a domestically-oriented industry, with nearly 90% of its revenues accounted for by the home country market in 2004.

## **FRAMEWORK**

We make use of three complementary approaches to the explanation of an industry’s international competitiveness: a production function approach that focuses on factors of production broadly conceived, elements of international trade theory, and the competitiveness of

nations model (developed by Porter 1990). The resultant framework suggests that differences in the performance of the industries depend on firm-level variables that managers control, which are conventional factors of production such as labor and capital, but also factors that are potentially especially important to software production and exports, such as management, technology, and infrastructure. The framework also suggests importance for international linkages established by firms as part of their strategy, and the competitiveness of markets in which firms operate (from Porter's model that includes the firm's strategy, structure, and rivalry among firms as determinants of the industry's strength.) A role of government is manifested in the creation of the institutional environment for the firm, and in specific trade, investment, and industrial policies of the government that affect software firms directly.

The list of explanatory variables that we analyze follows:

- Labor and management skill: the education of employees, the share of professionals in employment, and the experience of managers
- Management effectiveness: the quality of products or services, geographic clustering of firms, and the fit between management of professionals and the national culture
- Labor productivity and cost: labor productivity, wages, and unit labor cost
- Capital: physical capital and finance
- Infrastructure: electric power, transportation, and telecommunications
- Technology: research and development inputs, new product outputs, and patent and royalty earnings
- International linkages: non-equity strategic alliances, foreign ownership, and role of overseas residents
- Market competitiveness: ease of entry, pricing power, concentration, and foreign trade and investment threats
- Institutions: legal, educational, and governmental
- Government policies: tax, trade, investment, industrial policies

## **METHODS AND DATA**

To obtain answers to the research questions we raise, we make use of two multivariate quantitative analyses of new firm-level survey data – the IFC Software and Hardware Firm Surveys (described below). In one analysis we isolate statistically the differentiating features of the firms in each country's industry. Because the Indian and Chinese software industries are similar in size and growth but differ dramatically in their export intensity, an explanation of differences between these two sets of firms contributes to our understanding of the export performance of the Indian software industry. We also use the same survey data to analyze the growth determinants for the firms in each country's industry in a multivariate framework – why some firms grow faster than others.

Some explanatory variables are not easily measurable statistically or not available in the IFC surveys, or they are nation- or industry-level rather than firm-level. Therefore we also use the existing World Bank Investment Climate Surveys of India and China as supplementary data to describe the business environment of firms in these two countries.<sup>3</sup> In addition we use qualitative evidence about the business environment in each country's software industry, tracing the legacy of the past public policy framework and the features of recent government actions that are likely to affect managers' decisions and firms' performance. Finally, we conducted a small number of personal interviews with software managers and consultants.

The IFC survey consists of a sample of senior managers of software firms in India and China. The survey was carried out by face-to-face interviews. The questionnaire consisted of nine pages of questions answered by checking boxes, marking scales, or filling in blanks. Interview information was cross-checked and supplemented with financial information from company annual reports and other public sources. This means that data on objective variables such as sales revenue come from official sources rather than a manager's recollection.

The software sample consists of 179 firms, of which 119 are in India and 60 are in China. The sample of software firms in India was drawn from membership lists of five industry associations and an annual trade publication review of each industry.<sup>4</sup> The Indian software sample design included all the medium-large firms and a random sample of the small firms. As a consequence the sample covered 91 percent of the Indian software industry by sales revenue.<sup>5</sup> The response rate from software firms was 62 percent.

The Indian software sample represents the industry but not necessarily the thousands of very small firms in it. It also represents the industry in terms of the ownership of the firms, but it has relatively fewer software services firms and relatively more software products firms than the industry.

Questionnaires were completed by personal interviews conducted by staff members of the Confederation of Indian Industry from January-March 2004 in the five leading locations of the industries (Bangalore, Delhi (including the suburbs of Gurgaon and Noida), Mumbai, Pune, Chennai, and Hyderabad (software only)).

