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Software Export Success Factors and Strategies in Developing and Transitional Economies

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Table of Contents

Software Export Success Factors and Strategies in Developing and Transitional Economies

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Abstract

Many developing and transitional economies (DTEs) have become active or interested in software exports. This paper analyses the experiences of the three largest exporters – India, Ireland and Israel. It develops a 'Software Export Success Model' on the basis of that analysis. It uses the model to investigate current strengths and weaknesses of three 'second-tier' exporters: Russia, the Philippines, and China. It then draws some conclusions about recommended actions for these and other would-be software exporting nations.

A. Introduction

Most application of information technology (IT) in developing and transitional economies has been 'intensive'; that is, applied to pre-existing processes and outcomes (Narasimhan 1983, Heeks 2002). However, IT can also be used in an 'extensive' role to develop new processes and, hence, new products and services. In extensive applications, there is a much clearer link between IT and the creation of jobs, incomes and skills than is the case for intensive uses of the new technologies. This paper therefore discusses extensive applications of IT; specifically the provision of software-related goods and services.

In the provision of software, two focal dimensions can be identified (Heeks 1999):
?? Market location: sales to export and/or domestic markets.
?? Output type: sales of software products and/or services.
In this paper, we will look at both products and services, but – while we do briefly discuss export—domestic linkages – we will look only at the export segment. Barriers to entry into exports are greater than for entry into domestic sales. Software exports can also exacerbate inequalities, since they are often virtual enclave activities with relatively few trickle-down benefits to the poor[3]. However, general developmental rewards are greater, in terms of income/productivity per head, profits, foreign exchange earnings, and the infusions of knowledge that can accompany

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[3] Or, more accurately, few benefits that have been charted, since linkages between IT exports and local poverty alleviation remain largely unresearched.

international operations[4]. We also recognise the considerable interest in software exports among developing and transitional countries.

This interest has been piqued partly by the size and growth rate of the potential market. The global software market has been predicted to grow from US$90bn in 1997 to US$950bn in 2008 (Nasscom-McKinsey 1999). Such prognostications predate both the dot.com failures and terrorist attacks of 2001. However, current predictions see, at worst, 18 months of IT market stasis in 2002-3 before a return to double digit growth rates (Donoghue 2001). DTEs are therefore attracted to markets for both software products and software services that are each worth tens of billions of US dollars in overall terms, and which each normally grow by well over 10% per annum in real terms. Even the 'narrow' market niches that DTE software exports address are huge: in 2000, the US alone is estimated to have spent US$5.5bn on offshore software services; a market that has been growing at more than 25% per year (Infoworld 2001).

Countries are also attracted partly by the perceived software export success of other developing and transitional economies. The perceived 'winners' have been led by the 3Is – India, Ireland and Israel[5]. These countries' exports are described in Section B and analysed in section C through the presentation of a 'Software Export Success Model'. Following the first-tier software exporters, there has emerged a set of second-tier nations – we select Russia, the Philippines and China for analysis in section D – which have expanded operations particularly during the 1990s, but which have much smaller exports.

The purpose of this paper is to analyse the export strategies and results of both first and second-tier software exporters. Our methodology is analysis of country case studies drawn from our own fieldwork and writings on India, and from secondary sources. Our objective is to draw lessons both for the studied countries themselves and for other DTEs: those like Hungary, Jordan, South Africa, Sri Lanka and others which have identified themselves as third-tier aspirants and started to take action, and also others – the majority of developing countries – which have yet to take any serious action on such aspirations. The final section of the paper (section E) draws together these analyses and lessons.

B. First-Tier Software Exporters: The '3Is'

We start our analysis with the major software exporting DTEs; the 3Is of India, Ireland and Israel. Detailed analysis of critical success factors will be given in the next section. Here, we present a brief historical and statistical picture of each country's software export sector.

[4] See, for example, studies on the developmental impacts of software exports in specific countries by Grundey & Heeks (1998) and Arora & Athreye (2002); and across countries by Correa (1996).

[5] Classification of Israel and, particularly, Ireland as developing/transitional is debatable. However, both can be seen as representing nations on the European periphery in economic as well as geographic terms, and both have socio-economic histories that share features in common with those of DTEs, especially of not having industrialised by the mid-part of the 20th century.

India

India exported its first software services and products in the mid-1970s. However, it was not until the 1980s that vigorous and sustained growth began, as multinationals like Texas Instruments started to take a serious interest in India as a centre for software production (and as a market for products).

In terms of products and services, there have been continuous exports of software products since the early 1980s. These include enterprise systems, design software, and database management tools. However, such exports have consistently formed less than about 5% of total exports. Indian software exports have been, and remain, dominated by services (Heeks 1998).

Within the overall segment of software services exports, though, trends of change are detectable. Indian firms began with a strong emphasis on 'bodyshopping': the transportation of software staff to work overseas at the client's site. In the late 1980s, around 75% of export earnings came from bodyshopping. By the early 2000s, this had dropped to nearer 60% (Dataquest 2001), indicating a slow but steady trend towards offshore working.

This has been paralleled by a second trend: that of moving up the value chain from supply of programming services to addition of design/analysis services to complete turnkey project services. As with offshore working, the trend of change has been greater within individual client—vendor relationships than in the industry overall.

The result has been that – for many years – India has been the developing world's software leader. It is estimated to have exported US$5.1bn-worth of software in 2000/1, having sustained average annual growth of more than 40% over the last decade (Heeks 2001). Software accounted for 8% of India's total exports, and an estimated 140,000 were employed by something like 1,000 firms in software exports in 2001 (Kumar 2001). Just under half of the Fortune 500 now outsource software development to India (Moitra 2001).

