UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

Technology transfer and development: implications of four case studies
Session 2

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COURSE ON KEY ISSUES ON THE INTERNATIONAL ECONOMIC AGENDA

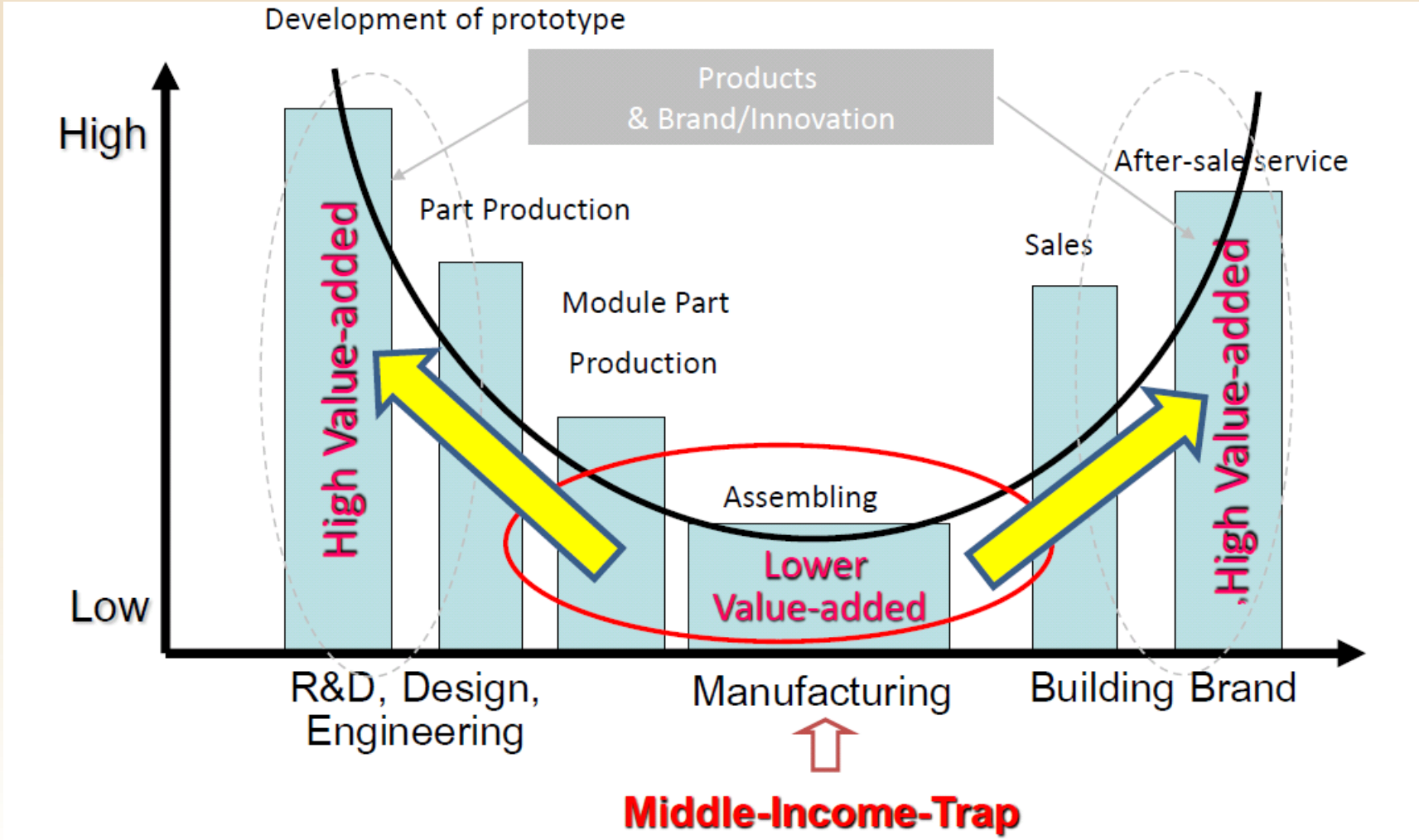
The case studies on ToT

- Part of series of UNCTAD case studies on technology transfer in developing countries. Requested by member states.
- Purpose: investigate the role of ToT in economic development and building competitive local industry.
- Approach: Four industries in four economies with different technologies (low, medium and high technology production).
- Cases: automobiles in South Africa; integrated circuits in Taiwan Province of China; buttons in Qiaotou, China; biotechnology in Argentina.