The Chinese sample was drawn randomly from a central government statistical report (National Statistical Bureau 2003) that identified the population of firms in Beijing and Guangzhou, to which was added firms in Shanghai based on local interviewers' knowledge of the industry. The response rate was 30 percent. Interviews were conducted by Renmin University survey research unit staff members in Mandarin or Cantonese languages.

The Chinese hardware sample covers 31% of the industry by sales revenue. The Chinese software sample covers only four percent of the Chinese industry's revenue (because in China revenue is spread among a very large number of very small firms). Chinese software firms in the sample are slightly larger than the industry average but broadly represent the products versus services breakdown of the industry; more firms in the sample are foreign-owned and fewer are government-

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<sup>3</sup> Some general findings are reported in Batra, Kaufman, & Stone 2003; we use the original country data.

<sup>4</sup> Confederation of Indian Industry, NASSCOM, and *Data Quest Top 200*. For the hardware sample, the sources were Confederation of Indian Industry, *Data Quest Top 200*, Electronic Components Industries Association, Manufacturers Association of Information Technology, and Telecom Equipment Manufacturers Association.

<sup>5</sup> Firms with sales revenue of more than \$50 million constituted only 1% of the number of firms in the industry but together had 90% of the industry's revenue, while 90% of the firms had sales revenue of less than \$3 million.

owned than is true for the industry but the proportion of privately owned domestic firms is representative.

**FINDINGS:  
WHY THE INDIAN SOFTWARE INDUSTRY IS EXPORT-INTENSIVE  
BUT THE CHINESE INDUSTRY IS NOT**

The findings we report are a synthesis of all our analyses, and therefore we do not in this paper present tables of regression coefficients, although those results do appear in other (not yet published) papers. In the text of the paper we summarize the findings and in accompanying tables we report quantitative results.

**Labor**

The first answer typically given to explain the export success of the India software industry is labor: India has an abundance of low wage technically skilled labor and is a low-cost supplier. That is true, and India does have absolute advantage and probably also a comparative advantage in software services production (Arora & Athreye 2002, Maneschi 2004). This can explain Indian firms' export success to western markets. It does not explain why the Indian industry is export oriented while the Chinese industry is not.

China also has a large pool of technically educated labor. Chinese labor wages are not significantly different from Indian wages. Labor productivity is not greater for Indian firms; in fact, it is lower and distinguishes the two countries' firms in a multivariate analysis. (In all the India-China comparisons, we control for the difference in the software services-products mix between the two countries.) Unit labor cost is not different between the two countries. The abundant and cheap labor argument does not explain India-China differences.

There are three labor advantages that Indian software firms have over their Chinese counterparts nevertheless. First, Indian software firms employ relatively more professionals than Chinese firms, and Indian software professionals have higher educational qualifications than their Chinese counterparts. Second, Indian software managers have greater length of experience than Chinese software firms, and firms with more experienced managers grow faster. Third, even though Indian firms have smaller labor productivity than Chinese firms, Indian firms with higher productivity grow faster whereas labor productivity doesn't affect the growth of Chinese software firms.

Our inference from these findings is that Indian software firms have better managers and more skilled workforces than Chinese software firms without incurring higher labor cost.

**Influence of the English Language**

English is spoken by all educated Indians but not by all educated Chinese, and that is an often cited reason why India is a major software exporter and China is not. The largest market for software exports by far is the English-language speaking United States. The US market for information and communication technology was about \$712 billion in 2005, more than double the size of the next market, which is Japan, according to one data source.<sup>6</sup> The three largest software services exporters are English-speaking countries: India, Canada, and Ireland. The

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<sup>6</sup> European Information Technology Observatory (2005). Data include IT hardware, software, and telecommunication services.

Philippines and South Africa, however, which also have educated English-speaking professionals, are farther down the list of software exporters and not much different in rank from Russia, which is not an English-speaking country and does not have large numbers of English-speaking professionals. Furthermore, the second and third largest markets, Japan and Germany, are not English language countries.

