Local Innovation and Global Value Chains in Developing Countries

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Agenda

① Global Value Chains (GVCs):

- Focus on the role of leading firms and inter-firm networks in upgrading;
- Limitation: little attention on understanding the upgrading process in itself. How is knowledge accessed? How firms in GVCs learn and innovate?

② GVCs & Innovation:

- Focus on how firm level efforts and on the interactions among enterprises, institutions, research bodies and policy making agencies within innovation systems contribute to learning and innovation in firms involved in GVCs;

③ Conclusions and policy implications.

Learning and innovation in LDCs

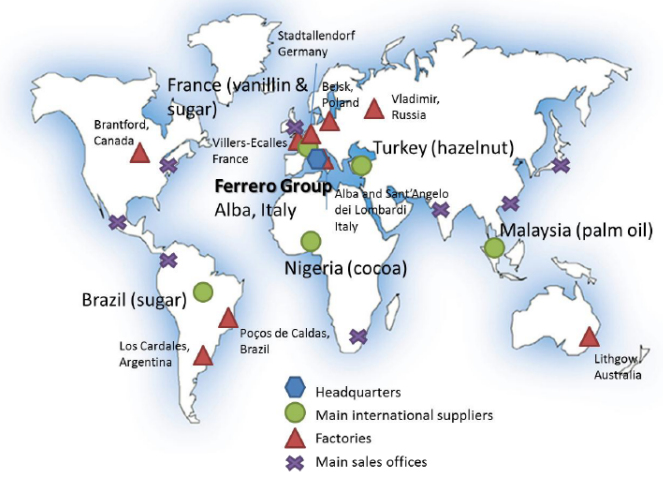
- In emerging countries, the external sources of knowledge are particularly crucial in the innovation process;
- Different strands of literature have analysed the impact of foreign sources in the process of capability building in innovation:
  - Learning from exporting (see Wagner, 2007 for a survey);
  - Foreign Direct Investments (FDIs) through spillovers, imitation and direct innovation efforts (Barba Navaretti and Venables, 2004);
  - Global Value Chains (GVCs) have assumed an increasingly important role.

Global Value Chains (GVCs)

- According to UNCTAD (2013), GVCs account for some 80 % of global trade;
- GVCs offer great opportunities for accessing external knowledge but these opportunities need to be exploited;
- Which role well functioning innovation systems and firm level innovation and learning processes do play in supporting the upgrading of local firms involved in GVCs?

The Nutella GVC

Figure 6. The Nutella® global value chain



Source: Ferrero, Sourcemap and various on-line sources.

What is a GVC?

- A value chain is the full range of activities that firms engage in to bring a product to the market, from conception to final use: design, production, marketing, logistics and distribution to support to the final customer;
- They may be performed by the same firm or shared among several firms;
- As they have spread, value chains have become increasingly global: **Global Value Chain (GVC)**.