Abbreviations

BT	Biotechnology	FDI	Foreign direct investment
GM	Genetically modified	GVC	Global value chain
IC	Integrated circuits	JV	Joint venture
OEM	Original equipment manufacture		
ODM	Original design and manufacture		
OBM	Original brand manufacture		
R&D	Research & development		
SME	Small and medium sized-enterprise		
S&T	Science & technology		
SET	Science, engineering & technology		
STI	Science, technology and innovation		
TNC	Transnational corporation (MNC)		
ToT	Transfer of technology	VC	Venture capital

Value chain and value added



- Case 1: Integrated circuits in Taiwan Province of China

Integrated circuits in Taiwan POC: context

- Electronics industry starts 1950s
- Policy aims: exports, forex, jobs, growth
- Strong policy support: industrial policies, STI (clusters), trade (exports and imports), FDI, financing (direct equity, VC, seed capital, soft loans, R&D tax credits), education and training, macroeconomic stability
- Many SMEs - clusters externalized/shared R&D
- Established Hsinchu Science-Based Industrial Park (HSIP) cluster in 1980

IC in Taiwan PoC: Channels of ToT

- JVs with foreign TNCs + TNC local subsidiaries in early stages
- Sub-contracting production (OEM)
- Reverse engineering, imitation in early stages
- HSIP science park (1980) - firm-PRO-university linkages + spinouts
- Industrial Technical Research Institute (ITRI) laboratories
- R&D by local firms in later (maturity) stage
- Training of local engineers abroad - universities, TNCs
- Returning diaspora from Silicon Valley, USA (brain circulation)
- Investment in education system (absorptive capacity)
- Licensing foreign technologies

IC in Taiwan PoC: role of ToT and results

- ToT critical to accelerate firms technological learning, upgrading in production and design
- HSIP a resounding success
- Result: IC firms moved to technology frontier (OEM to ODM; little OBM)
- IC industry became huge export industry
- IC industry stimulates growth, exports, forex, jobs, technological learning, skills development, technological & innovation capabilities

- Case 2: Button production in Qiaotou, China

Buttons in Qiaotou, China: context

- Button industry starts late 1970s
- Based on private Chinese entrepreneurs
- Buttons low tech industry
- Local (Yongjia county) government takes policy action in 1990s
- establish institutions, links from Chinese universities/design centres with SMEs - provide R&D, knowledge, technology, equipment, designs
- Goal: help local firms upgrade, grow industry

Buttons in Qiaotou, China: ToT channels

- Training in Italy & import of inventory and quality control methods (early stage)
- Manufacturing for foreign buyers (early stage - foreign designs)
- R&D by Chinese universities (Lanzhou Technical University, Huanan University of Technology)
- Designs by Chinese design centers
- Machinery imported (early stage) and some manufactured in China (late stage)

Buttons in Qiaotou, China: role of ToT and results

- ToT critical for upgrading
- Knowledge and R&D remained outside button producers - in universities and design centers
- Qiaotou button cluster a successful sectoral innovation system
- Result: local button firms upgraded, massive market share by 2008
- Qiaotou a major global button producer, highly integrated into clothing GVCs

Case 3: Automobiles in South Africa

Automobiles in South Africa: context

- Important manufacturing industry, started in 1920s
- Auto industry medium technology
- In 1980s, most auto producers (assemblers and component firms) local firms.
- Moderate policy support - strong trade protection, local content requirements (from 1960s)
- Rapid trade liberalization from 1995
- Little auto industry-specific STI support
- Global auto industry has evolved: Today highly globalized (global production networks and GVCs), production highly fragmented, competitive

