

Innovation: enabling technology trends and networks for Asian SMEs

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This article explores the power of information technology to facilitate innovation – R&D capabilities and the business impact of such research – and the strength of collaborative models that further research. It emphasizes the potential of small and medium enterprises, a key market segment in Asia, to both grow and to innovate in order to meet global competition. R&D in Asia is not just the story of off-shoring, but an internal revitalization as well. Sharing technology resources (as with cloud computing), and knowledge resources and enabling resources (as with co-innovation partnerships) is the way forward, the author argues. Governments and industry groups can play a key role in fostering research. Such synergies empower small and medium enterprises to leap into a better future.



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An innovation framework: definitions, strategy and themes

Enterprises invest in research and development (R&D) as a key enabler of their innovation strategy. Tata Consultancy Services (TCS) believes innovation can be broadly defined as an idea that makes a material difference to an organization's current capabilities or creates a future capability.

According to Harvard Business School professor and author Prof. Clayton Christensen, innovation can be divided into three discrete subsets: derivative innovation, platform innovation and breakthrough innovation. These segments require different environments and support systems to

emerge and create maximum business value. TCS applies Prof. Christensen's segmentation as follows:

- Derivative or sustaining innovation that continually provides improvements on current services and solutions;
- Transformational improvement or platform innovation that facilitates a swift move to 'visible adjacencies' in terms of emerging technologies and markets; and
- Disruptive or breakthrough innovation that enables customers to access potentially game-changing technologies or/and new market business models.

The effectiveness of investment in the in-house R&D function, or indeed the extended co-innovation network (for example, TCS COIN™)

if one exists, can be measured in terms of impact on one or more of these innovation dimensions. For example:

- Investments in research that results in derivative innovation impact to the business will be measured on metrics such as productivity, features that enhance the competitiveness of existing products and introduction of new variants into the market;
- Platform innovation investments will be measured on new products introduced into existing markets, or larger leaps in technology or business models aimed at existing or future customer segments; and
- Investments in disruptive innovation models will typically be done independent of existing business elements, and are connected to market-making strategies at the enterprise level. These investments have a different risk profile, and are usually measured in terms of the impact of a portfolio of such investments.

The role of open innovation models and co-innovation networks is a key enabler of an enterprise innovation strategy.¹ This subject will be discussed later in this paper.

What of the actual themes that are driving research agendas in enterprises today? These 'themes' are more an articulation of the outcomes that the research programmes could influence, rather than the means (i.e. the content of the research programme). Themes provide a useful bridge between what the research community does, and what the business community could use the research for.

It is clear that there are a set of attention-grabbing, 'here-and-now' imperatives, which are driving short-term priorities. There are many business imperatives in the mid-term horizon as well. Finally, there are the 'grand challenge' problems, which are candidates for investment in the 'large-scope, high-risk, high-impact' category.

¹ See "Innovation Networks: Casting a Wider Net for IT Innovation" on www.tcs.com.

The here-and-now priorities for research in most enterprises are driven by themes like operational efficiency, simplification and business agility. Any research outcome that can improve the productivity of an enterprise, increase its efficiency or reduce its costs will immediately grab the attention of the business. Initiatives that can lead to simplification of business processes, technologies and platforms, and can yield measurable reductions in the complexity of doing business, would also be welcome. Such initiatives too could impact the organizational agility; others could specifically aim at the speed of doing business and consequently become attractive and valuable to the business.

While these proposals grab immediate attention, ongoing priorities around security, privacy, regulatory response and risk management are usually high on the fear-and-uncertainty index. Organizations will continue to invest in these, sometimes in spite of economic conditions.

On a medium-scale time horizon, enterprises do realize that they need to invest in the future. Several key issues dominate this category of themes – how does an enterprise understand its customers and markets and their changing, often ephemeral, needs. How does, based on this understanding, the enterprise design and create its products and services to provide the best possible experience to the customer. Given today's technology, the advertising message and often the actual products and services, may need to be delivered ubiquitously – anytime, anywhere.