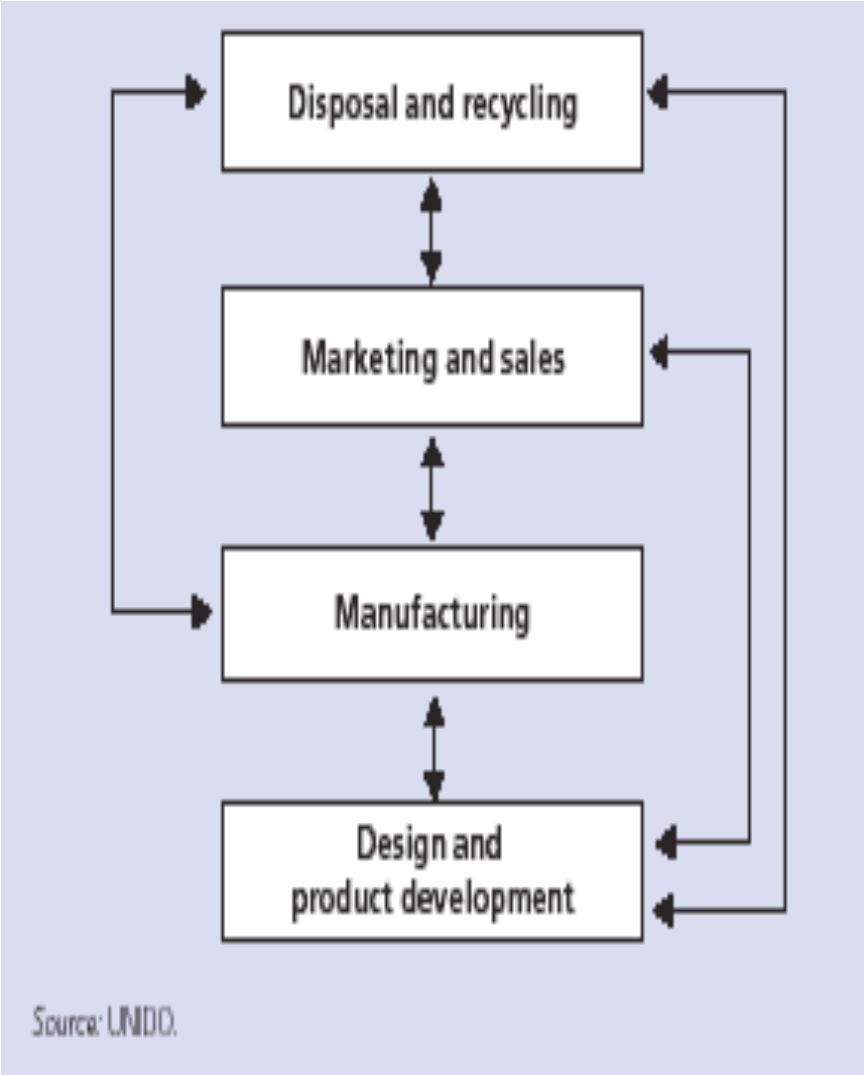
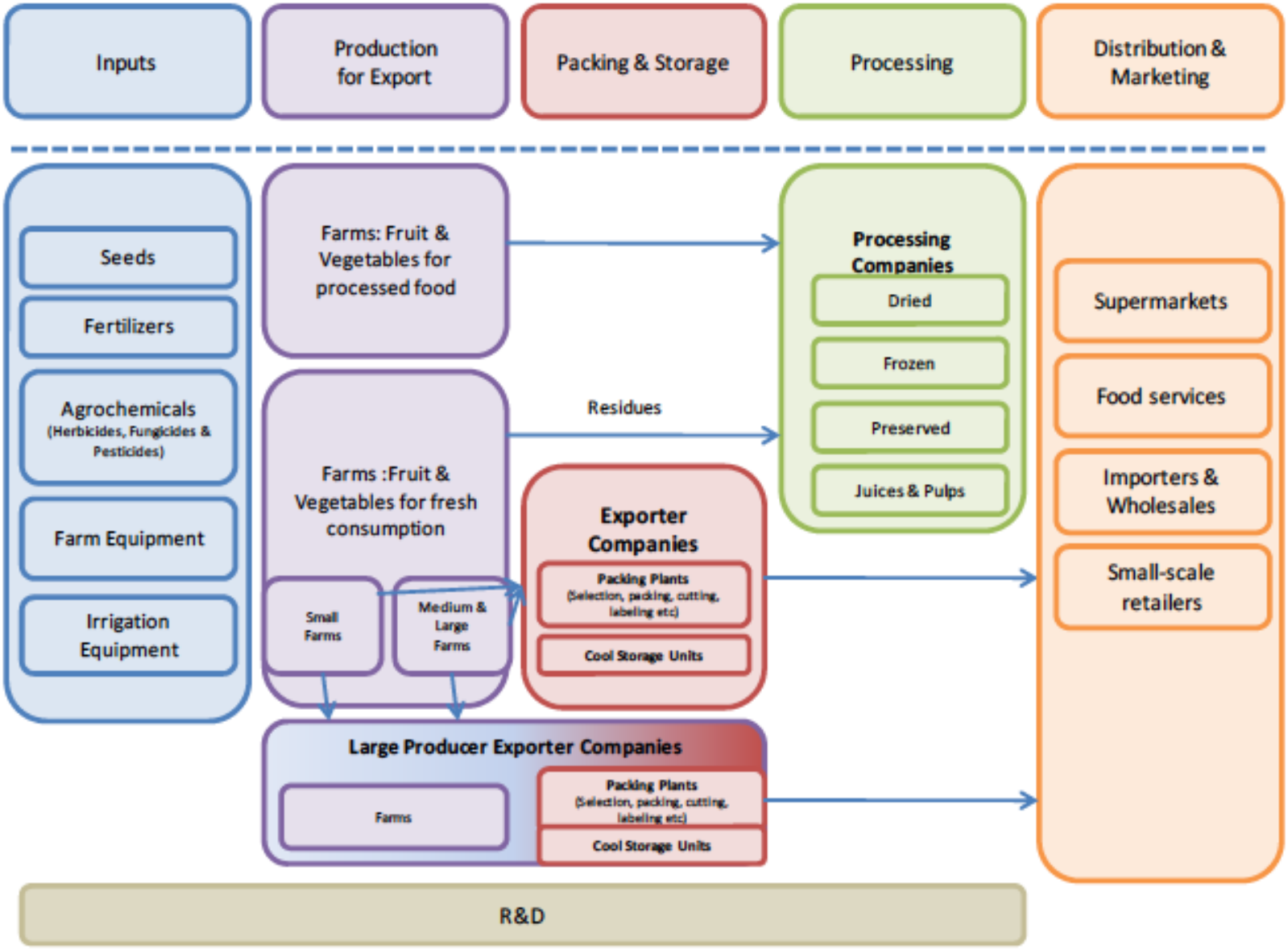


Figure 2. Fruit and Vegetables Global Value Chain



Source: (Fernandez-Stark et al., Forthcoming-c)

The drivers of GVC rise

① Trade costs have decreased significantly: the container revolution;

② Rapid advancing in ICTs: cheaper and more reliable TLCs and increasing powerful PCs have facilitated co-ordination and monitoring of activities at large distance;

③ Liberalization: falling barriers to trade and investments;

④ Large gaps in skilled and unskilled wages.

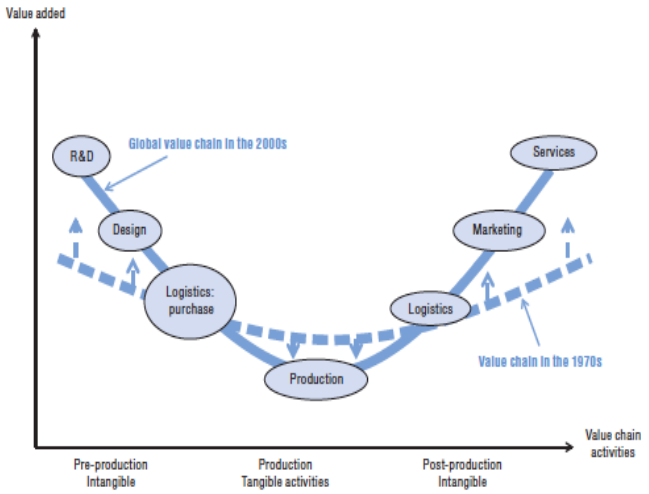
GVC has deepened the process of globalization

- **Geographically:** more emerging and developing countries involved;
- **Sectorially:** manufacturing but also services;
- **Functionally:** production and distribution but also design, R&D and innovation.

GVC and Development

- By focusing on all links in the chain (not just production) GVC analysis helps to identify **which activities are more lucrative than others**;
- A central concern of value chain analysis is to "unpack" the relationships between **global lead firms and local producers** – and the opportunities and constraints that result from entering such relationships.

Value Added along the GVC: The Smiling Curve



Source: Based on Shih (1992), Dedrick and Kraemer (1999), and Baldwin (2012).

- Which activities along the GVC are more lucrative than others?
- In GVC the most value creation is generally found in:
  - **Upstream activities** such as design, product development, R&D and manufacturing of key parts and components;
  - **Downstream activities** such as marketing, branding and customer service;
- **Assembly,** often offshored, to LDCs, **represents only a small part of value generation**.