Predictions of US$50bn-worth of exports by 2008 (Nasscom-McKinsey 1999) seem over-optimistic. Nevertheless, though Y2K and most euro conversion work now lies behind India, there are expanding future opportunities in e-commerce, m-commerce and legacy-to-Web services amongst others (Moitra 2001).

Ireland

Ireland's love affair with software can be charted back to the early 1970s and three things: Irish entry into the European Economic Community, the deliberate efforts of its Industrial Development Authority to attract high-tech multinational investment via financial incentives ("such as employment, training, capital and R&D grants"), and heavy investment in education and telecommunications (ORiain 1997, Coe 1999). This particularly began to bear fruit in the 1980s (when software was explicitly targeted for the first time) and 1990s, as Ireland's IT reputation spread and as European market unification made Ireland an attractive European production base.

A major initial area of software export activity lay across the boundary of services and products. Software multinationals (typically from the US) came to Ireland to set up local subsidiaries. These local ventures did not write the main original code, but undertook localisation (such as addition of interfaces and manuals in UK English and other European languages), and then locally produced and distributed the shrink-wrapped packages.

From this starting point, the Irish software industry has determinedly diversified. Package customisation and localisation remain key activities, but the largest number of firms now work in software services. The emphasis has been on Internet and multimedia consulting, with a focus on turnkey projects rather than contract programming or bodyshopping (EI 1997, ORiain 1997). A few firms produce niche products such as programming languages and tools, and products for specific sectors such as financial services.

Ireland's software industry has grown by an average of 20% per annum during the 1990s. As for all other countries discussed here, statistics vary from source to source. However, Ireland is often cited as the world's second largest software exporter, with software exports valued at US$8bn in 2000 (Moore 2001)[6]. It is said to produce about 40% of the packaged software sold in Europe and exports some 80% of output. In 2000, some 30,000 people were employed in the industry in roughly 700 firms, of which just over 100 (most of the largest and responsible for nearly 90% of exports) were foreign-owned (Kelly 2000, NSD 2001).

Prospects for growth seem good, with firms showing an especial interest in areas that have hitherto lain outside the investment spotlight: provincial towns and Northern Ireland.

Israel

The very early roots of Israel's software success lie, as they do for India, in the post-independence, government-funded drive to increase technical expertise. A technically-proficient cadre trained by the military in the 1950s found themselves in key positions from the 1960s onwards (Ariav & Goodman 1994). This cadre formed a network that spanned the military, the government and the private sector. As computer hardware and then software became commoditised, an opportunity presented itself. The cadre was able to see opportunities for private sector commercialisation of software developed through military- and government-funded R&D.

Beginning slowly in the late 1970s and early 1980s, this trend of commercialisation really took off during the 1990s. Israel's main strength has been the export of niche market software products. These particularly include communications utilities, and security and anti-virus tools; an original area of concentration in which new products are continuously being developed (de Fontenay & Carmel 2002). New product niches have also been created, including application generators, database management tools and educational software.

[6] Kelly (2000) and OECD (2000) report Irish software exports as roughly half this amount.

The result was roughly US$2.45bn-worth of software exports in 2001 (DoS 2001), with annual export growth rates typically around 10%. About 300 software houses in Israel employ some 20,000 staff, and exports represent roughly three-quarters of their output (*The Hindu* 2001). Of all Israeli IT firms, some 120 are listed on the NASDAQ: a figure second only to Canada for non-US stocks. Major US IT firms all have local software subsidiaries, though Israel's exports remain fairly geographically diversified – about one-third go to the US, the remainder mainly to a variety of European destinations. Its product focus has also reduced the impact of perceived Middle Eastern instability.

C. Critical Success Factors In Software Exports

How have these three nations been able to succeed in software exports? Our analysis of their software industries builds upon – and has been structured on the basis of – earlier models of national and software industry critical success factors. A generic model is that of Porter (1990), who sees key factors for industrial competitiveness as: demand conditions; local factor conditions; structure and strategy of local firms; and related/supporting industries.

Alongside this, we can set developing country-specific software models, which see key success factors as:

- human capital and costs; overseas linkages and diaspora; government policy (Balasubramanyam & Balasubramanyam 1997);
- access to inputs; overseas linkages; firm clusters; firm-level strategy; government policy; national vision (Heeks 1999);
- government policy; geographic distribution of firms (Hung 2000);
- skilled people; access to technology; structure and management of software firms; communication of information and knowledge (Krishna et al 2000);
- linkages and trust/transfers; industry clusters; access to inputs (Dayasindhu 2002).

There is clearly overlap between these factors. For the purposes of initial analysis, these literature-derived critical success factors were integrated and synthesised into five factor dimensions: demand; national vision and strategy; international linkages and trust; software industry characteristics; and domestic input factors/infrastructure.

Each of these dimensions was then analysed on the basis of the 3Is' experience, as described below[7]. The intention was to develop a more detailed success factor model.

Demand

For all three industries, the nature of demand has been critical. As already noted above, the global software market has registered average double-digit growth for the past twenty years. There has also been a huge gap between demand for, and supply

[7] Unless otherwise indicated, evidence is drawn from sources already cited.

of, software labour[8]. This has created a strong pull into the market. It is also very forgiving of delays, errors, problems, etc.

The importance of domestic demand is less clear. Both India and Ireland, with their service-related focus, have relatively weak or small domestic software markets. There is evidence that this has helped push software firms into exports (Heeks 1996). On the other hand, the presence of a domestic market in both countries has attracted foreign investors who set up linked software export operations. Israel, with its product-related exports, is possibly different. It has made use of a relatively sizeable and demanding domestic market as the springboard for exports. Nevertheless, as noted above, the Israeli software industry is export-dominated.

