Review of Industrial Competitiveness and Growth of Solar Firms in India:
Exploring role of Technology Management and Policy

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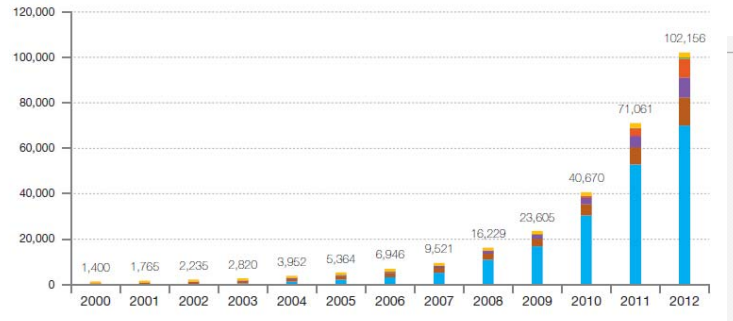
Executive Summary

- Indian Solar Market has grown rapidly after the Ministry of New & Renewable Energy (MNRE), Government of India (GoI) announced National Solar Mission (NSM), an enabling policy framework for rapid diffusion of solar energy, e.g. 22GW capacity by the year 2022
- In an attempt to foster competition in a transparent manner, GoI preferred auction route with cap of 5MW per bidder. Unintended consequence was a fragmented industry with sub-scale players
- Moser Baer, a global leading player in optical storage was one of the early entrants in the solar sector and made good progress, before NSM, focusing on European Markets and India
- Company explored opportunistically across the value chain and across technologies, not focusing on differentiation and capability building and is yet to find a profitable growth path
- This paper attempts to study the twin impact of policy, technology management and their relationship on a focal firm's competitiveness

Solar growth across Regions



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
ROW	751	807	887	964	993	1,003	1,108	1,150	1,226	1,306	1,590	2,098	2,098
MEA	n/a	n/a	n/a	n/a	1	1	1	2	3	25	71	192	601
China	19	24	42	52	62	70	80	100	140	300	800	3,300	8,300
Americas	146	178	225	290	394	501	650	863	1,209	1,752	2,780	4,959	8,717
APAC	355	495	686	916	1,198	1,500	1,825	2,096	2,631	3,373	4,956	7,628	12,397
Europe	129	262	396	598	1,305	2,289	3,281	5,310	11,020	16,850	30,472	52,884	70,043
Total	1,400	1,765	2,235	2,820	3,952	5,364	6,946	9,521	16,229	23,605	40,670	71,061	102,156

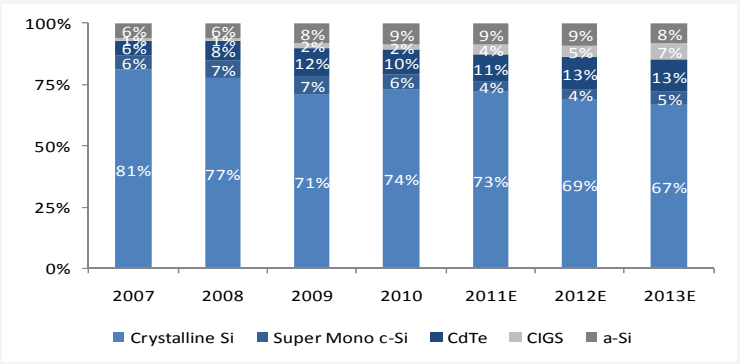
ROW: Rest of the World. MEA: Middle East and Africa. APAC: Asia Pacific.