Automobiles in South Africa: ToT channels

- Purchase of machinery and equipment, software
- R&D and investment in training by local auto firms
- Informal learning by doing
- Licensing foreign technology
- Foreign owners (TNCs)/partners (for JVs)
- Foreign experts
- PRO-firm collaboration
- Durban automotive cluster - supports learning by firms
- Training programs
- University-firm research links weak; minor source
- Assembler-supplier links weak; insignificant source

Autos in South Africa: role of ToT, results

- ToT critical for firms to compete
- Results: early stage (protectionist): mixed: some technological learning, capability development
- Results: since 1995 liberalization: mixed - some upgrading, but externally driven
- Auto industry still important, but limited upgrading, all asemblers foreign-owned
- Education and training policies inadequate; policy mix sub-optimal

Case 4: Biotechnology in Argentina

Biotechnology in Argentina: context

- Argentina an early adopter of biotechnology (BT)
- BT heavily R&D intensive, high-tech
- BT a set of technologies - used in health, agriculture
- Mostly local firms, some TNCs in agriculture (mainly GM seeds)
- GM crops largest export product in Argentina
- Moderate policy support for BT: soft regulatory framework, approval of GM techniques and products; modest public financing of R&D, promotion of industry-research collaboration, R&D tax incentives, seed capital.

Biotechnology in Argentina: ToT channels

- Academic research, mostly international collaboration
- Firm-university-PRO R&D collaboration
- Buying of seeds from foreign TNCs
- Acquisition of lab equipment and manufacturing plants
- Acquisition/establishment of dedicated BT firms to do R&D
- Hiring of BT graduates from local universities (absorptive capacity)

Biotech in Argentina: role of ToT and results

- ToT critical in increasing agricultural productivity
- Results: Argentina a successful adopter of foreign BT inputs (GM seeds) and techniques
- BT-based agriculture a large export industry
- Biopharmaceutical drug prices lower in Argentina than most of Latin America
- Argentina: strong STI capabilities in BT in local region (Latin America) but Asian countries progressing faster (China, India, Rep of Korea, Singapore, Taiwan POC)
- A moderate success: a regional leader but other developing economies progressing faster, innovation capabilities still behind the frontier in BT agriculture

Key success/failure factors in ToT & upgrading

- Developing human capital (education and skills) and basic R&D (absorptive capacity)
- Investment by firms: capabilities, skills, tech & innovation
- Design, implementation of policies (national, state and/or local level) - to build STI capacity, strengthen innovation systems, promote ToT
- Establishing tailored institutional/policy frameworks for STI, institutions
- Leverage multiple channels of ToT (international + local)
- Balancing firm-level + industry-level effort with public sector support (PP collaboration)
- management of strategy, policy mix over time

Conclusions (1)

1. Many possible paths to building technological and innovation capacity and using ToT as part of process

- Different development strategies, institutional frameworks, policy frameworks and policy mixes used
- Different circumstances, industries and policy approaches make each ToT experience context specific, reducing replicability
- Global economy evolving: narrowing policy space, rise of GVCs
- No blueprints to follow, no one-size-fits-all approach
- National policy experimentation and policy learning necessary

Conclusions (2)

2. Active policy intervention needed in developing economies for upgrading

- Liberalizing economy, integrating into the global economy and relying on FDI/TNCs not an adequate policy approach
- Building adequate absorptive capacity is always necessary
- Also, building STI capabilities and strenghtening innovation systems
- Supporting ToT can play important role

Conclusions (3)

3. ToT important for building capabilities, but only part of process of developing competitive firms and industries.

- Successful upgrading requires ToT, SET plus innovation capabilities (including management, organization and entrepreneurial capabilities).

- S&T must be fused to innovation for industrial upgrading and competitiveness

Conclusions (4)

4. Policies on ToT and STI do not work in isolation. Policy mix is critical - industrial policies and policies on trade, FDI, education and training, SMEs, entrepreneurship and competition + macroeconomic.

- Effective policy design and implementation
- Policy coherence
- Policymaking capacity must be developed

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