Transformation of NIS in China in market reforms: 1980s-1990s

- NIS as Analytical Instrument
- NIS Transformation in China—the process
- Re-combination Learning
  -- Intensive learning in micro-foundations
- Discussion and summary

**** Questions:**

Why does a gradual process work? ("policy learning")

Why development paths differ?

** **Key words:**

Policy Process; Micro-foundations of IS

hat are national innovation systems?

- National Innovation systems are defined as the "...set of distinct institutions(1) which jointly and individually contribute to the development and diffusion of new technologies(3) and which provide the framework (upon) which governments form and implement policies(5) to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts(4) which define new technologies. (Metrcalfe 1995)

hat are national innovation systems?

- From this perspective, the innovative performance of an economy(6) depends not only on how the individual institutions (e.g. firms, research institutes, universities) perform in isolation, but on “how they interact with each other(2) as elements of collective system of knowledge creation and use, and on their interplay with social institutions (such as values, norms, legal frameworks)”. (Smith 1996)

hat are national innovation systems?

- (1) Set of distinct institutions
- (2) Interact with each other
- **Actors, institutions, their operation and interactions**
- (3) Development and diffusion of new technologies
- (4) knowledge, skills and artefacts
- **Functions: development and use of knowledge and technologies**
- (5) Policies
- **Policy institutions and impact of policy on NIS are added as central**
- (6) Innovative performance of an economy
- **In order to explain innovation performance of an economy**

NIS as Analytical Instrument

The importance of institutions—defines incentives and the pattern of information flows

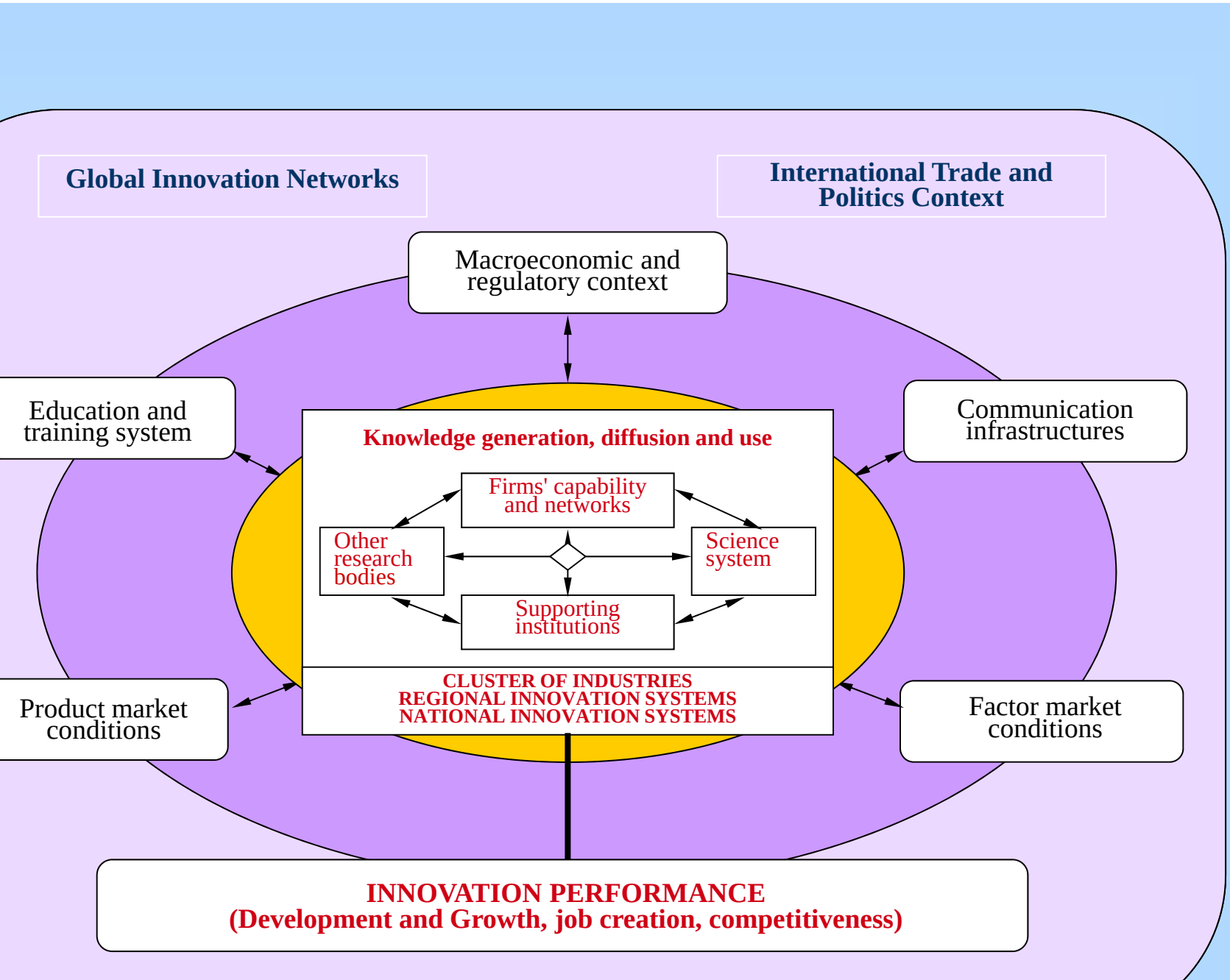
Interaction/interactive learning—between producer and user, and between technology and institutions; interactions drive dynamic and complex innovation and change

"Systems" for innovation—R&D institutions along are not innovation systems; firms alone can not innovate.

