

**Emerging Economies Research Dialogue**  
*Review cum Brainstorming Workshop*

**Technology and Innovation**

**New Delhi, India; March 21, 2011**

# Papers for Discussion

1. A Preliminary Evaluation of Indigenous Innovation Policy of China *by Xielin LIU and Peng Chen*
2. Innovation Systems in Latecomer Development: Sectoral Evidence from South Africa and Malaysia *by Banji Oyelaran-Oyeyinka*
3. Evolution and Dynamics of the Brazilian National System of Innovation *by Jose E Cassiolato*
4. Uncovering Innovation Dynamics and Development Processes: A Mexican Perspective *by Elisa Calza and Mario Cimoli*
5. The Role of the Diaspora in supporting National Innovation System: The experience of India, Malaysia and Taiwan *by Rajah Rasiah, Yeo Lin & Anandakrishnan Muniratha*
6. Perspective on Public Funded Research for Technological Development: Insights from India's Technology Trajectory *by Amit Shovon Ray and Sabyasachi Saha*

# Overall Summary

1. Country's national Innovation ecosystem covering historical perspectives; Government policy, priority, incentives; industry's capability, investments in innovation; overall macroeconomic structure and many related items were captured in the following papers:
  - a) A Preliminary Evaluation of Indigenous Innovation Policy of **China**
  - b) Evolution and Dynamics of the **Brazilian** National System of Innovation
  - c) Uncovering Innovation Dynamics and Development Processes: A **Mexican** Perspective
  
2. Specific case studies are developed covering a sector's development; impact of attracting the Diaspora and impact of public funded R&D in following papers:
  - a) Innovation Systems in Latecomer Development: Sectoral Evidence from **South Africa and Malaysia**
  - b) The Role of the Diaspora in supporting National Innovation System: The experience of **India, Malaysia and Taiwan**
  - c) Perspective on Public Funded Research for Technological Development: Insights from **India's** Technology Trajectory

# Overall Observation

1. Commendable initiative by ICRIER
2. The papers are exceptionally well written and authors are masters in the fields
3. Highly informative papers. Insights and analysis of the authors are very good.
4. Purpose for all these papers could have been
  - a) Analysis of nations (of similar historical and economic backgrounds) on some important and relevant “inputs” and “outputs” those are indicators of technology driven innovation systems
  - b) “Inputs” could have been mapped in Govt Policy, Incentives, Delivery mechanism, Intermediation, S&T infrastructure, Higher education, Global S&T partnerships, Industry investment in innovation, IPR regime, and many more
  - c) “Outputs” could have been measured in terms of Industry’s ownerships in Global IPs, its global tech-market leaderships, technology applications to societal problems and national challenges, rise in technology led entrepreneurships and many more
  - d) Finally, some recommendations could have been emerged from the best successes in the nations

# **A Preliminary Evaluation of Indigenous Innovation Policy of China**

*by Xielin LIU and Peng Chen*

# Summary of the paper

- ❑ Innovation in China at present seems to be more incremental than radical
- ❑ Government has established State owned Enterprises and Public R&D facilities to decrease dependence on foreign technology less than 30%
- ❑ Reason for moving towards indigenous innovation
  - *Foreign invested enterprises accounted for more than 85%*
  - *Culture of imitation and copying*
- ❑ Government spends more money on applied research than basic research

# Summary of the paper (contd..)

- Govt. subsidy to enterprises will lead to decrease enterprises' R&D expenditure while subsidy to research institutions will promote enterprises' R&D expenditure
- Inputs of innovation in different ownership of enterprises
  - *State Owned Enterprises (SOEs) get more support from Govt. but experienced decline in R&D human resources*
  - *Private and foreign enterprises spend more money on R&D than SOEs*
  - *Number of R&D labs in SOEs declined*
  - *Private enterprise labs have more Scientist than SOEs*
  - *Amount of money required for adoption of imported tech. is more in SOEs*
  - *Private enterprises have more patents than SOEs*

# Summary of the paper (contd..)

- ❑ Top-down innovation policy if complemented by bottom-up approach then it can yield more innovation capability
- ❑ Three challenges
  - *To indirectly promote innovation by investing in institutions*
  - *Support private enterprises in their framework of indigenous innovation policy*
  - *Create environment for domestic industry to avail the FDI spillover effects of R&D*



# Observations

- ❑ The rationale behind the Chinese Government funding SOEs could also be mentioned as there could be other reasons like socio-political which could justify such policy
- ❑ Has the expenditure on SOEs by the Govt. produced any products of National Importance in all the compared years that could justify Govt. supporting the SOEs?
- ❑ Did the private enterprises benefitted from the improved infrastructures like efficient ports, good quality roads etc. which Govt. facilitated keeping in view the SOEs?

