



University of Oxford

Department of International Development

SLPTMD Working Paper Series

No. 005

**Global Value Chains and Technological Capabilities: A Framework
to Study Learning and Innovation in Developing Countries**

Andrea Morrison

Carlo Pietrobelli

Roberta Rabellotti

Global Value Chains and Technological Capabilities: A Framework to Study Learning and Innovation in Developing Countries *

Andrea Morrison

Department of Economics and
Quantitative Methods, Università
del Piemonte Orientale, Italy

Carlo Pietrobelli

CREI, Università Roma Tre, Italy

Roberta Rabelotti

Department of Economics and
Quantitative Methods, Università
del Piemonte Orientale, Italy

ABSTRACT

This paper presents a critical review of the Global Value Chain literature in light of the “Technological Capabilities” approach to innovation in LDCs. Participation in GVC is beneficial for firms in LDCs, which are bound to source technology internationally. However, the issues of learning and technological efforts at the firm-level remain largely uncovered by the GVC literature. We propose a shift in the empirical and theoretical agenda, arguing that research should integrate the analysis of the endogenous process of technological capability development, of the specific firm-level efforts and of the mechanisms allowing knowledge to flow within and between different global value chains into the GVC literature.

Corresponding author:

Carlo Pietrobelli c.pietrobelli@uniroma3.it ph. +39 06 57067476 Fax +39 06 57067511

* Preliminary drafts of this paper were presented at the PRIN “Dynamic Capabilities between Firm organization and Local Systems of Production” final conference in Bologna, at SPRU, University of Sussex, at Globelics India 2006 and at the UNCTAD Conference in honor of Sanjaya Lall in March 2007. We wish to thank Martin Bell, Paulo Figueiredo, Jorge Katz, Riccardo Leoncini, Sandro Montresor, Rajah Rasiah, and Frances Stewart for their useful comments.

1 Introduction

In these days nobody would resist the contention that learning and innovation are key determinants of competitiveness and growth of nations, regions, clusters and firms. Sometimes, more refined observers would stress that competitiveness is affected by firm-specific attitudes and actions together with the meso and macroeconomic contexts in which firms are inserted. Yet, these ideas need to be integrated and encompassed in a consistent fashion, and this has been achieved only occasionally, and perhaps more effectively by business scholars than by economists.

In developing countries (LDCs), following an established line of research exploring the international sources of development – e.g. learning by exporting, FDI spill-over (Barba Navaretti and Venables, 2004) - the Global Value Chain (GVC) approach has recently shown how international linkages can play a crucial role to access technological knowledge and enhance learning and innovation (Gereffi, 1994 and 1999; Giuliani *et al.*, 2005; Kaplinsky, 2000; Humphrey and Schmitz, 2002 *a* and *b*; Pietrobelli and Rabellotti, 2006).¹

Value chain research explicitly focuses on the nature of the relationships among the various actors involved in the chain, stressing the role that global buyers and producers may play in supporting LDCs' producers learning and innovation activities, and explores their implications for development. The concept of '*governance*' is central to the analysis. At any point in the chain, some degree of governance is required in order to take decisions not only on 'what' or 'how' a good/service should be produced but sometimes also 'when', 'how much' and even 'at what price'. In this literature, governance is more than only coordination, as the proactive involvement and participation of all the actors within the value chain is crucial. Governance may occur through arm's-length market linkages or non-market relationships.²

The final aim of this literature is indeed to explore if and how globalization – and the specific form it takes within GVCs – may foster industrial development and innovation in emerging

¹ As initially defined by international business scholars, a value-added chain is “the process by which technology is combined with material and labor inputs and then processed inputs are assembled, marketed and distributed. A single firm may consist of only one link in this process, or it may be extensively vertically integrated...” (Kogut, 1985). In this literature, the key issues regard which activities and technologies a firm keeps in-house and which are outsourced to other firms, and where the various activities are located.

²Humphrey and Schmitz (2000) distinguish among three possible types of non-market governance: network, quasi-hierarchy and hierarchy. They suggest that global buyers tend to hinder the functional and inter-sectoral upgrading. This is confirmed by a number of other studies showing that global buyers have indeed a clear incentive to keep their suppliers dependent on them and not to disclose their core competencies, and accordingly to discourage their attempts at developing strategic competencies, in particular those

countries. In this regard, the notion that is most often used is that of *upgrading*, reflecting the urgent need to move beyond the pursuance of only higher production efficiency. Business scholars use this word extensively (Porter, 1990), economists are more reluctant, and following the principle of specialization and comparative advantage, rather focus their attention on production efficiency. However, given the existence of imperfections and extra-normal rents in international markets, and considering the different dynamic learning opportunities offered by different sectors and management functions, the idea of upgrading to newer sectors and functions is indeed appealing (Pietrobelli and Rabellotti, 2006).

Nevertheless, if the final goal of GVC theory is to explain industrial development and innovation in developing countries in the new context of globalization and transnational inter-firm linkages, how could one avoid a central focus on the endogenous process of technological capability development, on the specific firm-level efforts and on the contextual factors enhancing and/or hindering the process? This is indeed what the well-established tradition of studies on Technological Capabilities (TC) in developing countries (Bell and Pavitt, 1992 and 1995; Dahlman *et al.*, 1987; Evenson and Westphal, 1995, Katz, 1987; Lall, 1987; 1992 and 2001; Pack and Westphal, 1986) proposes, offering a solid theoretical background to integrate the GVC literature and build a theoretical framework to explain industrial development in developing countries. Drawing upon the evolutionary approach of Nelson and Winter (1982), the TC literature claims that technological change is the result of purposeful investments undertaken by firms, and therefore transfer and diffusion of knowledge and technology are effective insofar as they also include elements of capability building.

Moreover, how can GVC literature avoid to fully exploit the theories innovation and knowledge in a developing context? Different degrees of complexity, tacitness and appropriability of knowledge affect the GVC governance structure, the opportunity and speed of upgrading and its intensity and direction. Of course, chain leaders' appropriability strategies also affect producers' learning activities. To this aim, also the TC approach has a lot to teach us in terms of the micro-level processes of learning, capability building and innovation.³

concerning design and marketing (Bazan and Navas-Aleman, 2004; Giuliani *et al.*, 2005; Schmitz and Knorringer, 2000).

³ Incidentally, these strategies can increase the private returns of individual producers who join value chains, but they can also hinder collective learning processes and have negative social effects on the cluster producers belong to.

Notwithstanding the important advances accomplished by the GVC literature, there are a number of issues that need to be further addressed, and the TCs approach may substantially contribute towards this effort. For example, the concept of upgrading and its use is often rather fuzzy: is it a synonym for innovation or rather the result of it? Indeed, an explicit account of TCs may enrich and clarify the GVC approach in this regard. Upgrading at the firm-level (i.e. the pre-conditions, the mechanics, the investments and the strategic behaviour required) is indeed related to capability development, does not need to refer to “climbing up” the value chain but essentially to deepening the capabilities within the same functions of in additional functions along the value chain, explicitly studying how upgrading.⁴

Secondly, a focus on what occurs at the firm level, on the mechanisms of learning, capacity building and innovation, as proposed by the TCs approach, draws the attention to innovation theories and focuses on some key features of knowledge such as codifiability and complexity. This has occurred only recently in GVC studies (Gereffi *et al.*, 2005; Giuliani *et al.*, 2005), showing that differences in knowledge may crucially help to elaborate a theory of value chain governance

Thirdly, stating that *any* form and extent of firms’ insertion into global value chain is beneficial to *all* firms, the GVC literature implicitly assumes away the need for idiosyncratic and firm-specific learning strategies, that is constantly advocated by the TCs approach. Moreover, knowledge does *not* freely flow within a cluster, it is not evenly distributed therein and some (local) actors may enjoy locational or other advantages to get access, absorb, and use knowledge (Giuliani, 2005), and consequently to develop TCs.