Although some studies of the strengths and weaknesses of the Indian software industry cite English language as an important factor (Aggarwal & Pandey 2004), others do not (NASSCOM 2004). Chinese software managers themselves in interviews we conducted were quite clear about the way in which the English language affected Chinese software growth, especially exports. It doesn't take English proficiency to write lines of code, and there are ample numbers, and growing numbers, of Chinese software engineers who can do that; it is not a constraint. However, the ability of Chinese software managers to obtain export business, including the negotiation of contracts and follow-up customer service, is limiting because of limits on the numbers of these managers who are able to work in English comfortably. The English language answer is important without doubt but not a sufficient explanation of India's success.

## **Management**

A firm's top managers can lead its growth and development in several ways. One of the most important features of Indian software firms that stems from management action is their achievement of quality certifications.

*Quality Certifications.* Indian software companies initially promoted the acceptance and use of CMM software quality certifications, and then many Indian firms achieved these certifications. It was a way for them to overcome the liability of foreignness and the adverse country of origin effect which they suffered in the early years of the industry. Quality certifications assure export customers that the supplier can deliver the contracted service on time, in full, and within budget. Today more Indian software firms have CMM quality certifications than Chinese software firms, and Indian firms have more of these certifications and at higher levels. Furthermore, both Indian and Chinese firms that have quality certifications have faster revenue growth than firms without them, and this favors the Indian industry.

*Independence of Action and Entrepreneurial Orientation.* A second feature of Indian software firm management refers to national culture. Software production is a creative process – at least some parts of it. While writing or testing lines of code might be quite routine, customized software development for western clients requires ingenuity and inspiration, and it benefits from initiative and quick decision making that doesn't depend on group consensus. The analysis of our survey data shows that the interaction between the entrepreneurial orientation of the firm and the independence of action of its professional employees distinguishes Indian from Chinese software firms. It is not entrepreneurial orientation by itself – Chinese professionals are no less entrepreneurial than Indians – but rather its combination with the questioning habit of Indian professionals that matters.<sup>7</sup> Indian national culture provides the basis for these traits. Indian national culture is unusual in its tolerance for ambiguity and comfort with uncertainty (Hofstede 1991). This means that Indians are unusually open to novel and unstructured situations, and are tolerant and comfortable with few rules.

## **Technology**

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<sup>7</sup> In interviews we conducted, Indian software company managers suggested the tendency toward independence – to question rules and policies; and we note that Nobel prize-winning economist Amartya Sen's most recent (2005) book is entitled *The Argumentative Indian*.

Technology has not been critical to the development of the Indian software industry. Indian software firms lag behind their Chinese counterparts in technology inputs and outputs, but that lag hasn't hampered the Indian industry's growth. Fewer Indian than Chinese software firms have R&D expenditures, and those that do spend less. This result is due only in part to the greater concentration of software services rather than products firms in the Indian industry – software products firms are more likely to have R&D expenditures than software services firms. In addition, Indian software firms introduce fewer new products than Chinese software firms. Until very recently, the software business wasn't an especially high technology business. Advanced technology was not the basis on which firms competed, especially for software services. The export business was mostly customized software services, much of which was low-end entry level work for which neither R&D nor new product introductions were important.

### **International Linkages**

One of the most important explanations for Indian software success is the linkages that the firms have established with foreign firms. The critical linkages are non-equity strategic alliances that matter in three ways: Many more Indian software firms have them than Chinese software firms, the Indian firms have more of them, and among Indian firms but not Chinese firms a larger numbers of alliances contributes to faster revenue growth. Many of the Indian firms' alliances are marketing alliances with large western producers of software platforms (Siddharthan & Nollen 2003).

The role of non-resident Indians – a different type of international linkage – is another frequently mentioned advantage of Indian software firms (for example, Ramamurti & Kapoor 2001). The argument is that the large numbers of NRIs in the US provided the bridge between the US export market and the Indian supply location, and sometimes NRIs were founders of software firms in India. No doubt this advantage existed in the past (but not for Chinese firms because the even larger Chinese diaspora was not as well situated occupationally or geographically), but it is not important currently. The importance of roles such as access to markets and management practices is modest and not different for Indian firms compared to Chinese firms.