The importance of policy and policy institutions—policy *process* determines the outcome of reform programme; "Interaction between policy and the work of NIS"

Development is a process combining effective use of existing recourses and new resources and "variety" creation

Explanation of performance of aggregate social system via survey on micro-foundations


Global Innovation Networks
International Trade and Politics Context
Macroeconomic and regulatory context
Education and training system
Communication infrastructures
Knowledge generation, diffusion and use
Firms' capability and networks
Other research bodies
Science system
Supporting institutions
CLUSTER OF INDUSTRIES
REGIONAL INNOVATION SYSTEMS
NATIONAL INNOVATION SYSTEMS
Product market conditions
Factor market conditions
INNOVATION PERFORMANCE
(Development and Growth, job creation, competitiveness)

Evaluation Criteria on NIS Transformation

penness	For the vitality of NIS --In various forms: Technology Licensing; Procurement of capital goods; FDI; OEM Assembly; Sample Machine import
centives	--Strength --Orientation (to innovation or to quantitative expansion)
ustering	Characters of interaction between system's members --Vertical (I-O relation) and horizontal relations --Structure (vertical integrated or network-based) and operational norms of firm
pporting stitutions	Embody knowledge flows, mediate clustering/linkages --via planning apparatus or market mediation --Interaction/coordination channels --Legal, educational, technological infrastructures
&E base	Competence structure and innovation potentials --Strength and specialized pattern of knowledge creation --Intensity and responsiveness to the need of firms
earning ynamics	How the innovation "dynamo" firms learn and innovate --Models of learning

he Pre-reform system
and R&D Portfolio

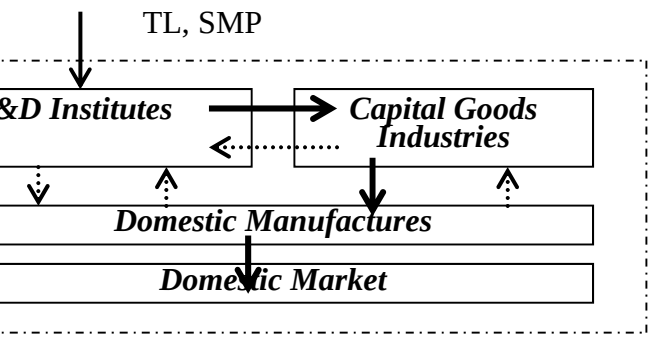
&D establishments: total 9,153

e at the levels above "county": 5,793

Those at the county level: 3,360

S&E: total 343 thousand

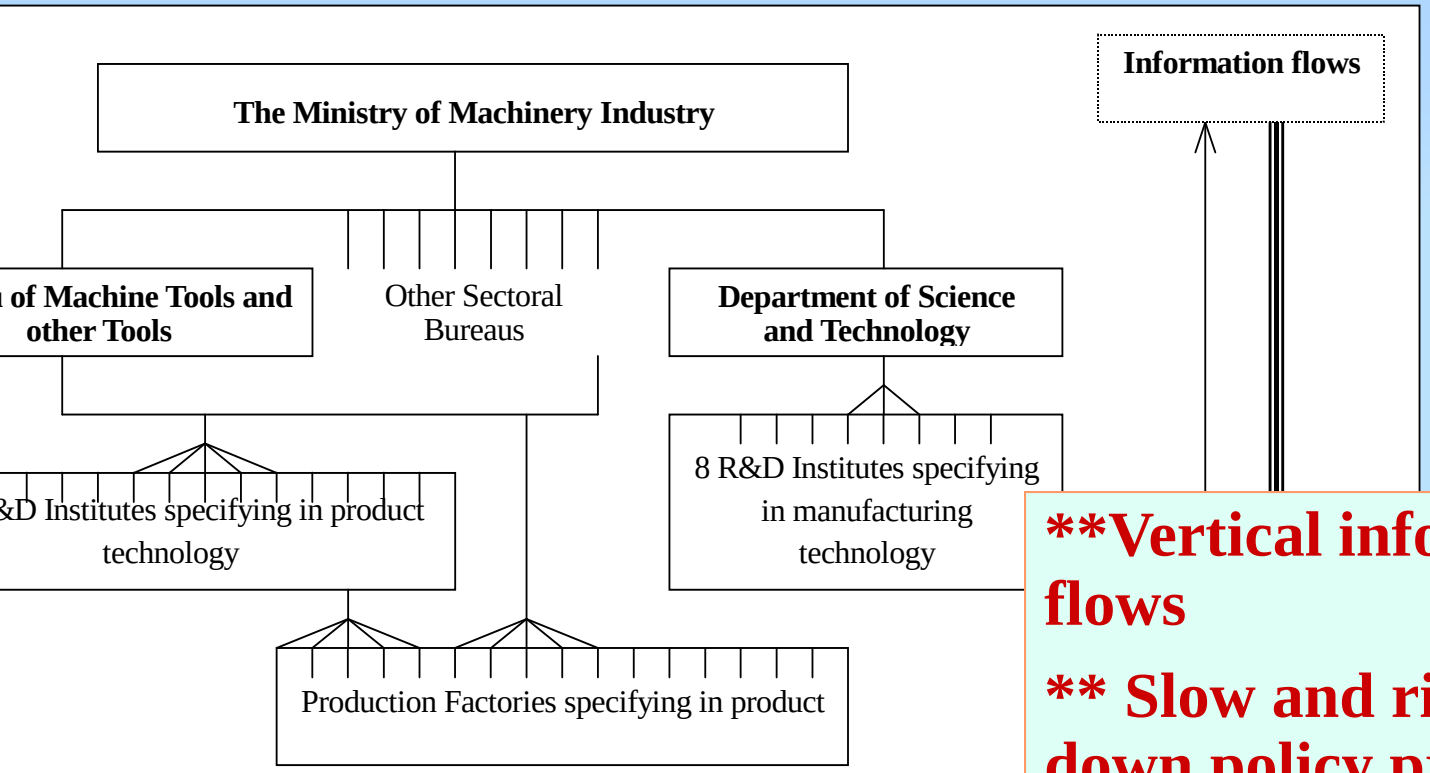
In which who work in the first category: 319 thousand .