In sum, this paper argues and explores how the theory of TCs may usefully integrate the GVC approach, focusing on the endogenous processes of technological capability development, on the specific firm-level efforts and on the mechanisms and forms of governance, allowing knowledge to flow within and between different global value chains, and fostering processes of learning and innovation.

The paper is organized as follows. In the next section we present a brief survey of the TC approach. Section 3 is a critical review of how some selected GVC studies analyze learning, innovation and knowledge diffusion. In this section, we outline a framework of analysis by bringing explicitly the TC framework into the GVC approach. Section 4 summarizes and concludes.

⁴ The work of some scholars has partly recognized this (Bell and Albu, 1999; Caniëls and Romijn, 2003; Schmitz, 2004),

2 Technological Capabilities in Developing Countries

The Technological Capability approach represents a radical alternative to the neoclassical framework, that rests on the well known conceptualization of technology as freely available, absorbed without any risks and costs and efficiently used by every enterprise. As a necessary consequence, learning is not required and any inefficiency is due to government interventions.

In contrast, the technological capabilities literature draws upon the evolutionary approach of Nelson and Winter (1982) and stresses the importance of learning in markets prone to imperfections and populated by firms with a satisfying behavior.⁵ Within this framework, the specificity of the TC approach is its focus on innovation and learning in developing countries. In this section, we summarize the main elements of this approach, that we argue may be usefully integrated into GVCs theory.

Technological Capabilities are the skills - technical, managerial or organizational – that firms need in order to utilize efficiently the hardware (equipment) and software (information) of technology, and to accomplish any process of technological change. Capabilities are firm-specific knowledge, made up of individual skills and experience accumulated over time. Technological change is neither exogenous nor automatic, but rather it is the result of purposeful activities, or “technological efforts” undertaken by firms. Most of the technological efforts do not take place at the frontier of technology, and are required to make explicit the many tacit elements of technology and to access, implement, absorb and build upon the knowledge required in undertaking production.

The transfer of technology to a firm is not like transferring a physical product but it includes essential elements of capability building. Simply providing equipment, operating instructions, patents, designs and blueprints does not ensure that the technology will be effectively utilized. Learning plays a central role in this approach, and its success depends on the efficacy with which markets and institutions function, uncertainty is coped with, externalities tapped, and coordination achieved. If the learning period is long and costs, uncertainties and leakages are very high, coordination with other firms in the supply chain exceptionally difficult, or information, labor and capital markets particularly unresponsive, ‘difficult’ knowledge may not be absorbed – even where it would be efficient to do so.

⁵ Among the main contributions to this approach, see Bell and Pavitt, 1992 and 1995; Dahlman *et al.*, 1987; Enos, 1991; Evenson and Westphal, 1995, Fransman and King, 1984; Figueiredo, 2001; Katz, 1987; Lall, 1992, 1993 and 2001; Pack and Westphal, 1986; Pietrobelli, 1997 and 1998; Wignaraja, 1998.

These processes of mastering, adapting, diffusing technology vary according to firm, sectoral and technological idiosyncrasies. Thus, the properties of knowledge (e.g. complexity, cumulateness, appropriability), the channels of technology transmission (e.g. technical assistance, labor mobility; licenses; turn-key plants) and the firms' differences in absorptive capacity influence the path, speed and direction of learning and innovation (Cohen and Levinthal, 1990; Breschi et al., 2000; Nelson and Winter, 1982).

Following Lall (1992 and 2001) a useful categorization of TC is based on two classificatory principles: the functions they perform and their degree of complexity.⁶ On the basis of the first taxonomy, it is possible to single out "investment", "production" and "linkage" capabilities, which are different although can be inter-related, partly over-lapping and often strongly interdependent among them.

Investment capabilities refer to the skills required before and during the investment: they include the capabilities to assess the feasibility and profitability of a project and to define its detailed specification, as the technology required, the selection of its best sourcing, the negotiations of the purchase (costs and terms) and the recruit and train of the skilled personnel required.

Production capabilities include the skills necessary for the efficient operation of a plant with a given technology, and its improvement over time. Process, product and industrial engineering capabilities are part of this subset. Among the infinite number of operations that require adequate skills are: the assimilation of technology, its adaptation and improvement, the quality control, the inventory control, the monitoring of productivity, the co-ordination of different production stages and departments and finally the process and product innovations related to basic research activity.

Linkage capabilities are required because of high transaction costs in inefficient markets, where the setting up of extra-market linkages often corresponds to an efficient and rational strategy. Therefore, special skills are needed to establish technology linkages among enterprises, between them, with service suppliers and with science and technology institutions.

In each of the category described above there are TCs with different degrees of technological complexity. These are used for routine, adaptive and replicative activities or for innovative

⁶ The complexity and the variety of TCs does not pretend to be portrayed exhaustively here. Other categorisations have been proposed by Bell and Pavitt, 1995, Dahlman *et al.*, 1987, Enos and Park, 1988, Figueiredo, 2002, Katz, 1987.

and risky actions. The different degrees of complexity of technological capabilities indeed explain the diverse levels of industrial performance across countries (Lall, 1990; Pietrobelli, 1998). Besides, the approach does not presume that all firms will necessarily build up their capabilities in a linear sequenced process, neither it does imply that firms will start and end at the same stages (Figueiredo, 2006).

The policy implications of this approach are straightforward: policies are needed at the firm-level to support the building and strengthening of technological capabilities. Clusters, (global) value chains, production networks and other forms of industrial organization may influence TCs to a different extent in different circumstances, but firm-level efforts to build and improve TCs are the *sine qua non* of industrial development (Lall, 2001), and need to be integrated in the analysis of the effects of the various forms of industrial organization in developing countries.

3 Learning and innovation in GVCs: a critical review of some selected studies

In this section we attempt to exploit the analytical framework of TCs to study technology and innovation in a GVC context. Indeed, the original contribution of this paper is to reconsider the GVC literature in order to investigate how knowledge generation, diffusion processes and building up of TC capabilities occur in GVCs. This effort explicitly hinges on the TC literature, and Table 1 sketches the main categories and issues we intend to analyze within the GVC context. These cover most of the relevant dimensions outlined by the evolutionary and TC literature on innovation and learning at the firm-level.

