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## **COMPETITIVENESS THROUGH EXPORT CLUSTERING: STRATEGIC CONSIDERATIONS**

### **INDIA**

#### **THE ESSENTIAL INGREDIENTS OF BANGALORE'S SUCCESS: SOME LESSONS FROM THE CLUSTER**

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## Introduction

For developing country strategy makers, the software cluster in Bangalore is of interest for a variety of reasons.

- It represents in a microcosm several of the developments associated with globalisation.
- It is a knowledge oriented or human capital intensive industry which has attracted multinational firms to Bangalore both as producers and consumers of software, turning the city into an international gateway for trained labour.
- It's the most famous success story of the digital age and it's located in a developing country.
- It's an example where the State has actively assisted the growth of the industry.

What are the ingredients that have made India's 'Silicon Valley' as successful as a technology cluster with national and global impact? Can these be replicated? What collective role can industry, workforces, educators and government policymakers play in creating such successful clusters in their own countries?

These are some of the intriguing and high-stakes questions facing players and strategy-makers in the cutting edge of information and communication technologies.

## Indian Clusters<sup>1</sup> in Perspective

Clusters in India have been in existence for decades and sometimes even for centuries. According to a UNIDO survey of Indian small scale industry (SSI) clusters undertaken in 1996, there are 350 SSI clusters and approximately 2000 rural and artisan based clusters in India. It is estimated that these clusters contribute 60% of the manufactured exports from India. Among the larger clusters, the most famous are:

- Tirupur, which is responsible for 80% of the country's cotton hosiery exports;
- Agra with 800 registered and 6,000 unregistered small scale units making approximately 150,000 pairs of shoes per day with a daily production value of 1.3 million dollars and exports worth US \$ 60 million per year;
- Ludhiana, a city that is well known as the Manchester of India, which alone contributes 95% of the country's woolen knitwear, 85% of the country's sewing machines and 60% of the nation's bicycle and bicycle parts.
- And of course the world famous cluster of Bangalore, operating in the IT sector.

Starting with the setting up of the first software R&D centre by Texas Instruments at Bangalore in the early 80s, the software industry grew by leaps and bounds. Scores of IT entrepreneurs set up software export services that over the years have captured both market opportunities as well as the attention of businesses and media across the globe. What has been the key component to this success is that these software export companies constantly upgraded their skills and sought to provide whatever services US and Europe business required.

Bangalore was home to 13 companies that generated foreign software services income of \$US 8 million in 1990-91. There are now more than 1400 IT companies in this capital city of the Indian state of Karnataka that sits on India's southern high plains (the Deccan Plateau), and

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<sup>1</sup> This paper has adopted Porter's (1998) simple definition of industrial clusters as 'geographic concentrations of interconnected companies and institutions in a particular field'. This definition embodies three important aspects relevant for the present example of clustering. Firstly, it follows that agglomerated firms and institutions belong to a 'particular field', i.e. they are concerned with the same sort of economic activities, that is, they belong to the same industry or sector. Secondly, they are 'interconnected', i.e. they can be connected through input-output relations, or they can be competing firms connected through competition (rivalry). Thirdly, the paper is not only concerned with firms but also with institutions related to the field.

they generate export income of more than \$US5 billion a year. Today , the Bangalore IT cluster is the biggest in India, and the fourth largest in the world. This cluster consists of small, medium and large companies including wholly foreign owned firms such as Motorola, Indian owned ones such as Infosys and joint ventures such as PSI Data Systems. During the late 80's and early 90's, there has been an increase in the number of collaborations between Indian and foreign software companies involving informal subcontracting, semi-formal contracting and distribution agreements (Heeks, 1996<sup>2</sup>).

It is estimated that about a quarter of the Indian software industry is located in Bangalore, earning it the sobriquet, the 'Silicon Valley of India'. A bit of a misnomer since Technically Bangalore isn't into silicon (micro-chips/hardware), its strength is not IT manufacturing – it's into exporting software and IT services, an annual 5 billion US dollars worth. That's the brand.

