Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?

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Summary. — The Innovation Systems (IS) literature tends not to emphasize the crucial impact of international knowledge and innovation exchange and collaboration through, for example, inter-firm and intra-firm networks and Global Value Chains (GVC). In developing countries this aspect is crucial, with integration in GVC playing a growing and very important role in accessing knowledge and enhancing learning and innovation. However, there is no agreement in the literature about how innovation systems and GVC interact, and how this interaction is likely to affect enterprise learning.

Three main conclusions emerge from the theoretical analysis and evidence presented in this paper. First, learning mechanisms can vary widely within the various forms of governance of GVC; they can be the result of the pressure to achieve international standards, or be facilitated by direct involvement of the value chain leaders when the suppliers’ competence is low and the risk of failure to comply is high. When the competences of the actors in the value chain are complementary, learning is mutual and is based on intense face-to-face interactions. Second, as we “open” IS to foreign sources of knowledge, the relationship between GVCs and IS is nonlinear and endogenous, and mutually affecting. On the basis of our model, we would expect a well-structured and efficient innovation system would help to reduce transaction complexity and enable transactions based on relational forms of GVC governance. Third, the internal governance of GVC is a dynamic phenomenon that is subject to continuous adjustments and changes, and the nature of the IS affects this co-evolution.

Key words — global value chain, innovation system, learning

1. INTRODUCTION

These days, no one would disagree that learning and innovation are the key to competitiveness and growth of countries, regions, and firms. In addition, some observers emphasize that innovation and learning in their turn are affected by firm-specific attitudes and actions, and the meso and macroeconomic contexts in which firms operate. In advanced countries, the concept of Innovation System (IS) was developed to account for the role played by the institutions and the organizations that systemically interact and have an effect on the rate and direction of technological change in an economic system (Lundvall, 1992; Nelson, 1993).

However, it is being stressed increasingly that the ISD approach would be enriched by the incorporation of an international dimension (Asheim & Herstad, 2005; Bunnell & Coe, 2001; Carlsson, 2006; Fromhold-Eisebith, 2007). The IS literature often plays down the crucial impact of international information exchange and collaboration on the generation and diffusion of knowledge and innovation, for example, through inter-firm and intra-firm networks.

This argument in relation to less developed countries (LDCs) is even more important. The extra-national influences on the innovation process are particularly crucial given that frontier innovation is rarely achieved in LDC and most of the knowledge and technology has to be imported. Various strands in the literature analyze the impact of foreign firms in the process of innovation and learning in developing countries, the most recent focuses on Global Value Chains (GVC). For firms in developing countries inclusion in GVC not only provides new markets for their products, it also plays a growing and crucial role in access to knowledge and enhanced learning and innovation.

In taking account of the linkages of IS to foreign sources of knowledge, we have to recognize that the relationship between GVC and IS is nonlinear and endogenous, and mutually affecting. For example, in terms of enterprise learning, GVCs may contribute to improving the local IS, which, in turn, will affect decisions about local sourcing of inputs, and support for local firms’ learning and innovation.

This paper addresses two research questions: how do learning mechanisms operate in different types of chains (i.e., through pressure to learn or through explicit support and deliberate knowledge transfer)? And, what is the supporting role of the IS in GVC-driven learning and innovation processes?

We use empirical evidence from our own research and secondary sources. Given the highly differentiated reality behind
the sketchy and simplistic term “developing countries,” we focus on a particular group of middle-income developing countries: Brazil, Taiwan, and Mexico. In Section 2 we discuss the concept of IS in developing countries and review the main issues addressed in the GVC literature in order to highlight the different mechanisms of learning that may prevail in different types of chains. Section 3 explicitly links GVC and their different governance patterns to the notion of IS, and discusses avenues of mutual interaction. Section 4 concludes.