How to move along the smiling curve? Economic Upgrading in GVC

- Economic upgrading is **moving up the value chain** through:
  - the **efforts of companies;**
  - **conducive (national/regional/local) innovation and business systems**;
- There are four types of upgrading:
  ① Process upgrading;
  ② Product upgrading;
  ③ Functional upgrading;
  ④ Inter-sectorial/inter-chain upgrading.

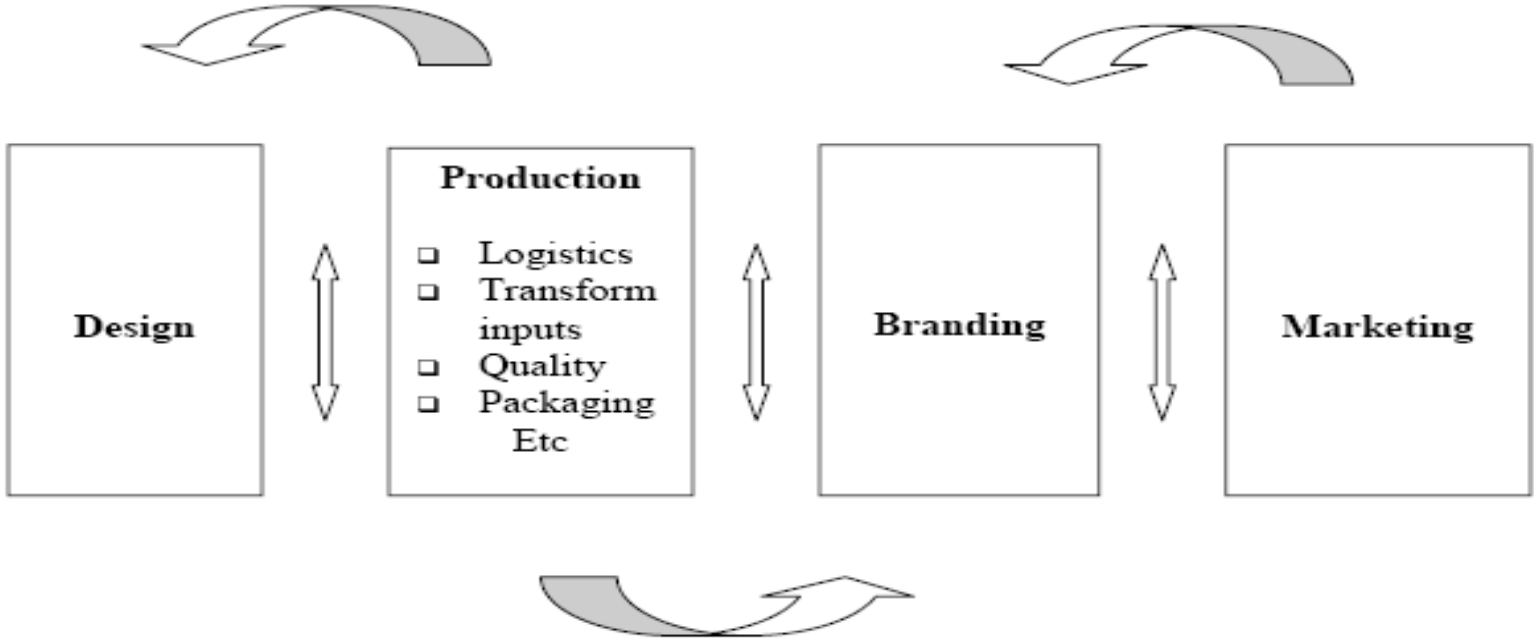
Process and Product Upgrading

① **Process upgrading** implies reduction in costs, productivity and flexibility increases by reorganizing the production system or investing in new or better equipment/technology;

② **Product upgrading** involves a shift to more sophisticated, complex, better quality products as well as producing a larger range of products.