# Observations (contd..)

- ❑ It would be good to explore whether Govt. allocates the R&D expenditure for the SOEs every year based on a logical process or the SOEs themselves reduced their R&D expenditure
- ❑ Any correlation between employment and investment in SOEs? Are they supported initially to create employment?
- ❑ Even though this paper identifies three challenges it would be good to have a concrete policy measure and time bound means to achieve them, at least a progress in that front

# **Innovation Systems in Latecomer Development: Sectoral Evidence from South Africa and Malaysia**

*by Banji Oyelaran- Oyeyinka*

# Summary of the paper

- ❑ The paper analyses the main institutional mechanisms that foster the emergence and performance of the firms in knowledge intensive sectors
- ❑ It illustrates inter-linkages between state policy, technological capabilities and interactive learning
- ❑ Analysis focuses on two main propositions
  1. *Examine the microeconomic process of interactive learning leads to innovation in latecomer economy*
  2. *Firms in latecomer economy require state support to produce and innovate in face of a immature market*
- ❑ Analysis shows that state support is not just implementing a set of policies but the ability to set up institutions that reflect a harmony b/w knowledge and physical infrastructure

# Summary of the paper (contd..)

- ❑ Regarding building innovative capability the south African survey revealed
  1. *Quality control and reverse engineering are the major upgrading paths for firms*
  2. *Growing interaction with customer needs and learning by doing is effective*
- ❑ Firms that collaborates with others
  1. *Have higher export intensity*
  2. *Older than non collaborators*
  3. *Indulge much more in own product development*
- ❑ Malaysian Govt. introduced proactive policies to attract high-tech multinationals to Penang (Tech park)

# Summary of the paper (contd..)

- ❑ Similar to firms in SA, firms in Malaysia also learn mainly through quality control activities and reverse engineering.
- ❑ The study emphasizes
  1. *Focus on combination of factors specific to institutional innovation*
  2. *Harmony of institutions and policies that bring about change*
  3. *Limitation of the state in deliberately building knowledge infrastructure*

# Observations

- ❑ The ICT sector selected by the author may not be the strength of the select countries. What is the rationale behind selecting this sector?
- ❑ Comparison of Software vs. Hardware in SA and the regions, Penang vs. Johor in Malaysia creates two dissimilar examples to be compared
- ❑ “those firms receiving state support tend to be more innovative than those that do not” - Why?

# Observations (contd..)

- ❑ “..what counts is the combination of factors as well as the coherence and harmony of institutions and policies that bring about change”- does this imply that combination of factors might be unique to the situation?
- ❑ If policy and infrastructure created are delinked, then what brought those infrastructure facilities in regions which aided in the industrial development? Was there any other compelling reasons for Govt. to create infrastructure facilities without any policy precedent?



# Evolution and Dynamics of the Brazilian National System of Innovation

*by Jose E Cassiolato*

# Summary of the paper

- ❑ The paper highlights
  1. *Limitations of the Brazilian National Innovation System*
  2. *Inefficiency of the traditional indicators of innovation to measure innovativeness of some of the core sectors like services and agro-industry*
  
- ❑ Author touches upon the narrow and broad view of NIS
  1. **Narrow View** = *Linear approach primarily focuses on S&T policies covering R&D and interaction between scientific and tech infrastructure*
  2. **Broad View** = *Systematic understanding of socioeconomic capabilities, historical processes, institutional evolution and development trajectories with very specific local features and dynamics*
  
- ❑ Colonization in Brazil hindered growth of scientific and technological knowledge till first half of 19th century