National Vision and Strategy

All three first-tier software exporters have had a national strategy to promote their software industries generally and software exports particularly. The presence of a national strategy for software exports is therefore be recognised as a vital part of software export success (Balasubramanyam & Balasubramanyam 1997). Indeed, it goes beyond this – critical to each country's success has been a vision of what software could achieve for the country; a vision shared by a relatively small but committed group of government officials and private entrepreneurs. Such visions first emerged in the 1970s, were sustained through lean early years in the 1980s, and only truly came to fruition in the 1990s. This has typically required institutional support within government, such as that found in Ireland's Industrial Development Authority and its National Software Directorate, and in industry, such as India's National Association of Software and Services Companies.

The detail of strategies for achieving each vision has undoubtedly been somewhat iterative. That is, it did not cast the exact vision of market segments in stone pre-hoc. Instead, given some starting point, strategy has flexibly reacted to what has worked (and what has not). The capacity for such iteration and flexibility – found both within government and within the private sector – is thus seen as a further critical success factor (Heeks 1996).

One may note that the 3Is do overlap in what they are doing. All, for example, export some software products; all export some software services. However, the bigger picture is one of differentiation. India means software services; Ireland means product-related services for multinationals; Israel means home-grown product exports. This differentiated branding has undoubtedly helped each to succeed as simultaneous first movers in software.

That, of course, has been their most important *initial strategy* – to be first. But what *succeeding strategy* have they now been adopting to sustain market share given that they are no longer alone? This has been the key challenge for all three that has driven succeeding strategy – increasing competition from other DTE software producers.

[8] Shortfalls of software workers for the US alone are typically cited around the 1 million mark (Lakaeva 2000a).

Given their different market segments, though, and other differences, each country has followed a somewhat different strategic path.

India had a starting point of bodyshopping programming services, and has faced challenges of rising labour costs and brain drain of staff based onsite as well as competition from new entrants. Its key succeeding strategy has therefore been that of *climbing the value chain* – moving to higher-skill contracts with more offshore elements. This has been particularly successful within individual client—developer relationships, where it has sometimes been accompanied by vertical market specialisation (i.e. a focus on Western clients in a particular sector such as hotels or clothing). India faces a general challenge of relative weakness in project management skills in the industry overall. However, 20 of the 37 recipients of the Capability Maturity Model highest level rating are Indian software exporters (Moitra 2001). This indicates the strength of capacity that has been built for managing offshore software export projects within many of the key firms.

India has been rather less successful at strategically addressing two other challenges:

?? its dependence on the US (which takes about two-thirds of Indian software exports) and related vulnerability, reflected in a 2001/2 slowdown in export activity (Farrell 2001)
?? national and regional instabilities that have generally worsened since 2001.

Ireland has been more fortunate. Its perceived stability has increased since the brokering of the Northern Ireland Peace Accord, and its exports go to a large number of European countries as well as to the US. Nevertheless, in other ways it has faced challenges similar to those in India: rising labour costs (Irish GDP per capita now outstrips that of the UK) and a continuing brain drain that have exacerbated fears about competition from other, cheaper locations and about 'footloose' multinationals moving away to such locations.

As described, its response has been one of *diversification* away from localisation/customisation of foreign packages, into software services projects and into niche market products. The former has been the more successful – relatively weak provision of venture capital, weak support for local R&D, and a small domestic market remain continuing challenges for product development. There have also been attempts to increase the indigenous firm base. The Irish government has used various carrots and sticks to encourage local managers in multinational firms to spin off their own local software start-ups.

For Israel, already at the top of the software value chain, the main challenges have been obsolescence of current products or competition from other product firms, and also the danger of dependence on the military sector. Its strategy has therefore been one of *innovation and differentiation*. It is continuing to produce new software products in existing market niches. At the same time, it is making new software products in new market niches – typically ones that do not derive from or relate to military innovation – in order to retain market share.

International Linkages and Trust

Exports, of course, mean making and sustaining linkages with markets and customers (and suppliers) overseas. All three countries have been strong in this. At the original and often continuing root of such linkages has been a national diaspora. For Ireland and Israel, flight from poverty and/or persecution settled large numbers overseas, particularly in the US, prior to the creation of the current nation states. From the 1960s onwards, all three countries have been losing managers and other professionals to the lure of the green card.

Often maligned as a costly 'brain drain', this diaspora formed the basis for contacts and then contracts that set each country's software export market in motion. Scratch beneath the surface of all early exports and you find a US- or Europe-based expatriate. As emigration has continued (fostered by software exports in some cases), the potential for ever-more linkages and ever-more trade grows too. Reverse migration has also started to be significant, with returnees coming home to invest in software start-ups in all three countries, especially since the mid-1990s.

Although the diaspora has been vital, more normal marketing operations have also been used to build export trade. Governments have helped by providing market information, by organising and subsidising attendance at overseas trade fairs and exhibitions, and by supporting the formation of trade/industry associations like India's Nasscom. 3I companies have helped themselves by setting up subsidiaries in overseas markets, enabling them to get 'close to the customer'[9].

Getting close to the customer is also part of building *trust*; a factor that underlies all software trade. All imports involve risk for clients, especially the outsourcing of services to remote locations. Without some degree of trust, no trade will take place. Good marketing and diasporan contacts get over the initial trust barriers. They continue to be surmounted by fulfilment – the ability of 3I software firms to deliver sufficiently high-quality software outputs close enough to time and budget in order to sustain trust. This has given each 3I country a reputation and track record that reduces perceived risk and enhances trust.

The building of trust has particularly been possible through the creation of close, expanding client—developer relationships. Many or most of the significant players in all 3I software exports have been involved in relationships with single, large multinational clients. Typically, these clients have invested in a local subsidiary or joint venture. By thus internalising market transaction costs, they have saved money and also built the trust that has enabled expansion of export operations.

All 3I governments have encouraged such linkages by offering tax breaks and other financial and non-financial incentives to multinational investors in software exports, and by removing red tape for business operations. The result, for example in India, has been the presence of software subsidiaries for almost all major IT firms, and for many other leading multinationals.

