

The governance of global value chains

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ABSTRACT

This article builds a theoretical framework to help explain governance patterns in global value chains. It draws on three streams of literature – transaction costs economics, production networks, and technological capability and firm-level learning – to identify three variables that play a large role in determining how global value chains are governed and change. These are: (1) the complexity of transactions, (2) the ability to codify transactions, and (3) the capabilities in the supply-base. The theory generates five types of global value chain governance – hierarchy, captive, relational, modular, and market – which range from high to low levels of explicit coordination and power asymmetry. The article highlights the dynamic and overlapping nature of global value chain governance through four brief industry case studies: bicycles, apparel, horticulture and electronics.

KEYWORDS

Global value chains; governance; networks; transaction costs; value chain modularity.

The world economy has changed in significant ways during the past several decades, especially in the areas of international trade and industrial organization. Two of the most important new features of the contemporary economy are the globalization of production and trade,¹ which have fueled

the growth of industrial capabilities in a wide range of developing countries, and the vertical disintegration of transnational corporations, which are redefining their core competencies to focus on innovation and product strategy, marketing, and the highest value-added segments of manufacturing and services, while reducing their direct ownership over 'non-core' functions such as generic services and volume production. Together, these two shifts have laid the groundwork for a variety of network forms of governance situated between arm's length markets, on the one hand, and large vertically integrated corporations, on the other. The purpose of this article is to generate a theoretical framework for better understanding the shifting governance structures in sectors producing for global markets, structures we refer to as 'global value chains'. Our intent is to bring some order to the variety of network forms that have been observed in the field.²

The evolution of global-scale industrial organization affects not only the fortunes of firms and the structure of industries, but also how and why countries advance – or fail to advance – in the global economy. Global value chain research and policy work examine the different ways in which global production and distribution systems are integrated, and the possibilities for firms in developing countries to enhance their position in global markets. One of our hopes is that the theory of global value chain governance that we develop here will be useful for the crafting of effective policy tools related to industrial upgrading, economic development, employment creation, and poverty alleviation.

1. FRAGMENTATION, COORDINATION, AND NETWORKS IN THE GLOBAL ECONOMY

For us, the starting point for understanding the changing nature of international trade and industrial organization is contained in the notion of a value-added chain, as developed by international business scholars who have focused on the strategies of both firms and countries in the global economy. In its most basic form, 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: 15). The key issues in this literature are which activities and technologies a firm keeps in-house and which should be outsourced to other firms, and where the various activities should be located.

Trade economists are also concerned with how global production is organized. Arndt and Kierzkowski (2001) use the term 'fragmentation' to describe the physical separation of different parts of a production process, arguing that the international dimension of this separation is new. Fragmentation allows production in different countries to be formed into

cross-border production networks that can be within or between firms. Feenstra (1998) takes this idea one step further by explicitly connecting the 'integration of trade' with the 'disintegration of production' in the global economy. The rising integration of world markets through trade has brought with it a disintegration of multinational firms, since companies are finding it advantageous to 'outsource' an increasing share of their non-core manufacturing and service activities both domestically and abroad. This has led to a growing proportion of international trade occurring in components and other intermediate goods (Yeats, 2001).³

If production is increasingly fragmented across geographic space and between firms, then how are these fragmented activities coordinated? For Arndt and Kierzkowski, the options are clear: 'Separability of ownership is an important determinant of the organizational structure of cross-border production sharing. Where separation of ownership is not feasible, multinational corporations and foreign direct investment are likely to play a dominant role. Where it is feasible, arm's-length relationships are possible and foreign direct investment is less important' (Arndt and Kierzkowski, 2001: 4).

This binary view of how global production might be organized, either through markets or within transnational firms, is explained by transaction costs economics in terms of the complexity of inter-firm relationships and the extent to which they involve investments specific to a particular transaction – asset specificity (Williamson, 1975). Arm's-length market relations work well for standard products because they are easily described and valued. Coordination problems are reduced not only because their ease of description makes contracts simple to write, but also because standard products can be produced for stock and supplied as needed. At the same time, because standard products are made by a variety of suppliers and bought by a variety of customers, problems arising from asset specificity are low.

Conversely, the transaction costs approach offers various reasons why firms will bring certain activities in-house. First, the more customized the product or service, the more likely it is to involve transaction-specific investments. This raises the risk of opportunism, which either rules out outsourcing altogether, or makes it more costly because safeguards have to be put in place. Second, even without opportunism, transaction costs increase when inter-firm relationships require greater coordination. For example, non-standard inputs and integrated product design architectures involve more complex transfers of design information and therefore intense interactions across enterprise boundaries. Integral product architectures are more likely to require non-standard inputs, and changes in the design of particular parts tend to precipitate design changes in other areas of the system (Fine, 1998; Langlois and Robertson, 1995). Similarly, coordination costs increase for parts whose supply is time-sensitive, as separate

processes have to be better coordinated in order to synchronize the flow of inputs through the chain.

Nevertheless, recognizing the importance of transaction costs need not lead to the conclusion that complex and tightly coordinated production systems always result in vertical integration. Rather, asset specificity, opportunism, and coordination costs can be managed at the inter-firm level through a variety of methods. Network actors in many instances control opportunism through the effects of repeat transactions, reputation, and social norms that are embedded in particular geographic locations or social groups. Network theorists (e.g., Jarillo, 1988; Lorenz, 1988; Powell, 1990; Thorelli, 1986) argue that trust, reputation, and mutual dependence dampen opportunistic behavior, and in so doing they make possible more complex inter-firm divisions of labor and interdependence than would be predicted by transaction costs theory.

