

Development Informatics

Working Paper Series

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Paper No. 15

Building Iran's Software Industry: *An Assessment of Plans and Prospects Using the Software Export Success Model*

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2003

ISBN: 1 904143 37 7

Published by: **Institute for Development Policy and Management**
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View/Download from: <http://idpm.man.ac.uk/wp/di/index.htm>

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2003

Abstract

Many developing and transitional economies have become involved in software exports, most notably India and Israel. A number of aspirant countries such as Jordan and Argentina are attempting to develop strategies to enter the global software marketplace adopting various strategies. This paper analyses the potential of Iran as a software export nation using a conceptual framework: the Software Export Success Model. Drawing on empirical data from interviews and secondary literature, the paper contributes in two main areas. Firstly, a preliminary assessment of the strengths, weaknesses and recommendations for Iran as a software export nation is presented. Secondly, the paper provides an assessment of the Software Export Success Model in relation to the Iranian context.

A. Introduction

Despite the global economic downturn in 2002 and the events post-September 11, many commentators agree that international demand for offshore software development and associated services is likely to remain buoyant. Global economic downturn has tended to cause some Western firms to seek destinations for outsourcing in order to become more competitive. Some are actively searching offshore destinations for outsourcing offering advantages over in-house or in-country development (Bjorhus 2002, Businessweek 2003, Economist 2003a).

The large, expanding market for offshore provision of most types of software and IT-enabled service continues to attract developing and transitional countries to offer such services as a means to development. Jordan and Pakistan are attempting to emulate the example of the "3Is" of India, Israel and Ireland. A number of East European countries like Ukraine and Romania, spurred by the success of Russia, are attempting the same (Grundey & Heeks 1998). These different countries are using varying strategies and approaches to try to tap into this global market.

Policymakers and software companies in Iran are part of this trend. They are keen to explore the development potential of engaging in global software exports and at the

same time develop their domestic industry. Any development of the software industry through global processes would, of course, carry with it the potential for broader social and political transformations.

The focus of this paper is to critically analyse some of the strengths and weaknesses of the Iranian software industry, and discuss some implications for the development and implementation of a software export strategy which aims to leverage the potential of the industry. We present some results of fieldwork and analysis of Iran's software industry drawing on fieldwork undertaken by the authors in October 2002. This data is analysed in relation to the Software Export Success Model (Heeks & Nicholson 2002).

The contribution of this paper lies in analysing software export attempts being made by Iran, a country which to date is largely unmentioned in the global information technology (IT) domain and is reported mostly vis-à-vis its political developments. A conceptual contribution comes from the empirical application of the model, which was constructed on the success factors of India, Israel and Ireland in software exports. The analysis of Iran provides insights into ways of expanding the existing model. It also helps to develop a critique of the ongoing Iranian strategy process. This will be of interest to policymakers in developing and transitional countries engaged in similar strategic processes.

The paper is structured as follows: in the next section we present our methodological approach followed by a summary of the conceptual framework on which the fieldwork and analysis are based. We then describe and analyse the Iranian case and in, the final section, provide some implications for Iran and for the research model.

B. Methodology

The authors were invited by a private sector IT organization based in Tehran, Iran to support efforts to develop a software exports strategy. This organization, which has been actively involved in the IT sector for many years, gave the invitation having read about some of the research conducted by the authors in the area of global software work.

There is very little public domain information about the IT industry in Iran and it is extremely difficult to get statistics and details. This makes the task of conducting research into the industry both complex and also challenging. The authors started off with an extensive literature review of the Iranian economy, industry and politics. Initially, we were struck by the amount of negative reporting on Iran, making us realize that a major challenge which Iran faces in any export work is countering this negative image.

Following the literature search and initial information-gathering exercise, the authors conducted twelve interviews in October 2002 (detailed in Table 1). Interviews were at policy level with government officials, with trade association representatives and with managers of several individual software companies. We also visited the beautiful island of Kish in the south where the government is making interesting attempts to develop infrastructure in a bid to promote the island as a free trade zone.

Type	No. of interviews
Policy-level official	5
Trade association representative	3
Software company manager	4

Table 1: Interviews, number and level

Our overall research strategy could be categorized as interpretivist; guided by the knowledge of reality as socially constructed by individual human actors (Walsham 1995). An interpretivist approach tries to understand the perspective of different actors towards the IT situation in Iran, without trying to give the status of "truth" to one interpretation over another. Instead, the approach was to try to understand the multiple perspectives presented to us, and to understand why the interpretation of one person differed from another's on similar issues.

For example, we interviewed staff in the Iranian agency responsible for developing software exports (known as Sanaray). Interviewees in Sanaray seemed to perceive our Iranian sponsor and us as "competitors" and as a result painted a much brighter picture of the Iranian situation compared to some of the other officials we met who had different stakeholder interests. We were also guided by action research concepts in that we were actively involved in assisting in the process and reporting to strategy makers. We carefully documented our thoughts and reflections in relation to the case and relating findings to the conceptual framework (Baskerville & Wood Harper 1997).

Interviews, both in Tehran and Kish, would typically involve an elaborate meeting between the two researchers, their Iranian contact and a group of three to six people from the Iranian organisation. These meetings typically lasted between one and three hours, and were mostly conducted in English. Some of the respondents, especially the senior government officials, often preferred to discuss in Farsi, and in such cases our Iranian contact acted as the translator.