Table 1: The framework of analysis

Key issues in the TC approach	Relationships with <i>governance and upgrading in the GVC</i>
1. Knowledge features relevant for transfer (i.e. complexity, tacitness appropriability)	Different degrees of complexity and tacitness of knowledge, combined with different TCs and different sources of technological knowledge affect: <ul style="list-style-type: none"> ▪ the GVC governance structure (relational vs. captive governance): two-way relationship between GVC governance and TCs; ▪ the opportunity/speed of upgrading (localized learning; absorptive capacity); ▪ the intensiveness/direction of upgrading (active vs.
2. Nature of TCs in firms (i.e. investment, production and linkage capabilities)	
3. Firms efforts and acquisition of TCs in firms (internal and external sources and channels of knowledge)	

All these elements have deep implications not only for firms' upgrading but also in turn affect GVCs governance and strategies. In other words, the direction of causality is two-way. Thus, for example, we may expect that a higher (lower) degree of knowledge complexity will

induce global buyers to establish closer (more distant) relationships with local producers, and consequently contribute to the emergence of specific modes of governance (more relational or more captive). For example in modular systems the greater codifiability of relatively simple technological processes may often induce hierarchical and distant relationships, like in third tier car components producers in Mexico (Lara *et al.*, 2005). Similarly, the absorptive capacity of local producers may affect GVCs opportunities to convey information and knowledge and provide opportunities for learning. Thus, we may expect GVC leaders searching for efficient and capable local producers and select them accordingly, like for many electronics GVCs in East Asia (Ernst *et al.*, 1998; Guerrieri *et al.*, 2001). Looking at the same issue from the perspective of a developing country's suppliers implies that different degrees of absorptive capacity allow firms to identify and explore close/distant knowledge and technological channels to a different extent. In turn, this contributes to explain why firms embedded in similar GVC may upgrade at different rates or following different patterns.

Given that the GVC literature encompasses a wide range of issues and disciplines rooted in rather different theoretical backgrounds, we have conducted our analysis on some selected papers⁷ within this burgeoning literature. These include the most influential contributions on GVCs in developing countries, and their effects on firms' upgrading.⁸ All the studies under analysis interpret the concept of *upgrading* in terms of improvements in either products, processes or functions, and analyze to what extent different patterns of governance contribute to reinforce, or conversely hamper, upgrading in firms and clusters. The studies share some consensus on the effect that different modes of governance would have on upgrading.

In terms of the *unit of analysis* adopted, the studies differ to a large extent, ranging from clusters to industries and nations. The individual firm is never the central focus, although the majority of studies implicitly assume this dimension into the analysis.

From a *geographical* point of view, the studies cover a wide and differentiated set of experiences of GVC in developing countries. Some focus on Newly Industrializing Countries (NICs), such as Brazil, Mexico and Taiwan (Bair and Gereffi, 2001; Gereffi, 1999; Kishimoto, 2004; Quadros, 2004), others are more concerned with countries at a lower stage of development (Barnes and Kaplinsky, 2000; Gibbon, 2003; Gibbon and Ponte, 2005; Nadvi, 2004).

⁷ The complete list of all the studies analyzed is presented in the Appendix.

⁸ A useful source of information about this approach is the website of the Global Value Chain Initiative at <http://www.globalvaluechains.org>.

For the sake of simplification, we suggest to identify two different “schools” or approaches within the broad GVC literature (Table 2): the *internationalist* approach, which includes the North-American school on GVCs, well represented by Gereffi and some European-based scholars as Kaplinsky and Gibbon and colleagues at the Danish Institute for International Studies, and the *industrialist* approach, mainly represented by Humphrey, Schmitz and colleagues at the Institute of Development Studies, at the University of Sussex. The labels proposed - *internationalist* and *industrialist* - roughly identify the early background and/or the methodology of research prevalent in each approach: *internationalists* privilege a macro perspective, both in terms of level of analysis and of policy focus; conversely the *industrialists* adopt a micro founded framework of analysis with a policy focus oriented towards local and cluster development.

Table 2: Different GVC schools

	<i>Internationalists</i>	<i>Industrialists</i>
<i>Main focus</i>	GVCs governance and upgrading mainly in LDCs	GVCs governance and upgrading mainly in LDCs
<i>Methodology</i>	Macro approach Industry level data/trade data	Micro approach Case studies, qualitative data
<i>Policy focus</i>	International division of labour, role of bilateral/multilateral trade agreements, FDI	Competitiveness of clusters, local and cluster development policies
<i>Theoretical background</i>	International economics, political economy, TNC theory	Industry studies, local development, cluster studies

This classification is helpful to highlight diversities between groups and similarities within each class, although we are aware that differences can be found within each group and the two approaches often overlap, given that scholars of both schools substantially share similar thinking and frequently interact among each other, as exemplified by several co-authored papers. Thus, it is worth stressing that boundaries between these groups are rather loose, but the grouping we propose may serve the purpose of an expositional device. Nevertheless, what clearly marks the difference between them is the method of inquiry: the *internationalists* mostly concentrate on the industry as a whole, while the *industrialists* mainly investigate specific clusters, and adopt a case-study methodology.

3.1 Upgrading and/or innovation: synonymous or different concepts?

The concept of “upgrading” has its origin in international trade theory where it is used to indicate a shift towards a specialization in higher value-added goods *within the same sector* in

studies on the dynamics of countries' specialization. This is different from diversification, i.e. specialization in new areas of comparative advantage *in different sectors* (Guerrieri *et al.*, 2001). However, this notion hardly translates into a useful definition at the firm-level, and it does not reflect the current use of this term in most economics and management literature.⁹

In the studies examined the concept of upgrading suffers from some logical contradictions: it is used as a synonym for innovation, yet it is also intended as the outcome of an innovation process.¹⁰ Thus, the two concepts, upgrading and innovation, frequently overlap and are interchangeably used, although the innovation process itself is never directly investigated in this literature.

Indeed, in many empirical studies of upgrading there is a mixing up of causes and effects. Although some recent contributions advocate that upgrading needs investments and efforts at the firm level (Kishimoto, 2004; Schmitz and Knorringa, 2000; Schmitz, 2004), most of the empirical analyses lack a systematic attempt to investigate learning and innovation at the firm and cluster level. When upgrading is identified, it is often stressed that this is the outcome of some activity aimed at building capacity; yet this activity is at best only mentioned and never fully examined. Such an attitude hampers an analytical treatment of the concept and besides it may lead to misleading policy suggestions, as it assumes the presence of upgrading whenever a “good” outcome emerges from a buyer-producer interaction.¹¹ Moreover, if upgrading is crudely defined as an increase in per-unit value of products, then it may be the result of various forms of innovation but also of cost reductions, like for example by squeezing wages, itself a short-term and vulnerable strategy insofar as lower-wage firms and countries continuously emerge in international markets.

In light of all these considerations, we argue that it is advisable to stick to the concept of innovation, whenever it produces an increase in the value added; indeed innovation is

⁹ In this literature, the use of this concept clearly has its merits, as it represents a useful sophistication from the mere notion of production efficiency, to include product diversification, the acquisition of new skills and capabilities for different functions and even sectors, and so on (Porter, 1990, Pietrobelli and Rabellotti, 2006).

¹⁰ An exception is in Kaplinsky and Morris (2001), in their view: “the concept of upgrading (as distinct from innovation) explicitly recognizes relative endowments, and hence the existence of rent (...). Thus innovation has to be placed in a relative context – how fast compared to competitors - and this is a process, which can be referred to as one of upgrading.”(37).

¹¹ This incongruence is partly recognized by the GVC literature, for example Meyer-Stamer *et al.* (2004) comment that “...at first glance the issue of upgrading appears to be straightforward enough. For a firm, upgrading means getting better-producing better products and producing them in a more efficient way. However, things are more difficult than that”(328) and they add that the GVC literature has “to rethink the concept of upgrading and acknowledge that it must be a relational category” (330).

affected by the level and depth of TCs, together with the industrial and organizational context in which firms in developing countries are inserted.