# Summary of the paper (contd..)

- ❑ Period of import substitution had transformed Brazil into an industrialized nation by 80s with an industrial structure similar to OECD countries
- ❑ But the second oil Crisis restricted this growth and to counter that Brazil open up its economy
- ❑ Brazil formulated policies
  1. *To achieve macroeconomic stability at the cost of lowering state investment in industrial R&D and scientific research*
  2. *Relied on FDI and global technology and spill over effect*

# Summary of the paper (contd..)

- ❑ Rich biodiversity is responsible for development in agro-industry
- ❑ high heterogeneity and unequal regional distribution of wealth (inequality) was responsible for
  1. *Low quality education*
  2. *Regional pockets of excellence*

# Observations

- ❑ Report states that by 1980 Brazil has transformed its production structure into not much different from other OECD countries- it is not very clear though to what sophistication level (compared to OECD economies) this production structure was supported by endogenous technological innovation
- ❑ The report points out that traditional innovation measurement parameters are not sufficient to capture the innovativeness of sectors like “services” and “agri-industry” but fails to mention any alternative approach

# Observations (contd..)

- Report observes the decrease in state funding for the Brazilian center of excellences (CoEs) like “EMBRAPA”, “Embraer” or “Cenpes” which as a result had to liquidate some of their functionalities, is a negative step. But importance of public funding and less reliance on market funding to create and sustain CoEs needs more clarification

# Uncovering Innovation Dynamics and Development Processes: A Mexican Perspective

*by Elisa Calza and Mario Cimoli*

# Summary of the paper

- ❑ This paper highlights the drawback of the National Innovation System (NIS) as a sole framework to bring improvement in the macroeconomic condition
- ❑ The author suggested to combine the macroeconomic policy and productive structure with NIS framework to achieve greater success



# Summary of the paper (contd..)

- Three fundamental dimensions of innovation dynamics
  1. *Macroeconomic fundamentals = policy implementation for sustaining economic stability*
  2. *Production structure*
  3. *National Innovation System = linkages and systemic interaction between institutions and other actors of Innovation*
  
- Macroeconomic fundamentals
  1. *Initially Mexico introduced policy of import substitution*
  2. *Local production boosted by public funding*
  3. *Public investment was channelized to create institutional infrastructure and scientific and technological research*
  4. *Following the crisis in 80s Mexico opened up the economy*

# Summary of the paper (contd..)

## □ Production Structure

1. *Macroeconomic fundamentals affected the production structure (export-led)*
2. *Multinationals sourced its technology internationally without banking on local R&D*
3. *This condition did not support national technological capability building*

## □ National Innovation System

1. *Also affected by policy shift*
2. *Government relied on export-led growth and subsequent technology spillover effect*
3. *Public funding for institutional research was reduced*

## □ Macroeconomic fundamentals took the center stage to shape the innovative capability building in Mexico

# Observations

- ❑ Authors claim of emulating the combined approach of macroeconomic policies, production structure and NIS by other developing nation is not compelling enough, as challenges faced by other nations are very different on the ground (Ex. India needs strong NIS system more than macroeconomic policy amendment)
- ❑ How the production structure and the NIS has affected the formation of macroeconomic policy has not been portrayed effectively

# **The Role of the Diaspora in Supporting National Innovation System: The experience of India, Malaysia and Taiwan**

*by Rajah Rasiah, Yeo Lin & Anandakrishnan Muniratha*

# Summary of the paper

- ❑ This paper analyses & examines
  1. *The cross flow of national human capital in the development of national innovation system*
  2. *Sector specific approach like Taiwan in IC Industry for connecting and coordinating the spill over of globally evolved knowledge*
- ❑ Taiwan's experience with the Diaspora has been the most impressive as the government being able to attract them to research and teaching into universities, public labs and to manage high tech companies
- ❑ Taiwanese Diaspora was instrumental convincing the govt. to launch ITRI in 1974 and to develop the integrated circuits (IC) industry

# Summary of the paper (contd..)

- ❑ Government investment into building the high tech infrastructure was a major development in the transformation of Taiwan into a high tech hub (*Hsinchu Science Industrial Park*)
- ❑ Well coordinated positively designed policy was responsible for Taiwanese growth
- ❑ India benefited from returning Argonauts from 1990 sans any explicit brain gain policy in place
- ❑ Indian Govt. adopted policies to support the software industry, raised standard of infrastructure and opening up of the economy

