India:

An Emerging Research Cluster

In collaboration with:

Professor Srinivasa Rangan,
Associate Professor, Management, Babson College;
Boston, MA, USA

VALUE LEADERSHIP GROUP, Inc.
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For more information please contact:

Value Leadership Group Inc.,
• strategies that build value •

Europe:
Kastor Building, 20th Floor
Platz der Einheit 1
60327 Frankfurt am Main, Germany
Tel: +49-(0)-69-975-03406
Fax: +49-(0)-69-975-03200

Also in USA & India

www.value-leadership.com

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About the author:

Professor Srinivasa Rangan, Associate Professor, Management, Babson College; Boston, MA, USA

Professor Srinivasa Rangan is a highly acclaimed expert on strategic alliances, a recognized author, and a popular teacher of strategy and international business at Babson College. His book, Strategic Alliances, An Entrepreneurial Approach to Globalization, was named by BusinessWeek as one of the top 30 business books of the year in 1995. Professor Rangan worked closely for nearly a decade with Professor Michael Porter, who also served on Dr. Rangan's dissertation committee at the Harvard Business School.

Dr. Rangan holds the Kingsbury Term Chair at Babson College, where he is a research fellow at the Asian Institute and Institute for Latin American Business. He teaches regularly in executive education programs at Babson, Amos Tuck School of Business Administration at Dartmouth College, and at several companies.

India: An Emerging Research Cluster

Professor U. Srinivasa Rangan

A new global economic paradigm is taking shape. While nationally embedded development of industry clusters may continue to hold sway in new and emerging technologies such as nanotechnology, the global economy is also witnessing the development of value-activity based clusters, especially in established industries. The rise of China as a major manufacturing center for diverse industries and the rise of India as a major services center for diverse industries both suggest that value chain activities themselves could become kernels around which competitive clusters may emerge. Indeed, it is becoming increasingly clear that, in the last several years, especially since liberalization and economic reform began in the early 1990s, India has begun to emerge as a research and development center for industries ranging from software to bio-pharmaceuticals. An emerging research and development cluster of the type we are witnessing in India suggests that multinational firms would do well to take advantage of it at an early stage since first movers may gain considerably in such emerging clusters.

Industry Clusters versus Activity Clusters

It is now widely recognized that geographic concentration of industries does occur in many parts of the world. Such industry clusters come into being due to many reasons. As Professor Michael Porter of Harvard University pointed out, the availability of specific factors of production, existence of sophisticated demand, the propinquity of related and supporting industries, and the likelihood of competitive market structures tend to create and perpetuate such industry clusters. The computer hardware and software cluster in Silicon Valley, the chemicals and pharmaceuticals cluster in Germany and Switzerland, and the consumer electronics cluster in Japan are but some examples of industrial clustering.

What we are now witnessing is a further evolution of these clusters through a new international division of labor. Three revolutions have fostered this evolution. The first is the transportation revolution that has significantly lowered the cost of physical movement of people and goods across the world. The second is the communications revolution that has dramatically lowered the cost of long distance exchange of voice and data. The third is the international trade revolution that has drastically lowered the barriers to international trade between countries in goods and services. The new international division of labor simply permits dis-aggregation of value chain activities in any industry across the globe by taking advantage of these revolutions.

Consider this example. Apple Computer's revolutionary product, the iPod, was conceptualized and designed in the Silicon Valley, its embedded software was mainly written in Hyderabad in India, is largely manufactured in China, and is being marketed worldwide. In more and more industries, we are witnessing such de-integration of value activities. What is more, specific value activities are being sent to the same

destinations: manufacturing goes to China, for example and software is often done in India. In other words, value activity clustering is now a reality of global competition.

This concept of value activity clusters is both derived from and goes further than Professor Michael Porter's ideas. His cluster views the industry with all its attendant value chain activities as the unit of analysis. In his elaboration of Silicon Valley, for example, he places enormous stress of how all the value activities relating to computer hardware and software are close to each other in the Valley and how close interaction between researchers, suppliers, manufacturers, marketers, and users allows the reinforcement and perpetuation of the industry cluster. My view is that with China's emergence as a manufacturing hub and India's emergence as a service hub, it now makes as much sense to talk about value activities cluster such as R&D and manufacturing as industry clusters. As the iPod example demonstrates, nearness of all the value activities is neither necessary nor sufficient to compete successfully in the global market place. Indeed, if anything, recognizing and taking advantage of value activity clusters may be the key global competitive success.