3.2 Knowledge features and transfers in GVCs

As already emphasized in the Introduction, a more explicit reference to innovation allows to stress that differences in codifiability, complexity and tacitness may influence how knowledge is transferred within GVCs and affect the balance of power and the patterns of governance. This implies saying that local producers face several obstacles, besides power asymmetries, when dealing with external sources of knowledge. Although this latter point has been partly recognized by the GVC literature (Schmitz, 2004), we claim that it requires further investigation: first, because it may be that most of the upgrading activities supported by buyers are more related to their appropriability strategies (e.g. to reduce leakages and to speed up process or product development, like in the shoe cluster in Brazil, Bazan and Navas-Aleman, 2004) rather than to provide innovation opportunities to local producers and second, because the nature of knowledge changes along the value chain, hence absorption capabilities of local producers need to change accordingly.

Most of the studies considered admit the existence of factors binding the spread of knowledge within GVCs and influencing their pattern of governance. In particular, the studies within the *industrialist* approach often mention the presence of hampering factors like the power asymmetries emerging out of buyer-driven relationships: “power asymmetry is central to value chain governance. That is, there are key actors in the chain who take responsibility for the inter-firm division of labor, and for the capacities of particular participants to upgrade their activities” (Kaplinsky and Morris, 2001: 29). Chain leaders are those who coordinate and govern the GVC¹², whose members, in many respects, depend upon them for setting up their own strategies. GVCs are shaped by governance structures (e.g. arm's length relations, quasi-hierarchy, networks), which define how local producers participate to the distribution of rents produced in the value chain.

Clearly, “buyers do not always provide support for this upgrading” (Humphrey and Schmitz, 2004: 358). In a study on the shoe sector in various countries, Schmitz and Knorrinda (2000) stress the links between GVC leaders and upgrading, looking at the obstacles and enabling conditions affecting the buyer-producer relation. They note that “the problem is that

¹² Kaplinsky and Morris notice that different actors are engaged in the coordination and management of the value chains. These nodal points may change over time, and the power over the chain can be exercised in

marketing and often design, are part of the buyers' own guarded core competence" so, they conclude that "there is conflict", and this is particularly evident in non production activities, where "one would therefore not expect the lead firm to share their core competence with others in the value chain" (197). In the same vein, Bazan and Navas-Aleman (2004) and Navas-Aleman (2006), studying the shoe cluster of Sinos Valley in Brazil, observe that "buyers are the undisputed leaders in the chain, exerting control over intermediaries, local producers and often input suppliers as well" (115). Furthermore, the authors write that "buyers have resisted sharing their knowledge on higher valued added activities such as design, branding, marketing and chain coordination" (115). Therefore, it is the asymmetry of power between them and local producers that often prevents buyers from supporting local suppliers' upgrading.

However, this is not always the case, and in other studies the emphasis is on how global leaders transfer knowledge and information to local producers. For example in a study on the Taiwanese ICT industry, Poon (2004) notes that: "Taiwanese suppliers gradually upgraded their technological capabilities through technology transfer and knowledge diffusion (by playing the OEM/OBM role for network flagships)." (134). Further on this point, she argues that knowledge spillovers have been quite pervasive in the industry as a whole, in fact "various type and levels of technological knowledge and skills absorbed from network flagships by the first tier (...) were then diffused to smaller firms, resulting in the upgrading of all manufacturers operating within the IT Global Production Network." (134). Similar patterns of diffusion have been envisaged also by Gereffi (1994) in his seminal work on various Asian countries.

The evidence presented above is useful to single out the main regularities in GVC patterns of governance, but it should not be given a normative meaning or even used (or misused) to draw policy implications. That is, it cannot be assumed that the specific governance structure is the *only* determinant of the leaders' inherent ability or interest to convey knowledge to local producers and provide learning opportunities. The latter technological efforts and absorption capabilities are also crucial, and the GVC literature often underplays them, and with a high dose of determinism suggests the idea that knowledge transfers and upgrading are influenced mainly by the institutional settings, with GVC structures and chain leaders' strategies setting the pace and direction of knowledge flows and upgrading (either in favor or against the interests of local producers). Indeed, although less frequent in LDCs, network-

different ways: those who are "ensuring consequences along the chain" can be different from those who are "actively managing or coordinating the operations" (2001: 29-30).

based chains would be more beneficial for upgrading than quasi-hierarchical value chains, which in turn are better than market-based relationships in fostering process and product upgrading.¹³ Little or no regard is explicitly given to other issues like sectoral specificity, knowledge features and to the consequences of these for local firms' upgrading.

In sum, whatever the role played by leaders (i.e. supporters or obstacles to technology transfer and learning), technology and knowledge transmission – and their effectiveness – often appear as exogenous to the local firms involved. That is, they would be either determined by the leader strategy (i.e. GVC governance) or by other forces like for example clusters' external economies and collective efficiency. The level of the firm and the differences in technological regimes and sectoral systems of innovation tend to be overshadowed. Yet, as discussed in Section 2, knowledge features and firms TC-building strategies affect the pace and direction of learning and knowledge absorption. Moreover, innovation theory in the Schumpeterian tradition taught us that different technological regimes showing different combinations of complexity and appropriability of knowledge, set the conditions in which firms can absorb and transfer it (Malerba and Orsenigo, 1993). Thus, for example we may claim that the higher the complexity of knowledge, the greater the need for integrated forms of governance/interaction. On the other hand, simple technology may be easily transferred/absorbed through market based relationships.

It is worth to point out that we do not underplay the importance of 'conflicts', power asymmetries and GVC governance in knowledge transfers. On the other hand, this dimension was notably weak in the TC literature. All these elements should be combined within a framework where firm-level dimensions as well as technological regimes are also included in order to explain how knowledge is transferred within GVCs and how it can be used.¹⁴

3.3 GVCs and technological capabilities: nature and modes of acquisition

Firm-level analyses of the learning and innovation processes in local SMEs and of their technological capabilities, although often cited as important, do not constitute a core issue in the GVC studies reviewed. Most papers mention them but do not address the details of their nature, of their dynamics and of their acquisition. Thus for example, in summing up the main results of an extensive research project on clusters and GVCs, Schmitz (2004) stresses that upgrading “requires continuous investment by the local firms themselves in people,

¹³ Network-based chains would “support an open-ended upgrading path” (Humphrey and Schmitz, 2004).

¹⁴ Gereffi *et al.* (2005) have made a recent interesting effort to incorporate knowledge features in their theoretical framework. We will further discuss this issue later.

organization and equipments” (356), probably having in mind some notion of technological capabilities. Along the same lines, Kishimoto (2004) points out the importance of pre-existing capabilities in sustaining functional upgrading in the Taiwanese computer industry. He observes that: “Taiwanese producers already possessed basic production skills and some design capabilities” and that “holding enough technological capability is a necessary condition for getting orders” (Kishimoto, 2004: 247).

The issue of capability is somehow implicit also in the early internationalists studies on GVCs, for example Gereffi argues that East Asian countries, after entering GVCs as first-tier suppliers of large international buyers, became full-package suppliers and “thereby forged an innovative entrepreneurial capability that involved the coordination of complex production, trade and financial networks” (Gereffi, 1999: 55). According to Gereffi, the transition from OEM (Original Equipment Manufacturer) to OBM (Original Brand Manufacturer) in East Asian countries was made possible by the extensive organizational learning occurred at the firm level, and prompted by the insertion into GVCs. In a recent analysis about the de-commoditization process occurring in the coffee industry, Kaplinsky and Fitter (2004:20) claim that the “more durable and substantial way of enhancing producers incomes lies in the systematic application of knowledge to the coffee value chain”, and that firms need to enhance their ‘branding’ and ‘blending’ capabilities – that is they have to learn how “to promote the virtues of location-specific ‘images’ and tastes” (18).