Both the authors made notes during the meeting and these were transcribed as soon as possible afterwards and comments added. Discussion of our notes amongst ourselves and with our Iranian colleague helped us to develop and refine our interpretations from the meetings. We tried to relate our interpretations to our other research in the area and experiences in other countries and more specifically to the Software Export Success Model which we discuss next. Discussions with our Iranian colleague over dinner and other informal settings were very useful for our understanding as he is actively engaged in the current strategy-making process based in Tehran and has been involved in the industry for more than two decades. He helped us to develop a historical perspective on some of the issues which we otherwise would have missed out on. He was also very aware of the relationships between the different departments that we visited and thus helped us to provide a context for our interpretations.

C. Conceptual Framework: The Software Export Success Model

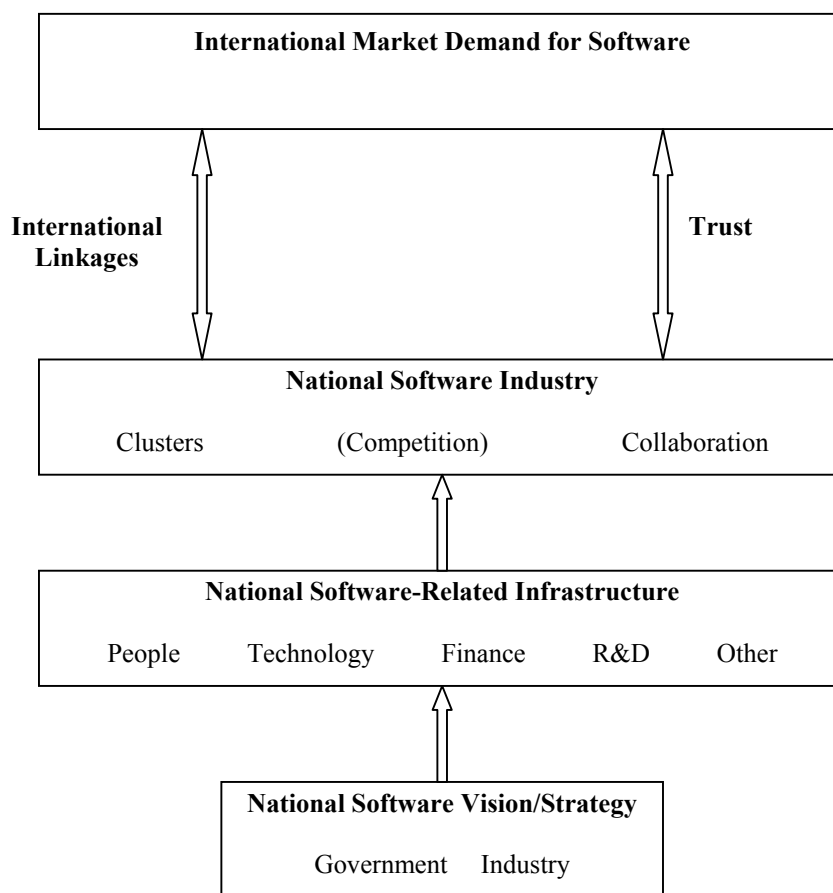


Figure 1: The Software Export Success Model

In Figure 1 is the Software Export Success Model is shown (Heeks & Nicholson 2002). The model is essentially exploratory and was initially developed based on a literature search of other models and frameworks relevant to developing offshore software exports. The authors reflected on their respective empirical experiences and associated academic and practitioner literature on the "first-tier" software exporters, the Indian, Irish and Israeli software industries or "3Is". This process enabled common factors to be derived which were grouped into categories considered central to the development of success of these three countries. The model was then applied to three "second-tier" nations: Russia, China, and Philippines.

The model is made up of five categories: demand for software, national software vision and strategy, international linkages and trust, national software industry characteristics, and national software-related infrastructure. We discuss each category briefly below:

- International demand for software is important for successful software exports. The role of domestic demand is less clear but by stimulating software capabilities it may facilitate exports (Schware 1992).

- First-tier software exporters all had a vision "shared by a relatively small but committed group of government officials and private entrepreneurs" (Heeks & Nicholson 2002). In India it was led by Nasscom (National Association Of Software And Service Provider Companies), in Ireland by the Industrial Development Authority, and in Israel by an agency of the Ministry of Industry and Trade. The model also distinguishes initial strategy and succeeding or sustaining strategy. India started its global software project in the eighties with body shopping but succeeded later in climbing the value chain. Ireland started with foreign direct investment but then diversified into other areas.
- International linkages – making and sustaining linkages with markets and customers overseas – have been critical to the development of the 3Is. The diaspora from all three countries (especially to the US) was critical in forging such ties. Linkages were also built through marketing operations set up by industry associations such as India's Nasscom. Another linkage issue is trust which was facilitated by the diasporan links and by the reputation of famous companies such as Microsoft or Intel who set up subsidiaries in the 3I nations. Externally-accredited standards such as ISO9000 and the Capability Maturity Model present an image of Western standards and "proven" output. Furthermore, anti-piracy measures and a legislature that can be relied upon to adjudicate fairly also facilitates trust. India's legal system, for example, being based on the British system, helped to provide some level of reassurance in this respect. The Software Export Success Model suggests strategy should be focused on creating a climate conducive to foreign investment. The authors draw on the various examples which suggest the liberalization of trade barriers and encouragement of foreign direct investment to facilitate growth.
- In the 3Is, clusters forged competition and collaboration between firms using world-class telecommunications. Knowledge transfer and other synergies provided by clustering were also key success factors.
- Availability of skills and the cost of labour as well as English language skills have been significant infrastructural features. Cheap working capital and loans have fostered growth as has investment in research and development which in particular in Israel was seen to come from government and military sources.