Enterprises are also becoming increasingly aware of the power of social and knowledge networks in defining and answering such questions. They are looking inside and outside the organization for creativity and collaboration to understand and serve the customer better. These 'Web 2.0' technologies inside the enterprise, and sometimes extending to the enterprise partner and supplier networks, are becoming more visible.

What about the strategic issues and grand challenges in areas like

the environment, healthcare, education, urbanization and transportation? These areas are large and complex, and have a scope beyond what any one organization or enterprise can grapple with. Conversely, the potential impact could be enormous – and this is the opportunity that makes the challenges attractive. Enterprises need to study these carefully, pick the areas where they could play a meaningful role, and then look for the right collaborative networks where their contributions can become part of a larger whole.

These perspectives on research and technology are applicable not just to very large enterprises, which have extensive investments in research, but could be relevant to all enterprises, especially small and medium enterprises (SMEs). Innovation networks become the key enabler for the shift in mindset from 'I am too small to handle the R&D lifecycle' to 'how can I increase the innovation capacity I have, with the right external enablers'. Any enterprise can define the specific problem to be solved, and the business opportunity arising out of the solution. This means that solving the problem will come from the innovation network.

SMEs in Asia

SMEs are the backbone of the economic structure in many Asian nations. On an average, SMEs make up over 80 per cent of all enterprises in Asia. They provide 60 per cent of the jobs and contribute directly up to 30 per cent of total exports.² SMEs themselves can be those in the intermediary stage of growing into large enterprises. As this sector grows and equips itself technically, it becomes a market for various technologies, communications and service providers. Hence, its capacity to drive national and regional economics cannot be understated.

² Statement by Dr. Kim Hak-Su, Under Secretary General of the United Nations and Executive Secretary of the Economic and Social Commission for Asia and the Pacific (UN-ESCAP), at the Joint Event for World SMEs Forum and World Trade Point Federation General Assembly Meeting, 7 November 2005, Bangkok, Thailand.

Table 1: Trends in R&D spending by foreign affiliates in select economies in 2003 – share in business R&D

Country	Total R&D (US\$ billion)	Business R&D (US\$ billion)	Foreign affiliate R&D (per cent of business R&D)
United States (2002)	276.2	194.4	14.1
Japan (2001)	133.0	92.3	3.4
United Kingdom	29.3	19.6	45.6
China	15.6	9.5	23.7
Rep. of Korea (2002)	13.8	10.4	1.6
Canada	13.8	7.9	34.8
India (1999)	3.7	-	3.4
Singapore	1.9	1.2	59.8
Thailand	-	-	28.1

However, SMEs have inherent traits that can cramp their growth in a highly competitive and globalized market:

- Key decisions are taken by individuals/owners or a small group;
- SMEs are usually dependent on people rather than process;
- Most SMEs place short-term gains over long-term vision;
- SMEs focus on cost cutting and getting more for less; and
- Most SMEs do not invest much in R&D.

The last characteristic is not specific just to SMEs; Asian businesses, big and small, have low spends on R&D. Developed countries seem to spend about 2-3 per cent of their gross national product (GNP) on R&D, out of which 50-80 per cent is contributed by the industry. Developing countries seem to spend in the range of 0.1 per cent to 1.0 per cent.³

The research capabilities of Asian countries differ widely. Table 1 indicates how much of this is fuelled by multi- or trans-national companies (MNCs and TNCs) investing in such research.

In 2002, the total R&D expenditure in the world was US\$676.5 billion, the total R&D expenditure of foreign

affiliates was US\$67 billion, and the total business R&D expenditure in the world was US\$449.8 billion.

Similarly, the number of scientists per million of people is small in case of India (157), as against 545 in China, 2,319 in the Republic of Korea and 4,097 in the United States. The number of Patent Cooperation Treaty (PCT) patents filed in 2005 by India was only 678, as against 2,500 in China and 4,685 in the Republic of Korea.

Asian SMEs are also known to be less innovative than those in the United States. Considering the number of patents filed as a proportion spent on R&D, smaller firms in the United States do better than the ones in Asia.

