Straying Slowly:
STI in Developing Economies

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I Critical Issues

1. Key Questions

- There are numerous studies and policy recommendations for STI development in Developing Economies (DE)

- **But,** only few developing economies have successfully developed effective and efficient STI

- **Why?**

I Critical Issues

2. National Gaps in per capita GDP (World Bank, 2013)

Developed Economies		Catch-up Economies		Developing Economies	
USA	53,143	Korea	25,977	India	1,499
Japan	38,492	China	6,807	Indonesia	3,475
Germany	45,085	Turkey	10,946	Vietnam	1,911
France	41,421	Thailand	5,779	Ethiopia	498
UK	39,337	Russia	14,612	Kenya	994
Italy	34,619	Gabon	11,571	Egypt	3,414
Netherlands	47,617	South Africa	6,618	Nigeria	3,006
Sweden	58,269	Brazil	11,208	Haiti	820
Canada	51,958	Mexico	10,307	Nicaragua	1,581
Australia	67,468	Argentina	14,715	Guatemala	3,478
	(US $)		(US $)		(US $)

I Critical Issues

3. R&D/GDP (World Bank, 2012 and Other Years)

Developed Economies		Catch-up Economies		Developing Economies	
USA	2.79	Korea	4.04	India	0.81
Japan	3.39	China	1.98	Indonesia	0.08
Germany	2.92	Turkey	0.86	Vietnam	0.18
France	2.26	Thailand	0.25	Ethiopia	0.24
UK	1.72	Russia	1.12	Kenya	0.98
Italy	1.27	Gabon	0.58	Egypt	0.43
Netherlands	2.16	South Africa	0.76	Nigeria	0.22
Sweden	3.41	Brazil	1.21	Haiti	-
Canada	1.73	Mexico	0.43	Nicaragua	0.03
Australia	2.39	Argentina	0.65	Guatemala	0.05
	(%)		(%)		(%)

I Critical Issues

4. Deindustrialization or Reindustrialization

	[Manufacturing]		[Agriculture]	
	1950	2005	1950	2005
Average 15 Asian Countries	10	22	49	14
Average 25 Latin American Countries	15	15	29	10
Average 18 African Countries	11	10	43	28
Average 68 Developing Countries	12	15	37	28
Average 21 Advanced Economies	29	16	16	2

(Szirmai)

I Critical Issues

5. Critical Discussions

- Incorrect diagnosis limits the chance to find a right solution
- Western practices/solutions are forced to fit afterwards, without prior modification for local circumstances
- Lack of local capabilities and strategies to find out tailored solutions to overcome specific local problems

II Prior Perspectives on STI in DE

II Prior Perspectives on STI in DE

1. Big Push

- Secure minimum amount of investments in the initial industrialization

2. Balanced Growth

- Expansion of sectors increases the market size of others

3. Unbalanced Growth

- Deliberate unbalancing of the economy is the best method

4. Import Substitution Industrialization

- To reduce foreign dependency and protection of infant industries

5. Dependency Theory

- Poor countries should not purchase manufactured products of rich ones

II Prior Perspectives on STI in DE

6. Appropriate Technology

- Technological choice of small-scale, labor- intensive, decentralized, etc.

7. Technological Capability Building

- Dynamic technological capabilities: existing capabilities + new capabilities

8. Technological Outsourcing

- Foreign buyers are important sources of technology and market

9. Technological Learning

- Assimilation, improvement, incremental innovation are key to competence

II Recent Perspectives on STI in DE

Practical Action Programs ?

- Self-Discovery
- Entrepreneurship
- Green Growth
- Resource-led Development
- Manufacturing Capability
- Post East Asian Model
- Global Production Networks

DEVELOPED COUNTRIES

INTERNATIONAL ORGANIZATIONS

DEVELOPING ECONOMIES

II Recent Perspectives on STI in DE

1. Self-Discovery

- DE should identify what can be produced with profit

2. Manufacturing Capabilities

- Manufacturing is the primary engine of economic growth/catch-up

3. Global Production Networks

- Access to foreign sources to offset the weak domestic capabilities

4. Post East Asian Model

- Simply imitating the East Asian Model is no longer valid

II Recent Perspectives on STI in DE

5. Resource-led Development

- Develop resource-processing technology for export and diversification

6. Green Growth

- Utilize opportunity from huge global market for green

7. Entrepreneurship

- New sources of growth by combining factors for promising opportunities

II Review of Existing Perspectives

☐ Key Recommendations

- Unique paths and distinctive capabilities
- Expansion and upgrade of local knowledge base
- Promotion of private sector
- Establishment of right institutions
- Enhancement of policy capacity