This model was intended to be used both for research and practice; in the latter case as a contingency approach to conducting an appraisal or possibly to 'benchmark' a country's position in relation to others. Of more relevance to research, the model could also be used as a frame for creative thinking for positioning strategies. In our empirical work in Iran, we were using the model as a sensitising device to gain a preliminary understanding of what issues need to be explored and as a means for comparison and discussion. We were not using it in a deterministic, causal sense.

D. The Iranian Context

Iran is a vast country which covers an area as large as Germany, France, UK and Spain but most is deserts and mountains. Iran is an Islamic republic, with an Islamic constitution and legal system run according to Sharia law in which the clergy officiates as judges. The country is a republic and a democracy. The clergy leader referred to as the Supreme Leader is Ayatollah Seyed Ali Khamenei, and Mohamad

Khatami is the President. In the recent years, Iran has been characterized by a devastating war with Iraq and a prolonged cultural revolution that transformed the political, social and cultural landscape of the country that had been developed under the regime of the Shah in the 1970s. These historical events have had a significant impact on the development of the Iranian IT industry.

Up to the late 1970s, Iran was a key hub of IT in the Middle East and many foreign suppliers had their own branches in Iran. The Iranian industry was very well developed in the '60s and '70s; for example, early software systems supporting the Farsi language were developed in Iran. After the 1979 revolution, the situation changed significantly. The large mainframe sector handled by the major foreign companies such as IBM and NCR sold out, and subsequently remained in the background even though their business interests were not totally terminated. The Iranian High Council of Informatics was formed at the time of revolution to solve disputes between Iranian and foreign companies. The period after revolution contributed to the stagnation of the Iranian software industry, and a number of legacy systems remained without adequate support. There were and still are many different government departments trying to establish control over the IT industry and this issue has never been resolved. As a result national strategy-making has historically been fragmented.

The Iranian software industry had strong roots in mainframe computing since the early 1960s. Since Iranian companies primarily served only internal market needs, they were without significant contact with major global IT developments. The stagnation of the mainframe sector continued until the personal computer boom came to Iran in 1985, leading to the development of a new sector. However, the industry remained largely cut off from leading-edge developments in major world centres of information technology. On the application end, the industry remained nascent, for example with very limited skills of project management.

In the late 1990s, Iran under President Khatami has witnessed gradual attempts to liberalize and open up certain sectors of the economy, especially information and communication technology (ICT). This liberalization and attention to ICT has been caused in part by recognition that the country needs alternative strategies to reliance on oil revenues and needs to plug into developments in the "network society." These attempts have been catalysed also by the attempts and reported success of the 3Is. The economy relies on its oil and gas industry, which accounts for over 80 percent of its export earnings. However, in political terms this drive to liberalization has led to polarization of the conservatives and reformists in Government. The US trade embargo, poor perceived image of the country in the US and Europe, and a general level of Middle Eastern instability continue to make building international software trade and relationships difficult.

The existing state of the Iranian IT infrastructure and plans for growth are summarized in the indicators shown in the tables in the Appendix. In essence, the key current challenge for the Iranian software industry can be summarized as follows: "How can Iran adequately meet the domestic demand for software applications of both the government and private sector, and at the same time develop capability of the Iranian software industry to become globally competitive?".

This is a multi-faceted problem that has to be addressed at many inter-connected levels. Three levels are crucial to address this challenge:

1. The Policy level: which concerns the efforts of various policy makers to compile data on the state of the industry and to provide enabling conditions within which the industry can develop.
2. The Industry level: which includes the industry trade associations and software firms involved in managing the production and marketing of software products and services in both the domestic and international arenas.
3. The International level: which concerns the domain to which the industry seeks to develop linkages in the future. This level includes Iranian expatriates, software providers and users globally, and the mechanisms by which the linkages can be developed.

E. Analysis

In the following sections we analyse some of the issues discussed previously, drawing upon the conceptual framework. The Iranian software industry, its strengths and weaknesses, are analysed with respect to the Heeks and Nicholson (2002) Software Export Success Model.

Market Demand and Linkages

In this section, we combine analysis of two parts of the Model: international market demand, and international linkages/trust.

International demand for software exports can partly be gauged from Indian software industry figures which show a sharp actual and predicted increase in offshore outsourcing of various categories. In 2000-01 fiscal year, Indian software exports grossed US\$6.2 billion of revenue and registered a 55% growth rate over revenues of US\$4 billion in 1999-2000 (Nasscom 2002). Forrester Research estimates that corporate budgets for offshore software outsourcing will more than double by 2004 (Bjorhus 2002). The biggest growth sector is perhaps IT-enabled services such as call centres, computer-aided design, medical transcription, animation, and accounting and finance.

The worldwide IT-enabled services sector is set to grow to US\$142 billion in 2008, a 41% compound growth rate from 2000 (Economist 2001). The bulk of the demand comes from the US. To a lesser extent demand for software development and IT-enabled services is from Europe: Indian companies have had particular success in the UK and recently in Italy. Other customer nations include major Far East economies keen to reduce costs in times of recession such as Japan. Regionally, and specifically, Afghanistan is a potential customer for Iranian software production because Farsi language software is in demand. In this case much, of course, depends on expenditure by international development agencies during reconstruction.