2. IS AND GVC IN DEVELOPING COUNTRIES

(a) Innovation systems

Application of the IS concept to developing countries is relatively recent, but is increasing rapidly. With regard to its application to developing countries, there are a number of reasons why this is not straightforward. First, innovation processes differ from those in developed countries: incremental innovation and absorption of knowledge and technologies new to the firm are more frequent and relevant than radical, new to the world innovation. While the analysis of IS in industrialized economies increasingly focuses on R&D and frontier innovation, in most LDCs, the nature of the technological effort is quite different, and is based mainly on firm-level activities which are not included in formal measures of innovation. In developing countries, most innovation is based on non-R&D activities which consist of operationalizing technology that is new to the situation of application (Bell, 2007). Second, the main science and technology organizations analyzed in developed country contexts, such as universities, research and development (R&D) laboratories, and research institutes, may not exist in some developing countries or may be inadequate, and linkages among them, and with local firms may be nonexistent or very weak. The organizations that are more important in the systems in developing countries are those providing technology diffusion and extension services such as metrology, standards, testing and quality (MSTQ), and technical and organizational consultancies (or Knowledge-Intensive Business Services—KIBS). Third, inflows of knowledge and technology from external sources are essential components of the innovation and learning processes in LDCs. Thus, it is the policies and institutions affecting international flows of equipment and services, human capital and foreign investments, as well as the GVC that matter.

This has led some authors to propose the term “National Technology System,” since the bulk of technological activity in developing countries concerns absorption of and improvement to existing technologies rather than frontier innovation (Lall & Pietrobelli, 2002, 2003, 2005). Most importantly, the concept of a National Technology System emphasizes that in developing countries what is essential is the ability to absorb and transmit to existing technologies rather than frontier innovation (Lall & Pietrobelli, 2002, 2003, 2005). Most importantly, the concept of a National Technology System emphasizes that in developing countries what is essential is the ability to absorb and transmit to existing technologies rather than frontier innovation (Morrison, Pietrobelli, & Rabellotti, 2008). What role the leaders of GVC actually play in fostering and supporting this process is one of the focuses of this literature (Giuliani et al., 2005; Pietrobelli, 2008).

The dynamics of governance patterns is crucial for understanding the opportunities for suppliers “to move up the value ladder,” moving out of the “low road” to competitiveness where competition is based mainly on price and squeezing wages, and the barriers to entry are low (Pietrobelli & Rabellotti, 2007). By building and deepening their technological capabilities, small suppliers in LDC can exploit opportunities for different types of upgrading: process upgrading which is transforming inputs into outputs more efficiently by reorganizing the production system or introducing superior technology; product upgrading which is moving into more sophisticated product lines in terms of increased unit values; functional upgrading implying the acquisition of new, superior functions in the chain, such as design or marketing, or abandoning existing lower-value-added functions to focus on higher-value-added activities; and inter-chain upgrading which is applying the competence acquired in a particular function to move into a new chain. The challenge is not always about moving into more advanced functions “along the value chain,” but is often about deepening the specific capabilities required to explore new opportunities offered “on the side,” in the value chain stage in which the firm is currently engaged (Morrison et al., 2008). Moving from natural resources to their exploitation, manufacturing, packaging, distribution, and branding is very important and can be described as climbing the ladder. But deepening capabilities to explore new original features and varieties at each stage of the GVC (e.g., from new flower varieties via biotechnological research, to new packaging with original, highly-valued characteristics) is also important, and clearly requires learning, creation, and acquisition of higher level skills, and more complex technological capabilities.

(b) GVC and their patterns of governance

It is quite common for enterprises to outsource a number of activities that previously were handled internally, and to keep in house those activities in which they have core competences. Different parts of the production processes are becoming increasingly dislocated across various developed and developing countries. A common feature in this new global division of labor is that lead firms, often from developed countries, engage in coordinating the activities of their business partners upstream and downstream. They may prefer different forms of governance for different strategic reasons. A very useful typology of GVC governance patterns was proposed by Gereffi, Humphrey, and Sturgeon (2005), who discuss the conditions under which different patterns can be expected to emerge. According to these authors, three factors determine the lead firm’s choice of governance: the complexity of the information involved in the transactions; the possibility to codify that information; and the competence of the suppliers along the value chain.

The GVC literature stresses the role played by the leaders in the chain in terms of transferring knowledge to their suppliers. For small firms in LDC, participation in value chains is a crucial means of obtaining information on the type and quality of products and technologies required by global markets, and of gaining access to those markets. However, this information needs to be combined with local technological capabilities and this requires substantial technological and learning efforts (Morrison, Pietrobelli, & Rabellotti, 2008). What role the leaders of GVC actually play in fostering and supporting this process is one of the focuses of this literature (Giuliani et al., 2005; Pietrobelli, 2008).

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(C) The learning mechanisms within GVC

Integration in GVC is increasingly common among firms in LDCs that get access to knowledge, learn, and innovate through participation in these chains. To satisfy requirements related to product quality, delivery time, efficiency of processes, environmental, labor, and social standards imposed
by GVC, firms specialized in different functions have to learn and to innovate. How learning takes place is influenced by the governance of the GVC, and different mechanisms of learning and innovation are likely to dominate in different types of chains. Table 1 presents some empirical evidence on the different learning mechanisms discussed in the rest of this section, in order.