[9] For example, the Irish government has set aside specific financial support for overseas expansion by local software firms, leading 70 to have subsidiaries in the US alone (Cochran 2001).

A number of other 3I actions can also best be understood in terms of trust. The enthusiasm for ISO9000 certification in India and Ireland is one[10]. There are few signs that certification actually improves software development. But what it does do is send a powerful signal to distant clients, "We are like you; we work according to your norms; we submit ourselves to your standards; you can trust us".

Likewise, action on software piracy and copyright – although forced on 3I countries at the political level – can also be read as a trust-building measure, assuring clients that the 3I nations are trustworthy in terms of their intentions. India, for example, has passed increasingly strong anti-piracy/copyright legislation for software in 1984, 1994, and 2000. For Ireland, with its software package production base, strong copyright laws were an essential starting point.

Software Industry Characteristics

Given their different operations, the characteristics of each 3I software industry do differ. However, three characteristics stand out as common. First is *competition* between firms. All three industries are dominated by privately-owned firms (often, as seen above, involving some foreign capital), and concentration ratios have been relatively low. Thus, all three involve hundreds of firms, typically of medium size (50-500 staff) competing relatively freely with each other[11]. Competition, though, should not be oversold. At least in services, the massive global gap between demand and supply for software labour has left many Indian and Irish firms pushing at an open door and finding inter-firm competitive pressures relatively weak (Krishna et al 2000). The result has been reduced pressure to innovate or differentiate.

The second characteristic has been *clustering*. Most software export firms in the 3Is cluster around a few locations: Bangalore, Mumbai, Chennai, Delhi and Hyderabad in India; Dublin and Cork in Ireland; and Tel Aviv, Haifa and Jerusalem in Israel. Clustering has brought a number of benefits: rapid interchange of information and knowledge (about best practices, about market opportunities), locational economies (it is cheaper to provide infrastructure in all its forms to a cluster of software firms than to the same number of firms that are scattered), and a raised marketplace profile (de Fontenay & Carmel (2001). Government has supported these efforts by helping bring infrastructure to the clusters.

The final characteristic has been *collaboration* – the ability of software firms to work together in areas of mutual benefit such as policy advocacy, overseas marketing, market research, and distribution of best practice. This has typically been enabled by the software industry associations and effective government agencies found in all three countries.

[10] Some 150 Indian firms have certification; the same is true of roughly 100 Irish firms (Cochran 2001, Moitra 2001).

[11] Agglomeration is a debatable fourth characteristic: having firms large enough to compete in a global market. The presence of medium/large firms would seem an obvious advantage, and such firms (often with foreign investment) dominate software exports in all three countries. The debate arises from the demonstrated ability of small firms in all three nations to also undertake software exports.

Domestic Input Factors/Infrastructure

Many factors form the tapestry of domestic infrastructure that supports and enables software exports. A number of these can be identified as key to the 3Is' success.

People

More than any other factor, software relies on people. Probably the 3Is' number one critical success factor has been the skills and expertise and size of the local labour pool. In part, this may be pre-existing – India and Israel had strong scientific and technical establishments (including defence) since the 1950s. In part, though, labour has been developed through deliberate government intervention to build the IT skills base, especially at tertiary level, where all three have had and have strengthened excellent technical education institutions[12].

At first sight, labour costs might seem to be central to software export success for the 3Is. While they have clearly been important, they need to be set alongside, rather than above, other factors. Survey evidence shows clients rate skills and the ability to close their labour demand—supply gap as more important than costs (Heeks 1996, Robb 2000). Evidence from Ireland shows continued software export growth despite labour costs that can exceed those of neighbouring countries; and Israel's software sells because of its quality and reputation rather than price.

Two other human elements figure in the 3Is' success. The first is English, the global business and IT language, and also – not coincidentally – the language that dominates higher education and, to a significant degree, business in all the 3Is. The second is knowledge. Initially through the diaspora but later through exports and client linkages, staff in 3I software exporters have built up a strong knowledge base: about overseas software markets, about overseas business norms and practices, and about specific customer needs and values. This has put them in a strong position to sustainably grow their software export business, whether in services or products.

Technology

Both Ireland and Israel have benefited from a strong technological infrastructure – of both hardware/software and digital telecommunications – that (at least in cluster locations) is equivalent to client country norms. This can be put down to liberalisation combined with government and foreign investment.

In its early years, India's domestic technological base was a critical weakness, not success factor. Hence, the reliance on bodyshopping as a way of short-circuiting that weakness. Since 1991, government investments have grown and liberalisation has increased the involvement of private funds and foreign investments in the technological infrastructure. Barriers to such investments, including import tariff barriers, have also been reduced. As a result, cluster-centred infrastructure now approaches that found in some Western countries[13].

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[12] The result, for example, is higher numbers of scientists, engineers and technicians per head of population than in neighbouring countries (UNDP 2001).

[13] For example, the number of high-speed leased lines in software rose from 10 in 1992 to more than 1200 in 2001 (ACCR 2001)

Finance

Governments in all three countries have acted to stimulate the supply of working and venture capital to software firms. All three have used a raft of tax breaks, marketing subsidies, grants, loans, legislative updates and removal of red tape in an effort to achieve this – a combination of both liberalisation (less government) and promotional intervention (more government). Israel particularly has brought all these together with infrastructure and advice in a set of high-tech 'incubators' that have helped boost export earnings (Kaplan 1998).

All three countries have also benefited from heavy investments of overseas aid that has been channelled into infrastructural investments. This has come from the international donor community in India's case; via the European Union for Ireland; and from the US for Israel.