International Linkages and Trust

The issue of international linkages and trust is a crucial one for Iran particularly because of the amount of negative publicity it has received in recent years. The United States has placed a trade embargo on Iran since 1995 as a part of its action against the "axis of evil" of "rogue states" along with Iraq and North Korea. This embargo has significantly affected the attempts of the Iranian industry to develop linkages for the software industry globally. We were given the example of Germany's SAP refusing to do a large project in Iran, apparently because the company did not want to run the danger of risking their strong North American interests.

The American embargo leaves Iran with the possibility of developing linkages with other Middle Eastern countries such as Bahrain and the United Arab Emirates, or other countries like Japan or Russia that are not so heavily influenced by the US embargo. Many European and Asian countries who are keen to exploit Iran's oil reserves largely ignore the embargo but it is still a major issue hampering development. Recent diplomatic efforts by Mr. Khatami have led to a softening of attitudes towards Iran in Europe. Recent diplomatic visits – such as those to France, Germany, Italy and Spain – are critical to reduce perceived risk of entering into software development relationships.

The main exports from Iran are oil, carpets, chemicals, pistachios and caviar. Major trading partners are Japan, Italy, South Korea, France and China for exports, and Germany, South Korea, Italy, the UAE, France and Japan for imports. There are particularly strong linkages with Germany, which forms a high percentage of the Western tourist influx, and German and Farsi have some structural similarities, meaning language learning can be relatively easy. Within Iran, there are already foreign subsidiaries in different industries. For example Daewoo and Peugeot have plants in Iran.

India has a time zone difference of about four-five hours with European countries, and this is relatively favourable for the coordination of software development work. As the Indian developers are in the afternoon of their daily work, the British or the Germans are starting their day and, as a result, clarifications can be sought and replies received between both sides. This process is slightly more complex in the Indian-North American relationships as the Indians would need to work much later in the night to be able to make real-time contact with the North Americans. In the case of Iran, while the time zone differences are not so problematic (about two-three hours each with India or Europe), the coordination of working days is more difficult. Iranians take their weekend on Thursday and Friday – unlike Europe and North America – meaning coordination of software projects would only be possible on three days of the week.

In addition to this problem, offshore software development projects require large amounts of face-to-face coordination for knowledge transfer and coordination (Heeks et al 2001, Carmel 1999). Visa regulations make travel to Iran quite difficult, which restricts regular and spontaneous face-to-face contact. Also certain aspects of Iranian society can deter some Europeans who would be expected to coordinate projects through such necessary regular visits. Issues include:

- Iranian society is segregated and women are expected to wear the chador or more commonly headscarves and overcoats.
- There is a lack of comparable nightlife to competing centres such as Bangalore or Dublin and no availability of alcoholic beverages.
- There are intermittent suppressive activities of the religious police and clergy judiciary including the death sentence imposed (but never carried out) on a German businessman for sex with an unmarried Muslim woman.
- Tehran, like the competing centre of Bangalore is polluted and choked with traffic and visitors quickly realise that Iran is still a cash-oriented society (typically US dollar cash) with little reliance on credit cards.

At the regional level, continued tensions and uncertain outcomes exist in relation to the Iraq crisis. Internally, tension within Iran between reformists and conservative clergy present a picture of repressed political instability potentially offputting to foreign investors and partners.

Moving to trust-related issues specific to software, an important consideration relates to laws to protect intellectual property, and the confidence which companies have in the implementation of these laws. Iran's widespread computer crime led to the introduction of a law against computer crime in February 1995 but this does not address software piracy and other crimes involving foreign companies. In our interviews some argued that piracy enables development by offering free, wide access to software products which otherwise would have been inaccessible. Others felt that stopping it by instituting and enforcing piracy laws would stifle innovation. On the other hand, piracy disables development by discouraging foreign companies who are unwilling to enter an investment environment that could be detrimental to intellectual property.

At a more micro-level of analysis, there are presently no Iranian software firms with standard certification ISO9000 or CMM (Capability Maturity Model – SEI 2002). Experience in India has shown that these standards help to reassure foreign companies wishing to develop outsourcing relationship in the absence of other information.

There are, however, isolated examples of Iranian linkages built from the bottom up, largely unsupported by government policy structures. Some software companies such as Tehran-based System Group have independently built offshore operations and product sales in Canada. Another Tehran-based company, PDP, has linkages with a Manchester, UK-based utilities software company. However, in nearly all cases of existing software export linkages there was some involvement of Iranian expatriates. On this basis, there have been initial attempts to develop linkages with India, Malaysia, Dubai and Afghanistan. The Iranian government is currently making concrete steps to make entry into the World Trade Organisation; an effort which is expected to go a long way in alleviating some of the trust-related concerns.

Domestic Demand

Domestic demand for software development has been estimated to grow from its current level of about US\$50 million at US\$2bn per year to about US\$10bn over the next five-year period. However, these figures are not based on hard statistical evidence (obtaining such evidence is virtually impossible as surveys are yet to be conducted.). Government funding is intended to be forthcoming to support this

growth. Iran is potentially a source of software development contracts at a time when the demand worldwide is lukewarm. Iran's exchange rate is set by a managed float and this makes exporting difficult but the average tariff of nearly 30% encourages production for the domestic market.

While there exists no concrete profile of the nature of domestic demand, we were given figures estimating that government demand makes up some 70% of overall domestic demand. This is mostly to develop back office applications to mechanize existing manual processes. However, demand is becoming more sophisticated; in the private sector, there are nearly 15,000 factories that have software development needs to be fulfilled. Thus from a demand perspective, Iran presents an attractive domestic market for foreign and domestic firms. However, the Iranian industry does not seem to currently have the capacity or the interest to meet this demand. Talking about the slowness of how the government systems worked, one respondent from an Iranian software firm told us "after eight months we can have a cup of tea with the government project managers and ask for a further extension to the deadline". Some of the firms felt that public sector contracts were often corrupt, involved favouritism and tended towards lower-level technologies, which were outdated in the West. It was also felt that government demand was not well defined and hard to convert into specific projects that could be contracted out.