China and India: Different Kinds of Activity Clusters

Of all the activity clusters that are coming into being, I view the emergence of two complementary value clusters – manufacturing in China and services in India – as the most interesting recent developments in the global arena. On the one hand, it is now clear that China has mastered the ability to manufacture parts, components, and final goods in a range of products from the simple such as toys to the highly sophisticated such as consumer electronics and computers. On the other hand, India has become the place to go with respect to services, again from the simple such as the help desk to the most complex such as software, research, design, and development. It is now impossible for any aspiring entrepreneur in the United States to escape the question from venture capitalists as to how they plan to take advantage of the capabilities of China in manufacturing and India in sophisticated services.

It must be stressed, though, that the two activity clusters – China's in manufacturing and India's in services – are complementary. Indeed, Chinese and Indian firms themselves have recognized this reality. For instance, the Chinese telecommunications technology firm with global ambitions, Huawei, has chosen to set up a research and development facility in Bangalore in India. Along similar lines, Indian firms such as the auto components firm, Sundram Fasteners of Chennai, have chosen to set up a manufacturing base in China. A corollary finding is that global firms should accord some recognition to these two different activity clusters and take advantage of them by apportioning their value activities accordingly.

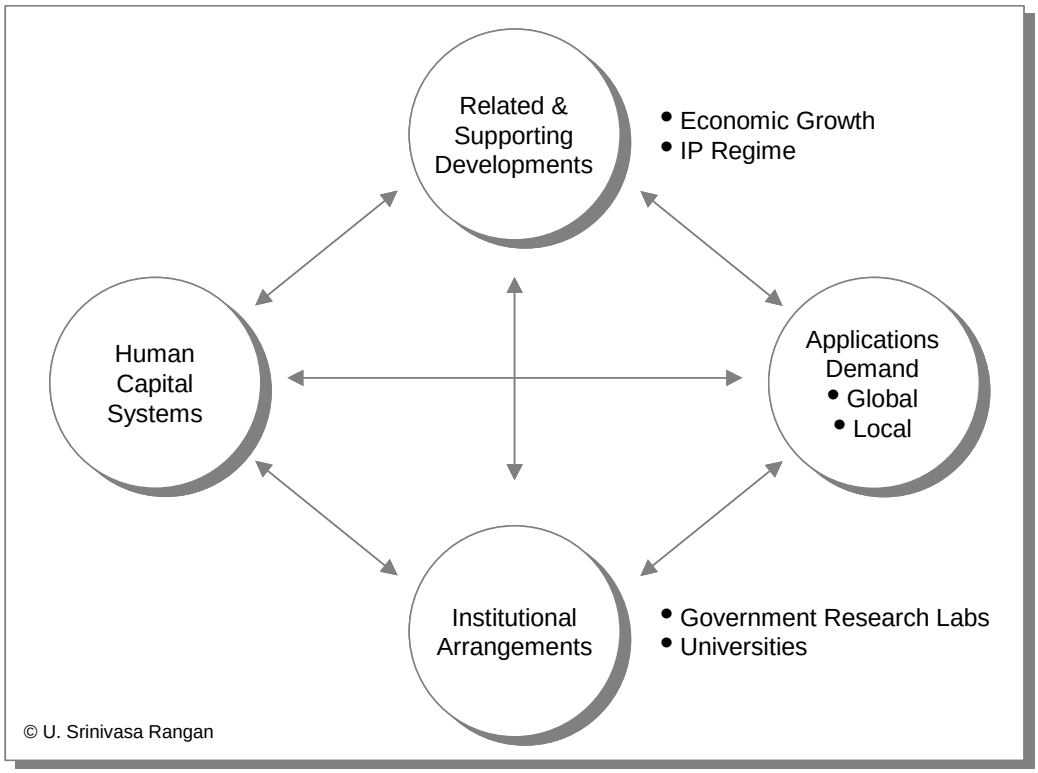
The Indian Research Cluster in the Offing

If India is spawning a research and development cluster, it behooves of us to inquire as to whether it is a transient or permanent phenomenon. My own view is that the Indian research cluster is evolving rapidly and has all the features of a self-reinforcing system that is the hall mark of a successful, long term activity cluster.

I conceptualize an activity cluster using the diamond of competitive advantage approach pioneered by Professor Michael Porter. The conceptual framework is shown in **Figure** 1 below.