☐ Missing Elements

- Highly meaningful implications, but less practical solutions
- Outsider's observations, no tailored bottlenecks to challenge
- Need to chart own paths suited to particular obstacles

III Difficulties and Problems in DE

1. No Contributions from STI

- **Many challenging agenda still remain**
  - Economic growth, industrial expansion, social welfare, sustainability
- **Critical basic needs are not solved**
  - Food, housing, sanitation, health, education, public transport, etc.
- **LDCs (Least Developed Countries): 48 countries**
  - Africa: **34**
  - Asia and the Pacific: **13**
  - Latin America: **1**

III Difficulties and Problems in DE

2. Poverty Traps

- **Progress in MDGs (Millennium Development Goals)**
  - Target for extreme poverty: to cut the 1990 rate in half by 2015
  - Attained the target, 5 years ahead of schedule, in 2010

- **However, Extreme Poverty remains unacceptably high**
  - Post-2015 agenda is under preparation, by September 2015
  - Extreme poverty: $ 1,25/day is applied (World Bank)

- **Extreme Poverty status in DE**
  - 17% of people in 2011 (43% in 1990, 52% in 1981)
  - 1.2 billion people in 2011 (1.91 billion in 1990, 1.93 billion in 1981)
  - 2.2 billion people, less than $2/day in 2011 (2.59 billion in 1981)

III Difficulties and Problems in DE

3. Current Status in LDCs

Critical Issues	Status
Extreme Poverty	**50.8% (2012)**
Share of World Export	**1.11% (2012)**
Share of Primary Commodities in Export	**78.7% (2012) >>> 67% (2001)**
Duty-free and Quota-free Market Access	**80% (2010): unchanged since 2004**
External Debt Stock of GNI	**28% (2012)**
Under-five Mortality Rate per 1,000 Children	**85 (2012)**

III Difficulties and Problems in DE

3. Current Status in LDCs

Critical Issues	Status
Access to Electricity	**31.5%** **(2010)**
Improved Drinking Water Source	**65.1%** **(2011)**
Improved Sanitation	**31.2%** **(2011)**
Life Expectancy	**62** **(2013)**
Population Growth Rate	**2.3%** **(2012)**

Ⅳ Constraints in STI Resources

1. Fundamental Conditions

Enterprises

- Lack of basic knowledge for technologies/products
- Relying on imported technologies
- Low degree of cooperation with research institutes

Universities

- Mainly teaching-focused (not research)
- Research has weak linkage to ongoing issues in industries

Public Research Institutes

- Mainly supports the interests of government
- No enough experience/expertise to support private industries

Ⅳ Constraints in STI Resources

2. Backward, Lagged and Stagnant (1)

- **Weight of GDP in the World (2010)**
  - **Latin America: 8.2%**
  - **Africa: 2.7%**
- **Weight of GERD in the World**

(%)

	1973	1980	1990	2000	2007	2009
Latin America	0.8	1.7	2.8	2.8	2.9	3.1
Africa	0.1	0.3	1.3	0.8	0.9	0.9
(South Africa)	-	-	0.7	0.5	0.4	0.5
(Sub-Sahara)	0.1	0.3	0.5	0.1	0.2	0.3

Ⅳ Constraints in STI Resources

2. Backward, Lagged and Stagnant (2)

Weight of GERD to GDP

(%)

	1973	1980	1990	2000	2007	2009
Latin America	0.3	0.5	0.5	0.6	0.6	0.7
Africa	0.3	0.4	0.6	0.3	0.4	0.4
(South Africa)	-	-	1.0	0.8	1.0	0.9
(Sub-Sahara)	0.3	0.4	0.5	0.2	0.3	0.3
World Total	2.1	1.8	1.8	1.7	1.7	1.8

Africa's Share of World Scientific Output

- <1.5% (1996), 2.0% (2007), 2.51% (2011)
- Korea 2.71% (2011)

Ⅳ Constraints in STI Resources

3. Neglected, Isolated World

- **Majority of STI comes from developed countries**
  - More than **84%** of world scientific production
- **1/3 of world's population is technologically deprived**
  - Never experience their own technological developments
- **STI activities are biased to agenda for developed countries**
  - Motivation of researchers is at odds with development goals

V Obstacles in STI Policy-making

1. Wrong Assumption: Market Failure

- Early stage of industrialization, **"Market Failure"** is irrelevant
- Overseas demand does not function
- Local demand is very weak
- Market economy does not exist in the majority of DE
- Therefore, **"Creation by Government"** is the key function