Furthermore, the literature on firm capabilities and learning, which has its roots in the resource view of the firm pioneered by Penrose (1959), provides other reasons why firms are prepared to buy key inputs in the face of asset specificity and therefore construct relatively complex inter-firm relationships. According to Penrose, how and whether firms can capture value depends in part on the generation and retention of competencies (that is, resources) that are difficult for competitors to replicate. In practice, even the most vertically integrated firms rarely internalize all the technological and management capabilities that are required to bring a product or service to market. Transaction cost economics acknowledges this fact by employing the variable of frequency. If an input, even an important one, is required infrequently, then it will likely be acquired externally. This is essentially an argument about scale economies. The literature on firm capabilities and learning, by contrast, argues that the learning required to effectively develop the capability to engage in certain value chain activities may be difficult, time-consuming, and effectively impossible for some firms to acquire, regardless of frequency or scale economies. Thus, firms must in certain instances depend on external resources. The doctrine of 'core competence' takes this a step further, arguing that firms which rely on the complementary competencies of other firms and focus more intensively on their own areas of competence will perform better than firms that are vertically integrated or incoherently diversified (Prahalad and Hamel, 1990).

These issues, while often discussed at the local or national level, or in the context of 'a dense network of social relations' (Granovetter, 1985: 507), can equally be applied to the structuring of global-scale production and distribution. The recent work of geographers such as Hughes (2000), Henderson *et al.* (2002) and Dicken *et al.* (2001) has emphasized the complexity of inter-firm relationships in the global economy. The key insight is that coordination and control of global-scale production systems, despite their complexity, can be achieved without direct ownership.

The theories of industrial organization discussed here, when considered cumulatively, suggest that different ways of dealing with the problem of asset specificity, and different motivations for constructing complex firm-to-firm relationships in the face of asset specificity, result in three modes of industrial organization: market, hierarchy, and network. But empirical observation tells us that not all networks are alike. In the next section we develop a theory that can help to specify and explain this variation.

2. TYPES OF GOVERNANCE IN GLOBAL VALUE CHAINS

If a theory of global value chain governance is to be useful to policymakers, it should be parsimonious. It has to simplify and abstract from an extremely heterogeneous body of evidence, identifying the variables that play a large role in determining patterns of value chain governance while holding others at bay, at least initially. Clearly, history, institutions, geographic and social contexts, the evolving rules of the game, and path dependence matter; and many factors will influence how firms and groups of firms are linked in the global economy. Nevertheless, a simple framework is useful because it isolates key variables and provides a clear view of fundamental forces underlying specific empirical situations that might otherwise be overlooked. Our intention is to create the simplest framework that generates results relevant to real-world outcomes.

In the 1990s Gereffi and others developed a framework, called 'global commodity chains', that tied the concept of the value-added chain directly to the global organization of industries (see Gereffi and Korzeniewicz, 1994). This work not only highlighted the importance of coordination across firm boundaries, but also the growing importance of new global buyers (mainly retailers and brand marketers) as key drivers in the formation of globally dispersed and organizationally fragmented production and distribution networks. Gereffi (1994) used the term 'buyer-driven global commodity chain' to denote how global buyers used explicit coordination⁴ to help create a highly competent supply-base upon which global-scale production and distribution systems could be built without direct ownership.

By highlighting explicit coordination in dis-integrated chains and contrasting them to the relationships contained within vertically integrated, or 'producer driven' chains, the global commodity chains framework drew attention to the role of networks in driving the co-evolution of cross-border industrial organization. However, the global commodity chains framework did not adequately specify the variety of network forms that more recent field research has uncovered. While, research on the horticulture industry (Dolan and Humphrey, 2000) and the footwear industry (Schmitz and Knorringa, 2000) reinforced Gereffi's notion that global buyers (retailers, marketers, and traders) can and do exert a high degree of control over spatially dispersed value chains even when they do not own production,

transport or processing facilities, recent research on global production has highlighted other important forms of coordination.

Work on the electronics industry and contract manufacturing by Sturgeon (2002) and by Sturgeon and Lee (2001) contrasted three types of supply relationships, based on the degree of standardization of product and process: (1) the 'commodity supplier' that provides standard products through arm's length market relationships, (2) the 'captive supplier' that makes non-standard products using machinery dedicated to the buyer's needs, and (3) the 'turn-key supplier' that produces customized products for buyers and uses flexible machinery to pool capacity for different customers. This analysis emphasized the complexity of information exchanged between firms and the degree of asset specificity in production equipment. Sturgeon (2002) referred to production systems that rely on turn-key suppliers as 'modular production networks' because highly competent suppliers could be added and subtracted from the global production arrangements on an as-needed basis. Around the same time, Humphrey and Schmitz (2000, 2002) distinguished between suppliers in quasi-hierarchical relationships with buyers, whose situation corresponds to 'captive suppliers', and network relationships between firms that cooperate because they possess complementary competences.⁵ Humphrey and Schmitz emphasized the role of supplier competence in determining the extent of subordination of suppliers to buyers. If global buyers needed to invest in supplier competence, they would need both to specify the product and process parameters to be followed by suppliers and to guard this investment in the supplier by remaining the dominant, if not exclusive, customer.⁶

Using the approaches outlined above and empirical reference points taken from many studies of global value chains,⁷ we propose a more complete typology of value-chain governance. We acknowledge, as do most other frameworks that seek to explain industry organization – from transactions costs to global commodity chains to organizational theory – that market-based relationships among firms and vertically integrated firms (hierarchies) make up opposite ends of a spectrum of explicit coordination, and that network relationships comprise an intermediate mode of value chain governance. What we add to this conceptualization is an extension of the network category into three distinct types: modular, relational, and captive. Thus, our typology identifies five basic types of value chain governance. These are analytical, not empirical, types, although they have been in part derived from empirical observation. They are:

1. *Markets*. Market linkages do not have to be completely transitory, as is typical of spot markets; they can persist over time, with repeat transactions. The essential point is that the costs of switching to new partners are low for both parties.