### **The worldview from Bangalore**

The Bangalore story has been unique and special. It worked and aped its Californian model. In doing so it reverse-engineered and innovated a fantastic success that many believe is just the tip of the ice-berg. Its vision and phases are captured below<sup>3</sup>:

<i>DREAM / VISION</i>	<i>PHASE / ACCOMPLISHMENT</i>
"We want to go to Silicon Valley"	Phase I: "Bodyshopping" (80's & 90's)
"We want to become like Silicon Valley"	Phase II: Remote software development for MNCs, with MNCs and by MNCs (90's)
"We will go/have gone beyond Silicon Valley"	Phase III: Offshoring of services <sup>4</sup> (90's and beyond)
	Phase IV: Innovation hub: IT and beyond (2000 plus)

### **Ingredients of success**

According to Rosenberg (2002) many success factors in the original California's Silicon Valley have been identified by researchers over the years: low taxes, venture capital, risk-taking start-up culture, business webs, physical infrastructure, IT-savvy local population, local "living laboratories," good local markets, networking skills, activities and organisations for communities of interest, collocation of companies in various stages of development, flexible organisational structure, legal/accounting services, M&A activity for flow of skilled labour and intellectual property, local academic and research institutes, commercial partnerships between academia and industry, activist government policy via research funding and small business debt assistance, speed of business activity, presence of role models, and human talent in innovators, serial entrepreneurs, marketers, and managers<sup>5</sup>. It's a long list. The success however is in the mix, the combination, the order in which the ingredients come into play, the environment – both local and global, the opportunities and the timing.

Some of the principal factors promoting clusters as identified in studies focusing on ICTs include

- the presence of educational institutions which produce a stream of engineers,
- technicians and scientists,
- state support in the form of tax incentives and subsidies,

2 Heeks, R. (1996) India's Software Industry, Sage Publications, New Delhi

3 Borrowed and developed upon from presentations by Dr Madanmohan Rao Consultant/Author, "The Asia-Pacific Internet Handbook," "The Knowledge Management Chronicles"

4 From BPO (Business Process Outsourcing) to KPO (Knowledge Process Outsourcing)

5 Rosenberg, David, 2002, Cloning Silicon Valley: The Next Generation High-Tech Hotspots, Reuters/Pearson Education, London

- salubrious living conditions which enhance the quality of life, especially in university towns,
- availability of venture capital
- and generation of forward and backward linkages.

In an interesting work by Zorawar Singh (2003) on the setting-up or 'siting' (FDI / Mode 3 of GATS) of firms, the most important factors which influence the decision of siting a facility by a technology organization are strategic location, good infrastructure, political stability, free-market economy, rule of law, availability of professional services and clean government. Software firms require redundancy in power sources and access to telecommunication lines, back up power, and space to expand their operations. Internet related firms combine high tech infrastructure and creative content requirements. Specifically, they need ready access to high bandwidth telecommunications systems such as fibre-optic cable<sup>6</sup>. All of these factors get multiplied when combined as a cluster. Similar businesses meet, network and cooperate, often leading to successes far greater than any of them could achieve alone.

### **What lies behind the success of the Bangalore IT Cluster**

Most of the factors mentioned above fit the case of Bangalore. The renowned Indian Institute of Science, which dates back to the days of the British Raj and pioneers research in engineering and the physical sciences is located in the city. So is the Indian Institute of Management, Indian Institute of IT, National Law School and the National Institute for Advanced Studies. It is also the home of the Bangalore University with its 14 engineering colleges, which train software and computer engineers. Several large state-owned defence and communications industries are here since the 50's. Bangalore was the chosen location for these technology intensive industries because of its educational and scientific resources, and its strategic location away from the borders of India.

South of India has a large pool of software engineers and programmers and their productivity appears to have been enhanced by the organization of the industry into a technologically dynamic cluster in Bangalore. Bangalore's strengths include widespread English skills, sheer numbers of lower-wage programmers, experience in managing global software and services projects, growth in MNC development centres, and connections with non-resident Indians (NRIs) in Silicon Valley who are excelling there (eg. VC Vinod Khosla, Sabeer Bhatia of Hotmail fame, Desh Deshpande of Sycamore, K.B.Chandrashekar of Exodus).

Most of the factors identified in the literature on clusters have contributed to the existence of the software cluster in Bangalore. But they are not adequate explanations; they fall short of painting the entire picture. Government support for the industry is available in other regions of the country too. Technology parks are to be found in fifteen other locations. Fiscal incentives are also not location specific to the firms. The education institutions in Bangalore do provide a rich source of supply of engineers and technicians, but the industry is not solely dependent on local talent. It draws its labour force from all over the country – and in fact from all over the globe now.

Marshall (1901<sup>7</sup>) identified how "concentration of many businesses of a similar character in particular localities" create the scale economies or externalities which are of profound significance for an explanation of the success of the Bangalore cluster. The Marshallian type of scale economies evolve over time as an industry takes shape from small beginnings, with a handful of firms, and gradually mushrooms into a cluster.