V Obstacles in STI Policy-making

2. Implementation Capability is Totally Ignored

- No introduction of feasibility check in STI plans and policies
- Feasibility check: cost/benefit analysis, possibility of resource mobilization, strict performance evaluation
- STI policy: just a collection of **"Wish List"** of stakeholders
- Priority setting and strategic choices are very difficult

V Obstacles in STI Policy-making

3. Poor Quality of Governance

- Statism controls most aspects of public life
- Absence of a clear cut philosophy of national development
- Paths from policy goals to policy tools remains as **“black box”**
- One-direction of hierarchical order: PPP does not exist

V Obstacles in STI Policy-making

4. Weak Policy Capacity

- Top priority is political objectives, intention and reasoning
- Government lacks analytical and administrative capacity to formulate and implement complex STI plans
- Government guided private sector development
- No autonomous bottom-up decision-making

V Obstacles in STI Policy-making

5. No Consideration on Global Competitiveness

- Global perspectives/standards are relatively neglected
- Lack of strategic analysis for international competition
- Mainly focus on producing goods for safe local market
- Incomplete technological capabilities for global competition

Ⅵ Bottlenecks in Technology System

1. No Concrete and Comprehensive Technology Paths

- Insufficient efforts to discover own distinctive paths
- Unclear indication for **“where to go”** and **“what to do”**
- Too much discussions and programs only for **“how to do”**
- No consensus building for shared vision and goals

VI Bottlenecks in Technology System

2. No Continuous Accumulation and Evolution

- Discontinuity in technology paths hinders further progress
- Lack of long-term commitment and continuous new inflows
- R&D does not increase without any stagnant period
- Weak incremental technology improvements on products

Ⅵ Bottlenecks in Technology System

3. No Interrelatedness and Synergy

- No interconnection among national core technologies
- Poor university-industry linkage, each follows own paths
- Weak linkage between leading sectors and supporting sectors
- Vicious cycle between limited resources and poor performance leads to low degree of specialization

VI Bottlenecks in Technology System

4. No Key Driving Forces

- Over-emphasis on agriculture and natural resource industries
- Over-emphasis on equal distribution of resources
  - No strong enterprise, supportive university, effective public research institute
- Thus, key driving forces for rapid growth are not articulated
- No strong manufacturing capabilities
  - R&D must rest primarily with private enterprises

VI Bottlenecks in Technology System

5. Skewed Resource Concentration

- Inclined to STI elitism to a handful of small elite groups
- “Science first, then technology follows” makes constraints for prominence of engineering
- R&D is mainly carried out in university and research center
  - R&D is largely divorced from productive activities
- Failure in producing well-qualified scientists and engineers to expand the pyramid of human resources

Ⅶ Policy Recommendations

1. Fitness between National Development and STI

- Systematic integration of STI into development agenda
- STI primarily supports the goals of growth, employment creation and poverty reduction
- Clear vision and shared goals through consensus building
- To integrate macroeconomic policies with sectoral policies

Ⅶ Policy Recommendations

2. Concrete STI Strategies

- **"Dual Growth Strategy":** (Agriculture/Resources) + (Industry)
- Moving away from **"Do-no-harm"** approach
- **"Right"** sectors, **"Right"** investment, **"Right"** technologies
- Concrete and comprehensive STI Master Plans

Ⅶ Policy Recommendations

3. Enhancement of STI Policy Capacity

- Recruitment of best manpower as government officials
- Administrative capacity to coordinate interest groups
- Powerful implementation capabilities of STI policies
- Empowerment to bottom-up approach in policy-making

VII Policy Recommendations

4. Accelerated Mobilization of Resources

- Expansionary policies for acceleration of demand growth
- Proactive public financing to provide investment capitals
- Expansion of public revenue, bank financing, FDI and ODA
- Fostering financial sector for productive investment with particularly bank credit

VII Policy Recommendations

5. Enforcement of Production Capabilities

- Fiscal and monetary tools/incentives for manufacturing
- Minimization of uncertainty and risks of private enterprises in their investments
- Progressive reduction of informal sectors and fostering of small enterprises to medium/larger firms
- Development of production clusters of primary commodities, with corporate network of forward and backward linkages

Ⅶ Policy Recommendations

6. Global STI Community

- STI must occupy a central place on international cooperation
- More incentives for industries in developed countries to expand their participation in STI cooperation
- ODA should not be driven by donor priorities
- Expansion of global joint programs to support DE's enhancement of STI policy capacity (e.g., PICMET)

Ⅶ Concluding Remarks

New Perspectives + Concrete STI Policies: Successful STI Achievement


Thank You!!