2. *Modular value chains*. Typically, suppliers in modular value chains make products to a customer's specifications, which may be more or less detailed. However, when providing 'turn-key services' suppliers take full responsibility for competencies surrounding process technology, use generic machinery that limits transaction-specific investments, and make capital outlays for components and materials on behalf of customers.
3. *Relational value chains*. In these networks we see complex interactions between buyers and sellers, which often creates mutual dependence and high levels of asset specificity. This may be managed through reputation, or family and ethnic ties. Many authors have highlighted the role of spatial proximity in supporting relational value chain linkages, but trust and reputation might well function in spatially dispersed networks where relationships are built-up over time or are based on dispersed family and social groups (see for example, Menkhoff, 1992).
4. *Captive value chains*. In these networks, small suppliers are transactionally dependent on much larger buyers. Suppliers face significant switching costs and are, therefore, 'captive'. Such networks are frequently characterized by a high degree of monitoring and control by lead firms.
5. *Hierarchy*. This governance form is characterized by vertical integration. The dominant form of governance is managerial control, flowing from managers to subordinates, or from headquarters to subsidiaries and affiliates.

3. A THEORY OF VALUE CHAIN GOVERNANCE

Having laid out this typology, our next step is to develop an operational theory of global value chain governance. Under which conditions would we expect market, modular, relational, captive, or vertically integrated global value chain governance to arise? Building on the work cited above, we will identify and discuss three key determinants of value chain governance patterns: complexity of transactions; codifiability of information; and capability of suppliers. In so doing, we acknowledge the problem of asset specificity as identified by transaction cost economics, but also give emphasis to what have been termed 'mundane' transaction costs – the costs involved in coordinating activities along the chain. It has been argued that these coordination, or mundane, transaction costs rise when value chains are producing non-standard products, products with integral product architectures, and products whose output is time sensitive (Baldwin and Clark, 2000).

Lead firms increase complexity when they place new demands on the value chain, such as when they seek just-in-time supply and when they increase product differentiation. However, lead firms also adopt strategies to reduce the complexity of these transactions. One important way of

doing this is through the development of technical and process standards. The complexity of information transmitted between firms can be reduced through the adoption of technical standards that codify information and allow clean hand-offs between trading partners. Where in the flow of activities these standards apply goes a long way toward determining the organizational break points in the value chain. When standards for the hand-off of codified specifications are widely known, the value chain gains many of the advantages that have been identified in the realm of modular product design, especially the conservation of human effort through the re-use of system elements – or modules – as new products are brought on-stream (Langlois and Robertson, 1995; Schilling and Steensma, 2001; Sturgeon, 2002). In the realm of value chain modularity, suppliers and customers can be easily linked and de-linked, resulting in a very fluid and flexible network structure. While the dynamics are market-like, the system remains qualitatively different because of the large volumes of non-price information flowing across the inter-firm boundary, albeit in codified form. Furthermore, a high-level of product differentiation can be accommodated with limited information exchange as long as differentiation is defined by a set of unambiguous and widely accepted parameters. Institutions, both public and private, can both define grades and standards and (in some cases) certify that products comply with them.⁸ The development of process standards and certification in relation to quality, labor and environmental outcomes perform similar functions.⁹

At the same time, the integration of new suppliers into global value chains also increases coordination challenges. Keesing and Lall (1992) argue that producers in developing countries are expected to meet requirements that frequently do not (yet) apply to their domestic markets. This creates a gap between the capabilities required for the domestic market and those required for the export market, which raises the degree of monitoring and control required by buyers.

These considerations lead us to construct a theory of value chain governance based on three factors:

- A. The *complexity* of information and knowledge transfer required to sustain a particular transaction, particularly with respect to product and process specifications;
- B. the extent to which this information and knowledge can be *codified* and, therefore, transmitted efficiently and without transaction-specific investment between the parties to the transaction; and
- C. the *capabilities* of actual and potential suppliers in relation to the requirements of the transaction.

If these three factors are allowed only two values – high or low – then there are eight possible combinations, of which five are actually found.¹⁰

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1. *Markets*. When transactions are easily codified, product specifications are relatively simple, and suppliers have the capability to make the products in question with little input from buyers, asset specificity will fail to accumulate and market governance can be expected. In market exchange buyers respond to specifications and prices set by sellers. Because the complexity of information exchanged is relatively low, transactions can be governed with little explicit coordination.
2. *Modular value chains*. When the ability to codify specifications extends to complex products, value chain modularity can arise. This can come about when product architecture is modular¹¹ and technical standards simplify interactions by reducing component variation and by unifying component, product, and process specifications, and also when suppliers have the competence to supply full packages and modules, which internalizes hard to codify (tacit) information, reduces asset specificity and therefore a buyer's need for direct monitoring and control. Linkages based on codified knowledge provide many of the benefits of arms-length market linkages – speed, flexibility, and access to low-cost inputs – but are not the same as classic market exchanges based on price. When a computerized design file is transferred from a lead firm to a supplier, for example, there is much more flowing across the inter-firm link than information about prices. Because of codification, complex information can be exchanged with little explicit coordination, and so, like simple market exchange, the cost of switching to new partners remains low.
3. *Relational value chains*. When product specifications cannot be codified, transactions are complex, and supplier capabilities are high, relational value chain governance can be expected. This is because tacit knowledge must be exchanged between buyers and sellers, and because highly competent suppliers provide a strong motivation for lead firms to outsource to gain access to complementary competencies. The mutual dependence that then arises may be regulated through reputation, social and spatial proximity, family and ethnic ties, and the like. It can also be handled through mechanisms that impose costs on the party that breaks a contract, as discussed in Williamson's analysis of credible commitments and hostages (Williamson, 1983). The exchange of complex tacit information is most often accomplished by frequent face-to-face interaction and governed by high levels of explicit coordination, which makes the costs of switching to new partners high.
4. *Captive value chains*. When the ability to codify – in the form of detailed instructions – and the complexity of product specifications are both high but supplier capabilities are low, then value chain governance will tend toward the captive type. This is because low supplier competence in the face of complex products and specifications requires a great deal of intervention and control on the part of the lead firm, encouraging the build-up of transactional dependence as lead firms seek to lock-in

suppliers in order to exclude others from reaping the benefits of their efforts. Therefore, the suppliers face significant switching costs and are 'captive'. Captive suppliers are frequently confined to a narrow range of tasks – for example, mainly engaged in simple assembly – and are dependent on the lead firm for complementary activities such as design, logistics, component purchasing, and process technology upgrading. Captive inter-firm linkages control opportunism through the dominance of lead firms, while at the same time providing enough resources and market access to the subordinate firms to make exit an unattractive option.