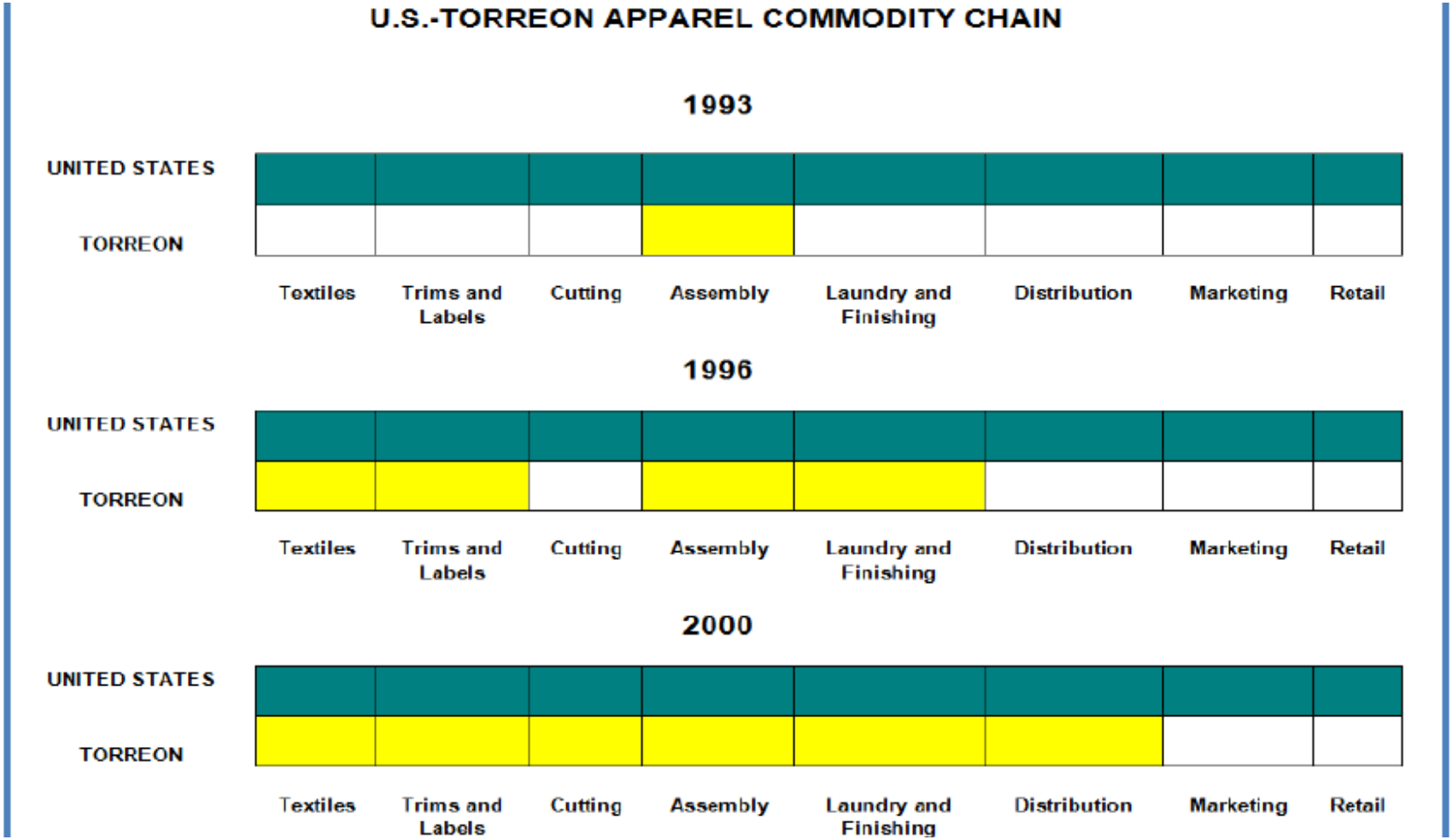
③ Functional upgrading

- Changing the mix of activities and **acquiring new skill intensive functions** (i.e. from manufacturing to design);



Functional upgrading is changing the mix of activities within and between links

Functional upgrading in Mexico



④ Intersectorial/inter-chain upgrading

- Applying competences acquired in one function of a chain and using them in a different sector/chain;
- **Sinos Valley shoe producers** (Brazil) have functionally upgraded (moving up to design, branding and retailing) in the **domestic/regional value chain**:
  - Leveraging their production capabilities acquired in the US value chain;
  - 'Made in Brazil' program promoted by the local business association to create a local design capability and a brand.

Upgrading in GVC is conditioned by governance

GVC governance depends on:

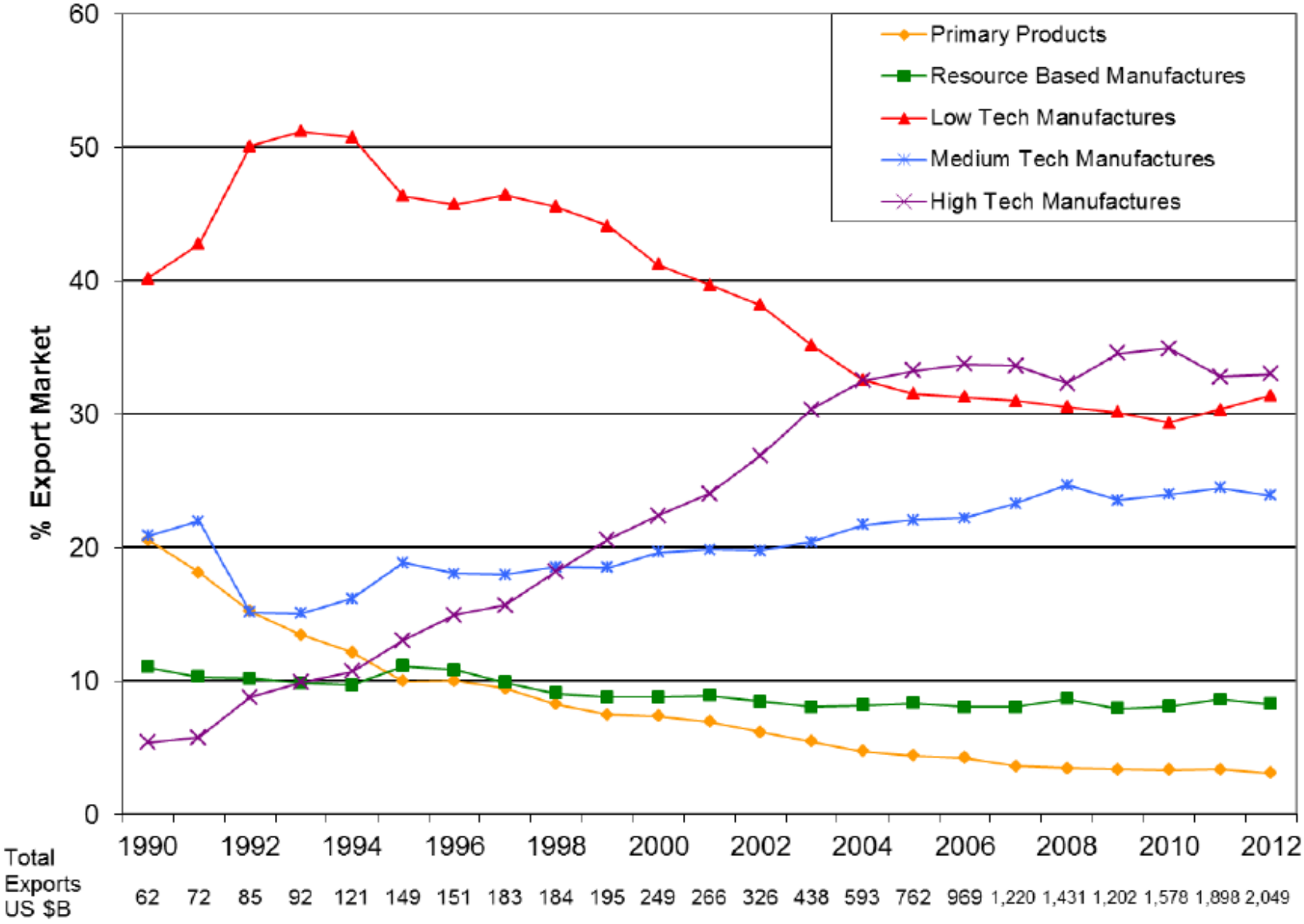
- The **complexity of the information** exchanged between actors in the chain;
- The **codification of the the information** into clearly defined rules, norms and standards;
- The level of **suppliers competence**.