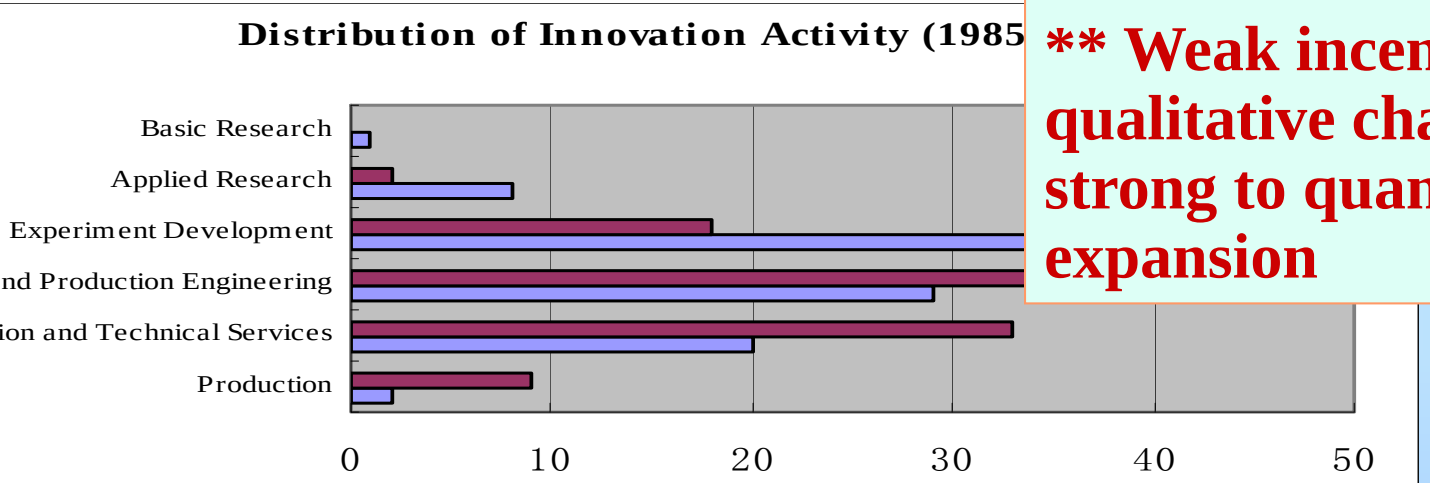


echnology Licensing PE: Procurement of Equipment
Sample Machine Procurement
Foreign Direct Investment OEM: OEM Assembly

cal information flows
and rigid top-down policy process
k incentive to qualitative change

Year	R&D of N. Income	Year	R&D of GDP
1953	0.1	1978	1.5
1954	0.2	1979	1.5
1955	0.3	1980	1.5
1956	0.6	1981	1.3
1957	0.6	1982	1.3
1958	1.0	1983	1.4
1959	1.6	1984	1.4
1960	2.8	1985	1.2
1961	2.0	1986	1.3
1962	1.5	1987	1.0
1963	1.9	1988	0.8
1964	2.1	1989	0.8
1965	2.0	1990	0.8
1966	1.6	1991	0.8
1967	1.0	1992	0.7
1968	1.0	1993	0.7
1969	1.5	1994	0.7
1970	1.6	1995	0.6
1971	1.8	1996	0.6
1972	1.7	1997	0.6
1973	1.5	1998	0.7
1974	1.5	1999	0.8
1975	1.6	2000	0.9
1976	1.6	2001	0.95
1977	1.6	2002	1.07
1978	1.8 (1.5 of GDP)	2003	1.13
		2004	1.23





****Vertical information flows**

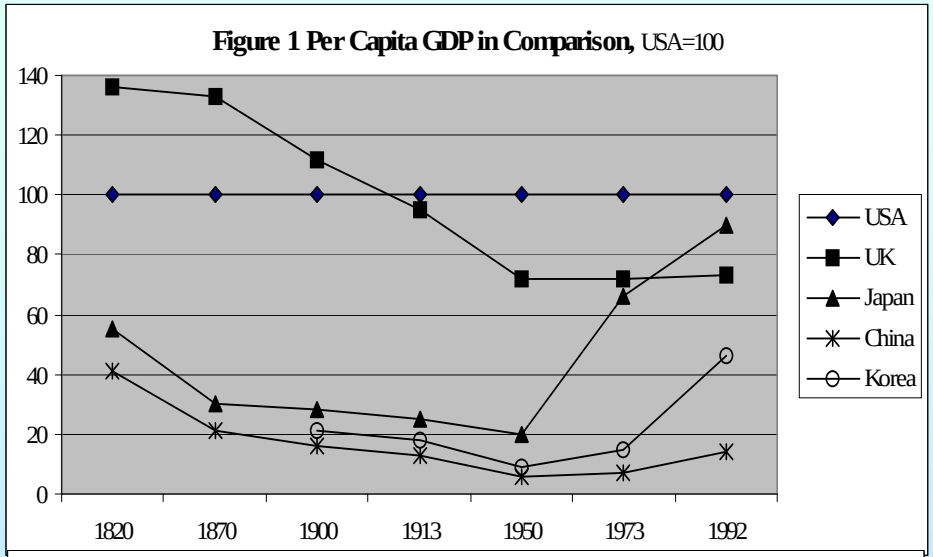
**** Slow and rigid top-down policy process**