Research and Development

All three countries have invested in software-related research and development, directly via government and indirectly via tax breaks for private sector R&D. In all cases, this has brought at least some indirect benefit for the human infrastructure; building skills and knowledge. The innovation benefits have varied. In product-focused Israel, with the highest R&D investments of the three, they have been crucial. Government-subsidised multimedia projects have been spun off into everything from games to business and home applications. Military-funded developments in signal processing and encryption have emerged in a variety of Internet communication and security packages. In service-focused India, success stories – especially commercialisation of publicly-funded R&D – are few and far between.

Other

Governments in the 3I nations have helped by providing or enabling an infrastructure of transportation (road and air), utilities, and business accommodation, especially to software export cluster locations. They have also assisted the knowledge infrastructure of ideas and best practices in their support for ISO9000 and for software industry associations.

The Software Export Success Model

A summary of the analysis above is presented in Table 1.

	India	**Ireland**	**Israel**
Demand	High external demand; weak domestic demand	High external demand; weak domestic demand	High external demand; strong domestic demand
National Vision and Strategy	Vision and strategy present: software services, then climbing the value chain	Vision and strategy present: product-related services for multinationals, then diversification	Vision and strategy present: home-grown product exports, then innovation and differentiation
International Linkages and Trust	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy	Diaspora and state-funded links; reputation and trust, partly through ISO and anti-piracy
Software Industry Characteristics	Some competition; clustering and collaboration	Some competition; clustering and collaboration	Strong competition; clustering and collaboration
Domestic Input Factors/ Infrastructure	Strong, low-cost human capital; catching-up in telecoms; access to capital; limited R&D success	Strong human capital; strong telecoms; access to capital; some R&D base	Strong human capital; strong telecoms; access to capital; strong R&D base

Table 1: '3I' Country Success Factor Similarities and Differences

On the basis of this analysis, the dimensional model presented earlier can now be drawn in greater detail. It is shown in Figure 1 as the 'Software Export Success Model'[14]. It shows drivers at top (pull) and bottom (push), and enablers in the middle.

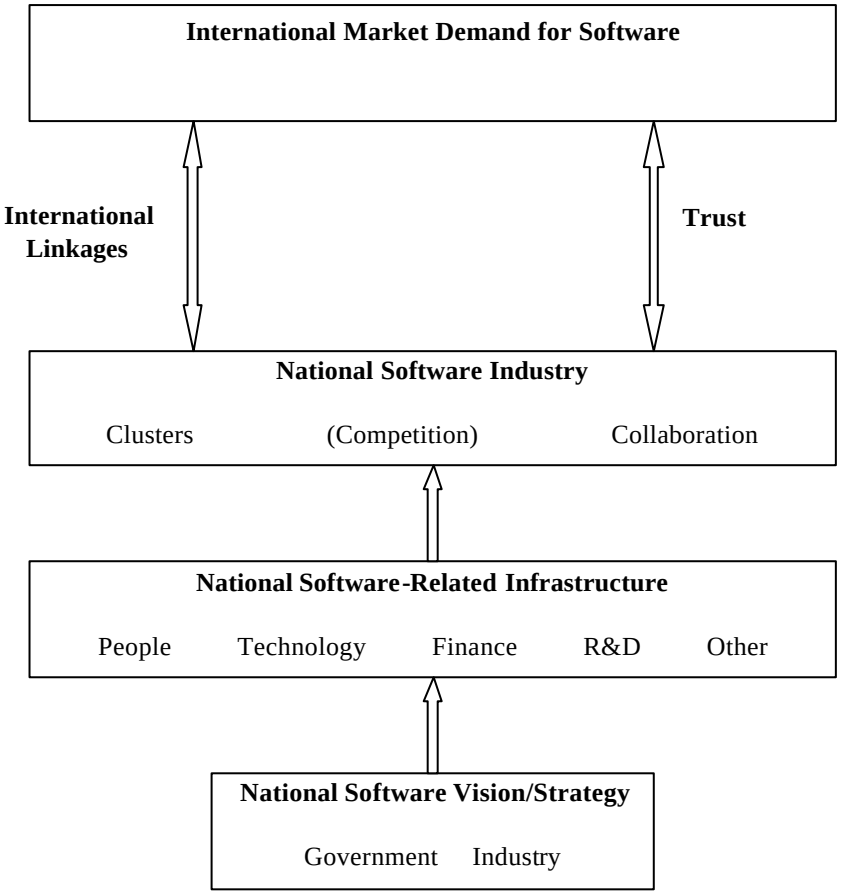

Figure 1: The Software Export Success Model

D. Assessing Second-Tier Software Exporters

Having developed a model of software export success from the experiences of the leading players, we can now assess the performance and potential of other developing and transitional economies. Three are selected here. Some elements of the export success model – specifically the presence of strong international demand – can be taken as a given for all three countries. Most elements, though, need to be analysed on a country-by-country basis.

Russia

Statistics are notoriously hard to gather in Russia – a legacy of state manipulation and mistrust. However, it is estimated that software export revenues for 2000 were

[14] This model has been developed from the experiences of DTEs. It is beyond the scope of this paper to test the model's relevance to industrialised economies, although it may well have a broader relevance.

somewhere between US$60m and US$100m, with an annual growth rate somewhere in the region of 50%, and between 5,000 and 8,000 programmers employed in software exports (Lakaeva 2000a, ACCR 2001).

Of total software exports, some 30% was products, which typically fall into niches such as text recognition, anti-virus or games-related applications with a strong scientific or technical content (Heeks 1999, Lakaeva 2000b). The remainder was software services, typically offshore programming work. The offshore industry is divided into two main camps (Lakaeva 2000a, ACCR 2001). First, there are around 100 companies of 10 to 20 programmers doing small jobs and getting contracts through friends and acquaintances. Second, there are about a dozen companies with 50 to 300 programmers which are partly or wholly foreign owned: Motorola, LG, Samsung, Intel, Microsoft, Sun and Boeing have all opened their own software development centres (Kitov 2001).