Governance Type	Complexity of transactions	Ability to codify transactions	Capabilities in the supply-base	*Degree of explicit coordination and power asymmetry*
Market	Low	High	High	*Low* ↕ *High*
Modular	High	High	High	
Relational	High	Low	High	
Captive	High	High	Low	
Hierarchy	High	Low	Low	

Why is China gaining global market share?

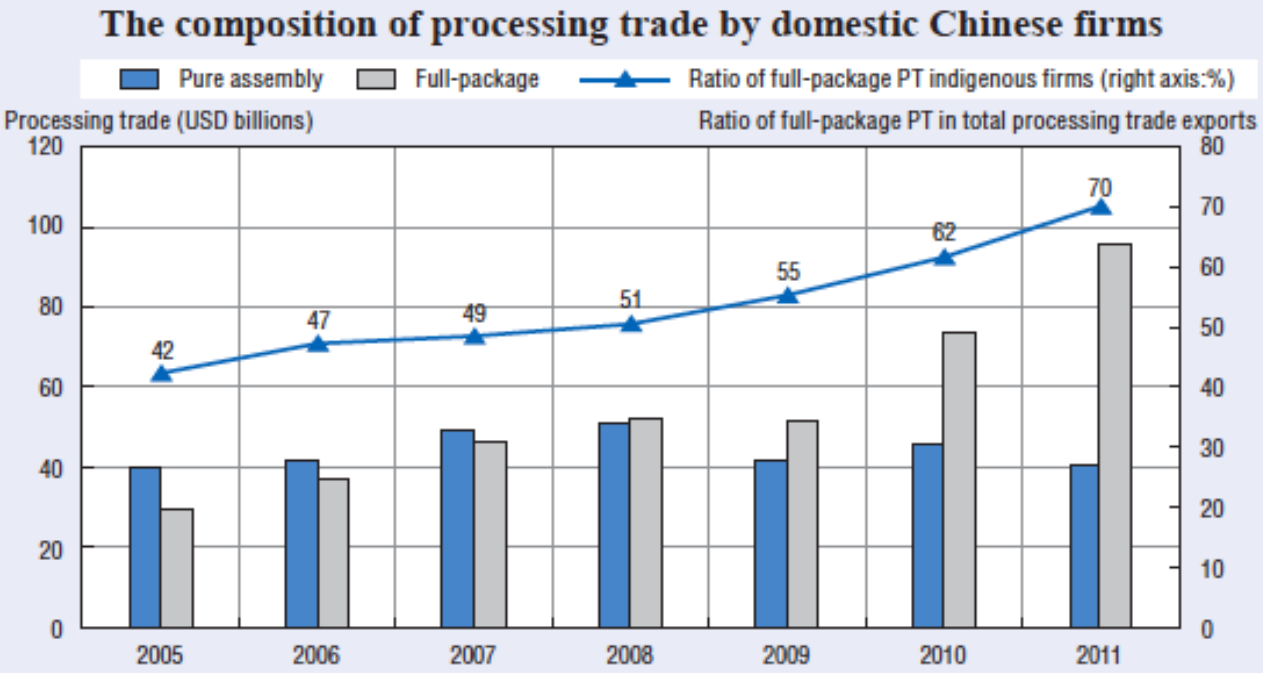
- China is a **lower-cost producer** overall (labor costs lower, but not transport & tariffs)
- China has huge **scale and scope economies** (supply-chain cities)
- China has **a coherent and multidimensional upgrading strategy** – diversify and add high value activities
- China is using **direct foreign investment** to promote **"fast learning"** in new industries
- China uses **access to its domestic market** to attract TNCs and promote knowledge spillovers

Composition of China's Exports to the World Market, 1990-2012



Source: UN Comtrade.

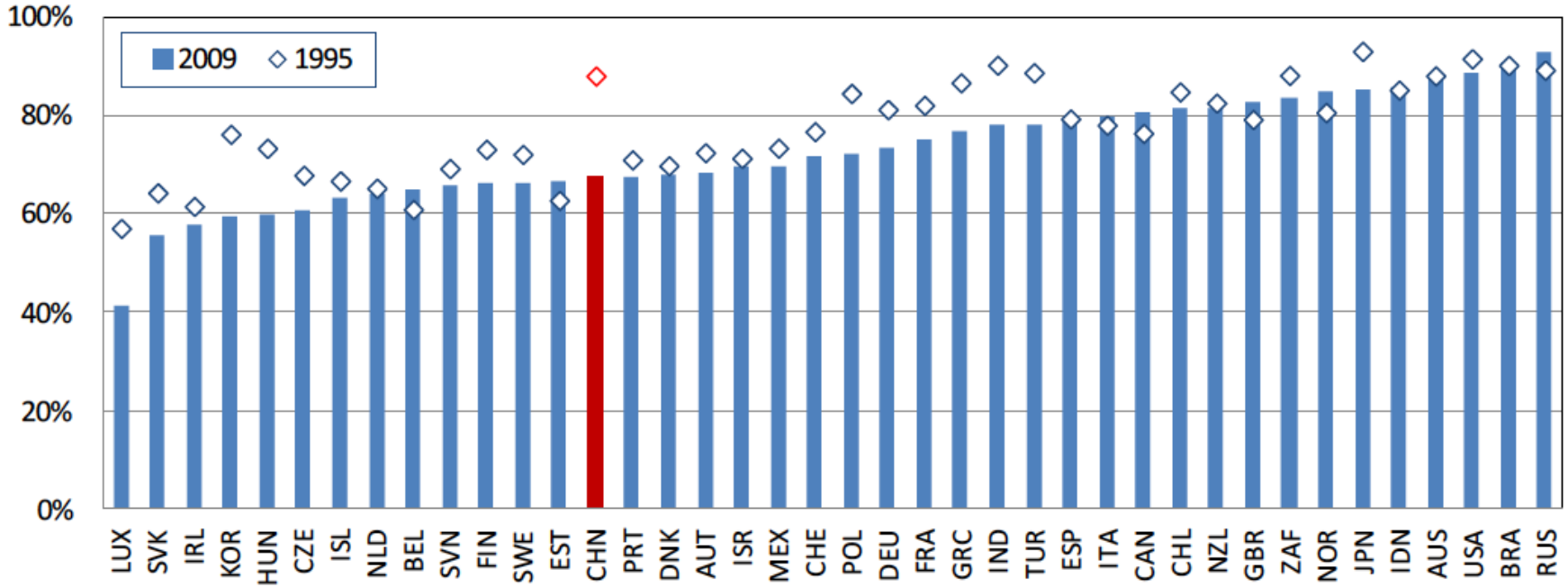
China process upgrading: from simple contract assembly to "full-package" manufacturing



Source: China Customs Statistics.