5. *Hierarchy*. When product specifications cannot be codified, products are complex, and highly competent suppliers cannot be found, then lead firms will be forced to develop and manufacture products in-house. This governance form is usually driven by the need to exchange tacit knowledge between value chain activities as well as the need to effectively manage complex webs of inputs and outputs and to control resources, especially intellectual property.

The five global value chain governance types, along with the values of the three variables that determine them, are listed in Table 1. These five types of global value chain governance arise from ascribing different values to the three key variables: (1) complexity of inter-firm transactions; (2) the degree to which this complexity can be mitigated through codification; and (3) the extent to which suppliers have the necessary capabilities to meet the buyers' requirements. Each governance type provides a different trade-off between the benefits and risks of outsourcing. As shown in the last column of Table 1, the governance types comprise a spectrum running from low levels of explicit coordination and power asymmetry between buyers and

Table 1 Key determinants of global value chain governance

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

There are eight possible combinations of the three variables. Five of them generate global value chain types. The combination of low complexity of transactions and low ability to codify is unlikely to occur. This excludes two combinations. Further, if the complexity of the transaction is low and the ability to codify is high, then low supplier capability would lead to exclusion from the value chain. While this is an important outcome, it does not generate a governance type *per se*.

suppliers, in the case of markets, to high levels of explicit coordination and power asymmetry between buyers and suppliers, in the case of hierarchy.

The fact that the governance types developed here can be used to illuminate how power operates in global value chains merits elaboration. In captive global value chains, power is exerted directly by lead firms on suppliers, which is analogous to the direct administrative control that top management at headquarters might exert over subordinates in an off-shore subsidiary or affiliate of a vertically integrated firm (or 'hierarchy' in our framework). Such direct control suggests a high degree of explicit coordination and a large measure of power asymmetry with the lead firm (or top management) being the dominant party. In relational global value chains, the power balance between the firms is more symmetrical, given that both contribute key competences. There is a great deal of explicit coordination in relational global value chains, but it is achieved through a close dialogue between more or less equal partners, as opposed to the more unidirectional flow of information and control between unequal partners as in captive global value chains and within hierarchies. In modular global value chains, as in markets, switching customers and suppliers is relatively easy. Power asymmetries remain relatively low because both suppliers and buyers work with multiple partners.

Figure 1 (next page) illustrates much of the above discussion in graphic form, showing the five global value chain types arrayed along the dual spectrums of explicit coordination and power asymmetry. The small line arrows represent exchange based on price while the larger block arrows represent thicker flows of information and control, regulated through explicit coordination. This includes instructions coming from a more powerful buyer (or manager) to a less powerful supplier (or subordinate), as in captive global value chains or within the confines of a hierarchy, as well as social sanctions regulating the behavior of more or less equal partners, as in relational global value chains. In the case of modular global value chains, thick information flows are narrowed down to a codified hand off at the inter-firm link, leaving each partner to manage tacit information within its own firm boundaries, or perhaps by combining some other form of global value chain governance, such as captive or market-based, for part of the chain. While relationships between the relational and modular suppliers and the firms providing their material inputs and components are displayed as market-based in the figure, they could equally take other forms.

4. DYNAMIC VALUE CHAIN ANALYSIS: SECTORAL CASES

Identifying the main types of global value chain governance, and providing a theoretical explanation for why they arise, are important steps and