The above examples hint that although in GVC studies there is the clear perception of the strategic relationship between upgrading and technological capabilities, they generally lack an explicit and detailed focus on TCs. In what follows, we analyze them through the lenses of Lall's categorization of technological capabilities (Lall, 1992 and 2001), addressing two interrelated issues: the *nature* of capabilities and the *acquisition* of capabilities, which can be either internal or external (Romijn, 1999; Bell and Albu, 1999).

The nature of technological capabilities and the limits of the notion of upgrading

Overall, the “industrialists” studies reviewed do not explicitly explore the nature of firms' capabilities in terms of the differences between investment, production, and linkage capabilities. They mainly refer to investments undertaken in the production process, or generally refer to “capabilities” without further categorizations and details. A partial exception is Kishimoto (2004), who explicitly accounts for the importance of capabilities and considers the different forms they may take for the upgrading trajectory in the Taiwanese personal computer value chain. In his study, Kishimoto presents some empirical evidence on the *linkage capabilities* accumulated by local manufacturers through intensive collaboration

with IBM and other TNCs. The recruitment of experienced engineers trained by multinationals is one of the main mechanisms of interaction he mentions. Quoting Ernst *et al.* (1998), Kishimoto also stresses the role of technological and managerial assistance provided by TNCs in improving *production capabilities*, both in the form of skill upgrading and by forcing subcontractors to upgrade product quality.

Moreover, some studies on the adoption of international standards by local producers in LDCs (Nadvi, 2004; Nadvi and Waltring, 2004; Ponte and Gibbon, 2005; Quadros, 2004), also explore the issue of capabilities. Most notably, Quadros (2004) provides detailed evidence on how producers intervene in the production and design phases in order both to accomplish standards' requirements and to collaborate with international buyers. By investigating the organizational setting of the design and engineering phases, he also explains why suppliers have developed rather low capabilities in planning and design, and how this restrained their chances to acquire new technologies from outside.

However, most other studies lack a firm-level (TC-based) focus, and eventually provide some evidence on how chain leaders assist local producers in upgrading (Barnes and Kaplinsky, 2000; Gibbon, 2003; Kaplinsky *et al.*, 2002; Meyer-Stamer *et al.*, 2004; Schmitz and Knorringa, 2000).

The *internationalist* approach provides some reasoning and evidence of *linkage capabilities*. This can be somehow envisaged in Gereffi's analysis of the 'triangle manufacturing' system developed by the Taiwanese firms in the 1990s in order to cope with decreasing profits and pressures from foreign buyers on reducing delivery time (Gereffi, 1994 and 1999). This system, as also stressed by Kishimoto (2004), enhances firms' capability of coordinating, searching and procuring external goods and services.

However, none of the above studies makes explicit reference and explores the vertical dimension of capabilities. Lall (1992) rightly reminds that this is a key element for classifying and assessing the nature of the mechanisms to build capabilities, since it allows to rank them according to their degree of complexity. The perception that the GVC framework considers certain types of capabilities intrinsically superior to others since they allow firms to climb upstream on the value added ladder (e.g. from production to design) is left unexplored.

This is inherently related to the fuzzy notion of upgrading, whose limits have been previously discussed. A vivid way to illustrate this concept has led several authors to write that upgrading within a value chain implies "going up the value ladder", moving away from activities in which competition is of the "low road" type and entry barriers are low. However,

although this description is certainly stunning and eye-catching, and offers some advantages, it is not very accurate. GVCs are hardly so linear as they are often described; indeed, this assumed linearity – often for the sake of simplifying their description - drives the attention away from all the detailed and equally important efforts to build and deepen TCs *at the same stage* of the value chain. We argue that the key issue is not always “functionally upgrading” and moving into more advanced functions “along the value chain”, but often deepening the specific capabilities required to explore new opportunities offered “on the side” of the stage of the value chain where the firm is currently engaged. Moving from natural resources to their exploitation, manufacturing, packaging, distribution and branding is very important and can be described as somehow “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 indeed also important, and clearly requires creation and deepening of higher skills and more complex TCs.

This view is consistent and provides a microeconomic ground for the newly-emerging approach that describes economic development as a process of “self-discovery” (Hausmann and Rodrik, 2003), where the diversification of the productive structure through a process of discovery, often supported by new forms of industrial policy, plays a central role.

As argued before, the studies reviewed say little or nothing about the vertical dimension of TCs and their different levels of complexity: they do not analyze whether the new capabilities are either routine, basic capabilities or rather of higher, innovative and advanced order. Without any clear distinction between the degree of innovativeness of capabilities, that is between the *knowledge using* and *knowledge changing* elements in capabilities (Bell and Albu, 1999), little can be said about the contribution of the chain leaders to strengthening local producers’ capabilities. In addition, in order to explore the dynamics of learning and innovation, it would be desirable to introduce a time dimension, and consequently to conduct longitudinal analyses of these capability building processes.¹⁵

Firms' efforts and acquisition of technological capabilities

Firms acquire technological capabilities getting access to technological knowledge from a variety of possible sources (e.g. FDI, joint ventures, licensing, imported equipment), and integrating it with in-house efforts and costly investments in learning, R&D, technical

¹⁵ Notable efforts in this sense are in Figueiredo (2001 and 2002) and Katz (1987).

assistance. Strategies may differ but need to be internally consistent.¹⁶ Although external sources of knowledge are essential, the creation and improvement of technological capabilities require some previous accumulation of skills, coupled with substantial firm-level efforts.

In the empirical GVC literature, the idea that “technological change is the result of purposeful, well-directed effort conducted inside the firm” (Pietrobelli, 1997: 4) is often implicit in theoretical discussions, but nearly absent in most of the empirical analyses. In most of these studies it is hardly explored what occurs within firms, what makes firms differ even if they belong to the same sector or the same cluster, and how firm-level efforts to develop TCs have added to (or compensated for the lack of) the opportunities offered by GVCs.

In spite of this weakness however, there is some indirect and sketchy discussion over the role of specific actors (mostly GVC leaders) in sustaining local producers' upgrading at the cluster or at the industry level. However, we claim that some studies put an excessive emphasis on the role of external actors. Of course this is partially a consequence of the research agenda set by this literature, which by definition focuses on global actors, but this focus ends up neglecting more careful analyses of in-house domestic technological and learning activities, that explain inter-firm differences in performance.

Thus, some studies notice the importance of learning within domestic markets, in particular for functional upgrading, and outline the viability of a strategy based on “*prior apprenticeship in the national market and ... operating in several chains simultaneously*” (Bazan and Navas-Aleman, 2004: 136). Others stress the role of industry associations and technical schools in enhancing skills and more broadly local capabilities (Meyer-Stamer, 1998, and Meyer-Stamer *et al.*, 2004). Overall, these latter contributions - and with them others in the “*industrialist*” group - pay attention to local sources and in particular to collective actions developed in clusters for sustaining firms' efforts to develop TCs and achieve competitiveness. Nevertheless, none of these authors clearly focuses on the firm-level dynamics leading to TC development.