R&D in Asia

Research off-shoring⁴ has been a growing Asian success story. Institutionalizing of invention and innovation to meet urgent market needs has been a key driver of this phenomenon. Global business expanded to Asian markets and answered the imperative to “design to the market”. The quest for knowledge workers (especially in the context of a fall in the number of Ph.D. and Master’s degree holders in science and engineering and the cutback on H1B in the United States) has spurred this. Availability of considerable pools of skilled resources, better connectivity, improved

⁴ By this, the author means both captive and outsourced.

infrastructure and cost-effectiveness have facilitated an increase in R&D outsourcing. Research in pharmaceuticals, biotechnology and information technology has found its way to Asia in the past decade.

In Asia, the R&D expenditures by majority-owned foreign affiliates of the United States-based MNCs increased from US\$400 million in 1994 to more than US\$2.1 billion in 2002. China, Singapore, Hong Kong (China), Malaysia and the Republic of Korea have been among the main destinations of such expenditures. More than half of the 300 largest R&D spending firms in the world had moved R&D outfits to China, India or Singapore. In China especially, the number of foreign R&D units showed a sharp growth from 1995 to 2005. The Republic of Korea too has witnessed remarkable growth in R&D contracting: by the end of 2004, 140 foreign affiliate R&D units had been opened in the country, including those of Intel, Motorola, Philips, Siemens and Microsoft (UNCTAD, 2005).

For Asian economies, it has been a good move up the value chain. The ripple effect has also been considerable in terms of a reverse brain drain and foreign direct investment (FDI) outflows in the region. Highly skilled Asians were able to find challenging jobs at home. Asian firms have been internationalizing. Of the top 50 developing-country MNCs, more than 75 per cent are based in Asia. FDI flow from Asia and Oceania quadrupled in 2004 to US\$69 billion, driven particularly by outflow from Hong Kong (China) of US\$40 billion. Outflows from Singapore and the Republic of Korea also rose significantly to US\$11 billion and US\$5 billion, respectively. It is worth noting that most of these investment flows have been going into other Asian economies. A 2005 survey by the United Nations Conference on Trade and Development (UNCTAD) identified 60 foreign R&D centres owned by companies from the Republic of Korea. Chinese companies have set up more than 75 foreign R&D units in both developed and developing countries. Many leading Indian software companies have established an R&D presence abroad (UNCTAD, 2005).

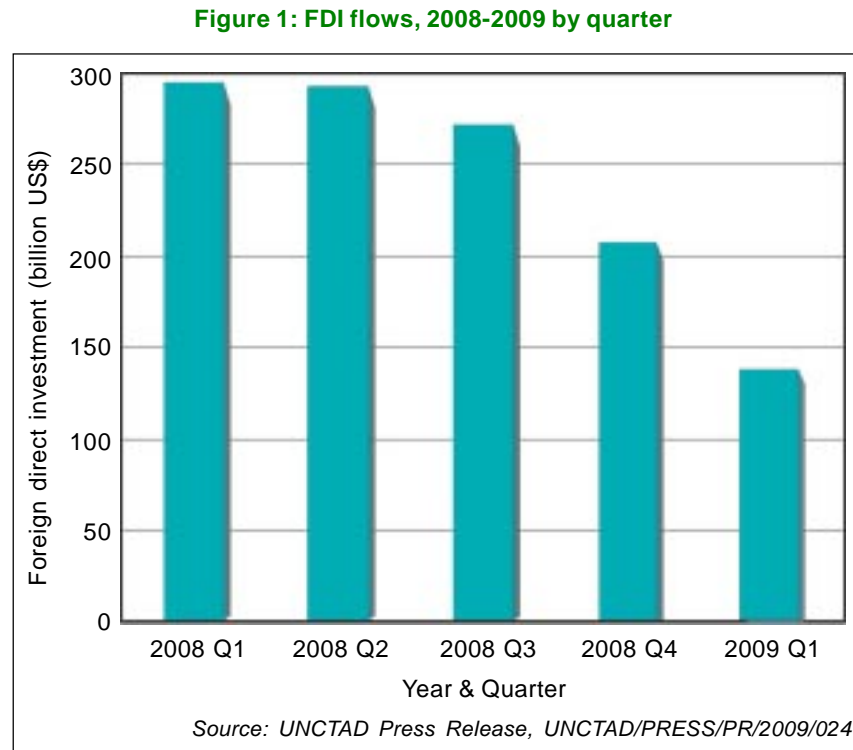
This year has been different. The economic slowdown has created new dynamics in R&D contracting. The most impacting and, perhaps, the most predictable trend is the sharp dip in FDI inflows worldwide (Figure 1).