One strategic direction towards meeting this domestic demand under consideration is to allow foreign direct investment involving joint ventures between Iranian and foreign companies. This linkage would help Iranian companies to gain global experience and technology transfer. Another benefit for Iran from this partnership strategy would be to provide employment opportunities to their large pool of technical graduates. Foreign companies would be attracted by the educated workforce, the size of the Iranian domestic market and its potential as an export base for the Middle East.

However, for this partnership strategy to work in practice, the Iranian companies would have to convince the potential partners of mechanisms to counter the current high levels of perceived risk of doing business in Iran. This arises from macro-level issues such as regional instability, with the implications of ongoing crises being felt in Iran. Other risks and deterrents to be dealt with include suppressed internal political and civil instability. At a more micro-level, there is a lack of coherent intellectual property law, complex and punitive taxes and difficulty in laying off labour. Suspicions can also arise from experiencing separate higher prices for foreigners for everyday expenses such as hotels (Economist 2003b).

National Software Industry

It is estimated that 150,000 people are employed within the ICT sector including around 20,000 in the software industry category (all estimates provided by Vetus Systems (Tehran, Iran) based on National ICT Applications plan statistics). There are around 1,200 registered IT companies and around 200 involved in software development which employ about 15% of total software workforce (3,000 people) with a university degree. The range of monthly payment for a software specialist is between \$300-\$800 net. Almost 95% of software work is bespoke development. The principal development platform is MS Windows and there are around 10% Unix

installations which are mostly in bank branches. For large back-office installations, the IBM mainframe is the dominant platform.

Technology

Some areas of achievement of the industry are in microelectronics, network security and telecommunications. However, the technology levels are limited primarily to business applications that are quite particular to the needs of domestic Iranian business. Applications in some cases are still running in DOS, reflecting the state of technological maturity. There is a widespread weakness in the management of software projects. Even though technical skills are high, the weakness of project management skills has led to the failure of large projects. The use of un-licensed (pirated) software provides the capability for the industry due to zero cost and widespread availability of the tools. Software companies may not be able to afford to buy these tools and applications legitimately. On the other hand, without legitimate purchase, there is then lack of technical support. An example was given to us of how two months were spent rectifying a problem on a pirated version of MySQL which could have been solved much quicker with access to the expertise which a software license would provide.

Capacity

Iran is faced with developing capacity to meet the large domestic demand and at the same time to become internationally competitive. The software sector itself, although strong in some areas, is not internationally competitive. The Iranian High Council of Informatics has categorized 543 informatics companies, and the software sector output is around US\$50 million although, once again, statistics are educated guesses rather than based on hard statistical evidence. Within the software development community there is an eagerness to develop outsourcing relationships, but lack of expertise on how to do so and also the handicaps of dealing with a US trade embargo. The industry software association is very keen to develop the export potential of the software industry.

Clusters and Collaboration

Most of the software companies (70%) are based in Tehran. There are no established clusters in Tehran but a major IT park is planned in Tehran to be finished by 2004 and there are plans for an IT park on the free zone on Kish Island which already contains the necessary technological infrastructure. There is at present very little direct collaboration between software companies. They operate independently and thus there are weak inter-firm competitive pressures and very little pressure to innovate or differentiate.

Products or Service: A Portfolio

The Iranian software industry needs to position itself with respect to the "product versus services" question. A strong product orientation may reduce exposure to the volatility of the global market; however, there are at present no internationally competitive products which could be marketed offshore. Product development requires a deep and close understanding of needs of the overseas market to which the

Iranian industry for historical reasons has had weak access. Several interviewees regarded "lower-level" coding or other service work (such as call centres) to not fit well with the "Iranian national character" and that "Iranians are not service-oriented", in contrast to perceived characteristics of Indians. Instead, Iranians preferred to follow Israel's example of focussing on high value addition product development work.

Clearly, a strict high-end product development work strategy is currently unrealistic given the limitations on the software industry and trust factors mentioned earlier. Instead, there is a need to develop a "portfolio approach" which may comprise of a list of different services ranging from call centres to high-end design. A key strategic question for the Iranian authorities is to understand the nature of this portfolio and the different priorities that should be accorded. India started with low-level services and moved gradually up a value chain to engage in high-level work as trust and capability built up over many years. Iran arguably may have more in common with China as both countries have a large, unexploited domestic market, which diverts companies from exports (Heeks & Nicholson 2002).

National Software-Related Infrastructure

People

The population of Iran is estimated to be about 65 million of whom around two-thirds are less than 25 years old. The labour force is not organised, and independent trade unions are largely non-existent. Iran has a number of strengths which make it potentially a player in the global software domain. Schooling is compulsory from 6-11 and 95% of children receive primary or secondary schooling. Approximately 77% of the population can read and write. Our experience was that most of the people we met of all three types (policy, trade association, software manager) could read and speak basic English but were at times reluctant to speak in English and preferred conversing in Farsi. In the higher education sector potential student demand exceeds supply but there is a large output of skilled graduates in the ICT area. Between 15,000 and 19,000 of these graduates per year are entering the workforce but there is not sufficient employment for them in the information and communication technologies sector.