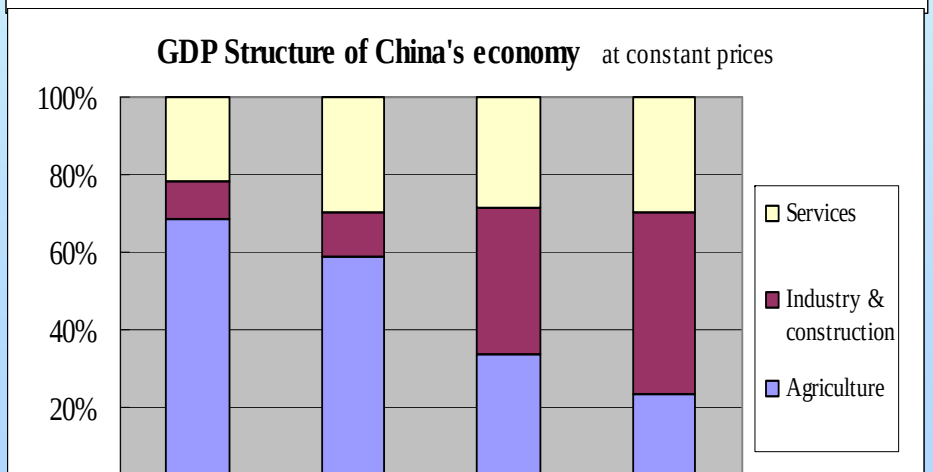
**** Weak incentive to qualitative change but strong to quantitative expansion**

apid growth in the past 20 years……

1979-2003 Average annual growth rate 9.4%

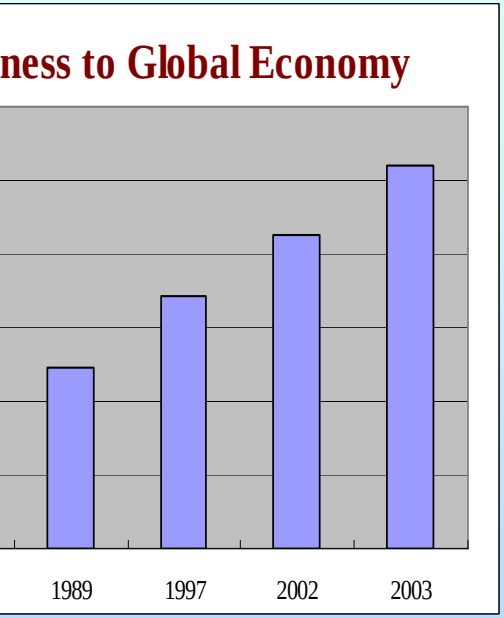
- Pragmatic trial and error
eform policy-making
- Participation in the global
conomy and re-allocation of
roduction from Asian tigers
- Re-deployment of
ccumulation production and
esign/testing capabilities
- thnic ties of overseas Chinese
- High saving and investment
ates
- Local governments'
ntrepreneurial involvement in
rowth and industrial projects

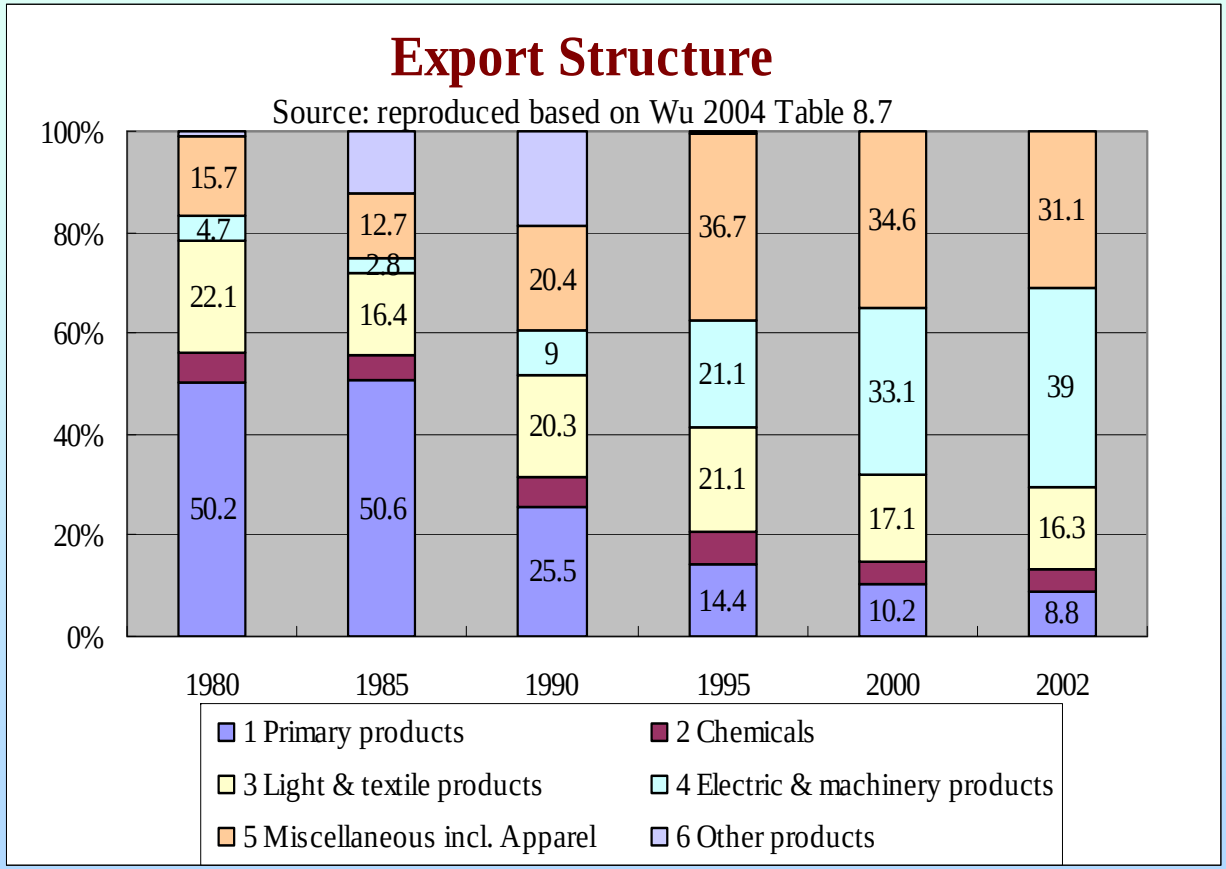




“Opening the door”