MNCs have been grappling with the economic downturn that is hurting in various ways – from failing market expectations, tighter credit conditions, reduced value of assets following stock market declines, and lower corporate profits. Many have tightened their belts, to better cope with current economic uncertainties, by laying off workers, cutting capital expenditure and curtailing output. Some amount of protectionism is also anticipated in outsourcing of jobs, especially high value jobs. Research funds are under a squeeze everywhere.

Why is innovation important for SMEs?

In this scenario, should Asian SMEs have innovation concerns as much as large enterprises do? Considering the fact that in today's environment a start-up can grow quickly and can gain a significant global presence, the potential to be realized is enormous. Asian SMEs have traditionally been catering only to local consumers and markets. However, with the opening up of various Asian economies and international media and Internet penetration within Asian nations, they have awakened to global standards and markets. There are cases like that of Out of Asia (OOA), a handicraft company from Yogyakarta, Indonesia, hiring university graduates to address key challenges of quality while taking advantage of Yogyakarta's competitive labour costs and abundant raw materials. Working with small producers, many of whom had previously only sold their goods along the sidewalk of Yogyakarta's main shopping street, OOA helped improve production capacities, delivery performance and quality control. Today, OOA has spawned several similar SMEs, which take international orders, have innovated on sourcing and marketing, and have their own online presences.

It is a whole new business model, requiring its own range of innovation.



From a simple business transaction, it creates the need for a chain of improvements – from new designs for a new market, to new quality standards, compliance to labour laws, better online marketing, packing and delivery processes.

With an increasing number of SMEs forming a part of supply chains, taking up outsourced jobs, connecting to global networks and playing their part in the knowledge economy, there is a need for constant innovation in this segment. Even the SMEs that cater to local markets can no longer pitch only on price points. Customers, as management guru Mr. C.K. Prahalad says, at the base of the pyramid deserve (and are asking for) a better deal. With Internet and television connectivity, SME consumers are brand-aware, technology-ready and want more out of a deal. And that means better products, innovative models and speeding to market...

Technology to spur innovation in the SME sector

The Asian SME segment is not a unified, undifferentiated one. Its presence

is across traditional sectors such as agri-based products to the newly evolved e-commerce retail industry. A vibrant segment, it is faced with competition at local, regional and national levels. Truly competitive SMEs have to be agile, get close to customers and be constantly innovative.

Technology is a keen enabler of innovativeness in SMEs. The arrival of broadband and the eager adoption of mobile-based technologies have empowered small business to address competition and demand for quality in a globalized and knowledge-based economy. While huge disparities exist in the nature of knowledge tools adopted, SMEs are transitioning towards addressing challenges with information and communication technologies (ICT). For instance, an online Web presence has become important for Asian SMEs. To build their online presence, SMEs in the developed countries of the Asia-Pacific (APAC) region will be spending over US\$7.6 billion on online advertising, Web hosting, development and maintenance in 2009.⁵

⁵ AMI Partners, Press Statement, 03 June 2009.

Beyond Web presence and advertising, ICT is changing the way small enterprises engage their customers and run their back-office processes. Computerization has helped cut costs by streamlining internal processes, improving services through faster communication with customers, and bettering promotion and distribution of products. Every link in the value chain is empowered.

It is not surprising that the New York-based market research firm, AMI Partners, believes that SMEs in Asia Pacific will spend US\$153 billion on ICT in 2009. SMEs in China, India and the Republic of Korea are expected to lead the region in ICT spend, accounting for more than 50 per cent of this expenditure. AMI predicts China's SMEs will account for close to 30 per cent of that amount with the Republic of Korea following at 20 per cent.