In arm’s-length GVC, which are more usual for relatively simple and easily codifiable transactions involving competent suppliers, only suppliers with the required capabilities can enter the value chain. Inclusion in a GVC provides a window—and related information—on the global market’s requirements in terms of products, processes, technology and standards. The main learning mechanisms are spillovers and imitation which allow small LDC firms to capture knowledge for adaptive change and innovation needed to stay in the value chain.

Schmitz (2004) provides some examples of market-based chains characterized by the small size of buyers. In Brazil, buyers selling in the domestic market purchase ready-designed shoes and sell them either under their own labels or under the supplier’s own brand. Similarly, in Ludhiana (India) knitwear firms sell to small foreign traders and also develop their own products (Tewari, 1999). Based on this empirical evidence, Schmitz (2004) concludes that advances in functional upgrading seem to be facilitated by dealing with small rather than large customers. It is the different capabilities of firms to make the required investments in design, product development, and marketing that may explain why some firms succeed and others do not.

When the complexity of the transactions is high and there are capable potential suppliers, then modular chains prevail with highly codified links and transactions. Technical standards, requiring suppliers to make products to a customer’s specifications and to take full responsibility for process technology, contribute to codification. In modular chains suppliers learn how to produce components and modules to fully specified technical standards. The need to adhere to these standards is important for inducing learning; lead firms impose pressure on their suppliers to innovate and keep abreast of technological advancements, but do not become directly involved in the learning process. In other words, lead firms represent a crucial external stimulus for learning and innovation among suppliers, and are the spectators and final judges of the process. In addition, upgrading within modular chains may result in positive externalities for the rest of the economy based on spillover to other sectors served by the same suppliers.

Firms involved in modular chains need to undertake specific investments, build specialized production capabilities and constantly update in order to remain in the GVC. Their learning efforts must be accomplished independently since they are not supported by the GVC leaders. Quadros (2004) analyzing the case of GM and Volkswagen in Brazil, shows that GVC local suppliers improved their production quality and achieved ISO 9000 certification, but the leading firms in these chains played little part in assisting suppliers to meet these standards. Technical support came mostly from consultancies and accredited certification institutions. Similar evidence was found for the automotive sectors in Argentina (Albornoz, Milesi, & Yoguel, 2002) and Mexico (Dutrenit, Vera-Cruz, & Gil, 2002).

In relational chains transactions are complex and not easily codified. Relationships tend to be idiosyncratic and thus difficult and time-consuming to re-establish with new value chain partners (i.e., switching costs are high). In relational chains mutual dependence is regulated through reputation, social and spatial proximity, long-term commitment and reputation and, in some cases, is based on family and ethnic ties. Trust is a deliberate strategy to enhance economic performance (Sako & Helper, 1998).

Given the complexity of tacit information and knowledge, the linkages in relational chains are very tight, and often involve a high proportion of face-to-face interaction and mutual learning. The firms in these types of chains have highly complementary competences. LDC suppliers must be able to maintain and strengthen their production and linkage capabilities to interact with lead firms in the GVC. Learning efforts imply (sunk) costs and take time, which binds parties into continued interaction.

An example of the evolution of a chain from captive to relational is the apparel industry in East Asia, which upgraded from assembly to “full package” production, requiring the development of capabilities to interpret designs, produce samples, monitor product quality, and meet buyers’ price and time

<table>
<thead>
<tr>
<th>Governance type</th>
<th>Complexity of transactions</th>
<th>Codification of transactions</th>
<th>Competence of suppliers</th>
<th>Learning mechanisms within GVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>- Knowledge spillovers</td>
</tr>
<tr>
<td>Modular</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>- Imitation</td>
</tr>
<tr>
<td>Relational</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>- Learning through pressure to accomplish international standards</td>
</tr>
<tr>
<td>Captive</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>- Transfer of knowledge embodied in standards, codes, technical definitions</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>- Mutual learning from face-to-face interactions</td>
</tr>
</tbody>
</table>

Table 1. Learning mechanisms within GVC

Source: Adapted from Gereffi et al. (2005).
conditions (Gereffi, 1999). According to Gereffi et al. (2005: 92), the main opportunity in these chains is that they allow “…local firms to learn how to make internationally competitive consumer goods and generate substantial backward linkages to the domestic economy.”