Figure 1

India: A Research Cluster in the Offing



An activity cluster becomes self-reinforcing and long term viable if four major forces act in concert and help each other. These are: human capital development systems, sophisticated applications demand, related and supporting developments, and institutional arrangements. The human capital development system consisting of schools, universities, and vocational training institutes provides the necessary general and activity specific capabilities for an activity cluster to come into being. The sophisticated applications demand can come from either or both of global and domestic firms. The related and supporting developments include such things as local economic growth and intellectual property regimes. While local economic growth builds on and reinforces an activity cluster, sophisticated and world class intellectual property regimes tend to permit transfer of technology from abroad permitting continuous upgrading of skill needed in the value activity cluster. Finally, institutional arrangements such as favorable government sponsored institutes and research laboratories tend to add to the vitality of the activity cluster over time.

In India's case, all these four dimensions are favorably evolving to lead to a vibrant and growing research and development cluster.

In the first place, India's universities and engineering institutes are world class and are producing a large number of high quality, English speaking engineers and scientists who are readily absorbed into the country's burgeoning technology intensive

industries such as information technology, bio-pharmaceuticals, and chemicals. This aspect is going to be further enhanced as the Government of India has now decided to invest further in technical and scientific education infrastructure of the country. Second, India's foray into high end technological research and development was initiated by sophisticated global demand from such firms as Motorola, Intel, Cisco, and Texas Instruments. All these have, for several years now, run research and development centers in India with considerable success. Indeed, they have expanded the roles of their research and development centers in their overall global research strategy. More recently, however, the domestic firms have taken the lead. Firms such as Nicholas Piramal of Mumbai in the biopharmaceutical industry have struck strategic alliances with multinational firms to do research in finding new molecular entities. The two – global demand and local demand – have reinforcing tendencies.

Third, India with its strong economic growth averaging about 7% to 8% per annum in real terms has now begun to generate domestic demand of a quantity and quality that force by itself has been instrumental in further upgrading and reinforcing the research and development cluster. Moreover, India's willingness to move towards global intellectual property regime with its attendant safeguards and enforcement mechanisms has further enhanced the credibility and sophistication of the Indian research cluster. Finally, the Indian government has created over the last five decades several national institutes and laboratories that have slowly come of age. They are now in a position to play further constructive role in making the Indian research cluster more sophisticated and dynamic.

Personally, I see this development as a natural evolution based on my work with Professor Michael Porter of Harvard University in the mid 1990s. We worked with the Confederation of Indian Industry (CII) to assess the economic development policies of India until then and the shape it needed to take if India was to take its place among more developed countries. Among the recommendations we made to the then finance minister and the current Prime Minister Manmohan Singh was to invest heavily in infrastructure, promote foreign investment in key areas, foster support for knowledge intensive activities such as software, and promote internal competition. In the following years, successive governments have followed many of those recommendations and India now stands at the threshold of creating a new economy based on knowledge workers.

Taking Advantage of Indian Research Cluster

It is now a truism to say that India must be considered a leading place for locating a research and development center by any aspiring multinational in any industry. The earlier a multinational moves to set up a research facility in India, the better it is able to take advantage of the opportunities in India. Motorola exemplifies this point. It set up its research facility in Bangalore way back in early 1990s. That facility has now become a key resource for Motorola's global software group. Motorola also offers some interesting lessons on how a multinational may work to benefit from India's research cluster.

In the first place, the research facility must be part of the global strategy. True, as the sophistication of the local demand rises, the research facility may address local needs. But placing it in India to address only local needs and not global needs may be unnecessarily constraining. Such embedding in global strategy helped Motorola in rapidly scaling up its research operations in India.

Second, in a related vein, it is necessary that the multinational show long term commitment to the facility by its initial actions on staffing, allocation of work, and initiation of mentoring from other global research facilities.

An important aside here is that since the Indian research cluster is in its early stages of development, the issue of staffing has become an important issue. Multinationals such as ABB and HP have brought in non-resident Indians who have developed major research reputation outside the country to kick start their research initiatives in India. Philips of Holland initially started with a local Indian researcher and later on found it advantageous to bring an accomplished non-resident Indian to head the research center. Indeed, even some Indian firms with global aspirations have gone this route of bringing in non-resident Indians to initiate their research centers. The Tata Group of India, for example, brought in a well respected scientist who was a professor at Cambridge University, England to head their research center. There are several reasons for it and all of them are relevant to other multinationals.

