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Software Strategies in Developing Countries

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Software Strategies in Developing Countries

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Abstract

Production of software provides many potential benefits for developing countries (DCs), including creation of jobs, skills and income. This paper reviews five different strategic approaches to software production that can be adopted:

- Export of software services, the model followed by India – the most successful producer – is beset by various constraints, but does offer opportunities for a few countries.
- Export of software packages has been far more limited.
- Production of packages for the domestic market is difficult given the domination of imported packages.
- Selling software services to the domestic market is the choice of most DC software enterprises, but it typically represents a survival strategy more than a development strategy.
- Finally, some firms successfully 'straddle the intersections' between the other strategies, often by recognising synergies and growth routes between different market segments.

Given the many constraints that exist, the paper reviews the factors underlying successful software production in developing countries, which fall into three domains:

- Enterprise tactics, such as the ability of successful firms to identify growth markets and to access necessary inputs.
- National strategy, such as government assistance in providing the inputs of finance, skills, technology and knowledge that successful firms require.
- National vision, that carries forward both government and enterprises.

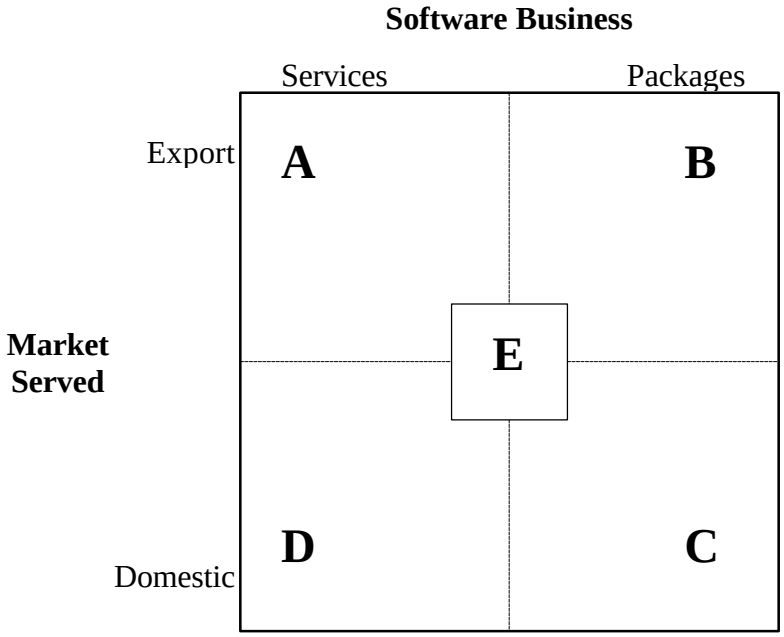
[1] An amended version of this paper will appear as an article in *Communications of the ACM* (http://www.acm.org/). The author acknowledges the contribution of Sy Goodman and anonymous reviewers to that article.

Introduction

Globalisation touches everything these days, and software is no exception. It's big business in developing countries (DCs)[2], from the headline-grabbing 'software factories' of Bangalore to the back-street database designers of Nairobi. And no wonder: many countries have cheap, talented labour that finds an easy route in to a business that is labour-intensive, has relatively low entry barriers, and few economies of scale. Computer science graduates need arm themselves with just a PC and a couple of user contacts to become part of the local information economy. Add a modem and they are global 'infopreneurs'.

But this is also a multi-faceted business: which software targets should developing countries be aiming for? Experience shows five strategic positions that could be taken by DC software enterprises, shown in Figure 1.

Figure 1. Strategic Positioning for Developing Country Software Enterprises



[2] The term 'developing country', as used here, encompasses not merely the nations of Africa, Asia, Latin America and the Caribbean, but also the transitional economies of Eastern Europe and other nations on the European periphery such as Turkey and Ireland.

1. Positions A and B: Are Exports 24-Carat or Fool's Gold?

At first sight, the export-oriented strategy represented by positions A and B seems highly attractive. As noted, the entry barriers appear low and the rewards appear high: extrapolation from the patchwork of incomplete and sometimes uncertain figures suggests developing countries exported at least US$3bn-worth of software in 1998/99. However, one must 'look behind the mask' at the reality of these exports.