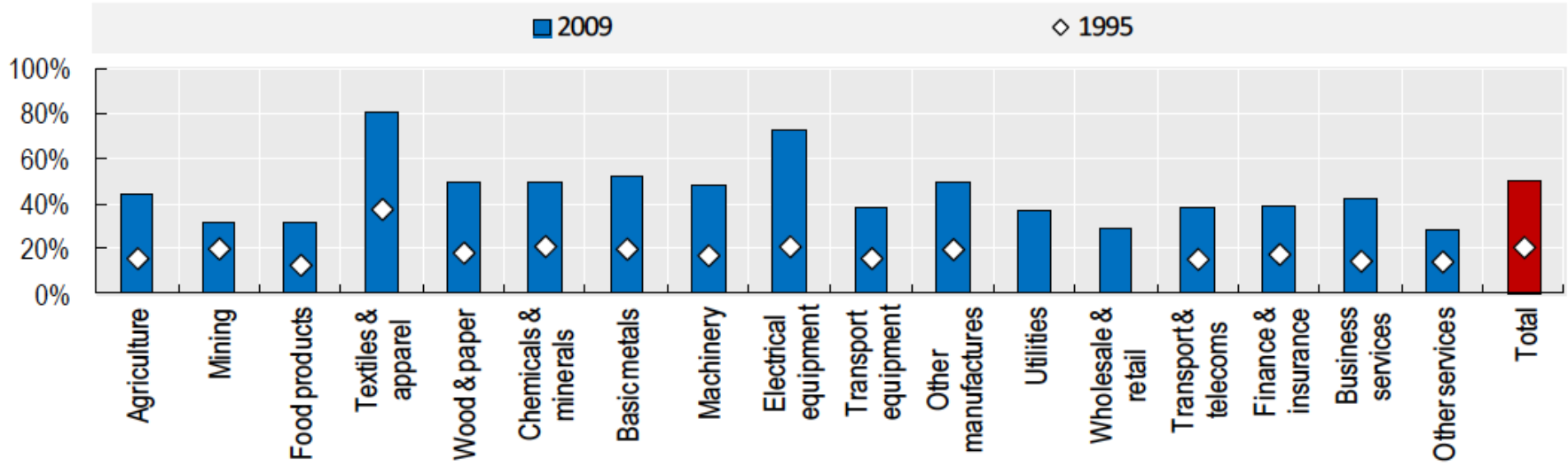
China's domestic value added content of its exports was 67% in 2009, below the OECD average (76%), the second lowest in the G20, and significantly below its level in 1995 (88%), reflecting China's increasing integration into global value chains (Fig. 1). China's accession to the WTO in 2001 accelerated this process of integration, with the foreign content of its exports increasing strongly from 19% in 2000 to 36% in 2005. This process has been characterised by significant shifts in China's specialisation. The share of value added exports of electronic products doubled to 30% between 1995 and 2009 while the contribution of textiles fell from 25% in 1995 to less than 20% in 2009. China's domestic value added content of its exports rose between 2005 and 2009 suggesting that China was beginning to extract higher value from global value chains.

Figure 1: Domestic value added content of gross exports, % (EXGRDVA_EX)



The share of intermediate imports that is used to produce exports was highest in the following product groups: Textiles and apparel (81%) and Electrical equipment (73%) (Fig. 3). Relatively high shares were apparent across most product groups (around 40%). In total about half of all China's imported intermediates are used in the production of exports, more than twice the proportion in 1995.

Figure 3: Share of imported intermediate inputs that are exported, by import category, % (REI)



A new role in the knowledge-intensive segments of GVCs?

- China is now the world's second largest spender on R&D after the United States;
- Patents held by Chinese residents increased at an average annual rate of 29% between 1999 and 2009;
- However, Chinese firms' patents, especially in the United States, are largely held by a handful of export oriented firms in computer, communication and consumer electronics industries, such as Foxconn, Huawei and ZTE;
- China's exports of commercial knowledge-intensive services (business, financial and communication services) have also expanded.

China Is Climbing the Value Chain

- Moving from low-technology to high-technology manufactured goods
- Moving from manufacturing to high value services
  - R&D, design, marketing of national brands (autos, appliances, telecom), logistics, finance
- Moving from inward FDI (joint ventures & technology transfer) to outward FDI (primary commodities, computers, shipping)

But beware…

- High tech exports doesn't mean high value added production: see the iPod case;
- Economic upgrading ≠ Social upgrading.

China assembles all iPods, but it only gets about $4 per unit -or just over 1% of the US retail price of $300

451 parts that go into the iPod

Hard Drive by Toshiba → Japanese company, most of its hard drives made in the Philippines and China; it costs about $73 - $54 in parts and labor -- so the value that Toshiba added to the hard drive was $19 plus its own direct labor costs

Video/multimedia processor chip by Broadcom→ American company with manufactures facilities in Taiwan. This component costs $8.

The retail value of the 30-gigabyte video iPod that the authors examined was $299 in June, 2007

Controller chip by Portal Player→ American company with manufactures .This component costs $5 .