Since 1999, economic growth in Iran has averaged 4.7 % per annum which is too low to secure sufficient jobs for the 700,000 job seekers who come to the market. GDP per capita, although rising, was, in 2002, 30% lower than in the 1970s (Economist 2003b). As a result, qualified people are tending to emigrate to North America and Europe in particular which is contributing to the "brain drain" (though also creating a basis for potential future links). Conversely, the country is suffering high levels of rising unemployment with a national average of around 16% or roughly 3.2 million (World Bank 2002). The Iranian workforce is of high technical ability evidenced by the ease with which they are employed abroad and they provide the potential to develop global linkages and thus software exports of various forms.

Software firms told us that there is a need to establish training centres that could provide both general and specialized training, for example in Visual Basic. There are high numbers of trained people in Iran, but paradoxically we were told it is difficult

for small private companies to get suitable staff and unclear where to recruit. While potential recruits have technical skills, they are very limited in practical experience and project management capabilities. As a result, employers find this pool of potential staff unattractive since they are reluctant to spend huge amounts of time and effort on training programmes. The absence of private training agencies in Iran, common in the case in India, further exacerbates this problem.

Research and Development

Research and development takes place mainly in universities. Although we did not secure interviews with university and research institute personnel, we were informed by policymakers that the connection between these institutions and the software industry is very weak. Clearly this poor linkage represents a missed opportunity. One can compare the situation with Israel where industry-research institute linkages were fostered by incubators and by technology transfer from military research, both of which were critical to the success of the software industry.

Telecommunications

The government in recent years has emphasized telecommunications and Iran has been upgrading its telephone system but it is not yet regarded as being to international standards. Since 1994, the number of long distance channels in the microwave radio relay trunk has grown substantially and the number of main lines in the urban system has doubled. Thousands of mobile cellular subscribers are served although prices are considerably higher than in Europe.

In the South, Kish Island, once playground to the Shah, has been transformed into a free trade zone with a strong telecommunications and technological infrastructure. The island itself is very attractive and presents excellent lifestyle possibilities with international standard hotels, pleasant climate, and leisure facilities. There is also a university for training and education. It is highly likely that once regional (particularly the Iraq-related crisis in 2003) and national instabilities (reformists versus conservatives) have been resolved that it would be a central base of foreign and Iranian information technology companies. At the time of writing, though, resolution of those instabilities remained in question.

In the main centre of Tehran, Internet usage in business is not prevalent other than for email services and many companies do not currently have a web site. Internet service is available with eight Internet Service Providers and 100,000 users being reported in 2000 (CIA 2002). The Internet was introduced in Iran in 1993 and there are around 50,000 Internet domains allowing potential access for about one million people. The domestic potential for commercial Internet usage is low, being held back by lack of any credit cards or an Internet banking system (Shoraka & Omidi 2002). The government has licensed private companies to offer Internet access but development has been hampered by concerns about a Western "cultural onslaught" leading to calls for laws to prevent uncontrolled Internet access.

Finance

Although we could not obtain specific information, interviewees from software companies complained about access to finance. Iran is dominated by state-owned institutions such as Bank Melli which are sensitive politically and slow to change. Interest rates for bank loans are described as disproportionately high and thus access to working capital and venture capital was regarded as difficult and expensive. Taxes are seen as prohibitive and the nationalistic bureaucracy can present obstacles to start ups (Businessweek 2001). There are few venture capitalists to encourage the development of new technologies, as has been the case in Ireland and Israel. More positively, the central bank unified Iran's multiple foreign exchange rates in 2002 and the World Bank may resume lending in the near future. Karafarin Bank offers promise as the first of the genuinely private banks offering lower interest rates.

National Software Vision/ Strategy

In March 2000, the Parliament approved the Third Five-Year Development Plan providing a broad-ranging programme of reforms. Government has allocated \$30bn to planning for "e-enablement" of the economy. Based on new government initiative and plans the amount of investment on ICT developments for next five years are shown in Table 3 in the Appendix. In total, government must invest US\$5bn and private sector investment must be as high as US\$7bn to achieve the goals for the next five years.

Historically, the responsibility for IT within the government represents a fragmented picture with multiple agencies being involved. To address these issues of fragmentation, a national informatics plan was proposed, under the direct control of the President. At a high level, the National Informatics Plan – or NICTA (National Information and Communication Technology Applications) as it is known – defines the broad areas of concern about development of information technology in Iran.

It is accepted that NICTA does not constitute a plan as such but a series of areas of concern and existing conditions with a budget and a mandate to emphasize the private sector. The high-level themes identified in the plan have been broken into a series of second-level themes which have been allocated to particular government departments to deal with. At this point, individual projects relating to second-level themes were allocated and tenders distributed and issued to various companies. Projects relevant to the software industry include:

- software strategy: the vision for the software sector and expanding the market
- banking and the need for IT
- software exports
- the linkages with Iranian expatriates in promoting exports
- the US trade embargo and mechanisms to overcome the problems
- training
- how to stimulate domestic demand
- IT parks

In general, the view of software company and industry association interviewees on the policy planning for the software industry was that it would be ineffectual. They stated

that they had seen many policy-level plans and little resulting action. They stated that the existing export stimulation organization, Sanaray, is not supporting their export activities and ambitions adequately. Sanaray offered great promise when set up as a private company in 1998 as the result of participation of more than 35 Iranian software companies. Sanaray sees its core business as "to actively coordinate and execute all international aspects of Persian IT industry. This includes consulting, marketing, and sales activities in matter of exports, local and international mergers and joint ventures, as well as consulting, registering and establishing local presence for interested international companies in the Persian IT landscape" (Sanaray 2002).