# Summary of the paper (contd..)

- ❑ The founders of top 10 software exporting firms in India are educated and trained in Indian institutions
- ❑ In India barrier for technological growth lies in the uncertainty of protection of IPR
- ❑ India gained due to its expenditure for higher education like in IITs, IIS, IIMs and IISC
- ❑ Malaysia failed to attract qualified Malaysians due to policy lacking in industrial focus, returnees came at personal capacity and without any strategic purpose

# Observations

- ❑ Lucid Interpretation on how best nations like India, Taiwan & Malaysia have attempted to counter the Brain Drain and how effective has been the Brain Gain policy
- ❑ The paper is relatively silent on some of hard realities which are essential to chalk out an effective conclusion
  1. *There has to be sufficient hard facts like a detailed professional skill mapping of the Diaspora employed in high level innovation activity. Meaning the data to be obtained is not just on how many professionals are employed abroad but more importantly where and what type of activities they are involved in*
  2. *Important to bring out a corollary from this paper on how professional skill/qualification/industrial experience of the Diaspora working in more advanced countries has influenced the S&T and HR policy*
  3. *What % of private sector investment in cutting edge research and development*



# Observations (contd..)

- ❑ The paper has made passing reference about the contribution of IP regime. A comparative status for IP protection in respective countries will bring to light the glaring inadequacy in IPR regime in spawning investment in high tech R&D
- ❑ Author states that Govt. investment into building high tech infrastructure was a major development for transformation of Taiwan into a high-tech hub a comparison need to be made with India & Malaysia in this respect to better understand such claim

# **Perspective on Public Funded Research for Technological Development: Insights from India's Technology Trajectory**

*by Amit Shovon Ray and  
Sabyasachi Saha*

# Summary of the paper

- ❑ The report covers a detailed description of the technological trajectory of pre and post reforms period
- ❑ India was lagging during 70s and 80s when Asian Tigers observed growth spearheaded by expansion of labor intensive manufacturing
- ❑ Pre reforms the basic objective of technology policy was development of indigenous technological capability
- ❑ Focus was on technological search, selection, implementation and capability building through reverse engineering
- ❑ Private R&D was encouraged to facilitate acquisition of technological capability through minor innovations

# Summary of the paper (contd..)

- ❑ Post reforms major change came in Governments attempt to separate institutional R&D and commercial R&D
- ❑ Collaborative R&D efforts of both the public and the private sectors through PPP models (NMITLI)
- ❑ Paper highlights Total Factor Productivity which indicates low contribution on industrial growth and economic prosperity by technological advancement
- ❑ Paper also highlights technological capability building as path dependence evolution. 3 states are
  1. *Production engineering = learning by doing + learning by adapting*
  2. *Reverse engineering = learning by design + learning by improved design*
  3. *Learning by setting up new production, system and processes with basic R&D capability*

# Summary of the paper (contd..)

- ❑ The public funded research (e.g. CSIR labs) has played an important role to build up the stage for post reforms advancement
- ❑ Challenge remains in the linkages between all stakeholders specially the public labs, industry and educational institutes

# Observations

- ❑ Analysis of S&T policy and its impact in the post-reforms period could have been more critical than showing some isolated successes like NIMITLI and DRPP as a result of policy shift
- ❑ Technological learning, capacity building and innovation is not the only factor for India's emergence in recent times. Factors like policy decisions to open up the economy, industry showcasing great deal of business acumen other than R&D are some critical issues
- ❑ India is still a factor driven economy and needs to go a long way to be a knowledge driven economy

# Observations (contd..)

- ❑ It would be important to explore India-Specific innovation ecosystem model including IPR regime that will enable changing the current situation
- ❑ It is important to explore a workable model of public funded research or industry-academia relation. The following questions needs to be addressed

*Do govt. trust industry? Do institutions have capability, infrastructure and accountability? Do industry have the mindset? Do we have enough capable human resource? Does the nation have clear prioritized focus/strategy? Do we have professional delivery mechanism?*

# Thank You

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