Demand continue from EU, America with China and APAC soaring [1]
Demand to shift from EU and USA to China, Japan and India [3], [4]

4

C-Si continues to dominate, though share expected to decline over the next few years [5, 6]

Module market share by technology



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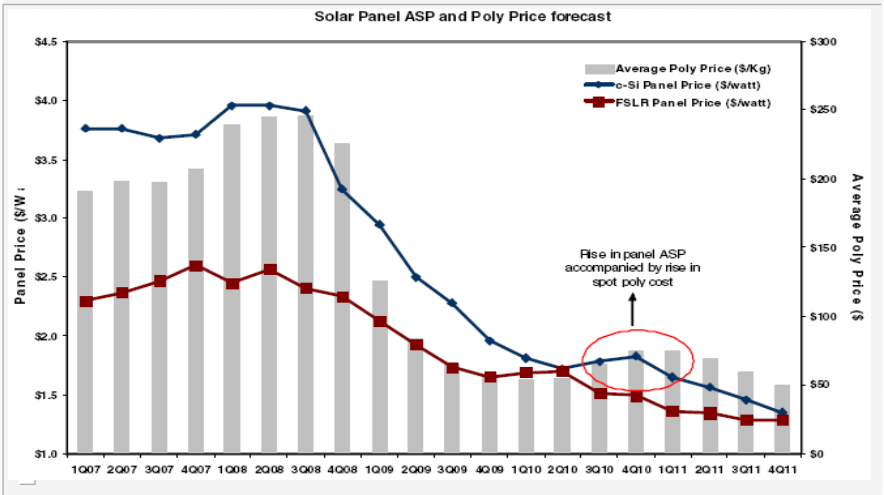
Continuous decline in module prices due to scale benefits, improved supply chain and R&D [5, 6]