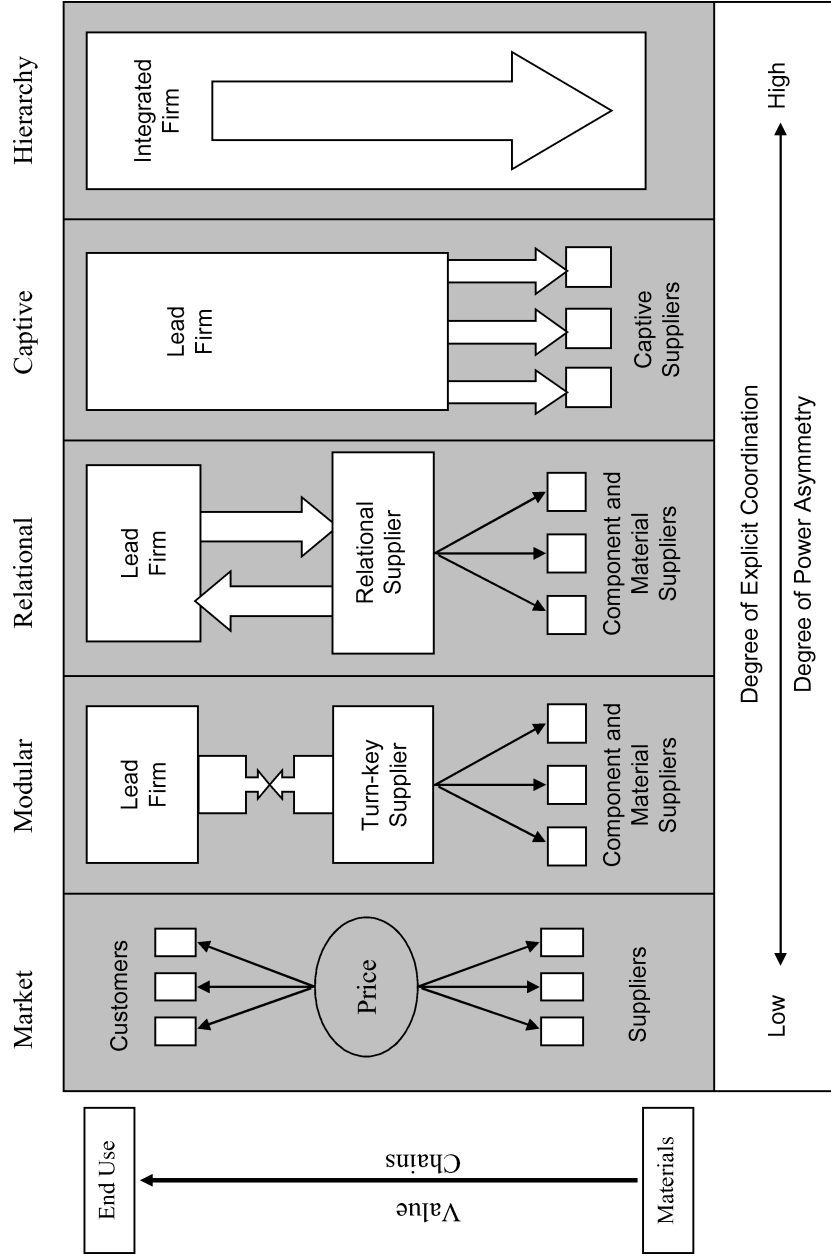


Figure 1 Five global value chain governance types.

Table 2 Some dynamics of global value chain governance

Governance type	Complexity of transactions	Ability to codify transactions	Capabilities in the supply-base
Market	Low	High	High
Modular	① High ②↑	High ④↓	High
Relational	↓ High	③↑ Low	⑤↑ High ⑥↓
Captive	High	High	Low
Hierarchy	High	Low	Low

Dynamics of changes in governance:

- ① Increasing complexity of transactions also reduces supplier competence in relation to new demands.
- ② Decreasing complexity of transactions and greater ease of codification.
- ③ Better codification of transactions.
- ④ De-codification of transactions.
- ⑤ Increasing supplier competence.
- ⑥ Decreasing supplier competence.

hopefully this work will lead us to a better understanding of the contemporary world economy. Nonetheless, to make it a useful tool for policy, a theory of global value chain governance should allow us to do more than just generate different forms of inter-firm coordination; we must try to anticipate *change* in global value chains. Case studies, in particular, clearly show us how governance structures evolve over time. In the following section, we highlight how global value chain governance structures have evolved in four distinct industries: bicycles, apparel, fresh vegetables, and electronics. Some trajectories of change are identified on Table 2, and we refer to these trajectories as we discuss each of the cases.

4.1. The bicycle industry: From hierarchy to market-based coordination

The evolution of the bicycle industry in the twentieth century provides a good example of how hierarchies can evolve toward inter-firm governance that relies primarily on market mechanisms.¹² It shows how market governance is enabled not only by low transaction costs – particularly costs associated with coordination of component design with final product design – and the economies of scale and production enabled by the rise of industry standards, but also by the development of specialist competencies among suppliers (trajectories numbers 3 and 5 in Table 2).

In the early years of the bicycle industry (the 1890s), vertically integrated firms manufactured bicycles, but production soon became fragmented. Today, there are large firms within each segment of the value chain, such as Shimano in drive-train components and several large branded bicycle manufacturers, but very few firms that span more than one segment (Galvin and Morkel, 2001: 40). The different bicycle components require different

competencies, which limits economies of scope. An integrated bicycle manufacturer would require many different technological competences, or would need to explicitly coordinate the activities of many different firms.

After the initial stage of the industry's development, specialist firms became more competitive than vertically integrated companies that made complete bicycles. Well-defined interfaces between various components mean that specialist manufacturers have the advantages of scale through demand pooling. To the extent that economies of scale occur upstream in the value chain, there are strong incentives for market coordination and the development of the institutional mechanisms to make this possible. The specialist knowledge of the suppliers also gives them a greater capacity to innovate within their specific product ranges, as long as this does not require changes in other components. Where these specialists dominate a market segment (for example, Shimano in drive systems), they can innovate within this area more successfully than others, and if extremely successful, may establish a new *de facto* standard applicable across the industry.

The industry standards required to make such specialization and divisions of labor work can arise in a variety of ways. They can be imposed by a dominant firm, as in the case of Shimano in bicycles and IBM in personal computers; they can arise informally through inter-firm networks, as with the emergence of regional standards in the early days of the bicycle industry; they can be managed by industry associations; or they can be regulated by international agencies and negotiations, as in the case of the development of new standards for mobile phones. The establishment of standards is often contentious and part of the competitive positioning of firms.

4.2. The apparel industry: From captive to relational value chains

The apparel industry has been characterized by global production and trade networks since at least the middle of the twentieth century, and the expansion and growing capabilities of its global supply-base have permitted it to move rapidly from captive to more complex relational value chains over the span of just a few decades. The epicenter of export-oriented apparel production has been East Asia, as Japan in the 1950s and 1960s, Hong Kong, South Korea, and Taiwan during the 1970s and 1980s, and China in the 1990s emerged sequentially as world-class textile and apparel exporters (Bonacich *et al.*, 1994). The key to East Asia's success was to move from captive value chains – i.e., the mere assembly of imported inputs, typically in export-processing zones – to a more domestically integrated and higher-value-added form of exporting broadly known in the industry as full-package supply.¹³ Whereas the assembly-oriented captive model required explicit coordination in the form of cut fabric and detailed instructions, full package production involved the more complex forms

of coordination, knowledge exchange, and supplier autonomy typical of relational value chains.