-Final assembly→ done in China, costs only about $4 a unit

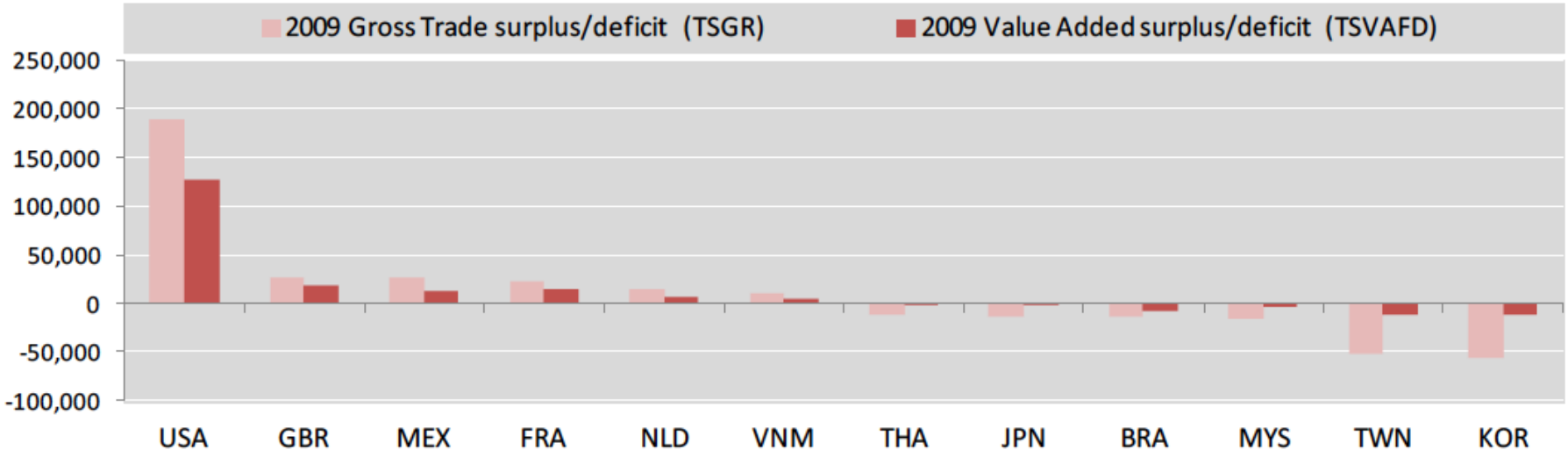
The unaccounted-for parts and labor costs involved in making the iPod came to about $110

The largest share of the value added in the iPod goes to enterprises in the United States→ $163 of the iPod's $299 retail value in the United States was captured by American companies and workers, breaking it down to $75 for distribution and retail costs, $80 to Apple, and $8 to various domestic component makers.

The bulk of the iPod's value is in the conception and design of the iPod. That is why Apple gets $80 for each of these video iPods it sells, which is by far the largest piece of value added in the entire supply chain. Apple figured out how to combine 451 mostly generic parts into a valuable product.

Source: Varian, Hal R. The New York Times, June 28, 2007. "An iPod Has Global Value. Ask the (Many) Countries That Make It."

Figure 6: Bilateral trade balances, USD million, 2009



Who captures Value in iPod?

- Apple captures most of the value;
- Suppliers of key inputs also gain a good share of value;
- Trade statistics may lead to wrong conclusion (is a “Made in China” iPOD a chinese or a US product?).

What is missing in the GVC framework?

- General positive expectation that firms coordinating the GVC (i.e. the lead firms) produce a positive impact on suppliers by transferring them valuable knowledge to compete in global end-markets;
- GVC studies tend to overlook the wide heterogeneity existing at the local level, as local suppliers are very different in terms of their capacity to absorb, master, and change knowledge and capabilities that lead firms in GVCs can potentially transfer to them;
- They are also heterogeneous in terms of their openness to sources of knowledge other than the GVC, and they are embedded in very diverse local innovations systems, some being more advanced and mature than others;
- Domestic technological capabilities at the firm (Morrison, Pietrobelli & Rabellotti, 2008), industry, cluster/region (Pietrobelli & Rabellotti, 2007) and innovation system levels (Pietrobelli & Rabellotti, 2011) do also need to be taken into account.

GVC & Innovation

- In a recent literature survey (De Marchi, Giuliani & Rabellotti, 2015), we have found 50 GVCs studies dealing with GVC & Innovation since 2005;
- In these 50 GVC cases we have searched for empirical evidence on:
  a) The *local firms' degree of innovativeness* taking into account the extent to which different types of innovations (product, process, market and organizational) have been undertaken at the level of the local firms that are part of the GVCs;
  b) The *learning mechanisms* adopted considering the extent to which local firms use:
     1. GVC learning sources (e.g. technology transfer from lead firms);
     2. Learning sources internal to the firms;
     3. External learning sources from non-GVC actors (e.g. local universities).

① GVC learning sources

Table IV.9. Learning mechanisms within GVCs

Governance type	Technology/knowledge-related determinants of governance types: Complexity of transactions	Codification of transactions	Competence of suppliers	Predominant learning mechanisms
FDI (ownership hierarchy)	High	Low	Low	• Imitation • Turnover of skilled managers and workers • Training by foreign leader/owner • Knowledge spillovers
NEMs:				
- Modular	High	High	High	• Learning through pressure to accomplish international standards • Transfer of knowledge embodied in standards, codes, technical definitions
- Relational	High	Low	High	• Mutual learning from face-to-face interactions
- Captive	High	High	Low	• Learning through deliberate knowledge transfer from lead firms; confined to a narrow range of tasks – e.g. simple assembly
Trade (market)	Low	High	High	• Learning from exporting or importing • Imitation

Source: Adapted from Pietrobelli, C. and R. Rabellotti (2011) "Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?", *World Development*, 39:1261-9.

How can policy support upgrading within GVC? The role of innovation systems (ISs)

	Governance Type	Determinants	Innovation Systems
1	**Market**	Low complexity	
		High codification	MSTQ organizations matter
		High supplier competence	Education, training organizations matter
2	**Modular**	High complexity	
		High codification	MSTQ organizations matter
		High supplier competence	Education, training organizations matter
3	**Relational**	High complexity	"Local" systems and complementary knowledge matter
		Low codification	MSTQ are perhaps less crucial
		High supplier competence	Education, training organizations matter
4	**Captive**	High complexity	
		High codification	MSTQ organizations matter
		Low supplier competence	
5	**Hierarchy**	High complexity	Local R&D organizations may benefit from interaction
		Low codification	
		Low supplier competence	GVC is expected to improve human technical skills

A well-structured, complete, smooth system makes **1-2-3** more likely to occur.
4-5 may prevail also with 'poorer', fragmented systems. The chain leader may compensate system weknesses, but upgrading is restricted.