$/wp costs falling sharply



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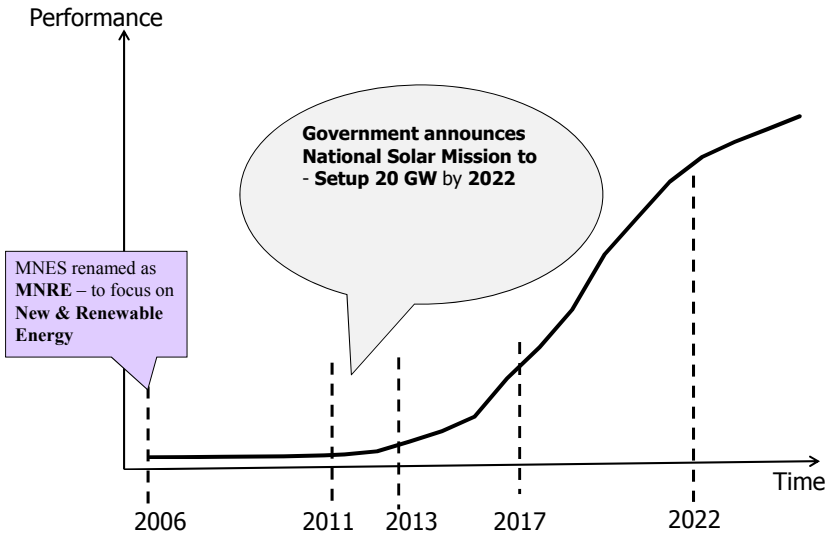
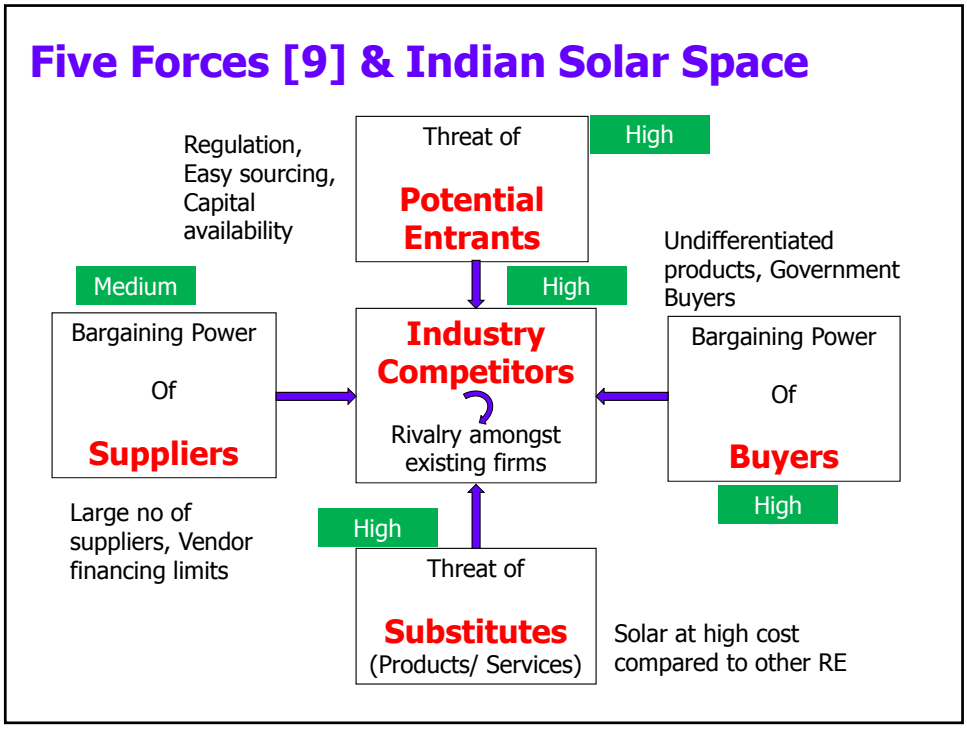
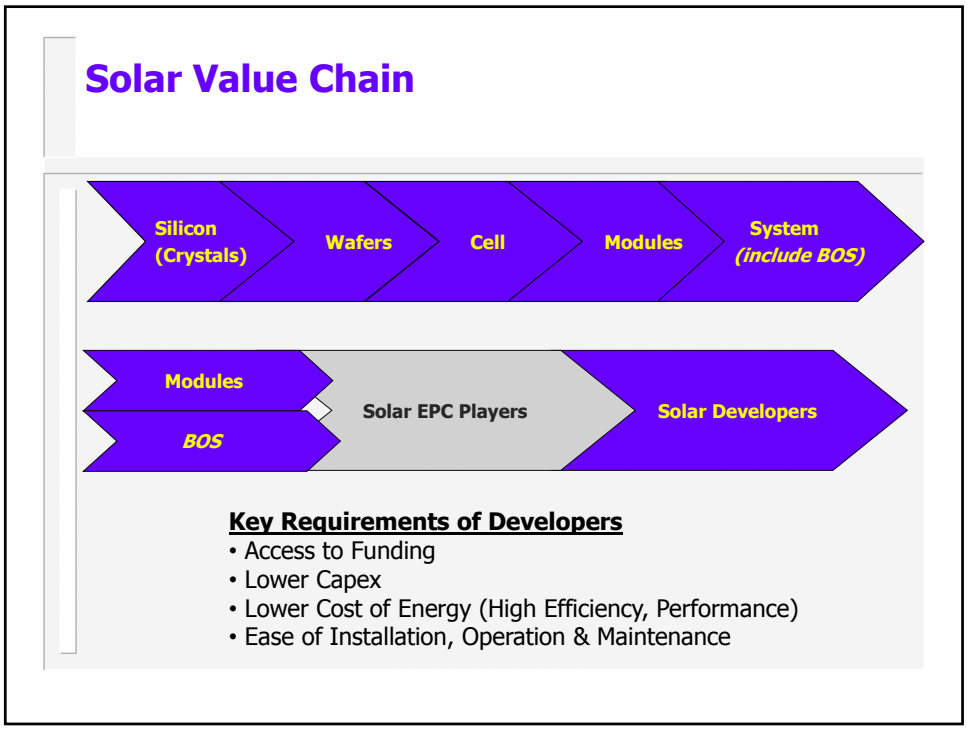
Solar in India

- **1992:** Ministry of Non-conventional Energy System **(MNES)** formed
- **2006:** MNES renamed as **MNRE [7]**– to focus on **New & Renewable Energy**
- **2011: Government announces National Solar Mission [8] to**
  - Setup 22 GW by 2022, 20GW on grid and 2GW off-grid
  - Reduce the cost of solar power generation in the country through
    i. long term policy
    ii. large scale deployment goals
    iii. aggressive R&D
    iv. domestic production of critical raw materials, components and products, as a result to achieve grid tariff parity by 2022.