Unlike captive networks, in which foreign firms take responsibility for supplying all the component parts used by local contractors, full package production requires offshore contractors develop the capability to interpret designs, make samples, source the needed inputs, monitor product quality, meet the buyer's price, and guarantee on-time delivery. From a development perspective, the main advantage of the full package export role, compared to simple assembly, is that it allows local firms to learn how to make internationally competitive consumer goods and generates substantial backward linkages to the domestic economy. Increasing supplier competence has been the main driver behind the shift from captive to relational value chains in the apparel industry (trajectory number 5 in Table 2). The establishment of overseas buying offices and frequent international travel supported the intense interaction required for exchanging tacit information and building personal relationships between buyers and suppliers.

Trade rules have had an important impact on global value chain governance in the apparel industry, and this provides just one example of how variables other than the three we have identified work to shape the architecture of cross-border economic activity. US import quotas established by the Multi-Fiber Arrangement (MFA) fueled the spread of global production networks in apparel beginning in the early 1970s. The existence of quotas prompted the rise of value-chain intermediaries, including East Asian trading companies such as Hong Kong's Li & Fung and manufacturers such as the Fang Brothers, to coordinate the flow of orders from US and European buyers to a large numbers of apparel factories established around the world in places with available quota (Gereffi, 1999: 60–63; Magretta, 1998). When the MFA is mostly phased out in 2005 in accordance with the World Trade Organization's Agreement on Textiles and Clothing, global apparel production is likely to become far more concentrated among the most capable firms in a handful of low-cost production sites, including China, India, Indonesia, Mexico, and Turkey (Gereffi and Memodovic, 2003: 12). Such concentration could well undermine the position of intermediary firms. Still, the variables we have highlighted in this paper continue to be important. To the extent that the ability to codify transactions is increased by this concentration process, and supplier capabilities continue to improve, we would expect the relational value chains in apparel to become more modular (trajectory number 3 in Table 2).

4.3. Fresh vegetables: From market coordination to explicit coordination

The changing nature of fresh vegetables trade between Kenya and the United Kingdom highlights a shift from market-based global value chain

governance to more explicit coordination, and it reveals the importance of the competitive strategies of UK supermarkets in driving this change.¹⁴ Beginning in the mid-1980s UK supermarkets began to use the quality and variety of their produce offerings as a main source of competitive differentiation, and in doing so generated several distinct forms of governance at different stages in the chain.

Until the mid-1980s, the fresh vegetables trade was handled through a series of arm's-length market relationships. Traders in Kenya bought produce in wholesale markets or at the farm gate and exported it to the United Kingdom, where it was sold in wholesale markets. However, as supermarket chains in the United Kingdom gradually took an increasing share of fresh food sales and therefore became more powerful actors, they began to introduce more explicit coordination in the chain. Supermarket saw fresh produce (fruit and vegetables) as strategic because it was one of the few product lines that could persuade consumers to shift from one supermarket chain to another. In order to attract customers, the supermarkets introduced new items, emphasized quality, provided consistent year-round supply, and increased the processing of products to provide fresh produce that required little or no preparation prior to cooking or eating. At the same time, the supermarkets were forced to respond to an increasingly complex regulatory environment related to food safety, particularly pesticide residues and conditions for post-harvest processing, as well as environmental and labor standards.

Supermarkets pursued these strategic goals by increasing explicit coordination in the value chain. Instead of purchasing through wholesale markets, they developed closer relationships with UK importers and African exporters, and moved to renewable annual contracts with suppliers whose capabilities and systems were subject to regular monitoring and audit. Supermarkets began to inspect suppliers prior to incorporation in the chain, and made regular spot checks at all points in the chain, right down to the field. The interaction of the firms in the chain also became more complex and relational. Suppliers and buyers worked together on product development, logistics, quality, and the like. This created new value chain relationships and competencies. Over time, relationships between supermarkets and UK importers took new forms, with the recent trend moving value chain governance in the direction of modularity. The supermarkets have reduced the number of UK suppliers/importers for each product range and given the remaining suppliers greater responsibility for supply chain management, product development, and consumer research. These importers work for a range of UK supermarkets and food retailers, although the three largest supermarket chains (Tesco, Asda, and Sainsbury) do try to avoid using the same suppliers.

Further back along the chain, organizational fragmentation has decreased and inter-organizational relationships have become relational. The

risks of this have been contained by the development of exclusive bilateral relationships. A Kenyan exporter will only deal with one UK importer, although it may sell to other markets through other channels, and a UK importer will only have one Kenyan supplier. There has even been some forward and backward integration between African exporters and UK importers, with outright ownership or equity participation. This bilateral dependence of African exporters and UK importers has not created captive relationships. First, importers and exporters do change partners from time to time. Second, there is a situation of mutual dependence and power symmetry. Exporters need an outlet to the UK market, but importers also need an assured supply of produce. Third, the exporters have become increasingly sophisticated and competent, as additional processing functions were transferred to Africa where costs are lower (trajectory number 5 in Table 2). In Kenya, the industry has become much more concentrated as the investment costs of processing have risen.

Within Kenya, the largest exporter of fresh vegetables from Africa to the United Kingdom, increasing requirements have led leading exporters to increase own-farm production at the expense of purchasing vegetables from both smallholders and large contract farmers. This can be seen as a case of increasing complexity leading to vertical integration when it is not accompanied by either codification or higher supplier competence.