The export image projected is one of 'virtual development' in which clients sitting in the West interact with software professionals developing packages overseas. The reality, though, is somewhat different with most software exports having:

- *A skewed output profile*: software *packages* represent a small proportion of total DC exports. Instead producers provide software *services*, which account for more than 70%, 80% and 95% of Russian, Philippine and Indian exports respectively (*Computing* 1997, Heeks 1998). The software success stories have therefore been overwhelmingly in position A rather than B.
- *A skewed location profile*: large amounts of development work take place at the client's site, i.e. by having DC software developers fly over to work with the client. For some, the skews are even greater. Pakistan exports around US$15m of software per year (Nicholson 1997). Its main software exporters now manage their software export operations from offices in the US and employ US-trained Pakistani programmers, throwing into question what it means to 'export' software and to be a 'developing country' company.
- *A skewed skills profile*: most work undertaken by DC developers is relatively low-skill software construction and testing, leaving the high-skill tasks of analysis and design residing in Western hands. Exporters from India – the Third World's software export giant – do take on a limited number of 'cradle to grave' contracts, but 80% or more of earnings come from the 'grunt work' of programming (Heeks 1998).

Despite these skews, the high profile of India's success particularly makes many wish to follow in its footsteps. Those who do find roadblocks along their path, including:

- *The infrastructure roadblock*. The software export trade increasingly demands a sizeable installed computer base; reliable and pervasive telecommunications links both domestically and internationally; and reliable electricity supply. Some Third World locations lack this infrastructure. Rapid strides are being made in overcoming this deficiency, as the global spread of telecommunications attests. Yet even here fax and email correspondence remain the backbone of use, and a substantial requirement remains for developers to visit and work at their client's site. Indeed, the telecom-enabled work being contracted offshore from the US crosses half-way with the firms, like those from Pakistan mentioned above, which are migrating to the US in order to be 'close to the customer' and in order to access scarce high-level skills. Telecommunications technology is thus slowly modifying this trade but has yet to revolutionise it.

- *The 'FUD' roadblock*. Many Western clients still express 'fear, uncertainty and doubt' about DC contractors and their business environment (Kumar 1998). Ask the average Western business manager to conjure an image of the Third World, and s/he will mirror the images of the mass media: of poverty, famine, war and corruption. Such stereotypes are hardly fertile ground in which to sow the seeds of software export, especially when combined with the toxin of outsourcing disaster stories: HP taken to court and (worse) paraded on '60 Minutes' over supposed exploitation of low-cost Indian contractors; insurance firm AIG's debacle in outsourcing an entire division's programming to Indian staff who were not up to the job. Thus, despite the massive growth in trade, sourcing software from developing countries remains anathema to large swathes of Western business: only 16% of US corporations see this as a significant strategy to meet their software needs (ITAA 1998).

- *The late-comer roadblock*. A number of developing countries – such as India and Singapore – arrived on the export scene many years ago. So, too, countries on the European periphery – such as Ireland, Israel, and Hungary – have been low-cost software export bases since the early 1990s. These countries have already built up contacts, policies, infrastructure, working methods, track records, etc. As a result,

the more established players threaten to consolidate their position whilst squeezing out late-comers (Heeks 1996, Taylor 1998).

In addition to first mover consolidation of existing export markets, three further opportunities arise within position A:

- First movers have been adept at service market diversification. Indian software exports have registered real-term annual growth of 40% or more – to nigh on US$2bn in 1998 – by successfully surfing the waves of demand from downsizing to Y2K and on to conversion for the new euro currency (Taylor 1998).
- First movers have also become concerned to move up the value chain. They aim to do this particularly through industry-sector specialisation that will both deepen trust relations with their clients and deepen their expertise. Add in strong software wage inflation that a few first movers have been suffering plus increases in the US H1B visa quotas used for foreign workers and – partly countervailing the squeeze described above – some limited opportunity gaps may be opening up lower down the value chain for 'second-comers' to the software export business. Recent exports from countries such as Sri Lanka and Mauritius support the existence of such gaps.
- Inter-DC markets are also growing: Africa, Asia and the Middle East are the target for around 5% of India's software exports, while Korean and Malaysian clients are outsourcing to countries like the Philippines, China and Vietnam.

Of course, the realities of this strategy must be faced since position A is typically an 'export enclave' in which skills and technology fail to trickle down into the domestic market. Staff who work on export projects are far more likely to move on to a Green Card than back to domestic market work. India loses around 15% of its software workers every year, largely to the US (Heeks 1996). Some firms haemorrhage staff so fast that they 'run in order to stand still', undermining their attempts to move up the value chain.