Interviewees wanted government to play a role in removing red tape and reducing risk for foreign companies and creating international links. The software companies we interviewed perceived a role for government also at the micro-level in export marketing support, funding and organizing trips to international trade fairs and providing advice on marketing. This role extends to macro-level diplomacy and creating a positive image of Iran and the industry. The current strategy of the government responds to this to some extent. The diplomatic efforts by Mr. Khatami were mentioned earlier; the government has also committed to removing non-tariff barriers and replace them with tariffs and progressively reduce the tariff bands and rate over the period 2000 – 2005. This, it is hoped, will eventually enable Iran to follow China in engaging in WTO negotiations.

F. Discussion And Conclusions

Having examined the Iranian case let us now consider implications for Iran and other countries and for improvements to the Software Export Success Model. In the final analysis, does the Software Export Success Model adequately explain the current success (or lack thereof) of the Iranian software industry? Table 2 summarises aspects of the Iranian position in the dimensions of the Software Export Success Model (SESM). Clearly, Iran is facing complex tensions such as the Iraq standoff which are out of control of the policy, industry and international levels we mention in section four. The SESM does outline the key weaknesses and opportunities and points to the strategies adopted by other countries which may inform action at these three levels.

<i>SESM Dimension</i>	Negative	Negative	Positive	Positive
<i>International demand</i>	Offshore services demand can be fickle e.g. some Indian programmers were "benched" in 2001	Regional crisis is likely to suppress demand for offshore software and other services in the whole region	High demand from Europe and North America for whole range of offshore services Demand from other states in Middle East and Gulf such as Afghanistan for Farsi software	High domestic demand may encourage foreign direct investment and partnerships
<i>International linkages and trust</i>	Embargo imposed by USA Poor image and label as part of "axis of evil" Iraq crisis in 2003	Internal political instabilities High levels of piracy Synchronising the working week	Existing trade arrangements due to oil sales Diplomatic missions e.g. to EU. Thawing of relations.	Unexploited diaspora-based links Reformist government
<i>National software industry</i>	Many state-dominated enterprises are inefficient and not subject to competition Outdated technologies Lack of ISO or CMM standards	Project management is weak Piracy means lack of software support No evidence of collaboration between companies	Clustering in Tehran and capability in Kish	Isolated examples of successful offshore outsourcing ventures
<i>National Infrastructure</i>	Weak R&D links Brain drain "National character" tends to avoid service orientation	Poor access to finance and venture capital English not as widely spoken as other software export nations	Young, low-cost, well-educated human capital	Reasonable physical infrastructure in Tehran and world class in Kish
<i>National software vision / strategy</i>	Confusing and fragmented strategy-making process Many previous failed attempts	Lack of statistics	Outline strategy present but amounts to high level themes	Commitment and funding at level of Mr. Khatami

Table 2 Summary of Iran's Software Export Success Model Strengths and Weaknesses

In the following sections we will discuss three specific issues, relating to the strategy-making process in Iran, the contribution of the Model, and the positioning of the Iranian strategy.

Process of Strategy Making

The process of strategy making in Iran is top down in its orientation and the level of involvement of stakeholders such as industry groups, universities and IT companies is acknowledged to be limited. As a result, efforts to strengthen the inter-connections between the software industry and research and development layers, so important to the success of Israel for example, have been limited. The strategy-making process is a legacy of policymaking in Iran but can be shown to differ significantly from – for example – Jordan's approach (see, for example, Reach 2002) which used many hundreds of meetings and workshops with a broad range of stakeholders.

At the industry level, software industry leaders are sceptical about the delivery of the strategy ("we've seen lots of strategies before") and unconvinced about what could be achieved by these efforts. They were concerned about corruption and the lack of will to make serious changes.

This has implications for the Model and for the Iranian strategy process. The Model does not at present cause policymakers to reflect on the *process* of strategy making. This implies the process of strategy making becoming explicit as a success factor drawing on the approaches adopted by each of the 3Is. The cultural feasibility of the process must be considered; Iran's political landscape is polarized between the religious conservative clergy and reformist groups. High levels of participation, and involvement of foreign consultants and companies (as seen in Jordan) would probably not be feasible for many reasons including the history of Iran and tradition of top-down decision making.

Contribution of the Model: State Initiatives

Drawing from the Software Export Success Model, we can identify a number of short- and medium-term tactics involving state intervention that could be relevant to Iran. These are currently very limited but some pertinent examples could be:

- subsidized marketing and market research
- funding an effective trade association
- providing grants for overseas expansion
- access to cheap capital
- training
- subsidized ISO9000 and CMM accreditation
- research and development improvements including incubators
- subsidized English language training
- encouraging cooperation between software companies especially by opening up positive export experiences to the industry
- linking up with expatriates

These tactics, drawn from the experience of the 3Is, are helpful but should not be used in a causal or deterministic sense. Iran faces a unique set of contextual and internal issues and the resultant tensions are very different to the circumstances encountered by the 3Is. An example was shown in the aforementioned strategy-making process and cultural feasibility of participative design. Another issue revealed in our

interviews concerned a perceived Iranian "lack of service orientation" which may form a significant barrier to offshore software exports. Exploring the implications of social, economic and political particularities of place is a theme which we continue into the following section.

Dichotomies of Strategy

The Software Export Success Model suggests strategy should be focused on creating a climate conducive to foreign investment. This is largely in accordance with the liberalizing strategy of the Iranian five-year plan including such strategies as encouraging foreign direct investment via joint ventures. However, this presents tensions and dichotomies in the case of Iran and exploring these tensions would be critical to Iran's success as a software export nation.