4.4. The US electronics industry: From hierarchy to modular value chains, and beyond

For most of the twentieth century, the electronics industry in the United States has been dominated by large, vertically integrated firms, first in the telephone industry (ATT) and then the radio industry (RCA), out of which grew other consumer electronics sectors such as television and eventually, computers (e.g., IBM). In the 1960s and 1970s, with the push for better semiconductors for military and aerospace applications, an independent, or 'merchant', components industry (e.g., Texas Instruments) gathered steam with the Air Force and the National Aeronautics and Space Administration playing the role of 'lead firm'. In the 1980s, as the civilian electronics industry began to grow rapidly with the personal computer, a range of other value chain functions were outsourced, beginning with production equipment for both semiconductor fabrication and circuit board assembly, and then spreading to specialized sub-components such as disk drives and monitors, and most recently to the manufacturing process itself in a practice called 'contract manufacturing'.¹⁵

During the 1990s nearly all major North American product-level electronics firms, and several important European companies as well, made the decision to get out of manufacturing. Plants were closed or sold off to contract manufacturers, driving a significant share of the world's electronics

production capacity into a handful of huge globally operating contract manufacturers. The contract manufacturer Solectron, for example, grew from a single Silicon Valley location with 3,500 employees and \$256 million in revenues in 1988 to a global powerhouse with more than 80,000 employees in 50 locations and close to \$20 billion in revenues in 2000. During the same period Solectron extended its service offerings beyond circuit-board assembly to include, among other things, product (re)design-for-manufacturability, component purchasing and inventory management, test routine development, final product assembly, global logistics, distribution, and after-sales service and repair. Global contract manufacturers such as Solectron introduce a high degree of modularity into value chain governance because the large scale and scope of their operations create comprehensive bundles, or modules, of generic value chain activities that can be accessed by a wide variety of lead firms. Standardized protocols for handing-off computerized design files and highly automated and standardized process technologies made it easy for lead firms to switch and share contractors, and inhibited the build-up of specific assets.

Today, as contractors seek new sources of revenue by providing additional inputs to lead firm design and business processes, and new circuit-board assembly technologies appear on the scene, such as those for boards with optical components, the hand-off of design specifications is becoming more complex and less standardized, making it harder for lead firms to switch and share suppliers. Closer collaboration in the realm of product design requires contractors to receive fully blown computer-aided-design files for their customer's new products; files that can contain core intellectual property. As contractors take over more distribution functions, lead firms must reveal critical knowledge about end-customer requirements and pricing. All of these interactions are being embedded in elaborate information technology systems that span the organizations of lead firms and their key contractors, creating new areas of risk for lead firms in the areas of intellectual property leakage and buyer-supplier lock-in. Shared information technology systems are evolving in two directions simultaneously: toward proprietary systems that increase asset specificity and lock-in, but better protect key intellectual property; and toward open standards (e.g., RosettaNet) and/or third-party systems that better support value chain modularity but that leave the door open for intellectual property leakage. The question of which direction the industry will take – toward proprietary systems and relational value chains, or toward commonly used standards and modular value chains – is still open, and its answer will help to determine the future shape of the electronics industry.

The electronics case shows value chain modularity is enabled by the codification of complex information (for example, through computerized product design and automated process technologies) because codification simplifies the hand-off at the inter-firm link. But the case also shows that

modularity can be undermined by 'de-codification' (trajectory number 4 in Table 2), spurred either by technological change, as in the case of the emergence of optical circuit board assembly technology, or by the bundling of supplier activities in such a way that suppliers reach across the codified link to assist with lead firm activities that remain tacit or are highly proprietary, or both, such as product design and customer contact.

4.5. The dynamics of global value chains

The case studies presented in this section are meant to highlight the dynamic and overlapping nature of global value chains. Value chain governance patterns are not static or strictly associated with particular industries. They depend on the details of how interactions between value chain actors are managed, and how technologies are applied to design, production and the governance of the value chain itself. Nor are value chain governance patterns monolithic. Even in a particular industry in a particular place and time, governance patterns may vary from one stage of the chain to another. While we believe that this dynamism and variation can largely be accounted for by the three explanatory variables presented in this article, more work will be needed to fully understand their dynamic characteristics. How and why do the complexity of information, the ability to codify information, and supplier competence change?

We can at this stage offer only a partial answer. First, information complexity changes as lead firms seek to obtain more complex outputs and services from their supply-base. This can reduce the effective level of supplier capabilities as existing capabilities may not meet the new requirements (trajectory number 1 in Table 2). Alternatively, reduced complexity may increase the ability to codify transactions (trajectory 2 in Table 2). Second, within industries there is a continuing tension between codification and innovation (trajectories numbers 3 and 4 in Table 2). As Storper (1995) and David (1995) have both pointed out, new technologies can restart the clock on the process of codification. Third, supplier competence changes over time: increasing as suppliers learn, but falling again as buyers introduce new suppliers into value chain, as new technologies come on-stream, or as lead firms increase the requirements for existing suppliers (trajectories numbers 5 and 6 in Table 2).

When we look broadly at the evidence provided by global value chain research across a variety of industries and time periods, it is tempting to make generalizations about trends in the global economy. In all of the case studies presented here, and many other industries as well, increasing capabilities in the supply-base have helped to push the architecture of global value chains away from hierarchy and captive networks and toward the relational, modular, and market types. Value chain modularity seems to be especially likely when suppliers offer lead firms greater levels of value

chain bundling (e.g., turn-key and full-package services), which has the advantages of internalizing tacit knowledge and pooling capacity utilization for greater economies of scale. However, organizational fragmentation will not lead to value chain modularity if codification is extremely difficult. For example, a strong shift toward fragmentation in the organization of the US motor vehicle industry beginning in the mid-1980s has resulted in value chains with strong relational elements. This can be partly explained by the difficulty of codifying complex mechanical systems (Fine, 1998), which has inhibited the rise of industry-wide standards and kept the complexity of the transactions between lead firms and suppliers high even as the capabilities of suppliers, driven in part by the consolidation of first tier suppliers, has increased dramatically (Humphrey, 2003; Sturgeon and Florida, 2004).