Another case of a local supplier that progressed from producing to buyer’s specification to own design manufacturing comes from the Taiwanese computer industry (Kishimoto, 2004). The knowledge was transmitted through the supply of blueprints from MNCs to local suppliers, and interactions among personnel to transfer the tacit dimensions of technology creation (Guerrieri & Pietrobelli, 2006). The technology and technical expertise acquired through manufacturing within a GVC, are transferred via the products manufactured for other multinationals and/or in the production for own designed and branded products. Taiwanese computer firms often participate in more than one GVC, and “leverage competences across chains” (Schmitz, 2006: 561).

In the Brazilian State of Espírito Santo, learning occurred in a relational chain, in which local small and medium sized firms (SME) benefited from interacting with larger firms, who acted as anchors for the local cluster. The process was fostered by the activities of intermediary institutions—matching the interests of small and large firms—and by the active role of the local government to give the authority and credibility for these firms to negotiate with large firms and create better linkages and collaboration with SMEs (Villaschi, Cassiolato, & Lastres, 2007).

When suppliers lack competences, there are also alternative patterns: hierarchy, which is vertical integration and occurs when are difficult to codify, and captive, buyer-driven chains where small suppliers are dependent on larger, dominant buyers that can exert high levels of monitoring and control, and where transactions are easier to codify.

In captive chains, lead firms intervene actively in the learning processes of suppliers that lack competences. Their support is usually confined to a narrow range of tasks—for example, simple assembly. However, there is a risk of lock-ins because lead firms do not sustain the development of strategic, core capabilities. The case of the shoe industry in the Sinos Valley in Brazil is an example of how inclusion in a GVC can facilitate product and process upgrading, but prevent functional upgrading, leaving firms dependent on a small number of powerful customers (Bazan & Navas-Aleman, 2004; Schmitz, 2006). Local shoe suppliers in the Sinos Valley were discouraged from engaging in design, marketing and sales because these were the core competences of the United States buyers, the leaders in the GVC. Brazilians have been members of footwear value chain mostly as producers, with their buyers keen to maintain the status quo. Other empirical evidence on the Brazilian sports shoes sector shows that local suppliers have developed the capability to adapt designs to local conditions (tropicalización), but have not been involved by lead firms in new design development (Lemos & Palhano, 2003).

Over time, the direct involvement of United States buyers in assisting the product and process upgrading of Brazilian shoe producers has diminished: in the 1980s, most support came from specialized United States technical staff, which were gradually replaced by local staff. The activity was moved to China in the 1990s, because the risk of supplier failure in Brazil was much higher (Schmitz, 2006).

The Sinos Valley shoe industry provides insights on the learning mechanisms that occur across (inter-) GVC. The functional upgrading in design, branding, and marketing, which was discouraged by the United States buyers, was achieved, and allowed the firms to sell to buyers in the domestic and regional markets in Latin America (Bazan & Navas-Aleman, 2004). A similar process of experience being transferred across chains occurred in the Mexican footwear sector, where producers also began selling in the domestic market and in some other parts of Latin America (Rabellotti, 1999).

At the opposite end of the typology is vertical integration, which is where the lead firm takes direct ownership of some of the operations in the chain and transactions are not easy to codify. This is similar to the case of intra-firm trade between a trans-national company and its subsidiaries, and implies various potential learning mechanisms analyzed in the literature on foreign direct investment in LDCs, such as transfer of management, skilled labor turnover, training of the local workforce, knowledge spillovers, and imitation (Barba Navaretti & Venables, 2004).

3. IS AND THEIR INTERACTION WITH GVC

GVC analysis is limited because of the lack of attention to the institutional context within which local firms interacting in GVC are embedded. This limitation is highlighted in the literature on Global Production Networks (VPN), which deals with how actors in the various networks are embedded in different places. This includes the geographical dimension from the national to the local scale (Ernst, 2002; Hess & Yeung, 2006). The work of geographers and planners on local industrial agglomerations stresses the spatial embeddedness of tacit knowledge and the importance of tight interdependencies between geographically clustered firms (Storper, 1995).