Even money can become partly enclaved. Much of that US$3bn leaves developing countries to pay for: travel and living allowances of the DC developers who work at the client site; marketing expenses; information and communication technology imports used for DC-based contract components; and profit repatriation by the many

multinationals involved in this trade (Mansell and Wehn 1998). Net earnings are thus far less than gross, knocking the headline figure back to less than US$1.5bn.

Opportunities must finally be set alongside opportunity costs. Putting your brightest software stars to work on applications that boost the growth of foreign firms and foreign economies incurs a large opportunity cost when applications to meet the many pressing domestic needs are consequently sidelined.

2. Position C: A Third World Microsoft?

Position A is a successful strategy adopted by a few developing countries, but not one that represents a panacea for all. Instead, then, should some software enterprises in developing countries be aiming for the production of domestic software packages: option C in Figure 1? In the general applications market of word processing software, spreadsheets, databases, operating systems and the like, they certainly should not.

Imported packages, either legal or pirated, have that market (shrink-)wrapped up, and entry barriers for local firms remain formidable (Correa 1996, Grundey and Heeks 1998):

- *The cost roadblock*. Low labour cost advantages are quickly eroded because of packages' high development costs. Microsoft's R&D budget is seven or eight times larger than the total earnings of Asia's largest software firm – Tata Consultancy Services – while its sales and marketing spend dwarfs the software revenue of whole continents. Most DC software firms simply do not have the revenue base to justify investing up-front in the research and development, advertising, sales and marketing necessary to make any significant inroads into even their local package market.

- *The piracy roadblock*. High rates of package piracy squeeze an already small domestic market, with well over three-quarters of all software pirated in many

African countries and less than 5% bought legally in China. This renders unit costs for marketing and distribution even higher.

- *The foreign preference roadblock*. Irrespective of price, quality and features, consumers in most developing countries seem to prefer foreign rather than local software. Whether the cause is ‘neo-colonial mentalities’ or ‘once bitten, twice shy’ from past experience of half-baked local products, the outcome is the same: barriers to position C.

So high are these barriers that, in sum, the Microsoft of the 21st century is not currently incubating in the technology parks of India or in Malaysia’s multimedia corridor.

3. Position D: Small Fish in a Small Pool

The vast majority of DC software firms sit in this market segment, largely because it is by far the easiest for them to enter.

This could be a good starting point for progress into, say, exports. A sizeable and demanding domestic market can be the springboard from which to launch into exports by providing a base of relevant skills, experience, user feedback on products, and track record. Second, a sizeable domestic market will draw large numbers of IT multinationals into collaborative relationships with local partners in order to serve that market. As these relationships deepen, an export component often emerges.

Unfortunately, the domestic software market in many DCs cannot yet be described as either sizeable or demanding. In Western countries, software represents more than 55% of the IT spend; in countries like China and Indonesia, the figure is less than 20% and there is a ‘technology lag’ of some years behind the leading edge (WTO 1998). This creates a ‘domestic enclave’ separated from the global market.

Because of this *domestic market roadblock*, most position D firms therefore remain position D firms: small fish in a small pool that do not grow and which get very limited exposure to new ideas and new technologies. For them, position D is more a survival strategy than a development strategy.

4. Position E: Straddling the Intersections

Alongside strategy A, position E represents the other main success story of developing country software, with a theme of specialisation for niche markets that include:

- sectoral niches like banking, insurance, health administration, hotel management, mining and forestry;
- application niches such as Web browser add-ons or text retrieval utilities;
- linguistic niches for regional languages like Spanish, Swahili or Chinese.

There is no single route for success here, but Chilean firms epitomise one major pathway. Typically they began by providing one client with Spanish interface software custom-built to meet particular local needs. They then created a 'semi-package': a set of menu or window interfaces used as a marketing or development platform for further customisation initially in the local market and then, as opportunities were perceived, in the Spanish-speaking markets of Latin America and even Europe. The result has been exports of nearly US$100m (Baeza-Yates et al. 1995).

Alternative routes include those of Israeli firms which have spotted export opportunities for domestic market packages, and even those of a few 'enclave-busting' Indian firms which have repatriated knowledge gained from service export contracts and incorporated it into customisable packages for the local market.