In the *internationalist* approach detailed references to local actors and their role for upgrading and TC development are indeed less frequent. This is clear in Gereffi (1999: 38), who investigates how GVCs contributed to upgrading processes in the East Asian apparel industry

¹⁶ See Lall (1996) on the different strategies followed by various Asian countries to get access to technology and develop technological capabilities. On this, see also Pietrobelli (2000).

and argues that leading firms (i.e. international buyers) play a prominent role: “*they are the primary sources of material input, technology transfer and knowledge in these organizational networks*”. Similarly, other studies pay attention to the role of international buyers, retailers, branded marketers and intermediaries, but say little on domestic actors, and less about TC development *within* firms’ boundaries (Kaplinsky, 2004; Palpacuer *et al.*, 2005).

Local actors may supposedly play a minor role, but still their analysis would help understand how firms acquire technology from outside, and if and how they are supported in their efforts to develop TCs. Thus, it would be useful to know which actors – firms, business associations or science and technology institutions - are involved, how they do master and adapt foreign technologies, how they influence the level and direction of investments in TCs, and so forth.

Insofar as the objective shared by the different branches of literature considered here is to understand the determinants of innovation and industrial performance in LDCs, then the analysis of indigenous learning, and the firms’ activities related to it, should not be underplayed, and policies should suitably focus on them. Differences in inter-firm (and inter-cluster) performance are in fact strictly related to their ability to build internal domestic knowledge bases, which in turn allows them to access external sources of knowledge, and to exploit them efficiently. Foreign sources of technology are clearly strategic and essential to access technological knowledge, and this makes openness desirable (Bell and Albu, 1999, Giuliani *et al.*, 2005). However, technology selection, adaptation and improvements are not mechanical, straightforward processes, but they require specific activities and investments.

The evidence discussed so far suggests that an incorporation of the analysis of the processes that lead to the creation of TCs, and of their microeconomic foundations, into the GVC framework could substantially improve our understanding. A more comprehensive approach should encompass the analysis of in-house activities, and integrate the process of transfer and acquisition of technologies with the in-house efforts of local producers. Within this framework, the TC approach may powerfully explain upgrading and performance in GVCs.

4. Conclusions and implications for future research

Global value chains represent a new form of industrial organization that is widely diffused in many industries across countries. Therefore, an analysis of its potential implications and consequences for firms in developing countries is of utmost relevance. However, recent research efforts in this direction have not fully clarified how global value chains foster innovation and learning processes in developing countries’ firms. On the one hand, it has often been hinted that entering GVCs causes a sharp and automatic impact, either positive or

negative, on local producers, in a deterministic fashion. On the other hand, the research agenda has focused on how local firms can join value chains, and on the influence of governance structures on upgrading. All this produces a harmful neglect of the analysis of the detailed mechanisms linking value chains with local firms' learning and innovation. The TC literature may usefully remedy this.

It is obviously false that entering global value chains – by itself – will lead to innovation and better industrial performance in developing countries. This is not a mechanistic and risk less process, and local firms need to invest in learning and building technological capabilities to effectively innovate. The direction, extent and strategy of these investments may also vary in relation to features of knowledge such as its degree of complexity, tacitness and appropriability, that in turn affect GVC leaders' strategies, and this has been insufficiently studied so far.¹⁷ At the same time, the GVC approach adds a focus on the role of the balance of power between actors in development that the TC does not have.

The insights offered by the Technological Capabilities approach, discussed at length in this paper, may usefully integrate the GVC approach, providing original conceptual insights to study innovation in a GVC context. This has also potential implications for the definition of upgrading itself, and leads us to question whether this is the relevant concept to apply, or whether we should be still thinking in terms of strengthening and deepening technological capabilities.

There is a wide agenda which future research should address following these considerations. Let us stress only two major points here.

First of all, firm-level surveys and questionnaires should be employed to explore the impact of global value chains on local firms' competitiveness and upgrading. There is an extensive empirical literature on how to measure TCs at the firm-level and how to study their determinants, that could be fruitfully used to this aim.¹⁸ The wealth of surveys and questionnaires increasingly produced, among others, by multilateral organizations, could be exploited to address the issues that are most relevant for developing countries' industrial development along the lines described in this paper.¹⁹ Research should contribute to improve the design of these surveys and help them capturing the relevant issues.

¹⁷A notable exception is Gereffi *et al.* (2005).

¹⁸ See for example the papers in the Special Issue on Technological Capabilities in Developing Countries of the *International Journal of Technology Management* edited by Figueiredo (2006).

¹⁹ See for example the recent attempt to use the existing World Bank firm-level surveys in Pietrobelli and Saliola (2006).

Secondly, these same studies should take a longitudinal approach to analyze TCs accumulation and GVC governance over time. The learning and innovation processes possibly fostered by these inter-firm arrangements and linkages may only be properly studied with a dynamic approach. This would have useful implications for future research and policy design and implementation.

References

- Bair J., Gereffi G. (2001). "Local clusters in global chains: the causes and consequences of export dynamism in Torreon's blue jeans industry", *World Development*, Vol. 29 (11): 1885-1903.
- Barba Navaretti G. and Venables A.J. (2004) *Multinational Firms in the World Economy*, Princeton University Press.
- Barnes J., Kaplinsky R. (2000), "Globalization and the Death of the Local Firm? The Automobile Components Sector in South Africa" *Regional Studies*, Vol. 34(9): 797-812.
- Bazan L., Navas-Aleman L. (2004), "The underground revolution in the Sinos Valley: a comparison of upgrading in global and national value chains", in H. Schmitz (ed.): 110-139.
- Bell, R. M., Albu, M. (1999), "Knowledge systems and technological dynamism in industrial clusters in developing countries", *World Development* 27 (9): 1715-34.
- Bell M.R., Pavitt K. (1992), "Technological Accumulation and Industrial Growth: Contrasts between developed and developing countries", *Industrial and Corporate Change*, 2 (2): 157-210.
- Bell M.R., Pavitt K., (1995), "The Development of Technological Capabilities", in I.U. Haque, Trade, Technology and International Competitiveness, EDI Development Studies, The World Bank, Washington D.C.: 69-101.
- Breschi S., Lissoni F. (2001) "Knowledge spillovers and Local innovation systems: A critical Survey." *Industrial and Corporate Change*, 10 (4): 975-1005.
- Breschi S., Malerba F., Orsenigo L. (2000), "Technological regimes and the Schumpeterian patterns of innovation", *The Economic Journal*, Vol. 110: 388-410.
- Caniëls M, H.A., Romijn (2003), "Firm-level Knowledge Accumulation and Regional Dynamics", *Industrial and Corporate Change*, Vol. 12, No. 6: 1253-1278.
- Cohen, W.M, D.A. Levinthal (1990), "Absorptive Capacity: A new perspective on learning and innovation", *Administrative Science Quarterly*, vol. 35: 128-153.
- Dahlman C., Ross-Larson B., Westphal L.E. (1987), "Managing Technological Development: Lessons from Newly Industrializing Countries", *World Development*, 15, 6: 759-75.
- Enos J. (1991), *The Creation of Technological Capability in Developing Countries*, London: Pinter.
- Enos J. , Park W.H. (1988), *The Adoption and Diffusion of Imported Technology: The Case of Korea*, London: Croom Helm.
- Ernst D., Ganiatsos T., Mytelka L. (eds.) (1998), *Technological Capabilities and Export Performance: Lessons from East Asia*, Cambridge: Cambridge University Press.
- Evenson R.E. and Westphal L.E., 1995, "Technological Change and Technology Strategy", in J. Behrman and T.N. Srinivasan, *Handbook of Development Economics*, Vol.III, Elsevier Science B.V., Chapter 37.
- Figueiredo P.N. (2001), *Technological Learning and Competitive Performance*, Cheltenham: Edward Elgar.
- Figueiredo P.N. (2002), "Does technological learning pay off? Inter-firm differences in technological capability-accumulation paths and operational performance improvement", *Research Policy* 31: 73-94.
- Figueiredo P.N. (2006), "Introduction", Special Issue on Technological Capabilities in Developing Countries, *International Journal of Technology Management*, Vol.36 Nos.1/2/3: 1-13.