At the national level, the relevance of rules, values, and institutions (e.g., financial system, corporate governance, education, and training system) that affect the character and evolution of industries and firms is highlighted in the literature on types of capitalism (e.g., Berger & Dore, 1996). Especially remarkable among these rules and institutions are those “…elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge… and are either located within or rooted inside the borders of a nation state” (Lundvall, 1992). These institutions and organizations can have profound effects on value chain governance and the innovation and learning strategies of firms in developing countries. In this section we explore the role of innovation systems in the GVC-driven learning and innovation process in developing countries.

We focus on two aspects of innovation systems: technology policies and technology organizations. Technology policies cover aspects such as technology imports via licensing and FDI, and incentives for local R&D and training. Technology organizations are those bodies that provide services such as MSTQ, R&D, training, and KIBS. This differs in industrial countries where the emphasis is much more on basic research and the creation of new knowledge. These organizations can be government-run, started by government but run autonomously, or started and managed by industry associations, or private actors. In developing countries, government-run organizations often play leading roles to counter the weaknesses in and precariousness of the private productive sector.

Many services provided by these organizations are the essential “public goods” of technological effort. Public research institutes and universities undertake basic research that does not yield commercial results in the short term, but provides a long-term base of knowledge for enterprise effort. Quality, standards, and metrology institutions provide the basic framework for firms to communicate on technology and maintain basic standards for the industry. Extension services alleviate
informational, technical, equipment, and other SME handicaps. KIBS are consultancy services related to technical and organizational issues and, so far, their investigation is confined to the developed country context; however, as Schmitz and Strambach (2009) show, they are become increasingly relevant in some developing countries. The provision of these services remedies market failures that all governments face, regardless of the national level of development.

How do different IS affect the determinants of GVC governance—and through this, the opportunity for enterprise learning and upgrading? The relationship between the form of governance and the nature of the system is intrinsically dynamic and cannot be univocal (one-to-one), given the variety of possible systems and the endogeneity of most of the events outlined above, and the frequent two-way causality and continuous feedback. The nature of the IS affects the range of possible modes of governance of value chains. Table 2 below shows the relationship between GVC governance and the nature of the IS. We discuss how the latter impacts on the three key determinants of governance: complexity of transactions, extent of codification, and suppliers’ capabilities. The last column in Table 2 presents some possible dynamic trajectories from the different patterns of GVC governance that may emerge from a well functioning IS.

(b) Complexity of transactions and IS

A well-structured and efficient IS can help to reduce the complexity of transactions and enable transactions based on arms’ length or on weak hierarchical forms of GVC governance—the risk of falling into a captive relationship, or being acquired by a leader is diminished. In other words, the lower the complexity of the transactions the less need there is for an effective IS—but an effective system increases the capabilities to cope with complex transactions.

When investors engage in make-or-buy decisions, they face a trade-off between lower production costs and higher transaction costs. In countries with weak institutions, weak contract enforcement, pervasive corruption, cumbersome bureaucratic procedures, multiple barriers to trade and poor infrastructures, it is difficult to capitalize on the benefits of inter-firm specialization (Altenburg, 2006).

The weaker the institutional framework, the costlier and riskier will be contract enforcement, inter-firm coordination and transactions will be more difficult, which favors nonmarket forms of governance, possibly vertical integration. The related bureaucratic procedures and high administrative costs of registration may exclude small firms from doing business, “emerging” out of informality, and linking up with global and national value chains.

In terms of science and technology, if the system offers efficient and homogeneous standards, testing, and quality assurance institutions and organizations, the costs of technology and learning-related transactions will be lower, and relational forms of governance will be smoother. Local firms’ learning in captive value chains may extend beyond simple tasks to design and planning of activities for example, the experience of the industrial and technological development of Taiwanese firms and clusters is an insightful example of an IS supporting the transition from hierarchy and captive chains led by foreign leaders, to local innovation, functional upgrading, and domestic firm-led value chains. Taiwan’s IS strengthened over time thanks to substantial investments in human capital and scientific and technological research, institutions and rules rewarding innovation, and organizations such as science and technology parks that further facilitated efficient inter-firm and university-industry collaborations in high-tech activities (Guerrieri, Iammarino, & Pietrobelli, 2001; Saxenian & Hsu, 2001; Tsai & Wang, 2005; Lee & Yang, 2000).