With its initial roots mainly in the domestic market, this position is under threat as that market comes to the attention of Western software producers. They have started to localise their packages – even some for niche markets – and to set up services subsidiaries. Nevertheless, through their local contacts and local understanding, DC producers retain a 'knowledge advantage' that some can put to good use.

Generic tactics and strategy are discussed next, but successful ‘straddlers’ also specifically depend on two aspects of market integration that mean they largely avoid the enclave and opportunity cost shortcomings suffered by position A:

- An entrepreneurial recognition of opportunities for synergy and leverage; seeing a local niche that will also sell overseas, or a package that will help sell customisation services.
- Demanding local customers; typically a set of regionally or globally competitive businesses which provide a channel from one market segment to the next.

Being realistic again, one must recognise that there are roadblocks here too (ones shared with other strategic positions). As well as domestic market demand and integration constraints, there are:

- *The skills roadblock*. Although one may criticise them for being often self-taught, the developing world’s programmers remain its main strength, providing a solid base of technical expertise in a number of countries. But the skills profile is too ‘programmer-heavy’ with simple coders making up 85% or more of all software personnel (Correa 1996, Heeks 1996). Where software development therefore starts to fall down is in the shortage of information systems analysis and design capabilities, especially an understanding of human and organisational requirements. There are also difficulties bringing software developments in on time, on budget, to the required quality because of limited software project management skills.

- *The finance roadblock*. World-over, software has a problem of financing, partly because of its intangibility and its heavy up-front investment costs. With a few honourable exceptions, there has been a conservative and bureaucratic attitude to finance and a lack of venture capital in developing countries.

5. Understanding the Winners

What is it that has differentiated those who have succeeded from those who have not in developing countries? Some reasons have already been described, but we can also identify more generic co-ordinated efforts made in three main domains by the 'winners'.

i. Enterprise Tactics. Little is known about the management tactics and critical success factors that underpin software enterprises in developing countries. What we do know suggests that tactics in relatively open developing economies overlap significantly with those in the West. Successful development of software enterprises has been based on factors such as: identification of demand-growth markets and synergies, cost or service innovation, and good marketing. Enterprises must also obtain sufficient access: to both investment and working capital; to programming, analysis and management skills; and to information technology.

In addition, successful software enterprises require effective mechanisms for transfer of information and knowledge that rely on three forms of both formal and informal networking:

- *Internal networking* such as meetings and team working.
- *Peer networking* between local software firms, typically based either on the high levels of staff turnover for which the IT industry is renowned, or on informal meetings.
- *Other external networking* between the enterprise and: foreign markets and innovators, potential and actual clients, and government officials. The US-based diaspora from India, Ireland and Israel has been fundamental to their external networking and, hence, to their software export success; a reminder that 'brain drain' has its benefits as well as costs.

In all this, we see why DC (and other country) software firms have tended to cluster. Not only are there collective efficiencies in the supply of infrastructure, people and money, but proximity also oils the wheels of informal knowledge exchange. Bangalore, for example – now lauded as India's 'Silicon Plateau' – provides the locus for the

semi-serious BAIT (Beer-drinkers Association of Information Technology). This regularly brings together senior IT industry managers in one of Bangalore's many pubs to exchange information and knowledge; that exchange being catalysed by the condition that they drink a minimum of six mugs of beer during the evening.

ii. National Strategy. Enterprise tactics alone are not enough to produce the critical success factors listed above, partly because firms face the various roadblocks which they alone cannot overcome. Higher authorities must therefore become involved. America built its IT industry on government money pumped in during critical early growth years in the 1940s, '50s and '60s. Similarly, government interventions to overcome roadblocks in developing countries have underpinned the success stories.

This is not the 'big brother'/'nanny state' model that many adopted in the 1960s and '70s, which would threaten to smother an otherwise lively industry with regulatory red tape. It is, instead, the model of government as industry promoter. But what does it mean in practice for developing country governments to become 'promotional states' in support of local software enterprises? It means they act along a range of fronts including (Grundey and Heeks 1998, Mansell and Wehn 1998):

- *Finance*. Successful governments act to stimulate the supply of working and venture capital to software firms, by enabling private sector and overseas funding. Countries like Israel and Taiwan have used a raft of tax breaks, marketing subsidies, grants, loans, legislative updates and extermination of red tape in an effort to achieve this.