Foreign ownership of software firms located in India tends to be portfolio investment whereas foreign ownership of Chinese software firms tends to be direct investment. Foreign ownership does not contribute to Indian software firms' growth but it does for Chinese software firms. The potential for foreign owners to provide access to foreign markets is not important for Indian software firms – non-equity strategic alliances do this – but it does contribute to the growth of Chinese firms, who don't have the other alliances.

### **Infrastructure**

The most important piece of infrastructure for software production is reliable electric power, and Indian firms suffer from much more serious electric power problems than their Chinese counterparts. However, Indian firms overcome this disadvantage by installing their own facilities. Most Indian firms are located in software technology parks that provide a more stable power supply but still depend on the public grid.

### **Market Competitiveness**

Firms are stronger internationally if the markets in which they participate are more competitive. Indian software firms face more competitive markets than Chinese software firms: they have less pricing power with customers, and entry is easier. This is partly but not wholly due to the services rather than products business of Indian firms. Indian software firms are also less threatened by foreign companies operating in their home market.

### **Institutions**

Indian legal and financial institutions are reputed to be quite good, yet Indian firms are claimed to be burdened by restrictive labor law and by dealing with government regulations. We find that none of these institutional features differ for Indian compared to Chinese software firms, in the view of firm managers. This result could be due to the relatively small footprint that these institutions have on the software industry.

### **Government Policies**

Another commonly held belief attributes the success of the Indian software industry to benign neglect from the government. This belief is wrong. It is true that the software industry, a service industry that emerged only a few years before the Indian “license raj” was dismantled, benefited from less regulation than, for example, the older hardware manufacturing industry. However, government was very active in promoting the software industry from its very early years, in three principal ways.

Government assisted software companies to overcome the major infrastructure weaknesses they faced in India – unreliable electric power and lack of international telecoms connectivity – by creating software technology parks with reliable power and satellite telecom links; and government permitted companies to build their own power and telecoms facilities in addition (it added to cost but not much).

Government liberalized imports of equipment that software companies needed; tariffs on the import of computers and components were drastically reduced in the early 1990s.

Government gave incentives early on to export software via specific income tax concessions: net earnings from export sales attracted no corporate income tax payments for 10 years. Chinese software companies also received income tax concessions from government but the Chinese tax concessions were not so directly linked to exports.

Not all government influence on the Indian software industry was positive. Most importantly, Indian software firm managers feel more burdened with government bureaucracy than Chinese managers. In addition, Indian managers believe that low government efficiency is a greater hindrance than Chinese managers. Of course, these subjectively reported differences could be due to a greater tendency of Indians to voice disagreement.

### **Chance: Y2K**

There is room for chance or luck to favor or complicate an industry’s growth. For software, Y2K is such a factor. The realization in the late 1990s that computer systems would fail at the end of 1999 when the calendar changed to year 2000 – because years were designated in the code with only the last two digits – gave rise to a temporary surge in software conversion work. The Y2K problem was, it is claimed, a serendipitous piece of good luck for Indian software firms.

It is true that Indian software firms were well-placed to take advantage of Y2K work. Indian programmers were familiar with obsolete code that had been used many years before, Y2K conversion was labor intensive and at the low end of software development where India was especially labor-abundant, Indian software professionals were low-cost for foreign clients, linkages from western clients to Indian software firms had already been established via bodysourcing, and by the late 1990s it was possible to do this work inexpensively offshore in India via international telecom links. While software firms in other countries surely could also do Y2K conversion work, they didn't have the combination of a first-mover advantage and low labor cost that the Indian firms had.

However, it is easy to overstate the importance of Y2K for the growth of the Indian software industry. According to figures reported by NASSCOM and *Dataquest*, Indian software firms earned 16.5 percent of their export revenue from Y2K-related work in 1998-99 (April 1-March 31) and 12 percent in 1999-2000 (see Kumar 2001). These shares are significant but not dominant. Furthermore, the growth rate of Indian software export revenue was actually higher after Y2K than before: up 57 percent in 2000-01 over 1999-00 versus up 52 percent the prior two years. Y2K was at best a modest demand booster for Indian software firms at the time. The more important role played by Y2K was the increase in exposure to new export customers and the spreading of a reputation for quality work completed on time and within budget.