In the first place, the Indian Diaspora is especially well represented in the knowledge intensive arenas such as research and development. Many of them with significant accomplishment to their credit are willing to relocate to India for personal reasons. Two, the non-resident Indians have been exposed to Western research ethos as many have been trained in American or European universities. When they return to India, they bring that research process with them. Three, the Indian universities and institutes, while very good at teaching research methodologies, tend to be more hierarchical in interaction. The rough and tumble or hard give and take one witnesses in American universities is not often seen. Disagreements are expressed politely and intellectual challenges are made mildly. Returning non-resident Indians play a crucial role in transferring Western research ethos into the Indian scene. Four, and this is a crucial point, it is unnecessary to bring in a large cadre of such returning non-resident Indians for a research center to be effective. Each research center needs only a handful of such talented and accomplished returnees for the new research ethos to spread and take hold as graduates of Indian universities are methodologically well trained and all they need is a good leavening of their research training with Western type willingness to challenge conventional thinking. Five, it is therefore unnecessary for multinationals to think that they need to bring in an inordinate number of researchers from abroad to make the Indian research center to function effectively. A few well trained and accomplished non-resident Indians augmented by occasional visits or sabbaticals by scientists from American or European labs should be sufficient for India research center to become a top notch facility in a few years.

Third, a related issue is whether the Indian research and development facility will be a global competency center for the company as a whole or only a center focused on local needs or emerging market needs. Of the two polar extreme models –

global competency center versus emerging market center – the former seems to be the way many sophisticated multinationals such as Motorola and General Motors seem to have opted to operate. A global competency center approach has the opportunity to take most advantage of low cost, high quality research talent of India while at the same time keeping the option of focusing on local needs that may have wider applications elsewhere in emerging markets.

Fourth, the multinational needs to develop sophisticated organizational and management systems to take advantage of the research facility in India. Well thought out reward and control systems, progressive metrics, and well planned socialization approaches for Indian and overseas scientists and researchers will go a long way to make the Indian facility to hit its strides quicker and firmer.

Fifth, the earlier a multinational moves to set up a research and development facility in India, the better off it is. In other words, being a first mover has its own advantages. India provides a low cost base from which new technologies including breakthrough ones could be easily developed at a fraction of the cost of what it would take to develop technologies in Europe or in the United States. In other words, an India based research center will help a multinational to cement its position as a technology leader at a lower cost. Alternatively, the creation of such a center may well help in reformulating the technology strategy of the multinational concerned. It may allow the multinational to move away from a technology follower strategy to a technology leadership strategy.

It is often said that being a fast follower would be a better strategy than being a leader. It is argued that this is especially so in technology since a fast follower presumably is able to avoid the mistakes and pitfalls of the innovator or leader and thus is able to come up with better technological breakthroughs cheaper. Two examples of this type of innovation approach are Maytag in the major appliances industry and Caterpillar in the construction equipment industry. Historically, both have pursued a fast follower strategy waiting for their rivals to introduce new features and products and then following up quickly with better and bugs-free products and features.

What is often missed in this narrative favoring the fast follower strategy is that it overlooks some more relevant points. One, both Maytag and Caterpillar have now substantially moved away from the fast follower strategy. Both have sought to become leaders in innovation and new product/feature introduction, albeit with different levels of success. This movement away from fast follower strategy has much to do with the next point. Two, the fast follower strategy is best used when the technology frontier is moving slowly, cost of replication of other's technology is not high, and the penalty for being a second comer in the industry is not high. In more and more industries, the advent of three related developments – global competition, technological convergence, and focused strategies at the firm level – have made time a major component of international competition. Companies do not any more have the luxury of moving slowly in response to rivals' moves. Nor can they replicate others' innovations cheaply. More often than not, new technological breakthroughs occur at the intersection of disparate technologies and through alliances between firms. A company using a fast follower strategy is likely to be significantly handicapped by it in

this accelerated global marketplace. What is more in areas such as software, embedded or otherwise, currently contemplated changes in the intellectual property laws in Europe and the United States may make a fast follower strategy very difficult to sustain.

Conclusion

A sophisticated research and development cluster is in the offing in India. It behooves of multinationals to take advantage of the cluster by being an early mover in locating a research and development facility in India. Such efforts, however, call for well thought our organizational and managerial systems to make such an operation a success.

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