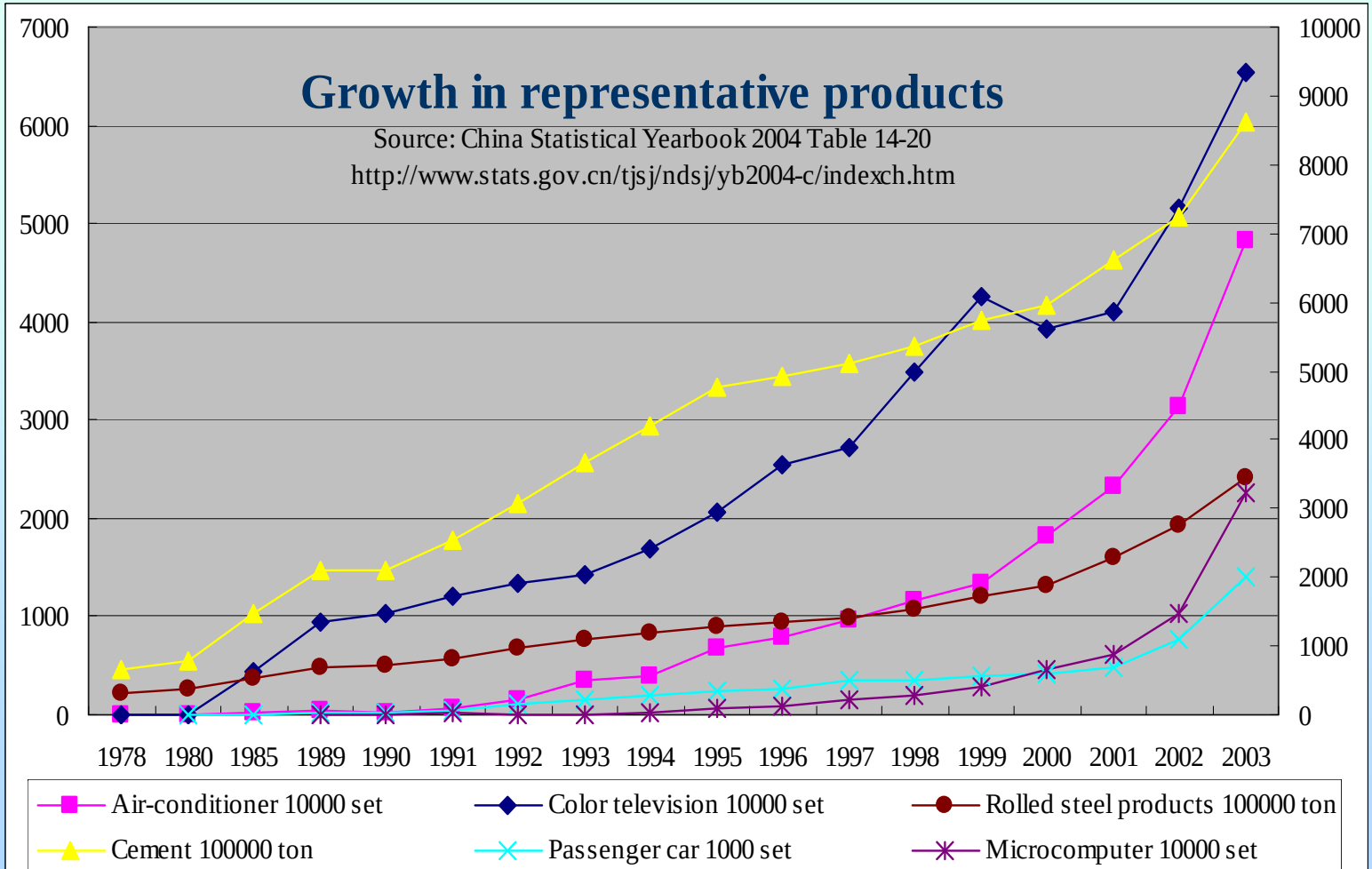
ticipation in global value chains and manufactured exports





mestic market: investment and expansion

the high investment rates annual 30-40%



Pragmatic reform policy-making;

deployment of accumulation production and design/testing capabilities,
ting with the opportunity from Asian “tigers” production Re-allocation

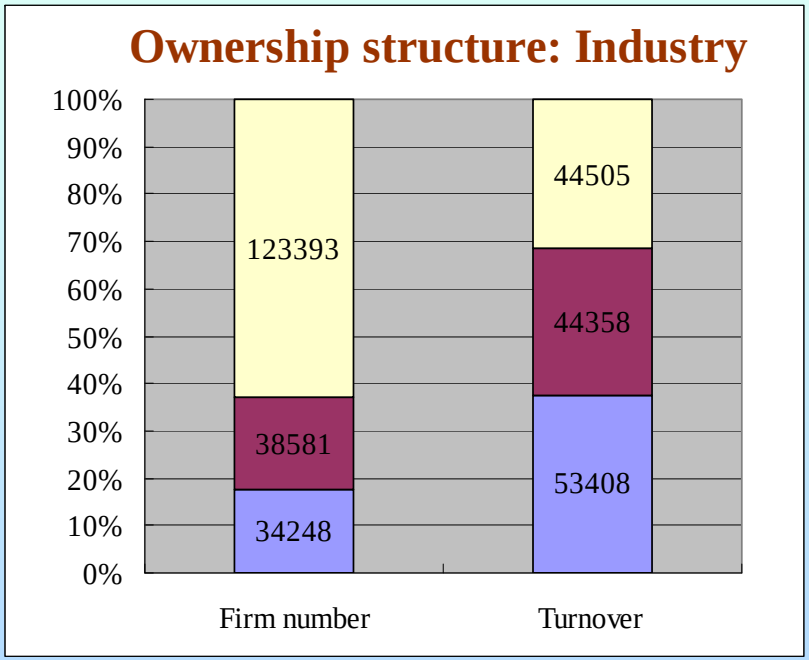
Agricultural reform since 1979

Industrial and urban reform since 1984

=>“Bureaucratic decentralization”