Iran faces the legacy of a history of extensive state intervention in the economy; specifically that there are several unprofitable and even unproductive state software enterprises. Iranian software companies, private and state-owned, because of their long isolation, may not be able to compete in the market with foreign software products and services if domestic market access is liberalized. Encouraging partnerships is an option but increases bureaucracy and governance risk for foreign companies over wholly-owned subsidiaries.

Dealing with the issue of products and services, Iran is perhaps pragmatically suited to attempts to grow through a portfolio of offshore data services and building capability in the domestic market. However, the large government sector is unattractive to indigenous private companies and thus would be likely to be so to foreign companies for the same reasons. The identified issues of the possible clash between "national character" and low-level data services may also make that strategy untenable. Iran thus is left with a large domestic market and an apparent lack of willingness and competence to exploit it. Furthermore, emulating Israel's product development path is problematic as there are a limited number of world-class software products to sell internationally.

Examples from other countries such as India which started with low-level services and moved gradually up a value chain are of interest but Iran may have more in common with China which is reviewed in Heeks and Nicholson (2002). Both countries have a large, unexploited domestic market which potentially takes prominence over exports. Emulating China's growth path though is difficult because of potential reluctance to engage in low-level data processing work (which would facilitate trust building and gradual moves up the value chain).

This rather gloomy picture of tensions must be resolved. Iran as a late entrant is facing entrenched markets and has to differentiate via niche markets such as specialized Farsi software or via specialised skills or via price. In the absence of identifiable export niches in products or services, the country has to make some radical changes.

Iran's Middle East location and well-educated, young population provides it with potential advantage as a centre for foreign and indigenous companies to exploit domestic and growing markets in other Middle Eastern countries and the Gulf States.

There is however a need in Iran's case to address the tensions outlined in this paper and develop a what we term as its own unique "portfolio approach" involving and addressing the needs of the policy level, industry level and international level. If the technical, political and social barriers outlined in the paper can be overcome, Iran may seek to develop competence in a list of different service offerings for domestic and international markets ranging from body shopping and call centres to high-end design. A key strategic question for the Iranian authorities and industry is to understand the nature of this portfolio and what are the different priorities that should be accorded.

Another important issue is to seek to develop collaborations with software firms in countries like India or Russia. Such collaborations can firstly help to provide experience in doing global software work, and secondly, provide resources to meet the growing domestic demand. This in the long run can help to create a favourable environment for computerization. On a positive note, we see some ongoing efforts by the Iranian authorities in this direction. In January 2003, a high-level team from Iran went to India and had meetings with Nasscom and visited potential companies with whom links could be forged. As a follow up to this visit, the Iranian authorities have invited Nasscom to Iran to conduct a workshop and also seek to establish a formal Memorandum of Understanding to further future collaboration.

There are thus some positive indications that Iran will become more active in the global software market in the coming years. These indications come from the policy level initiatives being taken by the government, pockets of global work being done by some Iranian companies which can provide learning for the larger industry, and recent attempts to develop global linkages with Indian companies. Efforts to develop an IT park are also underway in Tehran which can help to provide visibility and also infrastructure support to IT firms in the future.

Acknowledgements:

We wish to express our thanks for the help, openness and hospitality afforded to us by our interviewees especially Mr. S Ghassemi at Vetus Systems, Tehran; and to Richard Heeks, University of Manchester for comments on an earlier draft.

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Statistical Appendix

Table 1: General Iranian Indicators

<i>Indicator</i>	<i>Level</i>	<i>Source</i>
<i>Population (millions)</i>	67.7	1
<i>GDP (US\$ billion, 2001)</i>	114.1	1
<i>Telephones (Mainlines per 1000 people, 2001)</i>	149	1
<i>PCs (per 1000 people, 2001)</i>	63	1
<i>% in secondary education (2001)</i>	77	1
<i>Monthly programmer wage (2000)</i>	Rials 1,000,000 (US\$125) – 4,500,000 (US\$ 560), US\$300 - US\$800	2, 3
<i>Internet users (2001)</i>	250,000	1

Sources: Kiarostami (2000) [2], World Bank (2002) [1], Vetus Systems (Tehran, Iran) estimate [3].

Table 2: Comparison Chart of ICT Factors as of January 2003, and Projections for 2008

<i>Factor</i>	<i>Year 2003</i>	<i>Year 2008 (planned)</i>
<i>Percentage of governmental services via internet</i>	0	10
<i>Percentage of commercial services via internet</i>	0	10
<i>Percentage of health care services via internet</i>	0	10
<i>No. of schools equipped with ICT</i>	n/a	100
<i>ICT share in GDP</i>	1.1-1.3	2.5-3
<i>ICT employment rate per 1000</i>	150	300
<i>Iran global rank in ICT</i>	100	62

Source: Vetus Systems (Tehran, Iran). Derived from National ICT Applications plan.

Table 3: General View of Investment Needed to Reach the NICTA ICT goals on 2008

<i>Macro plans</i>	<i>US Dollars (Billions)</i>	<i>Share of private sector (percentage)</i>
<i>Communication developments</i>	4.5	80
<i>E-government</i>	2.7	20
<i>E-learning</i>	1.8	30
<i>E-health</i>	1.2	60
<i>E-commerce</i>	1.8	80
<i>Total</i>	12	

Source: Vetus Systems (Tehran, Iran). Derived from National ICT Applications plan.