- Fransman M., King K. (eds.) (1984), *Technological Capability in the Third World*, London: Macmillan.
- Gereffi G. (1994), “The Organization of Buyer-Driven Global Commodity Chains: How U.S. Retailers Shape Overseas Production Networks”, in G. Gereffi and M. Korzeniewicz (eds.), *Commodity Chains and Global Capitalism*, London: Praeger.
- Gereffi G. (1999), “International trade and industrial upgrading in the apparel commodity chain”, *Journal of International Economics*, Vol. 48: 37-70.
- Gereffi G., Kaplinsky R. (2001), “The value of value chains”, Special issue of *IDS Bulletin*, Vol. 32.
- Gereffi G, J. Humphrey, T. Sturgeon (2005), “The governance of global value chains”, *Review of International Political Economy*, vol.12(1): 78–104.
- Gibbon, P. (2001) ‘Upgrading Primary Products: A Global Value Chain Approach’, *World Development*, vol. 29 (2): 345-363.
- Gibbon P. (2003), “The African growth and opportunity act and the global commodity chain for clothing”, *World Development*, vol. 31 (11): 1809-1827.
- Gibbon P. and Ponte S. (2005), *Trading Down: Africa, Value Chains and the Global Economy*, Philadelphia: Temple University Press.
- Giuliani E. (2005), “When the micro shapes the meso: Learning and innovation in wine clusters”, Dphil thesis, SPRU, Brighton: University of Sussex.
- Giuliani E., Pietrobelli C., Rabellotti R. (2005), “Upgrading in global value chains: lessons from Latin America clusters”, *World Development*, 33, 4: 549-73.
- Guerrieri P., Iammarino S., Pietrobelli C. (2001), *The Global Challenge to Industrial Districts: SMEs in Italy and Taiwan*, Cheltenham, UK and Lyme, US: Edward ELGAR.
- Hausmann, R., D. Rodrik (2003), “Economic Development as Self-Discovery,” *Journal of Development Economics*, 72(2): 603-633.
- Humphrey J., Schmitz H. (2000), “Governance and Upgrading: Linking Industrial Cluster and Global Value Chain Research”, *IDS Working Paper*, No.120, Institute of Development Studies, Brighton: University of Sussex.
- Humphrey J., Schmitz H. (2002a), “How does insertion in global value chains affect upgrading industrial clusters?”, *Regional Studies*, Vol. 36 (9): 1017 – 1027.
- Humphrey J., Schmitz H. (2002b), “Developing Country Firms in the World Economy: Governance and Upgrading in Global Value Chains“, INEF Report, No. 61, Duisburg: University of Duisburg.
- Humphrey, J., H. Schmitz. (2004), “Globalized Localities: Introduction”, In H. Schmitz (ed.) *Local Enterprises in the Global Economy*,. Cheltenham and Northampton:Edward Elgar.
- Kaplinsky, R. (2000), “Globalisation and Unequalisation: What Can be Learned from Value Chain Analysis?”, *Journal of Development Studies*, 37(2): 117-46.
- Kaplinsky R. (2004), “Spreading the Gains form Globalization: What can be learned form value chain analysis”, *Problems of Economic Transition*, vol.47 (2): 74-115.
- Kaplinsky, R., Morris, M. (2001), ‘A Handbook for Value Chain Research’, Institute of Development Studies, University of Sussex and School of Development Studies, University of Natal.
- Kaplinsky R., R. Fitter (2004), “Technology and globalisation :who gains when commodities are de-commodified?”, *International Journal of Technology and Globalisation*, Vol.1(1): 5-28.

- Kaplinsky R., Readman (2005), "Globalisation and upgrading :what can be (and cannot) learnt from international trade statistics in the wood furniture sector" *Industrial and Corporate Change* 14(4): 679-703.
- Kaplinsky, R., Morris, M. Readman (2002), "The Globalisation of Product Markets and Immiserising Growth: Lessons From the South African Furniture Industry" *World Development* Vol. 30 (7): 1159–1177.
- Katz J. (ed.) (1987), *Technology Generation in Latin American Manufacturing Industry*, London Macmillan.
- Kishimoto C. (2004), "Clustering and upgrading in global value chains: the Taiwanese personal computer industry", in H. Schmitz (ed.): 233-264.
- Kogut B. (1985), "Designing global strategies: comparative and competitive value-added chains", *Sloan Management Review*, 2(4): 15-28.
- Lall S. (1987), *Learning to Industrialize: The Acquisition of Technological Capability by India*, Macmillan, London.
- Lall S. (1990), *Building Industrial Competitiveness: New Technologies and Capabilities in Developing Countries*, OECD Development Centre, Paris.
- Lall S. (1992), "Technological Capabilities and Industrialization", *World Development*, 20 (2): 165-186.
- Lall S. (1993), "Understanding Technology Development", *Development and Change*, 24(4): 719-53.
- Lall S. (1996), *Learning from the Tigers*, Macmillan: London.
- Lall S. (2001), *Competitiveness, Technology and Skills*, Cheltenham. Edward Elgar.
- Lara A., Trujano G, Garcia-Garnica A. (2005), "Modular production and technological upgrading in the automotive industry: a case study", *International Journal of Automotive Technology and Management* Vol. 5 (2): 199 – 215.
- Malerba, F., Orsenigo, L., 1993. Technological regimes and firm behavior. *Industrial and Corporate Change* 2, pp.45-71.
- Meyer-Stamer, J. (1998), "Path Dependence in Regional Development: Persistence and Change in Three Industrial Clusters in Santa Catarina, Brazil." *World Development*, vol.26(8): 1495–1511.
- Meyer-Stamer J., Maggi C., Siebel S. (2004), "Upgrading in the tile industry of Italy, Spain and Brazil: insights from cluster and value chain analysis", in H. Schmitz (ed.): 174-199.
- Nadvi K., 2004, "The effect of global standards on local producers: a Pakistani case study", in H. Schmitz (ed.): 297-325.
- Nadvi K., Waltring F., 2004, "Making sense of global standards", in H. Schmitz (ed.): 53-94.
- Navas-Aleman, L. (2006), 'Opportunities and obstacles for industrial upgrading of Brazilian footwear and furniture firms: a comparison of global and national value chains', Doctoral thesis, Brighton: Institute of Development Studies, University of Sussex.
- Nelson R., Winter S. (1982), *An evolutionary theory of economic change*, Harvard University Press.
- Pack H., Westphal L.E., 1986, "Industrial Strategy and Technological Change", *Journal of Development Economics*.
- Palpacuer F., Gibbon P. , Thomsen L (2005), "New challenges for developing country suppliers in global clothing chains: a comparative European perspective" *World Development*, Vol. 33 (3): 409-430.