=>“Incremental reforms”

S&T management system reform since 1985



R&D system Transformation in China: The policy *process*

1985	*Technology Market* ***(1)***
1987	*Merger* ***(2)*** of R&D institutes into firms
1988	The Torch Programme *Spin-off Enterprises and New and High Technology Industry Zones* ***(3)***
Early 1990	*Transformation of R&D institutes on a whole institute basis* ***(4)***
1999	Clarify and legitimate upon real progress of transformation

Result: Multiple Policy Solutions

（All the measures at current price）

	1985	1990	1995	2000
Technology Market ontract fees (RMB Billion)	2.30	7.51	26.83	65.07
Spin-offs umber of NTEs nual turnover (RMB Billion) port (USD Billion)	- - -	1,690 5.94 0.69 (RMB B.)	12,937 151.2 1.55	20,796 920.9 13.81
&D Performer (%) nterprises Independent &D institutes niversities	(1987) 29.3 54.7 15.9	n.a. n.a. n.a.	43.7 42.1 12.1	60.0 28.8 8.6

Official registration on transformation, By 2000

(2) Merger……..311

(4) Transformed to be profitable entities…629

(others) Become a part of University……24

Recombination Learning" in Market Reform

Four Parallel Processes

, ***Market reforms***
=>produce new incentives and induce innovative
pabilities reallocation;

, ***Re-organization of accumulated capabilities***
=>in novel and productive ways;

, ***Intensive technical/managerial learning***
=>to identify and fill major gaps in inherited
pabilities; and

, ***Institutional restructuring***
=>that support these developments.

Recombination Learning" in Market Reform

ple Sector	PC	Machinery	Textile
ological	--Product architecture	--Design engineering --Production Engineering	--Design --International marketing
s filling the	--Use and sales of advanced products	--Technology licensing	--OEM production
mulated ilities	--Design --Testing --R&D --Production	--Design --Testing --Production	--Production
utional cturing	--Spin-offs	--Transformation of R&D institutes --Transformation of state enterprises	--Export-production Zones --Joint-ventures --Local Small startups

Evaluation of NIS Transformation in China

Supporting/Coordination Capacity ＋－

Science and Engineering Base ＋－

(A “shallow” structure of innovation competences)

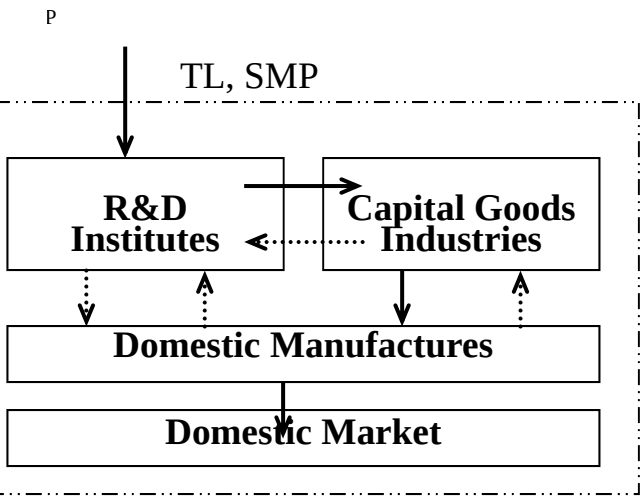
Learning Dynamics ＋

	Year 1		Year 2	
expenditure Billion (GDP%)	1987	5.67 (1.0%)	2000	89.6 (1.0%)
sic Research %	7.7		5.2	
plied Research %	32.1		17.0	
perimental Development %	60.2		77.8	
I International Rank	1987	24	1999	10 (India 13) (Russia 8)
TP International Rank	14		8 (India 23) (Russia 7)	
International Rank	10		3 (India 12) (Russia 9)	
ts, USPTO granted Number: China	1992	41	2001	266
India	24		179	
Russia	67		239	
S. Korea	586		3,763	
Taiwan	1,252		6,544	

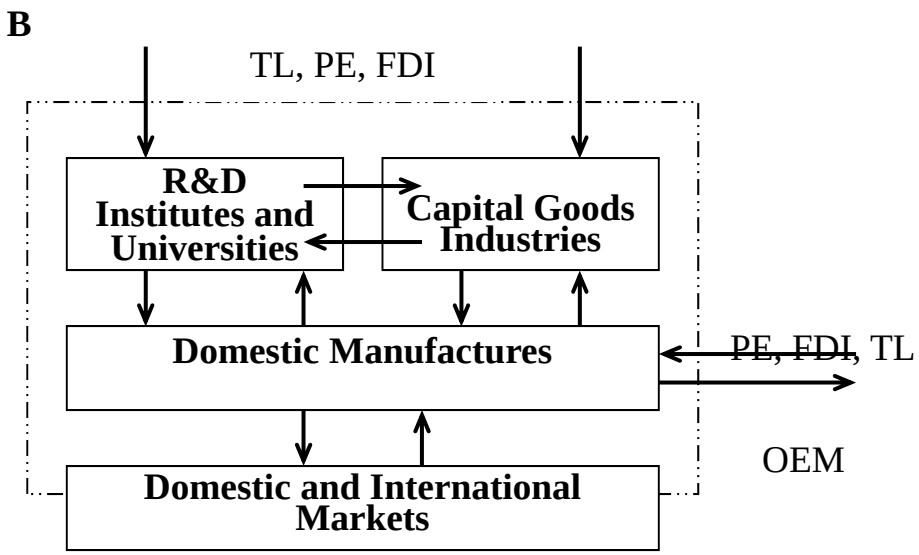
Evaluation of NIS Transformation in China