However, how efficiently can small firms manage their information technology (IT) processes? Will this divert their energies from driving their core competencies? Here are some pain points in the delivery and consumption of IT:

- IT products made for large enterprise clumsily shrink-wrapped for SMEs;
- Prevalence of pirated software and the consequent instability of systems;
- Increasing security requirements and threat to data and systems;
- Time and effort required in managing IT infrastructures in house; and
- Rapid obsolescence of the legacy systems present.

The economic crisis has brought other challenges. Investments in IT may be hard to come by. Operating costs have to be cut down. Staff layoffs may impact IT departments or IT staff. So how to keep IT management simple and get the best out of it? Let us look at some emergent paradigms.

Cloud services: the new paradigm in IT

The arrival of cloud computing technology brings a promise of innovative business models for IT. It is well suited for small businesses, which

are just adapting to computerization and have little or no legacy applications, and can benefit from an on-demand computing paradigm and a pay-as-you-use model.

Cloud computing is a Web-based service that offers standardized IT-based capability provided by off-the-shelf or commoditized hardware components. It offers customers billing based on actual usage. It also offers scalability to customers – the ability to 'flex' and add capacity on the fly.

Cloud computing offers multiple layers of services: from 'infrastructure as a service' (processors, storage, network bandwidth) to 'platform as a service' (specific platform services ranging from basics like file systems to higher services like mail and office productivity), to 'software as a service' (SaaS, like business software) to even business processes or IT as a service. Each of these layers could be built on the lower layers – so a SaaS offering could be built on a scalable infrastructure-as-a-service core.

'All IT services on a utility model' should be an attractive option: the service provider owns and manages the software, platform and infrastructure and the customer pays for use. The solution can be offered in layers, covering hardware, networking, office applications (e-mail, software and so on) and business applications such as customer relationship management, payroll management and human resources management. On this, fits a fifth that is based on the vertical or industry relevant to the subscriber. The SME platform of TCS that offers IT as a service is based on this model.

The benefits to SMEs are many:

- A single window for all IT requirements: SMEs typically deal with multiple vendors for IT solutions leading to poor integration and lack of service levels across the stacks. IT as a service will encompass solutions covering the entire stack needed to run the daily operations of SMEs.
- Minimal set-up time: In an IT-as-a-service model, setting up the entire IT environment takes minimal time. Software updates with

newer features are also more frequent with no business downtime. This enables an SME to leverage the benefits of state-of-the-art IT quickly and efficiently.

- Effective cost control.
- Minimal capital expenditure: Under the IT-as-a-service model, there is minimal capital expenditure. SMEs do not have to own either the application or the infrastructure.
- Reduced operating expenditure: SMEs will only incur operating expenditure, which will be equivalent to the subscription charges levied as per the IT services rendered. The model will also eliminate the requirement of maintaining IT specialists on their payrolls.
- Pay-as-you-use model: IT as a service helps SMEs align their IT requirements to the current business needs. Monthly subscription or pay-as-you-use model allows SMEs to scale up with their IT needs easily.

Of course, safeguards are required in using IT as a utility. The vendor must provide favourable service level agreements that cover downtimes on the service or loss of data. The vendor must provide access to data and the "lock-in" of application should not hamper the growth of the enterprise.

Mr. Nicholas Carr, a technology watcher and author of *The Big Switch* draws a parallel between IT as a utility and electricity as a utility (Carr, 2008). Today, we cannot imagine using electricity that does not come on a wire from a remote source at the flick of a switch. Computing power too perhaps will follow this model and be available as we need it and in the quantity we need, as a utility. Just like the electricity as a utility that empowered businesses, IT as a utility will empower users to move towards successful business models and innovative goals.

Innovation networks

The other trend that is furthering innovation today is the connection to networks. The move by TCS to an open and collaborative innovation network has been rewarding. There are reasons why such a model will work for SMEs as well.

Work in every industry has become interdisciplinary. A car is no longer a sum of its mechanical parts. It has become a combination of microprocessors, sensors and mechanical parts. Today's cars have more computing power than Apollo spacecraft, they say.