Sector Lifecycle: Impact of Government Initiatives



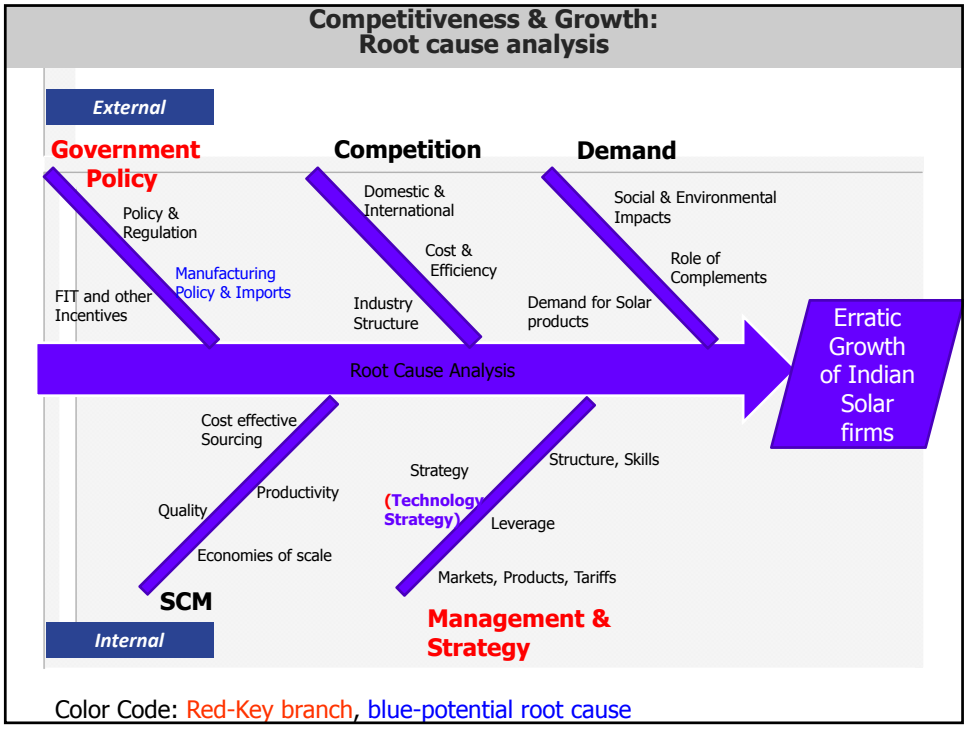

Five Forces [9] & Indian Solar Space
Regulation, Easy sourcing, Capital availability
Threat of
Potential Entrants
High
Undifferentiated products, Government Buyers
Medium
High
Bargaining Power Of Suppliers
Industry Competitors
Rivalry amongst existing firms
Bargaining Power Of Buyers
High
Large no of suppliers, Vendor financing limits
High
Threat of
Substitutes
(Products/ Services)
Solar at high cost compared to other RE


Solar Value Chain
Silicon (Crystals)
Wafers
Cell
Modules
System (include BOS)
Modules
BOS
Solar EPC Players
Solar Developers
Key Requirements of Developers
• Access to Funding
• Lower Capex
• Lower Cost of Energy (High Efficiency, Performance)
• Ease of Installation, Operation & Maintenance

Problem Structuring

Emerging Industry

Issues	Strategic Choices
▪ Technological uncertainty ▪ Strategic uncertainty ▪ Emergence of new customer needs => first time buyers ▪ Shift in relative cost relationships ▪ High initial cost but steep reduction ▪ Economic and social changes that make a product or service viable ▪ Availability and cost of inputs ▪ Access to funding ▪ Regulatory approvals ▪ Learning curve/ Experience	• Focus or Presence across the Value Chain • Timing of Entry • Greenfield approach v/s Acquisitions • Shaping industry structure • Externalities in industry development (industry's image, standardization) • Changing role of suppliers & channels