Clustering enhances the local economic environment creating thereby linkages and externalities that particularly benefit export-related commerce. Externalities are generated

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<sup>6</sup> Zorawar Singh, 2003, Siting of Technology Organizations at [www.american.edu.initeb/zs](http://www.american.edu.initeb/zs)

<sup>7</sup> Marshall, A. (1901) Elements of Economics of Industry, Third Edition, Macmillan, New York

once a whole spate of firms engaged in the production of similar products locate in a specific region. It is, however, worth noting that clusters evolve over time and in many cases the potential for the generation of externalities promotes clusters. These local external economies are the passive benefits that arise from the geographical proximity of producers. The defining characteristics are (a) a specialized and skilled labour pool; (b) the availability of specialised inputs; (c) improved market access; and (d) enhanced access to specialised information on technologies and markets. Each of these factors is of particular significance to the ICT sector in general and Bangalore in particular. These are factors that contributed to the success of the software cluster in Bangalore. This success is effectively based on what is referred to as 'collective efficiency' - the competitive advantage derived from the combination of local external economies and joint action<sup>8</sup>.

Joint action is the active ingredient of collective efficiency and refers to joint efforts of improving effectiveness and competitiveness within the cluster. It's a combination of public private partnership on the one hand and the requirements of the export market that create the necessity for it. This joint action can take place within different types of linkages: (a) backward linkages to suppliers and subcontractors; (b) forward linkages to traders and buyers; (c) bilateral linkages between two or more local producers; or (d) within multilateral linkages among a large number of local producers, particularly through cluster-wide institutions such as business associations.

This suggestion is motivated by the argument that intense linkages and collaborative interaction between spatially agglomerated firms are particularly important determinants of success in knowledge-intensive industries. Out-sourced software development is one prominent example of the emerging "global commodity chains"<sup>9</sup> where mainly production is distributed between two main parties at different locations linked through a network. Studies have shown that software clusters are the ones most inclined to benefit from collective efficiency.

### **Macro factors: The role of the state**

Whilst Government in developed economies is primarily concerned with maintenance of existent systems, developing country governments such as India are also responsible in assisting ICT development as a promotional and developmental initiative.

State support has been a major factor in the growth of the Bangalore cluster. Besides establishing the Software Technology Park<sup>10</sup>, where a number though not all of the software firms are located, the Government of India has facilitated the growth of the industry through the provision of duty free imports of hardware, exemption from income taxes, installation of satellite facilities and exclusion from tedious customs and export clearance procedures. Surveys with firms have shown that more than 90 per cent of the firms included government support as one of the important reasons for their decision to locate in Bangalore.

The State Government of Karnataka was one of the first states in India to formally announce an IT Policy (1997) and establish a separate government department of IT (1999). It also made available land and provided the necessary infrastructure such as roads, electricity, water etc. in the IT parks established. State governments in India buoyed by successes in software exports have also provided incentives to attract software companies through opportunities of electronically mediated governance as a sector that such companies may want to reap benefits from<sup>11</sup>. Karnataka has over the years taken up several e-Governance projects where it has

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8 Rasmus Lema, 2005, The role of collective efficiency in Bangalore's software-export success, International Development Studies, Roskilde University (accessed at <http://www.druid.dk/ocs/viewabstract.php>)

9 Gereffi, G. and Koreniewicz, M (eds), 1994, Commodity Chains and Global Capitalism, Greenwood Press, Westport, Ct.

10 Established by the STPI (Software Technology Parks of India)

11 Singh. A.D. and Mitra, A. (2002). 'Impact of software trade on electronically mediated governance initiatives: an exploratory framework within the Indian context', International Seminar on ICTs and Indian Development: Processes, Prognoses and Policies, Sponsored by the Indo-Dutch Programme of Alternatives in Development (IDPAD), Bangalore, 9-11 December

actively involved the private sector. More important than the incentives has been the facilitating role played by Government.

### **Meso level Factors: Role of the support structure**

The STPI (Software Technology Parks of India) scheme was set up by the then Electronics Ministry of the Government of India. Bangalore was one of the first places where the STPI organisation established its IT park. This essentially provided two ingredients, a) dedicated 24 hour satellite-based data communication link for software exports, b) a supportive export facilitation environment. This scheme proved to be one of the key factors for success, as STPI parks came up in key export and business oriented locations (5 to start with and now 15) where supporting incubator services evolved. This intermediate and focused approach that concentrated on a few chosen locations rather than awaiting Internet connectivity across the country, provided the required infrastructure for a very successful software export strategy.