The establishment of relational value chains is also facilitated by a well functioning IS with active technical bodies, where the chain leaders and their local partners can meet to exchange complementary knowledge and to reduce the complexity of transactions. The development of specialized technical

<table>
<thead>
<tr>
<th>Governance type</th>
<th>Determinants</th>
<th>Innovation systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Market</td>
<td>Low complexity</td>
<td>MSTQ organizations matter</td>
</tr>
<tr>
<td></td>
<td>High codification</td>
<td>A well-structured, complete, smooth system makes 1-2-3 more likely to occur</td>
</tr>
<tr>
<td></td>
<td>High supplier competence</td>
<td>Possible dynamics</td>
</tr>
<tr>
<td></td>
<td>High complexity</td>
<td>Upgrading is restricted</td>
</tr>
<tr>
<td>2 Modular</td>
<td>High codification</td>
<td>“Local” systems and complementary knowledge matter</td>
</tr>
<tr>
<td></td>
<td>High supplier competence</td>
<td>MSTQ are perhaps less crucial</td>
</tr>
<tr>
<td></td>
<td>High complexity</td>
<td>Education, training organizations matter</td>
</tr>
<tr>
<td>3 Relational</td>
<td>Low codification</td>
<td>“Local” systems and complementary knowledge matter</td>
</tr>
<tr>
<td></td>
<td>High supplier competence</td>
<td>MSTQ are perhaps less crucial</td>
</tr>
<tr>
<td></td>
<td>High complexity</td>
<td>Education, training organizations matter</td>
</tr>
<tr>
<td>4 Captive</td>
<td>High complexity</td>
<td>MSTQ organizations matter</td>
</tr>
<tr>
<td></td>
<td>High codification</td>
<td>From 5 and 4 to 2: Thanks to improvement in MSTQ</td>
</tr>
<tr>
<td></td>
<td>High supplier competence</td>
<td>From 5 and 4 to 3: Thanks to improvement in “local” systems</td>
</tr>
<tr>
<td></td>
<td>Low complexity</td>
<td>From 5 and 4 to 2 and 3: Thanks to IS supporting the co-evolution of suppliers and GVC competences</td>
</tr>
<tr>
<td>5 Hierarchy</td>
<td>High complexity</td>
<td>Local R&amp;D organizations may benefit from interaction</td>
</tr>
<tr>
<td></td>
<td>Low codification</td>
<td>MSTQ organizations matter</td>
</tr>
<tr>
<td></td>
<td>Low supplier competence</td>
<td>GVC is expected to improve human technical skills</td>
</tr>
</tbody>
</table>

Source: Authors’ elaboration.
institutions is more common in local clusters, where they support local generation of innovative processes and practices (Bell & Albu, 1999). Several authors show that agglomerations are associated with the relational portions of GC (Schmitz, 2004; Sturgeon, 2003). The existence of these supporting bodies may be an attraction for GVC, promoting relational forms of governance and enabling the transition from hierarchical or captive chains to relational chains (last column in Table 2 the shift from 5 and 4 to 3).

(b) Codification of transactions and IS

In market-based transactions within efficient markets, all the relevant information is conveyed by the market price because the complexity of transactions is low. However, when complexity increases, enterprises in developing countries are unlikely to have the internal skills and capabilities to operate within a context of codified transactions. The IS can simplify their efforts and enhance their effectiveness, especially through the MSTQ infrastructure.

MSTQ institutions form the basic infrastructure for national technological activities. The use of recognized standards and their certification by internationally accredited bodies or GVC leaders, is increasingly demanded in world trade. Standards can reduce transaction costs and information asymmetries between seller and buyer, and minimize the uncertainties with respect to quality and technical characteristics.

The importance of industrial standards has increased and they make a major contribution to the diffusion of technology within and across industries. In developing countries, standards organizations disseminate best practices in an industry by encouraging and helping firms to understand and apply new standards, which is likely in turn to improve suppliers' competences. Redundant experimentation with new technologies is reduced, and enterprises are introduced to a common language that is shared across the international market. This reduces the complexity of inter-firm technical linkages and collaboration.

The existence of well-structured MSTQ institutions and organizations has important implications for GVC, for their governance and for developing countries' innovation and technology systems. They make the handling of complex transactions and the organization of the GVC web of local relationships easier. In principle, modular and relational chains are more likely to prevail, provided that local suppliers are competent, and understand and use technical codes and standards. The choice of either form may depend on the different degrees of knowledge codifiability.

Standards matter increasingly for natural resource-based activities. In Southern Chile a very successful salmon cluster has been developed since the early 1990s, and in this cluster the process of standards setting and compliance offers remarkable insights (Katz, 2006; Maggi, 2007). Compliance with international standards has allowed the Chilean salmon industry to progress from passive to active learning, with more involvement of local firms as value chain leaders, and suppliers in foreign-led chains (Iizuka, 2009). A meso-level institution, the Association of (Chilean) Salmon Industries, played a crucial role in this process.