Factor Selection

- Technology Management & Competitiveness Journey
  - Firms with strategic intent and systematic capability building can climb to higher stages of competitiveness; e.g.
    - IBM, Siemens, Nokia, Samsung, Tata Motors/Steel, Toyota
  - Need for better technology management in India
    - Particularly by focal firms to climb-up
- Government Policy: Impact on Competitiveness of a Focal Firm
  - Access to Capital
  - Captive Market
  - Local/Regional to International to World class to LASTING

Study Methods

- Case study method
- Firm selected - Moser Baer
  - Reasons considered
    - One of the Early entrants
    - Active player in renewable energy arena
    - Track record of high growth
    - Leading market position in India
    - Quality manufacturing capabilities
- Force-field analysis: to find forces that can help achieve balances

Case study:
Solar Power & Moser Baer

Moser Baer India Ltd (MBIL) [11]

- Founded in 1983
- 1988 – entered into data storage industry
- 1999 – Set up a plant to manufacture CDs & DVDs(capacity – 150mn units)
- Became the largest Indian company in the export business of magnetic and optical media storage
- Cooperation with prominent institutes helped it to rapidly enter the photovoltaic industry

Elements of MBIL Strategy

- Have presence across the entire industry value system [12]
- Have investment in multiple PV technologies that provide opportunities for cost reduction
- Have advanced & low cost manufacturing expertise to ensure high quality products
- Have products that meet international standards
- Have commitment to R&D and innovation

Milestones–Moser Baer Photovoltaic

- **2005**
  - Announced Moser Baer Photovoltaic Ltd (MBP) as it's wholly owned subsidiary
  - Signed MoU with IIT, Delhi
- **2006**
  - Signed Technology MoU with IT BHU
  - In-house R&D Centre approved by Ministry of Science and Technology
- **2007**
  - Acquired OM&T BV - a Philips' optical technology and R&D subsidiary
  - Announced start of trial run of solar photovoltaic cell production facility
  - Set up the **world's largest** Thin Film Solar Fab
  - Launched US$150 mn FCCBs
  - Moser Baer Photo Voltaic announced commercial shipment of solar photovoltaic cells
  - Moser Baer Photo Voltaic announced US$880 million strategic sourcing tie-up with REC Group

2008
- Moser Baer Photo Voltaic announces strategic sourcing tie-up with LDK Solar
- Global investors inject Rs. 411 crore into Moser Baer's solar photovoltaic business
- Moser Baer announces successful trials of first Gen 8.5 Thin Film plant
- Moser Baer plans 600 MW Thin Film PV capacity with an estimated investment of over $ 1.5 bn

2009
- Moser Baer's thin film solar modules are now IEC certified
- Moser Baer to set up one of India's largest rooftop solar PV installations in Surat
- Moser Baer's thin film line ready for production of ultra-large solar modules

2010
- Achieves 7.3 % efficiency for single Junction Thin Film Modules
- Thin Film Product becomes internationally certified
- Emerges as the 1st Solar PV Company from India to achieve 100 MW of installations globally 'under its own brand'

2011
- Starts commercial production of junction boxes
- Commissions India's largest 5 MW solar farm in Sivaganga, Tamil Nadu & 5MW plant in UK
- Doubles warranties on products through in-house R&D

2012
- Moser Baer Photo Voltaic was admitted to corporate debt restructuring (**CDR**) in January