### SUMMARY

India is by far the world's leading exporter of software services and has grown very rapidly. The Chinese software industry is equally as large and fast growing but not export oriented. In this study we offer explanations why the Indian software industry achieved great international success while the Chinese software industry is scarcely noticed outside China. To do so we analyzed new firm-level survey data, considered the historical development and public policy framework of the two countries, conducted a small number of personal interviews, and took into account the published views of experts. This paper is a summary of findings adapted from a book manuscript on this topic. We present the findings verbally without showing econometric results that are available in other unpublished papers.

We find that several common previous explanations for the growth of the Indian software industry are insufficient, and new insights are needed.

Indian software firms are competitive exporters because of the low cost of skilled labor, but Indian firms have neither higher labor productivity nor lower labor wages than Chinese software firms. India's labor advantage over Chinese firms is that its firms have a more skilled workforce without higher cost, and more experienced managers. Indian software managers achieved quality certifications for their firms, unlike Chinese managers, and quality certifications contribute to firm growth. The Indian national culture that tolerates uncertainty and the independence of action exhibited by Indian professionals is conducive to software production.

Among the most important strategies of Indian software firms is the establishment of non-equity strategic alliances with foreign firms: many more Indian than Chinese software firms have them, they have more of them, and they contribute to the firm's growth. However, another source of international linkage, which is the services of non-resident Indians, which surely was important in the early years of the industry, is not important at the current time. The English language capability of Indian professionals is not critical, but English language skill among managers is.

Indian software firms lag behind their Chinese counterparts in both technology inputs and outputs, but this weakness was not critical for most of the work done by Indian customized software services firms. Neither is the weakness of Indian infrastructure a serious disadvantage. Although unreliable electric power and telecommunications are serious problems, Indian firms overcome them (at modest additional cost) by installing their own facilities, and by locating in government-provided parks.

The common belief that benign neglect from the government enabled Indian software firms to thrive is wrong. It is true that software services firms grew up as the license raj was being dismantled, but much beyond that, the government promoted software exports very directly. In addition to providing software technology parks, government offered tax concessions and lifted restrictions on imports of inputs. On the other hand, Indian software managers perceive greater hindrance to their business from excessive government bureaucracy and low efficiency of government services compared to Chinese managers.

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Table 1  
Values and Effects of Features of Indian and Chinese Software Firms:

Variables in **bold font** distinguish between Indian and Chinese firms in a logistic regression analysis where the dependent variable is the country of the firm.

Variables in *italicized bold font* are determinants of short term sales revenue growth of firms in a multivariate SUR analysis.

Skill Indicator <i>Finding</i>	Data for India	Data for China
Labor and Management		
<b>Professional employment (median share of total employment)</b>	<b>69%</b>	<b>29%</b>
Education among professionals: <b>Entry level qualification for new professional employees (median)</b>	<b>Post-graduate degree (≥17 years)</b>	<b>Diploma or 1<sup>st</sup> university degree (13-16 years)</b>
Experience of top managers: <i>Contribution of one more year of experience to revenue growth</i> Years of experience of top manager in the software business (average) Share of managers who have work experience abroad of at least 10 months	+7% 18.3 36%	-26% 16.7 2%
Quality certification: <b>Share of software firms that have a CMM quality certification</b> Average number of CMM certifications (for those with a certification) <i>Effect of having CMM certification on revenue growth</i>	<b>47%</b> 2.1 <i>90% faster</i>	<b>7%</b> 1.0 <i>No effect</i>
Entrepreneurial orientation (ave. score on 3-item 15-point scale): Independence of action (percent of managers who say professional employees have to be convinced to follow instructions when they do not fully agree) <b>Entrepreneurial orientation * independence of action score (interaction)</b>	11.2 47% <b>10.4</b>	11.1 7% <b>6.9</b>
<b>Labor productivity (value of output in USD per worker)</b> <i>Effect of 10% increase in labor productivity on sales revenue growth</i>	<b>\$25,567</b> <i>10% faster</i>	<b>\$29,625</b> <i>No effect</i>