Openness ++ **Incentives ++**
Clustering + (in relation to industry structure and firm structure)

	1985	1990	1995	2000
ort of capital goods (USD Billion)	16.24	16.85	52.64	69.45 (1999)
(USD Billion)	1.96	3.49	37.52	40.72



TL: Technology Licensing
SMP: Sample Machine Procurement
PE: Procurement of Equipment
FDI: Foreign Direct Investment
OEM: OEM Assembly



Transformation of the China's NIS

Questions

1. Why does a gradual process work?
2. Why development paths differ?
3. What characterizes a "less developed country" NSI as compared to a rich country NSI?

Why does a gradual process of reform work better in na in comparing to the more sudden reform in Russia?

Unintended fit" needs the feasibility of adaptation for policy nd for system's actors

Experimentation generates knowledge and information to reduce uncertainty

* *Such information and knowledge serve as* ***input*** *into policy-making and in rategic adjustment at firm/R&D institute;*

* *This paves ways not only for* ***policy adjustment*** *but also* ***pointing to where rms/R&D institutes to move for survival and further growth***

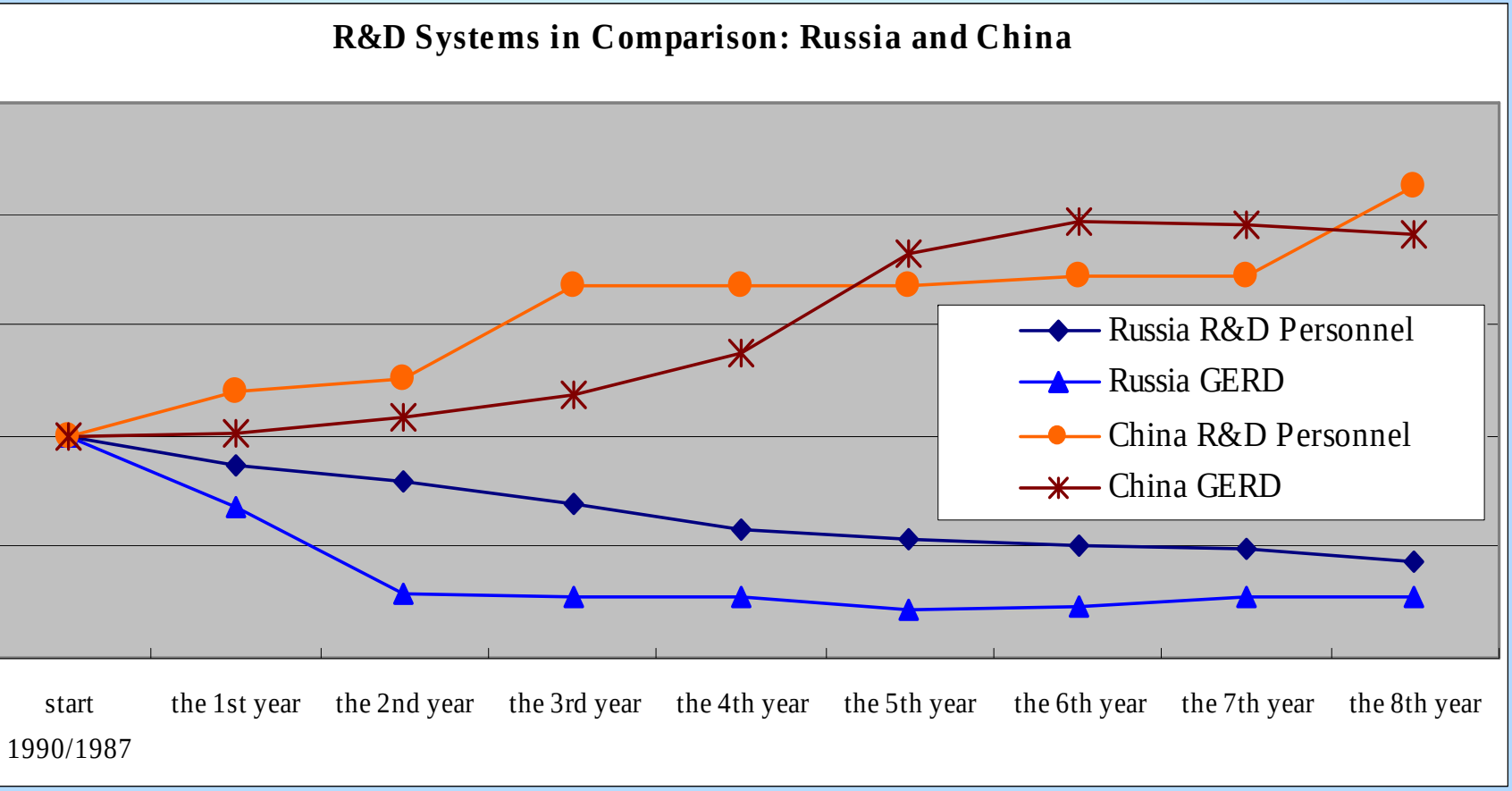
reconditions

Adaptive/responsive policy-making

Strategic vision as a general guidance

Consensus and Political stability: "controlled chaos"

omparison between a gradual process (China) and a “Shock therapy” (Russia)



The Reining Paradigm Washington Consensus:

Why does SAP Programme fail?