An explicit account of the dynamics involved allows a better understanding of the implications of different systems on GVC governance and the opportunities for learning: better MSTQ organizations will enhance the probability of a transition from hierarchical or captive value chains to modular forms of governance (last column in Table 2, the shift from 5 and 4 to 2).

(c) Supplier competence and IS

The IS includes all the institutions and organizations that contribute to improving suppliers' competences. They consist of the organizations responsible for education and technical training, and the set of incentives that induce individuals to invest in improving their knowledge and competence. As suppliers learn and acquire greater competence, GVC governance is likely to change. In very general terms, we would expect that increased capabilities in the supply-base will help to push the architecture of GVC away from hierarchical and captive networks toward more relational and modular chains (Gereffi et al., 2005). However, better capabilities among suppliers are also likely to have an effect on the prevailing mode of value chain governance, and ceteris paribus, enhance learning mechanisms within all value chains, allowing suppliers to benefit more from participation in a value chain.

A co-evolution of suppliers and GVC leaders can be envisaged since if suppliers acquire new competences, then the chain leaders, often buyers, need to change and adapt their core competences to the new governance patterns (Sturgeon & Lee, 2001). In order to support and fit in with the acquisition of new competences by suppliers, chain leaders will need to receive some benefits from these developments (Humphrey, 2006).

The case of the wine industry in South Africa, reported in Ponte and Ewert (2009) is an example. The main foreign market for South African wine is the UK and the way that the GVC is organized has undergone profound changes. Under pressure for shorter lead times, UK agents and marketers have had to increase their control over logistics (some importers are selling to retailers on the basis of delivery from the UK warehouse rather than “free-on-board” export from Cape Town). At the same time, UK agents and marketers have increased their role in product innovation, new packaging, new presentations and styles, while retailers are increasingly becoming shelf-space providers. South African producers' cellars have improved in terms of guaranteed wine quality, and improved capability to innovate production in response to consumer market demand.

In the electronics sector, value chain leaders are happy to outsource increasing amounts of production, including process-related design, to suppliers. In the two electronics clusters of Jalisco (Mexico) and Penang (Malaysia) analyzed by Rasisah (2007), chain leaders encouraged and supported the development of local technical competences. Local human capital and suppliers' competences, and the specific differentiation and division of labor that emerged in Penang and Jalisco, have allowed remarkable integration with multinational corporations and GVC.

Although, initially this generated improved economic and export performance, the lack of technical and R&D scientists and engineers, combined with relatively underdeveloped high-tech and R&D infrastructures in Malaysia and Mexico, have undermined the capacity of multinational corporations and local firms to achieve functional integration. Thus, this has not resulted in the horizontal integration necessary to enter higher value-added segments in value chains.

The cases of the electronics clusters in Malaysia and Mexico point to the difficulties involved in upgrading to high value-added functions. However, there are some examples of success in emerging countries (Schmitz and Strambach, 2009). The most obvious one is software in Bangalore, but there are interesting cases in very different sectors such as the wine industry in Chile. Cusmano, Morrison, and Rabellotti (forthcoming) describe one of the main competitive factors in Chilean wine production, which has a well integrated international GVC,
is the strong link with university research, which has allowed quality upgrade and scaling up in the global wine market. Another example is Tesco in Thailand, which has developed a novel, low build-cost store format that is essentially a small hypermarket core surrounded by a local fresh food vendor market (leased space) and a farming supplies area, in an attempt to circumvent the threat of tightened development control in low-income provincial “up country” towns where conventional large-format hypermarket development is considered infeasible politically and unviable commercially (Coe & Wrigley, 2007).

(d) Learning across different chains (IS can help)

There are some significant learning mechanisms in different value chains. In Taiwan in the 1990s, Taiwanese firms embedded in a developed IS, were frequently participating in more than one GVC (Guerrieri & Pietrobelli, 2006), and leveraged competences across chains (Schmitz, 2006). The same thing happened in the Sinos Valley in Brazil, where suppliers learned and employed various competences through working with two or more value chains (Bazan & Navas-Aleman, 2004).

Public policy can support diversification of value chains and learning across chains. For example, an information-bargaining organization to identify emerging/promising markets and value chain leaders could help by holding information and motivation events, subcontracting exchange schemes, and supplier fairs and exhibitions (Altenburg, 2006).