Analysed on the basis of the export success model, Russia has three main strengths (ACCR 2001):

?? Foremost is that of human infrastructure. Technical education has been a significant strength for many years, with Russia ranking third in the world in terms of per capita scientists and engineers (UNDP 2001). Sizeable numbers of these have had experience in major nuclear, space, military and communications projects and have moved into the software industry. Despite this experience, labour costs are low: variously estimated as on a par with, or significantly lower than those in India[15].

?? As indicated above, many Russian software firms already have valuable international linkages and investments. Coupled with the recent diaspora of Russian professionals, especially to the US and Israel, this has created a network of contacts that can build export trade.

?? Thanks in part to roots in technical education institutes and pre-existing R&D facilities, Russia's software industry has begun to cluster. 'Silicon cities' are particularly located in St Petersburg, Moscow and Novosibirsk, clustering around the local state universities and featuring local marketing consortia.

However, the country also has some important export success model weaknesses (ACCR 2001). Perhaps chief among these has been a lack of any clear vision or strategy for software export growth in the country. Firms have been left largely to their own devices, with few of the supportive interventions found, for instance, in the 3Is. This has had a particular knock-on into infrastructural weaknesses – poor financing, poor marketing, and limited, costly telecommunications are all the result.

Beyond these, the country is struggling with limitations in its human resources. They may be good – even excellent – technically, but English language skills are limited and there is poor knowledge of Western business practices. Outsourcing contracts are also stuck in 'programming prison': limited experience and few skills with software project management or quality control are preventing any generalised move up the value chain.

[15] For instance, Asia Pulse (2000) states that, where an Indian programmer may earn something like US$7,000 per year, the same level of talent can be purchased in some parts of Russia for less than US$3,000 (Asia Pulse 2000).

As there are two sides to the human infrastructure coin, so there are also with international linkages. Individual client—developer relationships are deepening, but this is not true of the Russian software industry more generally. Widespread piracy (arguably a legacy of the pre-1991 "all property is theft" mentality), a weak legal system, perceptions of widespread corruption plus heavy-handed bureaucracy have restricted the development of trust within the potential Western client base. An antipathy to market research and to opening offices overseas has restricted Russian firms' understanding of that potential Western client base.

The Philippines

The Philippines ranks second only to India as a developing country location for offshore software development. However, closer analysis reveals that its export activities are better seen as falling within a broader catch-all of 'IT-related services', covering not just software development but also back-office data services operations such as data entry, data processing, digitisation, transcription, help desk and call centre work. Data services have been particularly strong, with firms such as Barnes and Noble, Arthur Andersen, and America Online all setting up back office operations in the Philippines.

Software exports for 2000 are officially estimated at US$200m but it is unclear to what extent this figure covers all IT-related services, or to what extent it takes account of any bodyshopping and Internet-based exports (Hamlin 2001). In all, there are estimated to be more than 30,000 Filipinos available in the IT-related sector in several hundred – often foreign-owned – firms (Jatras 2001).

The foundation of the Philippines' IT-related services exports has been the former US facilities at Clark Air Base and at Subic Bay Naval Base. The US military withdrew in 1992 after volcanic damage to the air base. However, it left behind a strong local infrastructure of road and air transportation, telecommunications and accommodation (Moore 2001). It also left funds to support further infrastructural investments in the newly-created Subic Bay and Clark Special Economic Zone. Finally, it left a legacy of many former employees who had a good understanding of Americans and American working practices, and who formed a natural cluster within the zone.

This strength of knowledge about the West is one part of a vast web of international linkages that has been spun by the government's deliberate policy of encouraging labour migration. Some seven million Filipinos currently work overseas, and they provide a channel for the flow of knowledge and, sometimes, export-related contacts (del Rosario 2001).

The Philippines final export success model strength also lies in its people, through its education system. American English is taught in all local schools[16] and literacy rates – at 94% – are very high for Asia. Higher education has also received significant investments, including IT-related education, thus producing a substantial base of workers with IT skills.

[16] The country claims to have the third largest English-speaking population in the world.

On the downside, the Philippines has many similar weaknesses to those seen in Russia (Poe 2000). Government has been encouraging IT-related exports, but outside the key cluster areas, general infrastructure – roads and business accommodation as well as hardware and telecommunications – is poor. Labour cost estimates vary wildly, but there is a general sentiment that costs are somewhat higher than in India (Jatras 2001). Finally, trust – and related foreign investments – has been hard to build. Perceptions of political instability, corruption and poor legal safeguards permeate Western thinking. New IT laws were rushed onto the statute books in the wake of the ILOVEYOU virus – an event that may either have showcased Filipino IT skills, or emphasised perceptions of risk and untrustworthiness.

China

In contrast to many other developing and transitional economies, China already has a strong domestic software industry that dates back to the 1980s. Total domestic sales in 2001 were around US$3.8bn (China Online 2001). Software now employs some 100,000 people in more than 1,000 firms, showing overall annual growth rates of more than 20% per annum since the mid-1990s (TDC 2000). As a result of China's domestic focus (contrasting with India's export orientation in software), software exports form a relatively small proportion of turnover – around US$130m in 1999, almost all of which were services-related (Ju 2001).

In terms of the export success model, China's main advantage for the future is the presence of a clear government strategy (perhaps even a vision) for software. Enshrined within the tenth five-year plan (2001-2005) is a policy of prioritising software, including software exports, in the hope of emulating India's success – a hope that World Trade Organisation entry may greatly advance. This has recently brought tax breaks for software development, access to cheap capital, and relaxation of rules on sending employees abroad. China also has a strong telecommunications infrastructure and an appropriate educational system that delivers software labour with costs at or below those for an equivalently-qualified Indian (Joseph 2001).