Organizations have become interdependent, and technologies multidisciplinary. An IT organization is not just dependent on computer professionals. TCS Innovation Labs, for instance, employ researchers and scientists who are mathematicians, statisticians, process engineers, biotechnologists and doctors of medicine.

No organization, be it small or large, can do it all in-house. R&D used to be closely held knowledge, a secret within the organization itself. Today, with the opening up of economies, evolution of knowledge-based societies (where even a consumer is aware of something that is available across the globe) the rapid product cycles and equally rapid obsolescence, the need for speed to market have made it plain that all research cannot be conducted in-house. More importantly, it is no longer enough to stop with R&D. Taking new products, processes and solutions to market requires new ways of thinking around business processes as well. Here, collaborative networks become invaluable.

To effect significant transformations in small- and mid-cap segment, there is a need for supportive networks. There has been a call for networking in the SME segment from various perspectives: technology upgrading, financing, state policies and frameworks, and human resources development, to name a few.

Typically, an innovation network connects in-house R&D units with emergent technology research, funding and consulting agencies, key customers, academia, and multilateral organizations. "Co-solutioning" with two or three entities in the network creates benefits for all stakeholders. The constant presence within the network can impact the quality and market traction of products and solutions favourably. The knowledge that resides in innovation networks enhances the value chain of the business.

In the case of the SME segment, fostering a network may be beyond the scope of single entity. Creation of regional or local networks can further innovation. A good example is the Coimbatore District Small Industries Association (CODISSIA). The Association renders guidance and help to new entrepreneurs in product identification, project report preparation, and getting financing from banks and licences from various departments. CODISSIA has also played a part in setting up a Small Industries Testing and Research Centre (SiTARC). It has signed Memoranda of Understanding with several academic institutions in the region for R&D into various pain points that SMEs in the region face and for technology transfer.

Orchestrating such networks requires maturity and strategic skill. Technology transfer, holding or sharing of intellectual property rights (IPR), and royalties may often throw up tricky issues. The neutrality and the orchestrating strength of government bodies make the state a good candidate in fostering innovation networks.

Public-private partnerships

Governments in Asia have never been far away from regulating business environments. But the move from large state-run entities or public sector undertakings to the often more agile and productive public-private partnerships (PPP) has been recent. PPP has been tried in different sectors, especially in civic infrastructure, power, telecommunications, health as well as transportation.

In the realm of fostering research capabilities, especially with respect to SMEs, several Asian governments have support programmes. This has panned out in different initiatives – the creation of supportive environments such as technology parks, setting up of national and sub-national innovation networks, clustering of SMEs within an industry, and so on.

With the objectives of building indigenous capabilities for development and commercialization of contemporary products and processes of high impact and to combine research acti-

vities of industry with those of national research institutions, these government programmes have been incubating research with private enterprises.

TCS "co-solutioning" with New Millennium Indian Technology Leadership Initiatives (NMITLI) in the area of Bio-informatics is a case in point. There were 19 institutions with bio-informatics experts in touch with NMITLI, but didn't know how to make a software product, while TCS had the software expertise and the needed domain experts from industry to collaborate. Other small players and scientific institutions too contributed. The result was "Bio-Suite", an award winning product that facilitates drug discovery process. This provided a cost-effective tool for regional pharmaceutical companies, enabling them to innovate in their domain of drug discovery (incidentally, it also made competition drop prices heavily).

State-supported programmes can act as angel investors to incubate innovative product creation, provide a supportive environment for research, facilitate benchmarking to global standards and provide IPR guidelines.

To sum up, in a globalized market, innovation is a key differentiator. Asian economies have the knowledge resources, and have seen a surge in off-shored R&D, whether captive or contracted. It is time Asian economies revitalized their enterprises, especially their SME segment, which has enormous growth potential, with innovation. IT is an innovation enabler: cloud services, IT's new model, is sure to be an exciting option for SMEs. Moving to open collaborative networks, where governments can play a key role, can help SMEs surge ahead.

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