We have described in this section the multiply ways that IS interact with GVC governance, and suppliers’ learning and innovation. We discussed some possible forms of interaction and mutual effects, issues that further analytical and empirical research could throw further light on. Most importantly, future research could explore systematically the dynamics of GVC and the co-evolution of suppliers and buyers, and of related IS.

4. CONCLUSIONS

Questions have been raised about whether the spatial embeddedness of learning and knowledge creation could be challenged by alternative organizational forms. According to this view, organizational or relational proximity is more important than geographical proximity to support the production, identification, appropriation and flow of tacit knowledge. Thus, multinational firms and GVC with dispersed, but carefully organized knowledge bases and sites of innovation even in developing countries, and use of “communities of practice,” could compensate for lack of geographical proximity.

This paper shows that IS interact with GVC in multiple ways, and influence whether and how developing country firms learn and innovate through entering and interacting in these value chains. The relational proximity created within GVC does not replace, but rather interacts with IS.

The first main conclusion is that the different characteristics of value chains have an impact on the mechanisms of learning prevailing in the chain. In general, LDC firms learn and innovate based on their participation in the GVC because they have to satisfy the product quality, delivery time, process efficiency, environmental, labor and social standards requirements of these chains. The learning mechanisms within GCV vary according to the form of governance that is adopted: they can be the result of pressure to match international standards or may be facilitated by direct involvement of the value chain leaders if the competence of suppliers is low and the risk non-compliance is high. When the actors in the value chain have complementary competences, learning is mutual and based on intense face-to-face interactions.

The second conclusion of this paper is related to the multiple forms of interaction between IS, GVC governance and suppliers’ learning and innovation. On the basis of our model, we would expect a well-structured and efficient IS would help to reduce the complexity of transactions, enabling arms’ length transactions and weaker hierarchical forms of GVC governance. In other words, the risk of falling into a captive relationship, or being acquired by a leader, diminishes with a stronger IS. The less complex the transactions the less is the need for an effective IS, but an effective system also increases the capabilities to cope with complex transactions. The system of organizations in charge of MSTQ plays a central role, and may influence the form of governance adopted for developing country firms.

The third conclusion is that internal governance of the GVC is dynamic and subject to continuous adjustments and changes. We have explored some of these changes. Future research should consider the dynamism of innovation and explore systematically the co-evolution of suppliers and buyers, and the related IS. There is a large body of research showing that buyers have evolving strategies toward their supply chains (Sturgeon & Lee, 2001), and their strategies can differ, for example, in terms of knowledge transfer—some welcome opportunities to transfer parts of their activities to the supply chain, others obstruct this. The type of IS that prevails locally will affect this co-evolution.

Numerous avenues for further research are opened by this study. More quantitative analyzes of value chains, their forms of governance, and their impact on local firms are needed. More analysis of IS in developing countries is also needed, with specific emphasis on the features highlighted in this paper. Studies of the dynamics of GVC, and the policy strategies of developing country governments and suppliers are also required.

NOTES

1. For example, “learning from exporting” (Wagner, 2007), Foreign Direct Investments (FDI) and spillovers and imitation (Barba Navaretti & Venables, 2004; UNCTAD, various years).


5. However, we should stress that in LDC there are huge differences in imitation and technological capacity. A small number of developing countries have begun to make the difficult transition from being economically successful in industrial production to building up innovation capabilities (Schmitz & Strambach, 2009). Thus, China and India, or some
parts of these countries, have very similar IS to those in developed countries and in some sectors are world class standard (Altenburg, Schmitz, & Stamm, 2008).

6. This view of technology system as open and deeply embedded in global flows of knowledge and technology is shared by scholars such as Ernst (2002), who believes that IS theory fails to address the disruptive changes imposed by globalization on the geography of IS.

7. www.globalvaluechains.org provides a synthetic and clear presentation of these concepts.

8. We thank an anonymous referee for pointing this out.

9. Gereffi (1999) introduced the useful distinction between buyer-driven chains, dominated by large retailers, branded marketers, and branded manufacturers and producer-driven chains in which large, usually transnational, manufacturers play the central roles in coordinating production networks.

10. Although we argued in Section 2.1 that technology system is the more accurate term to describe systems in developing countries, for simplicity we use the term IS.

11. The literature on KIBS is vast. Among others, there are Miles (2005), Strambach (2008) and Wood (2002).

REFERENCES