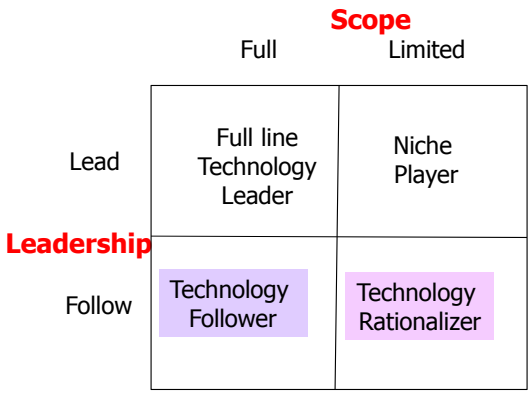
SWOT Analysis

Strengths	Weaknesses
▪ Unique facilities and operation capabilities ▪ Integrated play with presence across solar value chain ▪ Known brand in India & abroad ▪ Access to financial resources, talent pool, processes & systems ▪ Strong leader; e.g. Mr. D. Puri	• Undifferentiated product • Higher cost (than Chinese players) • Internal inefficiencies • Perceived quality issues • Too much diversification
Opportunities	**Threats**
• Peak power shortages in India • Renewable energy supported by Government • Wind and Biomass both have grown but peak shortage during day offers a potential for Solar • Fragmented industry offering opportunity for consolidation	• Intense competition: more than 50 players • Entry of international players • Regulatory uncertainty: FIT and Subsidy support? • Technology disruptions • Chinese imports

Moser Baer Solar Technology Strategy

- Focus on multiple technology verticals
  - Multiple technologies will co-exist for the next 5-10 years
- Implement technologies of today
  - Low risk
  - Significant room for cost reduction/innovation in existing technologies
- Industrialize technologies of tomorrow [13]
  - Solaria – Low concentration
  - SolFocus – High concentration
  - Sky line Solar – Mid Concentration
  - Stion – Nano Technology
  - Solar value – Low cost solar grade silicon
- Was integrated play (forward integration) good option?
  - Diversifications?

MB Technology strategy



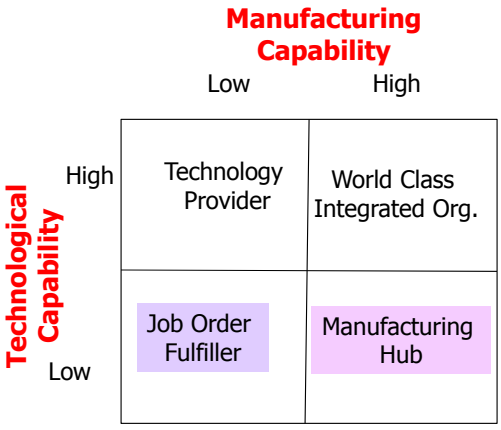
Technology Follower strategy
- adequacy in broad set of technologies, focus on deployment (EPC, presence across value chain)

Technology Rationalizer strategy
- adequacy in select set of technologies. Technology deficit compensated by other competitive strengths

As entry barriers lifted, too many players
- Diversification stretched the resources
-Drop in tariffs and profits
- Drop in EPC margins
- Company highly leveraged, unable to service debt

MB was a company that had all the resource to move from Full-line Follower to Leader, but has relegated itself to Rationalizer

… MB Technology strategy [14]



It started as a captive job order fulfiller.

MB increased its manufacturing capability.

Haven't focused on building technology capabilities beyond initial alliance efforts

Chinese players entered the market with bigger scale and due to lack of resources, MB couldn't scale up.

From Job order fulfiller, MB's focus could have moved to manufacturing capability and become a Hub in India

Findings, Implications & Takeaway

Indian Solar Market

- Large players have focused on grid connected solar installations due to assured demand
  - Feed-in-tariff commitment from Government for 25 years
  - Renewable Power Obligations
- Government has encouraged smaller players to test the market and to foster competition
  - Good response due to Low Risk and Capital availability
  - But has led to Lack of scale
  - Aggressive bidding meant low profitability in an otherwise attractive sector
- Companies are exploring opportunistic growth
  - Low focus on core competence or developing key skills

Moser Baer

- The case study confirms the phenomenon 'loss of competitiveness with policy intervention' and help improve its characterization
  - While grown rapidly, MBP yet to enter satisfactory profitability zone
  - Losses may be due to investment phase and slow market take-off; but not sure whether firm will become profitable in near future
  - Despite being agile, had trouble facing Chinese competition
    - **May sustain in NICHE & regain competitiveness**
- If wish to play opportunity-based game, rapid capability building on only few aspects becomes critical
- Despite becoming internationally competitive in storage (e.g. CD, DVD), the firm had tough time in SPV
  - Integration & diversification may be a cause
  - Lack of clear 'Technology Strategy' can be the cause?
- Should strive for journey up the value curve through capability building on engineering, RDDE