There is some clustering of software firms. Zhonguancun science and technology park in Beijing represents China's Silicon Valley and is home to IBM and Microsoft subsidiaries as well as dozens of other software firms. In addition, there are clusters in a number of coastal areas, such as Shanghai and Dalian. China's other cluster strength is in Hong Kong and its associated regions, with nearby mainland cities of Shenzhen and Guangzhou hosting a growing number of satellite offices for Hong Kong software firms. Hong Kong provides an invaluable interface to the international market with its multinational subsidiaries, its many existing trade linkages and contact networks with overseas Chinese[17], and its knowledge base of English and of Western business practices.

Export success model challenges for China are, again, reminiscent of those in Russia (TDC 2000). It has a programmer-heavy skills profile that constrains it from moving beyond coding contracts. Hong Kong aside, English language skills are limited as is

[17] Estimated to number around fifty million (Guest 2001).

knowledge of the West and Western businesses. Access to finance is difficult. It also has the whole low trust package – perceived corruption, an autocratic and bureaucratic style, high levels of software piracy, and the currently heavily-repressed potential for massive political instability. Finally, it is the mirror image of India since China's strong domestic market is drawing or holding resources away from exports (EIU 2001).

Summary

A summary of these three second-tier countries in terms of the software export success model is presented in Table 2 (negative features are italicised).

	Russia	**The Philippines**	**China**
Demand	High external demand	High external demand	High external demand; high domestic demand
National Vision and Strategy	*Vision and strategy absent*; some software services focus	Some government strategy present: IT-related services	Strategy present: software overall
International Linkages and Trust	Diaspora-based links. *Lack of trust and knowledge; high levels of piracy*	Diaspora-based links. *Lack of trust and high levels of piracy*	Diaspora-based links and Hong Kong interface. *Lack of trust and high levels of piracy*
Software Industry Characteristics	Some clustering	Some clustering	Some clustering
Domestic Input Factors/ Infrastructure	Significant, low-cost technical human capital. *Poor finance, marketing and telecoms; few English or higher-level skills*	Significant low-cost human capital; strong cluster-based physical infrastructure. *Weak general infrastructure*	Significant low-cost human capital; some physical infrastructure. *Poor finance; few English or higher-level skills*

Table 2: 'Second-Tier' Country Software Export Success Model Strengths and Weaknesses

E. Conclusions

Having analysed the experiences of three major DTE software exporters, and three second-tier exporters, what can we conclude?

In a general sense, the software export success model has proven useful as a way of understanding the experiences of developing and transitional economies. It offers a template against which to analyse national strengths and weaknesses. It also offers some more general guidance for countries seeking to increase their software exports. This guidance will be summarised below, under four main headings.

In all areas, the role of government is seen to be crucial. Some neo-liberals, of course, dispute this. They argue that governments should not intervene in industrial development, and they particularly identify the risks, costs and market distortions of having the state try to pick sectoral winners (O'Keeffe 1992, Jackson 1998). Others, however, see government as always having played an essential interventionist role in industrial development (Lipsey 2000). The value of such a role is emphasised by almost all analyses of software export development in DTEs (e.g. Press 1993, Correa 1996, Heeks 1999).

National Vision

The importance of vision in software export success has been identified above. Vision is not something that can necessarily be catalysed from outside. The most successful software exporters have had it – and sustained it for many years. The least successful have not.

National Strategy: Demand and Markets

Overall demand, as noted, is high in all the software export segments populated by developing and transitional economies. Nevertheless, the countries surveyed have tended to focus (at least initially) on particular market segments. To understand this, we need to move beyond the initial simplistic analysis that divided output markets into two: software products and software services. On the basis of the cases presented above (plus the work of Apte (1991) and Correa (1996)), we can now move to a somewhat more sophisticated model, as illustrated in Figure 2.

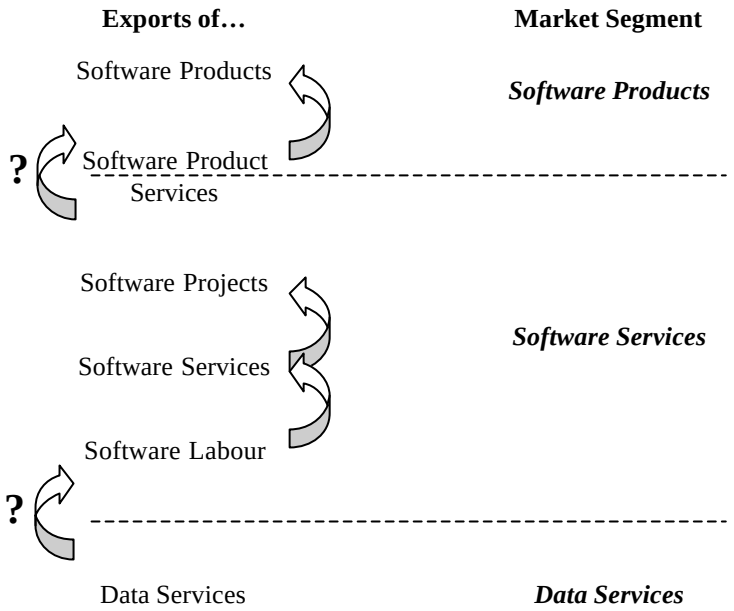

Figure 2: Software Export Output Segments

Addressing the other output market dichotomy – of exports and/or the domestic market – there are some who argue the importance of the domestic market; seeing, for example, that a strong domestic market should precede and link to software exports (Schware 1992). While true for *product* exports in the cases studied above, *services* exports seem able to grow with few domestic market linkages. This can also be turned around. Unless a DTE has a strong and demanding domestic market with viable international linkages, and some synergy between the domestic market and export opportunities, it should stick to service rather than product exports.