Wages and benefits: Starting wages for professionals (median USD per month)	\$315	\$330
Unit labor cost: median US dollars of labor cost per US dollar of output average US dollars of labor cost per US dollar of output	\$0.40 \$0.40	\$0.31 \$0.36
Technology		
Technology input: Research & development spending <b>Number of firms with R&amp;D expenditure</b> R&D costs as percent of total cost (median) Software services firms Software products firms	<b>72%</b> 5.0% 3.5% 15.0%	<b>93%</b> 22.5% 15.0% 30.0%
Technology outputs: <b>New product introductions in the last one year (average number)</b> Patent filings in last three years (percent with filings) Royalties and technology fees earned abroad in last three years % of all firms with earnings Amount of earnings if any received (median)	2.23 20%  21% \$85,744	2.66 34%  12% \$120,000
International Linkages		
Non-equity Strategic Alliances: Firms that have non-equity strategic alliances (%) <b>Firms that have <u>foreign</u> non-equity strategic alliances (%)</b> Firms that have <u>domestic</u> non-equity strategic alliances (%) Number of alliances (average, among firms with alliances) Number of <u>foreign</u> alliances (ave., among firms with alliances) Number of <u>domestic</u> alliances (ave., among firms w/ alliances) <b>Contribution of one more foreign alliance on revenue growth</b>	68.6% <b>60.2%</b> 31.3% 10.1 6.8 3.3 <b>+6%</b>	42.4% <b>11.9%</b> 42.4% 10.7 4.9 5.8 <b>No effect</b>
Foreign Ownership: Number of firms with: Some foreign ownership Some but <25% foreign ownership (portfolio investment) ≥ 25% foreign ownership (FDI; foreign management interest) 100% foreign ownership (wholly owned subsidiaries) <b>Foreign ownership stake, average over all firms</b> <b>Contribution of 10% greater foreign ownership stake to sales revenue growth</b>	58% 20% 30% 10% <b>23%</b> <b>No effect</b>	32% 2% 30% 22% <b>29%</b> <b>19%</b>

Role of Non-Residents: Firms in which non-residents have had a role (percent)	48.3%	23.3%
Importance of non-residents' role (sum of four scales where 0=no role and 5=very important role)	6.1	2.8
Type of role played by non-residents in firms where they have a role (where 1=no benefit and 5=very important benefit)		
Access to markets	3.9	2.9
Access to management practices	3.4	3.8
Access to technology	3.2	3.2
Access to capital	2.8	2.5
<b><i>Contribution of 10% greater importance of non-residents to The firm's revenue growth</i></b>	<b><i>No effect</i></b>	<b><i>25% faster</i></b>
Infrastructure		
<b>Electric power</b>		
<b>Power cuts: seriousness of problem</b> (1 = no problem, 5=major problem)	<b>3.1</b>	<b>1.9</b>
<b>Have own electric power facilities (percent yes)</b>	<b>87%</b>	<b>23%</b>
<b>Transportation</b>		
<b>Public transport failures (1 = no problem, 5 = major problem)</b>	<b>2.6</b>	<b>1.6</b>
Software technology parks, special economic zones, or export processing zones		
Number of firms located in these places (percent)	88%	83%
Government Policies		
Policies that help the firm's growth:		
Tax concessions	4.0	3.6
Number of firms that benefit from income tax concessions	81%	90%
<b>Infrastructure provision</b>	<b>3.8</b>	<b>3.0</b>
<b>Marketing support</b>	<b>2.6</b>	<b>3.7</b>
Research & development support	2.8	3.6
Education policies	3.4	2.3
<b>Liberalization of</b>		
<b>Import policies</b>	<b>3.5</b>	<b>1.4</b>
Foreign direct investment policies	3.4	1.9
Policies that hinder the firm's growth:		
Taxes – corporate income, excise & sales	3.6	3.6
Infrastructure quality and quantity	3.9	3.2
<b>Travel and visa restrictions</b>	<b>3.9</b>	<b>2.5</b>
<b>Bureaucracy and paperwork requirements</b>	<b>3.6</b>	<b>2.5</b>
Low efficiency of government services	3.4	2.5
High import tariffs and import restrictions	3.2	2.0