- Pietrobelli, C. (1997), 'On the Theory of Technological Capabilities and Developing Countries' Dynamic Comparative Advantage in Manufactures', *Rivista Internazionale di Scienze Economiche e Commerciali*, Vol.XLIV, No. 2, June.
- Pietrobelli C. (1998), *Industry, Competitiveness and Technological Capabilities in Chile. A New Tiger from Latin America?*, London and New York: Macmillan and St.Martin's.
- Pietrobelli C. (2000), "The Role of International Technology Transfer in the Industrialisation of Developing Countries", in Elena M. and Schroerer D. (eds.) *Technology Transfer*, Aldershot UK, Burlington USA: Ashgate.
- Pietrobelli C., Rabellotti R. (2006), *Upgrading to Compete. Global Value Chains, Clusters and SMEs in Latina America*, Cambridge Ma.: Harvard University Press.
- Pietrobelli C., Saliola F. (2006), "Power Relationships along the Value Chain: Multinational Firms, Global Buyers, and Local Suppliers' Performance", CREI Working Paper No.2, University of Rome 3, <http://host.uniroma3.it/centri/crei/pubblicazioni.html> .
- Ponte S., Gibbon P (2005), "Quality standards, conventions and the governance of global value chains", *Economy & Society*.
- Poon T. Shuk-Ching (2004) "Beyond the global production networks: a case of further upgrading of Taiwan's information technology industry" *International Journal of Technology and Globalisation (IJTG)* Vol 1 (1): 130-144.
- Porter, M. (1990), *The Competitive Advantage of Nations*, Free Press.
- Quadros R. (2004), "Global quality standards and technological upgrading in the Brazilian auto-components industry", in H. Schmitz (ed.): 265-298.
- Romijn, H. (1999). *Acquisition of technological capability in small firms in developing countries*, London: Macmillan.
- Schmitz H., (ed.) (2004), *Local Enterprises in the Global Economy*, Cheltenham: Edward Elgar.
- Schmitz H., Knorringa P. (2000), "Learning from Global Buyers", *Journal of Development Studies* Vol.37 (2): 177 –205.
- Wignaraja G. (1998) *Trade Liberalization in Sri Lanka: Exports, Technology and Industrial Policy*, London: Macmillan and New York: St.Martins Press.

Appendix. The GVC studies reviewed

Authors and studies	Main focus and results	Extent/Depth of Analysis of	
		Knowledge features*	TCs, nature & acquisition*
	Industrialists		
L.Bazan and L.Navas-Aleman (2004) – and Navas-Aleman (2006) Footwear industry in the Sinos Valley cluster (Brazil)	Cluster study: clusters' insertion into GVC and upgrading strategies. Functional upgrading prevails in market based value chains. Process and product upgrading are supported by quasi-hierarchical value chains.	LOW	MED-LOW
C.Kishimoto (2004) Computer industry, Taipei and Hsinchu area (Taiwan)	Cluster study :it adopts an historical perspective to study the upgrading process in the industry. There is an explicit distinction between production and knowledge systems. Product and functional upgrading are widely diffused in the cluster.	MED-LOW	MEDIUM
J. Meyer-Stamner, C. Maggi, S. Seible (2004) Tile industry, clusters in Italy, Spain, Brazil	Cluster study :analysis of the insertion of clusters into GVC and its effect on local collective action. Besides cluster and GVC approaches, it highlights the importance of sectoral factors.	LOW	MED-LOW
R. Quadros (2004) Automobile component industry, San Paolo (Brazil)	Cluster study :role of global quality standards for the upgrading strategies of local manufacturers and their effects on local and international linkages. Diffusion of global standard has improved local suppliers production processes but not engineering capabilities.	LOW	MEDIUM
K. Nadvi (2004) Surgical instrumental industry, Sialkot (Pakistan)	Cluster study: analysis of the adoption of global standards by local producers. Quality standards favored upgrading but did not extend to subcontractors. Besides, they seem to have weakened relationships with global buyers.	MED-LOW	MED-LOW
H. Schmitz and P. Knorringa, (2000) Footwear industry in China, India Brazil, Italy	Industry study: empirical analysis from a buyer perspective. It examines the role of buyers in fostering/hindering learning opportunities of producers. Buyers do not search only price competitiveness, but also quality, flexibility etc.	LOW	MED-LOW
T.Shuk-Ching Poon (2004) ICT industry in Taiwan.	Industry study: analysis of GVC as channels of knowledge and sources of upgrading. There is substantial evidence of upgrading fostered by GVC. Local capability is a precondition for industrial upgrading.	LOW	MEDIUM
	Internationalists		
R. Kaplinsky (2000) and (2004) Canned deciduous fruit and car component sector, South Africa.	Industry study: analyses of the dynamics of rents distribution along the GVC in different sectors. GVC approach allows to identify the main drivers governing these chains and who accrue major benefits from them.	LOW	LOW
J. Barnes and R.Kaplinsky (2000) Car component sector, South Africa.	Industry study: it examines how local component producers respond to increasing external competition. MNC increasingly integrated their local subsidiaries, reducing the space for locally owned suppliers.	LOW	MED-LOW

R Kaplinsky and R.Fitter (2004) Horticulture and coffee sectors in LDCs.	Industry study: it examines how LDCs can exploit changes in global market by entering new phases of the GVCs. Investing in knowledge is a winning strategy to accrue innovation rents.	LOW	MED-LOW
R Kaplinsky, M.Morris and Readman (2002) Furniture industry, South Africa	Industry study: role of buyers in fostering upgrading for their local suppliers. Production capabilities are increasingly widespread while buyers erect entry barriers for high value added activities.	LOW	MED-LOW
R Kaplinsky and J.Readman (2005) Furniture sector, comparative study	Industry study: measurement of comparative performance of several countries using data on unit prices and market share. Analysis of upgrading and downgrading trends.	LOW	LOW
G. Gereffi (1999) Apparel industry , East Asia	Industry study: analysis of the insertion and evolution of East Asian countries in GVC. Theoretical distinction between different chains (buyer vs. producers driven). Core-periphery patterns emerges in the US apparel suppliers system.	LOW	LOW
G. Gereffi, J Humphrey and T. Sturgeon (2005) Apparel, bicycle, electronics and fresh vegetables industries. LDCs	Industry study: governance patters differ according to three main theoretical perspectives: transaction costs; production networks; technological capabilities. Three factors allows to build a GVC theory: complexity of transactions; codifiability of transactions; capabilities of suppliers.	MEDIUM	MEDIUM
J. Bair and G. Gereffi (2001) Apparel sector, Mexico.	Clusters study: role of GVC in sustaining local upgrading. The arrival of global buyers has prompted local upgrading at industry and firm level. Institutional failures impeded further spill-over.	LOW	MED-LOW
P. Gibbon (2001) Primary sector, Tanzania	Industry study: upgrading in primary sector GVC. It suggests a new agenda for upgrading strategies and policy intervention.	LOW	MED-LOW
P. Gibbon (2003) Clothing sector, sub-Saharan Africa	Industry study: response of clothing sector to new trade agreements (African Growth and Opportunity Act) and upgrading consequences for local producers.	LOW	LOW
F. Palpacuer, P. Gibbon and L. Thomsen (2005) Clothing sector in European countries	Industry study: to what extent clothing GVCs offer upgrading opportunities for DCs. Analysis of the buyers strategies. They raise doubts about the worthiness of entering GVCs for DCs.	LOW	MED-LOW
(*) High: fully examined; Medium: partially examined; Med-Low: mentioned and sketchily analyzed; Low: only mentioned or not taken into account at all			