Early Entrant Strategies

To judge from the experiences of the 3Is, early entry into software export markets reaps considerable rewards. These first movers have been able to build up contacts, policies, knowledge, infrastructure, working methods, track records, etc. They therefore threaten to consolidate their position whilst squeezing late-comers. However, despite the benefits of early entry, countries that are already software exporters have latterly felt the challenge of competition, and other factors such as rising labour costs and the brain drain.

For those countries that are already software exporters, then, what strategies are open? Their strategies may include:

Value Addition

Movement up the model in Figure 2, from data services through software services to software products, represents value addition, with ever-increasing earnings per employee. The importance of making such moves derives from competition. New company and national entrants tend to move in at the bottom end, putting pressures on existing countries and firms to move up.

What we have seen from the cases is the capacity of national software industries – via individual firms – to move within market segments. India particularly has at least partly moved on from its bodyshopping origins to the management of whole software projects.

What has been less clear is the ability of industries to move between segments. India's inability to gear up from services to products has been marked. Behind the presented image of software, Indian firms have also been widely involved in data services (*The Economist* 2001); but relatively few have crossed over into software. A question mark therefore remains over the ability of countries like the Philippines to move from low-value data services to higher-value software services.

Diversification

An alternative strategic option for established players is diversification – moving away from competition or growing constraints in existing market niches into new market niches. Examples of this can be seen in all of the countries surveyed – both diversification of output type and of market location – suggesting it is a viable approach. On the other hand, one may also be struck by the difficulties of diversification. Despite years of dependency awareness, India still relies mainly on

service exports to the US market. Israel, similarly, still depends heavily on products. Perhaps diversification within market segments is easier than diversification into new market segments.

Innovation

As well as developing new niche products, countries involved in significant product exports have also tended to make use of innovation: bringing out new products in existing niches.

Late Entrants

The majority of developing and transitional economies are not early entrants into software exports. The strategies above therefore represent lessons for years to come. Instead, they are – or will be – late entrants that face the uphill task of competing against established players.

Some generic late entrant strategies – such as faster delivery or better quality or product differentiation/innovation – seem unlikely to offer a way forward. A few individual late entrant firms may use them, and they can give food for thought to particular exporters. However, they have not clearly been used by late entrants at a national level, and domestic input factors are unlikely to be supportive. Countries must look elsewhere, to two other generic late entrant strategies:

Low Cost

The three second-tier late entrants, and many late entrant firms within 3I and other countries, have at least partly adopted the low cost strategy. This strategy is rare in products – low labour cost advantages are eroded by high marketing costs. So low cost has worked mainly in software services through the use of cheaper labour than that offered by existing exporters, all of whom suffer from rising labour costs. For those whose wage structures permit, it is straightforward and simple. However, its effectiveness is questionable. As noted above, low costs typically rank below availability of skills and other factors in client rankings. First movers can also play the same game: when demand dropped in 2001, so did the prices charged by Indian firms, halving in some cases (Field 2001).

Market Niche

All three late entrants have also at least partly adopted the market niche strategy. They have identified areas in which DTE competition is weak and in which – thanks to domestic input factors – they are strong, and moved in. Examples include strong scientific and technical skills in Russia, work with Chinese language software for China, and offshore data entry work for the Philippines. Other budding entrants can therefore also scan both markets and domestic input factors (plus factors such as international linkages) to look for areas of potential strength. Moving into niches is as much a first mover as a late entrant strategy, and can bring with it many of the benefits of being first.

National Tactics: Infrastructure

No strategy will work unless the domestic infrastructure for software exports is supportive. Within their strategies, DTEs must therefore also devise a set of tactics to deliver that supportive infrastructure. These have been discussed above, and tactics specifically for national governments are summarised in Table 3.

Factor	Possible Promotional Interventions
People	General education at primary to tertiary levels; Specific further and higher education and training in IT- and software-related skills/knowledge; Investment/subsidies for research and development; Encouraging diffusion of best practice
Technology	Investment in telecommunications infrastructure; Encouraging/facilitating greater involvement of private and foreign investment in telecommunications; Reduction of tariff barriers on IT imports
Money	Investment in and facilitation of venture and working capital funds; Encouragement of foreign investment
Information	Investment in freely-accessible market research; Subsidised marketing activities
Innovation	Investment/subsidies for commercialisable research and development
Other	Investment in transportation and utilities; Reduction in bureaucratic procedures

Table 3: National Government Tactics to Support Software-Related Infrastructure

National Tactics: Linkages and Competitive Clusters

What can countries do to build the international linkages that are so vital to software exports? Four main actions suggest themselves:

?? Make it easier for people to get out: reduce the red tape and other restrictions on movement of professionals to other countries.

?? Encourage people and money and ideas to come in: this will particularly focus around creating a climate conducive to foreign investment, through tax incentives, liberalisation of financial controls and investment limits, and reduction in other bureaucratic overheads. It will also include stronger contacts with nationals overseas, and the use of workshops, seminars and the like to get ideas into the country.

?? Facilitate relationships: investment in both general and specific meetings both in-country and overseas that can help build trade relationships.

?? Build trust: address the perceived risks of software exports. Issues like regional instability may be outside institutional control. However, measures that can be taken include new legislation (e.g. on software piracy), and subsidies for ISO9000 accreditation.

What can DTEs do to encourage the competitive clusters that help software exports succeed? For some countries – akin to the India of the 1970s and the Russia/China of the 1980s – some liberalisation may be beneficial, freeing software firms from unnecessarily burdensome central restrictions and regulations.

More important will be investment in specific locations. Ideally, this should follow the 'organic' rather than 'inorganic' model. That is, governments should seek to strengthen existing clusters and proto-clusters rather than create new, artificial clusters, some of which have a history of costly failure.

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