#### ***The partnership factor***

*The Bangalore example of Government and private sector collaboration in the field of IT and software export promotion represents a unique and huge success story in the export sector. Such collaboration is unprecedented in most bureaucratic and business dealings in much of the developing world. As an illustration one needs to just look at the STPI (Software Technology Parks of India, an organisation of the Dept. of Electronics) example. While much of the state run telephone network (and Internet over it) continued to be undependable, the STPI established satellite earth stations and the STPI scheme for software exports worked very smoothly with total support of the user community. Since the whole software production base was essentially built on and for exports, it won for itself tremendous support of the bureaucracy, keen to show success in the earning of valuable foreign exchange for the nation. This accounts for the unique partnership and collaboration that the sector has shown. Such partnership has been the mainstay of supportive policies at the Ministries of Commerce, Finance and Electronics (now IT). (Quote from Singh, A. D., 2000, From Software to e-Commerce: India's success in the digital economy-Some lessons for the South, Executive Forum 2000, ITC, Geneva)*

In India (and Bangalore), the software and IT business association (NASSCOM) has been effective in lobbying with the central government and marketing abroad. It has however generally maintained a hands-off approach to collaboration and interaction among its members and between members. There are well-institutionalised information sharing forums related to global industry standards and business-development discussion forums. These range from annual IT exhibitions and conferences to specialized workshops and informal chat groups. However, both vertical and horizontal interaction related to core business areas lies beyond the scope of firm-to-firm cooperation and other group efforts. Interestingly, the sharing of common ideas and issues has continued without either leading towards common commercial initiatives or on the other, compromising individual enterprise business secrecy.

### **Micro level factors: Business and enterprise level Environment**

Foreign direct investment (FDI) and the growth of knowledge oriented production of goods and services associated with the phenomenon of globalisation also help explain the formation and growth of the Bangalore cluster. Foreign direct investment has directly aided the formation of the software cluster in Bangalore. Over one hundred MNEs including well known names in the information technology industry such as IBM, Hewlett Packard, Motorola and Texas instruments have established production facilities in Bangalore<sup>12</sup>. Such investments and the overall software orientation of the cluster have given it a very export centred orientation over the years. The majority of IT firms have of course not only benefited from this route but become specialised mainly in export related services and initiatives.

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12 The Software Cluster in Bangalore at [www.lanacs.ac.uk/people/ecavn/cluster.doc](http://www.lanacs.ac.uk/people/ecavn/cluster.doc)

The accepted cluster development approach views a cluster not merely as a concentration of small firms, but as an inter-dependent network among the local firms as well as between the firms and the other cluster actors like raw material suppliers, equipment suppliers, subcontractors, support institutions, customers and service providers. The Bangalore example however shows that the latter may not necessarily be true. Bangalore is an ICT cluster, but its individual firms are certainly not inter-dependent either on each other or at either ends of the supply chain, i.e. with suppliers or buyers. This of course is not to say that inter-firm collaborations do not exist. They certainly do but more so as part of the environment of 'collective efficiency' of the knowledge economy that's been mentioned before rather than the inter-dependent linkages seen in manufacturing.

The emergence of a critical mass of firms within the industry following the early public sector investments and initiatives has of course led to local economy benefits such as labour market pooling and information spillovers. However local market access is the least developed aspect of external economies in the cluster. This is one reason that local firms benefit primarily from factors such as easy access to (some types of) information, rather than those that arise from direct transaction between firms, such as a deepened divisor of labour<sup>13</sup>. In explaining the basis of success in the Bangalore cluster, however, this factor needs to be interpreted in combination with favourable factor costs and the 'business friendly' conditions provided by the national and regional state.

### **'Best Practice' and some lessons from Bangalore**

There are some 'best practice' lessons for business and industry that the Bangalore example has shown. Some of these are enumerated below:

- **Ingredients of success:** The existence and growth of the cluster in Bangalore are explained by a variety of factors including state support, endowments of skilled labour, foreign investment and the economics of agglomeration<sup>14</sup>.
- **Government's commitment is essential:** Government must show its backing by committing tax concessions and resources for infra-structure. This alone can lead to growth in this area. Governments must have specific IT/E-commerce policies and measurable, target oriented action plans. In Bangalore even more important than the incentives has been the facilitating role played by Government and its organisations.
- **Focus strategies:** Concentration of initiatives can be centred especially in urban concentrations, where the maximum potential for trade and commerce presently exists. India followed this strategy of providing digital data access initially at only important commercial centres, especially where there was a concentration of export-intensive industry. In India satellite earth stations were set up at key locations (only 7 initially) for providing 24 hour guaranteed access to software companies for export activities, much before Internet was available on the existing telecom channels<sup>15</sup>. In phase II now the range and strategy is widespread.
- **IT Cluster Management:** Though the STPI continues to provide the telecommunication links, maintain the main IT park and provide the required services for export facilitation, it does not directly 'manage' the Bangalore IT cluster as there are today several locations, services and options available for the IT sector.
- **Intermediate Strategies are useful:** Many developing countries may not be able to generate or attract the large investments needed for upgrading their telecom and other infrastructure across their entire country. Therefore, a more strategic option would be

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13 Lema, 2003

14 The Software Cluster in Bangalore at [www.lancs.ac.uk/people/ecavn/b/cluster.doc](http://www.lancs.ac.uk/people/ecavn/b/cluster.doc)

15 Another option is to set up Business centres in far flung places, linked to a common network and service that assists not only in access but also business promotion. Experiments in this regard have been quite successful from Sri Lanka to Brazil and even in Africa. Such models provide an immediate and workable solution that can be emulated by other developing countries.

to formulate and implement appropriate strategies by concentrating on the areas in which IT, electronic commerce and IT enabled services are most likely to bring the highest benefits.

- **Re-engineer existing networks and use global services:** Massive investments and flawless technological solutions are not always necessary or possible. Even existing networks can be reengineered and global services for the Internet and e-commerce sites can be utilized. Till recently, all data connectivity was through state run telecom services and a majority of Bangalore centred web-sites are based out of servers in the US.
- **Developments can be phased out:** An analysis of the Bangalore example has also shown that different *infostructure* are essential for certain types of development and can be brought fourth in a sequential and not necessarily simultaneous manner. The strategy for growth of software exports and now e-commerce and e-services in Bangalore shows phased level jumps. Starting with just data connectivity, the next step was incubating facilities in STPI and state government leased space, leading to the setting up of large software parks (Science Parks) and then increasing bandwidth for the whole city through fibre-optics and satellite gateways in the private sector.
- **Financial and human capital** needs to be planned for: It also requires securing the availability of factors of value addition such as capital (both financial and intellectual) and trained manpower. Some places will have this in abundance, and some will not. Even in Bangalore shortage of trained software professionals has been an issue and companies based there recruit their employees from all across the country. IT companies also carried out the moulding of non-software engineers into software work by sustained training and incentives. Similarly Venture Capital needed the necessary push from Government and the private sector.
- Success is more dependent on the **e-Business environment** and the seizing of opportunities rather than on physical location in a science/IT park.
- **Challenges and obstacles** include poor infrastructure, high telecom tariffs, a massive digital divide, government bureaucratic procedures, presence of just a few higher educational institutes, low R&D spending by IT companies, inadequate original and locally developed IP, less focus on products as compared to services, inadequate VC presence, and high employee attrition especially at the level of team leaders
- The Bangalore experience shows that **external linkages** have an important impact in forming local relations.
- **ICT Clusters** are not an instant solution, but they do bring measurable results. Comparative advantage in the endowment of skilled labour in a developing economy can get magnified if specific ICT industries and services are organized in terms of technologically dynamic clusters by external economies of cluster activity.
- **Clustering** however does not automatically lead to 'collective efficiency'.

#### **Some Lessons for corporates from the Bangalore research:**

- a) **Inter-firm collaboration** is a crucial factor of success in knowledge industries even though it may not necessarily imply inter-dependency. The case of Bangalore shows that regardless of knowledge intensity and trade in software, cooperative relations may be limited. In fact, the complementary features of export orientation and weak domestic market-linkages shape the determinants of active collective efficiency.
- b) In the digital world of software and e-commerce success has come with **grabbing opportunities** as they emerged - from data entry and Y2K fixes to now e-commerce and web-enabled services.
- c) **Recognize the context** – it is not about cheap labour. It is about talent
- d) **Encourage over-communication.** Leading research like “Global Software Teams” show that technology is a given, but more projects fail because people do not communicate

- e) Just as your buyers abroad lead you on the digital path, so must you for your domestic suppliers. Only then will the **digital chain** be complete and efficient

### **The Final Take**

Strategy-makers should not succumb to the danger of becoming '*cluster-phobic*'!

Clusters can be and are useful tools in export strategy development. However accomplishment is not an inevitable assurance and neither are they the be-all and end-all of initiatives required export advancement.

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