Possible Dynamics

- **From 5 and 4 to 2**: thanks to improvement in MSTQ
- **From 5 and 4 to 3**: thanks to improvement in "local" systems
- **From 5 and 4 to 2 and 3**: thanks to IS supporting the co-evolution of suppliers and GVC competences

Source: authors' elaboration

Well functioning ISs facilitate relational forms of governance

- **Active technical bodies** where the chain leaders and their local partners can meet, ease the exchange of knowledge and reduce the complexity of transactions. **This is common in SMEs clusters**;
- **Electronics in Jalisco (Mexico):** the development of an efficient IS has supported the transition from hierarchy and captive chains led by foreign leaders to the creation of a local innovation capacity and functional upgrading undertaken by domestic firms;

  - **Policy instruments**: training programs, high tech incubators, Science and Technology program co-developed by the State and the private sector.

Codification of transactions & IS

- Well functioning standards and metrology organizations facilitate the handling of complex transactions and modular chains are more likely to prevail;
- **Salmon in Chile:** learning to comply with standards it has achieved the involvement of local firms both as value chain leaders and qualified suppliers in foreign-led chains.
  - **Policy implications**: a meso-level institution, the Association of Salmon Industries, has played a crucial role in supporting local firms to upgrade their capabilities (Pietrobelli and Rabellotti, 2007).

Suppliers' competence & IS

- Increasing capabilities in the supply-base help to push the architecture of GVC away from hierarchy and captive networks and towards more relational and modular chains;
- **Wine in Chile and South Africa** (Giuliani, Morrison and Rabellotti, 2011): successful catch up in the highly competitive global wine market;

  - **Policy implications:**
  - Public-private partnership in research consortia involving companies, business associations and universities have facilitated the upgrade of the local wine producers;
  - In SA, WINETECH has implemented a participatory mechanism to set up the research agenda.

Learning mechanisms outside the GVC

②Firm-level learning efforts:

- Internal R&D efforts
- Hiring of skilled managers or workers
- Learning through acquisitions/joint venture, licensing;

③Other external channels unrelated to GVCs:

- Collective learning at the local level
- Learning from suppliers, universities, etc.
- Imitation form competitors.

Table 4: Learning mechanisms in GVCs

		#	%
Within GVC	Mutual learning from face-to-face interactions	17	34.0
	Training by GVC lead companies	11	22.0
	Knowledge transfer from lead firms confined to a narrow range of tasks	18	36.0
	GVC pressure to adopt international standards	17	34.0
Outside GVC			
Firm	Internal R&D effort	24	48.0
	Hiring of skilled managers and workers	13	26.0
	Learning trough acquisition/joint venture/licensing	10	20.0
Collective	Collective learning at the local level	12	24.0
Other	Learning from actors such as suppliers, universities	15	30.0
	Imitation from competitors	13	26.0

Cluster analysis

- The variables used for the cluster analysis are the following:
  - *Innovation* measured on a scale ranging from 0 (no innovation) to 1 (high innovation) based on the types of innovation performed (product, process, organizational and market), plus one whether product innovation was new-to-the-world;
  - *Learning within the GVC* measured summing the number of the GVC channels used by the firm on the total possible cases (codified on a 0-1 scale);
  - *Learning outside the GVC* measured summing the number of channels used by the firm outside the GVC on the total possible cases (codified on a 0-1 scale).

3 types of GVCs

①*GVC-led Innovators (9):* innovative local firms, which intensively use knowledge sources from within the GVC (e.g. Coffee GVC in Brazil lead by Illycaffè);

②*Independent Innovators (14)* also innovative firms, but whose learning sources mainly come from outside the GVC (e.g. Chinese wind GVC);

③*Weak Innovators (27)*: a large group of scarcely innovative firms, drawing selectively on some of the knowledge sources available within the GVC but poorly using other forms of learning (e.g. Kenyan clothing GVC to the US market).

Table 5: A GVC Typology

	GVC-led Innovators	*Independent Innovators*	*Weak Innovators*
Innovation	Strong	Strong	Weak
Within GVC learning	Strong use of GVC: Face to face Training Transfer of knowledge on narrow tasks Standard pressure	Selected use of GVC: Face to face Knowledge transfer on narrow tasks	Limited use of GVC: Face to face Transfer of knowledge on narrow tasks Standard pressure
Outside GVC learning	Selected use of extra-GVC: In-house R&D Imitation Learning from local actors	Strong use of extra-GVC: In-house R&D Hiring skilled employees	Very weak use of extra-GVC
GVC governance patterns	Multi-chain governance	Multi-chain governance Relational Hierarchical	Exclusively Captive Exclusively Hierarchical

Innovation in GVC: a virtuous *liaison*? not always…

- In developing countries in spite of being part of one or more GVCs, local suppliers do not always use the GVC as a privileged source of knowledge and technologies;
- In most of the observed cases, **GVC-related knowledge is exploited only as a complementary source to other channels of knowledge** (e.g. firm level efforts, collective learning at the local level, imitation, learning from other non-GVC actors, etc.);
- About half of our empirical observations are GVCs where **innovation is hardly taking place**, a condition that coexists with local firms' relative closure to both GVC-related and other kinds of knowledge sources, as well as with local firms' poor skills and knowledge creation efforts;
- Therefore, local heterogeneity – at the level of firms, clusters, regional or national system of innovation – strongly conditions the extent to which suppliers in developing countries take advantage of GVC-related knowledge.

GVC Policy Interventions

- GVC programs are widespread among international organizations and donors because they offer a practical way of working with the private sector;
- GVC initiatives are mainly aimed at:
  a) strengthening the weakest links in the chain (e.g. by improving the capabilities of local small suppliers);
  b) strengthening the linkages between firms (e.g. by improving knowledge flows between the local firms and the lead firms);
  c) creating new links in the chain for connecting local firms with new lead firms and/or end markets.
- Need of more systematic assessment of the impact in terms of innovation of the existing GVCs initiatives.

The way ahead

- More empirical research about learning and innovation heterogeneity at level of firms, clusters, regions and countries at the Southern-end of the GVCs;
- More empirical research about the relationship between innovation and upgrading in GVC, and in particular about social and environmental upgrading;
- More empirical research on GVCs led by lead firms from the South.

Thank you

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