Learning from Force-Field Analysis

- **Among alternatives one focusing on stakeholders may be useful**
  - Two ends of spectrum of continuum can be
  - Diffusion and balances (demanding local capability building)
- **Considering international players (open markets in India), forces on diffusion side are very strong**
- Current systems that focus excessively on cost competitiveness also encourages opportunistic behaviors (even by players on balance side) and investments in higher capabilities (e.g. design, engineering, R&D,..) are limited and only by few exceptional players
- **Shift towards balances will be difficult in India till**
  - Attractiveness of sector is enhanced
  - Reasonable returns become possible
  - All this will also demand major change in policies & macro environment

Implications

Implications for firms

- **While an exciting early stage opportunity, solar industry became less attractive very fast**
  - Particularly segments such as cells, modules were commoditized [16] in no time
  - Recovering from such situations take long time (e.g. MB)
- **Positioning in niche can help build some capabilities and survive hyper-competitive periods**

Implications for policy

- **Environment is less conducive, mainly due to policy**
- **Local value added thru manufacturing etc. is must for India**
  - **Policies should balance between diffusion & balances**

Concluding Remarks

- There are two paths to excellence and **industrial** competitiveness–opportunity-based and capability-based
- Government policy in India often seem to encourage companies to follow opportunity-based path
- Technology management has more importance, if the firm is more balanced and inclined to capability-based path
- Growth also requires building related ecosystems and supporting industries
  - Cooperative strategies with governments play a key role
- The phenomenon seems to be at play in several industries
- It is an exciting area of research; **let's explore cooperatively**

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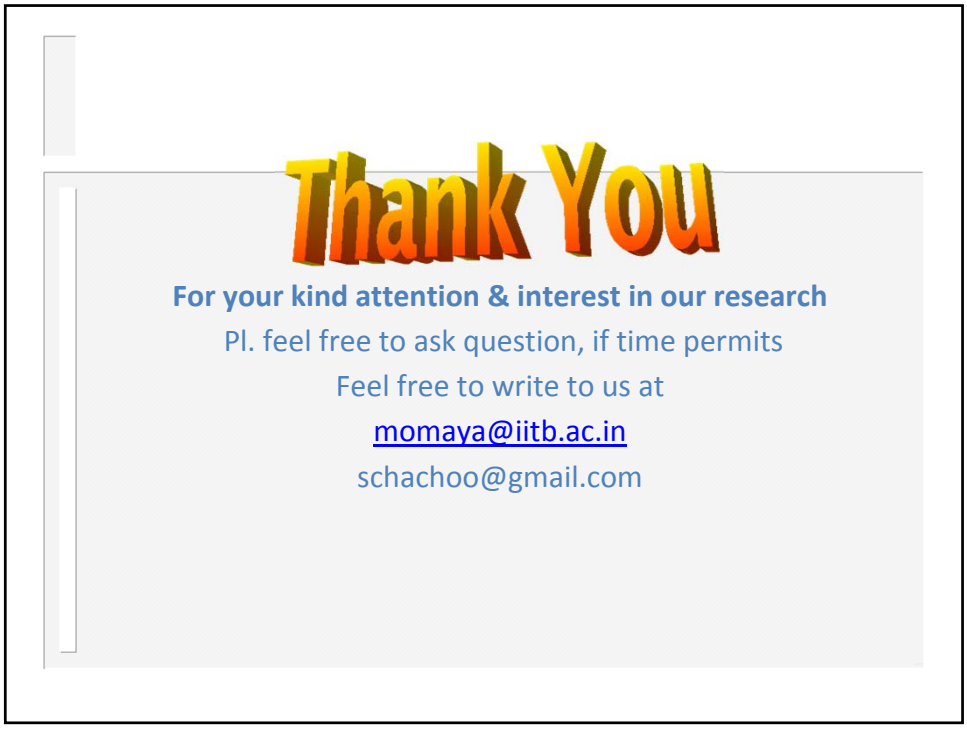
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