Rodrik 1995; Friis-Hansen (ed.) 2000; Barrett, Aboud, and Brown 2000; McMillan, Rodrik, and Welch 2002)

Theoretical rationale: ‘getting the prices right’ --namely, let the current international prices bring developing economies towards the status of general equilibrium

Policy Measures:

--Feeing prices via tax and subsidy reduction
--Privatization of land, factories and trade
--Cuts in public expenditure including infrastructure services

Pragramme Operation/implementation

--One set of policies put into a great variety of situation
--External experts dominate SAP implementation
--Conditional: Acceptance of SAP to be necessary condition for international loans

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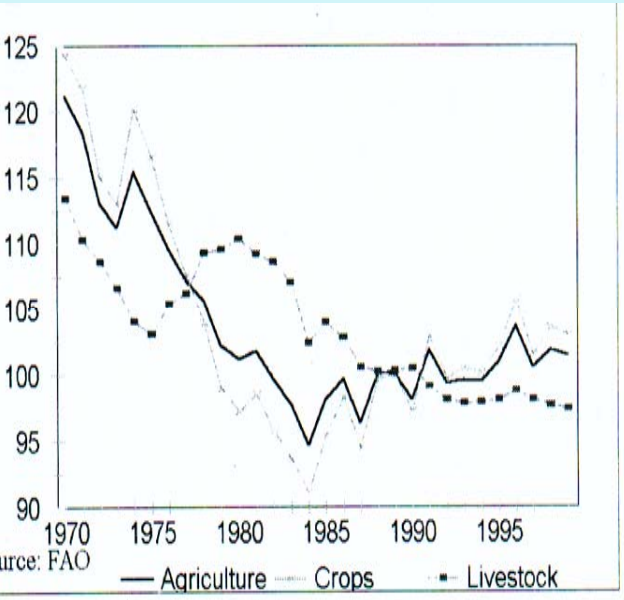
odrik 1995; Friis-Hansen (ed.) 2000; Barrett, Aboud, and Brown 2000; McMillan, Rodrik, and Welch 2002)

A large part of technical persons for agricultural-tech diffusion were dropped out

Road and irrigation infrastructure in disrepair or disappear

Supply of agricultural inputs turned to the hands of multinational companies; while coverage of the supply remains for 2%--4% peasants

Upstream and downstream industries of agriculture largely secede to operate ause of "comparative disadvantages"



Effects on Development

in Long-term:

degradation of production system and innovation system, except for a tiny part that integrated into international production

In Short-term:

also minimal, from low responsiveness

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Effects in policy learning

Telling-Failures with no progress in policy capacity

"In face of wide dissatisfaction with the SAP, most of the debates go merely around as 'Some feel that privatization and liberalizations have not been pushed far enough; and others believe that it has been pushed too far too fast" (Friis-Hansen (ed.) 2000).

Policy consideration fetched outside endogenous learning and ignored local conditions

The viability of a version of agricultural modernization based on high levels of external inputs, as the current reform programmes …imply to achieve, is questionable. 'Low external input sustainable agriculture' (LEISA) strategies are indispensably needed to integrated pest management, participatory conservation and use of plant genetic resources, and integrated soil fertility management', **this is absent in the SAP discussion.**

Increasingly knowledgeable and concerned people criticize Washington Consensus……

n Agenda for the New Development Economics"

oseph E. STIGLITZ, at the UNRISD meeting on **The Need to Rethink velopment Economics,** 7-8 September 2001, Cape Town, South Africa.

The seeming disappearance of development economics as a separate discipline some quarter century ago could not have come at a more inopportune time. Some of the criticisms…are valid …But their argument that developing countries are just like more developed countries, only lacking as much physical (and later,….human) capital and their assumption that competitive equilibrium theorem can be applied in a straightforward way is, if anything, even more misguided.

Joseph E. STIGLITZ 2001

n the last two decades, there has been a growing awareness of he limitations of the competitive paradigm…Yet, in this same eriod, the reigning paradigm in development economics was the Vashington consensus, which ignored these considerations, espite the fact that they are even more important to developing ountries.

A new development agenda thus must center around (i) identifying nd explaining key characteristics of developing countries,…and xploring the macro-economic implications…; (ii) describing the rocess of *change*, how institutions and economic structures are ltered in the process of development….It must do so in light of hanges in the global economy…

…with an evolutionary foundation and accumulated knowledge and methodology, the IS approach will ntribute substantially to the issues centered in the new development agenda

Why development paths differ?

- Co-evolution between policy, institution and technological opportunities
- Historically rooted characters
- Path-dependency: cumulative and self-reinforcement of initial choice

Korea versus Chinese Taiwan: e.g. in strength of central power

China versus India: e.g. in learning/cultural preference; English language capacity

Differing NSI: Korean and Chinese Taiwan

haracteristics	**Korea** Learning at individual large firms	**Taiwan** Small firm network-based learning
ing anism	**Cyclic reverse traveling up the capability ladder**	**High entry and forward and backward linkages**
unity of ng practice	Individual firms	A group of firms
ty of S&T and ry policy	"Picking the winners" to give direct support	Invest in infrastructure and neutral regulatory stipulation
rting tions	Provided by firms themselves under the close alliance with the government	Network, technological infrastructure; market friendly regulatory institutions
ion of R&D	80% at private firms	50% in public institutes
ological ths	**'Mass' technology, large systems**	**'Niche' technology, small systems**

Differing NSI: China and India

Both are in transition: Selected indicators

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le China becomes an emerging manufacturing center; India
ws rapid growth in software

What were the main difficulties in the transformation of China's NSI?

- Institutional/system inertia

➔Necessary consensus for reforms

➔Need centralized top-down decision

Great uncertainty associated with social innovation

➔Need flexibility for experimentation

➔ Need bottom-up feedback and “horizontal” referring of applicable practice

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