- *Education and training*. The state is likely to remain the prime source of fundamental capabilities relevant to software industry development. The best governments also work with other providers – including private trainers – to target the analytical and managerial skills that the developing world so crucially lacks. Use of international accreditation and certification schemes for skills has helped to address commonplace training quality deficits. Ireland's success in reinventing itself from poor, rural backwater to Celtic Cyber-Tiger has rested heavily on intensive

investment in people, with half the population going into tertiary education and considerable emphasis on IT courses.

- *Research and development*. Investment by DC governments in software R&D has hardly covered itself in glory. Most publicly-funded R&D systems need a radical overhaul, of which increased involvement of the private sector will form a centrepiece. Nevertheless, in some cases R&D has been a bulwark against the brain drain and against the growing concentration of innovation within multinationals. Best investments are focused on customisation to meet local needs and on the commercialisation of existing capabilities (e.g. via 'straddling'), not on wasteful basic research inspired by an imported Western agenda. Israel has led the way here, with government-subsidised multimedia projects that have been spun off into everything from games to business and home applications, and with military-funded developments in signal processing and encryption emerging in a variety of Internet communication and security packages.

- *Intellectual property rights*. Piracy has more to recommend it as a strategy for developing countries than is often admitted. It speeds diffusion of the local IT base, creates a broad foundation for learning through 'reverse functional engineering', and saves huge wads of foreign exchange. However, the maturation of a software industry goes hand-in-hand with a legal framework of IP laws and enforcement that only the state can provide. Such a framework is also a *sine qua non* for serious foreign investment. Microsoft, for example, only agreed to set up a software production facility in Egypt on condition of tougher government legislation against piracy.

- *Infrastructure*. From Singapore's intelligent island to South Africa's telecentres, the state has had a vital part to play in the creation of a telecommunications infrastructure. Given public investment constraints, however, some infusion of private and foreign capital has been essential to this process. Governments in a variety of countries, such as Brazil, have also moved to create 'software parks': hi-tech clusters that benefit from the economies of scale and informal networking noted above.

- *Procurement*. Because of its large purchasing power, the state can be the most important consumer for emerging software industries and – as in the US – can use its power to significantly influence the level and direction of industrial development. Thus, some governments have used their purchasing power to require and diffuse TQM best practice within local software firms, for example, by seeking only ISO9000-certified suppliers.

iii. National Vision. You can teach almost anyone the techniques of painting, but creation of a work of art requires an artist with vision who can apply those techniques in realisation of their vision. So, too, strategies such as those described above are all well and good, but they only emerge or sustain when there is a national vision for software. India now bestrides the software scene as a Third World colossus thanks to a thirty-year dream of software exports, shared by bureaucrats and industrialists alike but carried forward by some key 'artists with vision'.

Not all developing countries can follow India's path. However, they can reap the software rewards of hi-tech jobs, capabilities and income if they learn to combine successful tactics, strategy and vision.

References

Baeza-Yates, R.A., Fuller, D.A., Pino, J.A. and Goodman, S.E. Computing in Chile. *Communications of the ACM, 38,* 9 (1995), 23-28.

Computing Wired world. *Computing Global Innovators Series* (10 July 1997), p.7.

Correa, C. Strategies for software exports from developing countries. *World Development, 24*, 1 (1996), 171-182.

Grundey, M. and Heeks, R.B. *Romania's Hardware and Software Industry*. IDPM Development Informatics paper no.2, University of Manchester, UK, 1998.

Heeks, R.B. *India's Software Industry*. Sage Publications, New Delhi, 1996.

Heeks, R.B. *The Uneven Profile of Indian Software Exports*. IDPM Development Informatics paper no.3, University of Manchester, UK, 1998.

Information Technology Association of America. *IT Workforce Study*. Arlington, VA, 1998.

Kumar, B. Software men dubbed 'bad boys' by US companies. *Soc.culture.indian* Usenet newsgroup, (9 Aug 1998).

Mansell, R. and Wehn, U. (eds) *Knowledge Societies: Information Technology for Sustainable Development*. Oxford University Press for UNCSTD, Oxford, 1998.

Nicholson, M. Realism quashes euphoric projections. *Financial Times* (12 Aug 1997), p.4.

Taylor, P. New IT mantra attracts a host of devotees. *Financial Times India IT Survey* (2 Dec 1998), p.1.

World Trade Organization. *Computer and Related Services*. Geneva, Switzerland, 1998.