As standards, information technology, and the capabilities of suppliers improve, the modular form appears to be playing an increasingly central role in the global economy.¹⁶ Again, the general shift toward value chain fragmentation has been driven by the cost and risk advantages of outsourcing (assuming that a solution to the problem of asset specificity can be developed). When we take relational networks as our starting point, however, a shift to modular – and perhaps eventually to market – forms can be expected as standards and codification schemes improve because more fluid value chains offer additional decreases in cost and risk. Still, we resist the overly simplistic notion that global value chains are evolving along a single trajectory. First, the standards that enable the codification of product and process specifications are different across industries and are constantly evolving. Second, standards for codifying product and process specifications can become obsolete as technologies change or when there is a drive to bundle value chain activities in new ways. This can drive market and modular relationships, as we may be seeing in the case of the electronics industry today, back toward relational governance, and, if the problem of asset specificity becomes severe enough, the hierarchical form. Third, knowing the standard and adopting the protocol may not be straightforward, inexpensive, or immediately possible for all actors in an industry, and there may be competing standards in use that make choosing and investing difficult and risky. Since standards and protocols are dynamic, major advantages accrue to those actors that actively participate in the rule-setting process, which favors established actors and locations (Sturgeon, 2003). Finally, there is clearly no single best way to organize global value chains. In some product categories, where integral product architecture makes it difficult to break the value chain, vertical integration may be the most competitive approach to value chain governance. Sony and Samsung's success in consumer electronics has come despite, or perhaps because of, high levels of vertical integration. In the garment industry, Zara's success with extremely rapid product cycles – bi-weekly in some cases – has been supported by the company's in-house

textile manufacturing subsidiary and captive sewing workshops (Bonnen, 2002).

5. CONCLUSIONS

In this article we have developed a typology of global value chain governance and presented some theoretical justifications for why these patterns might occur. We argue that the structure of global value chains depends critically upon three variables: the complexity of transactions, the ability to codify transactions, and the capabilities in the supply-base. These variables are sometimes determined by the technological characteristics of products and processes (some transactions are inherently more complex and difficult to codify than others, for example) and they often depend on the effectiveness of industry actors and the social processes surrounding the development, dissemination, and adoption of standards and other codification schemes. It is the latter set of determinants, in particular, that opens the door for policy interventions and corporate strategy.

The global value chains framework focuses on the nature and content of the inter-firm linkages, and the power that regulates value chain coordination, mainly between buyers and the first few tiers of suppliers. However, it is important not to ignore the actors at both ends of the value chain. On the upstream end, component and equipment suppliers can wield a great deal of power. For example, in the personal computer industry two firms, Intel and Microsoft, set parameters that most other value chain actors must adjust to. The power of such 'parameter-setting' firms, such as Shimano in bicycles and Applied Materials in semiconductors, is not exerted through explicit coordination, but through their market dominance in key components and technologies. On the downstream end of the chain, highly knowledgeable users can play a significant role in determining the attributes and innovative trajectory of the products and services that global value chains churn out, as they do in many complex service industries such as enterprise computing. Even average consumers are far from passive, as Leslie and Reimer (1999) point out. Consumer culture, whether it emerges from the home, street, school, or park, can subvert the original intention of producers by altering and ascribing meaning to products in ways that designers and marketers never intended.

Our primary concern in this article is with organizational structures that span international borders and particularly in those that have a global reach. Nonetheless, local and national structures and institutions also matter. Geographers and planners have provided us with insights into how the spatial and social propinquity of local industrial agglomerations work to buoy organizationally disaggregated, and often highly innovative, economic activities (e.g., Storper and Scott, 1988; Storper and Walker, 1989). This work has usefully stressed the spatial embeddedness of tacit

knowledge and the importance of tight interdependencies between geographically clustered firms (Maskell and Malmberg, 1999; Storper, 1995). We acknowledge these points, and have argued elsewhere that such agglomerations are the places where the most relational portions of global value chains might be found (Sturgeon, 2003). The varieties of capitalism literature, coming largely from political science (e.g., Berger and Dore, 1996; Soskice, 1999; Streeck, 1992), similarly argues that national-level rules and institutions (e.g., in finance, corporate governance, and education and training) profoundly affect the character of industries. Other studies (Borrus *et al.*, 2000; Florida and Kenney, 1993; Lynch, 1998) show that many geographically rooted characteristics are carried abroad, as foreign direct investment projects local and national models onto the global stage. These variations can and do have profound effects on value chain governance. For example, even when the underlying conditions for emergent organizational forms such as value chain modularity are well established, as they are in the Japanese personal computer industry, large-scale outsourcing might be antithetical to long-standing corporate strategies and institutions, such as lifetime employment in large firms, which make radical industry reorganization extremely difficult and slow.

It is also clear that global-scale regulations, the 'rules of the game' as it were, have a profound effect on the shape and direction of change in global value chains. In a wide range of industries, from electronics to apparel to household goods, selective exemptions for duties on value added in particular locations, such as section 807 and most-favored-nation status for the United States and outward processing arrangements for Europe, have encouraged the geographical fragmentation of global value chains, as we have seen in the apparel case study. Yet political pressures in both developed and developing nations to retain (or gain) apparel jobs, and managerial desires to spread risk through geographical diversification, are likely to keep the apparel value chain more fragmented than it would be if production decisions were based on economic criteria alone.

While there are a multitude of factors that affect the evolution of the global economy, we feel confident that the variables internal to our model influence the shape and governance of global value chains in important ways, regardless of the institutional context within which they are situated. The governance framework that we propose takes us part of the way toward a more systematic understanding of global value chains, but much remains to be done.¹⁷ One of the most pressing areas is the development of policy tools for industrial upgrading that are consistent with the framework. One of the key findings of value chain studies is that access to developed country markets has become increasingly dependent on participating in global production networks led by firms based in developed countries. Thus, the governance of global value chains is essential for understanding how firms in developing countries can gain access to global markets, what

the benefits of access and the risks of exclusion might be, and how the net gains from participation in global value chains might be increased. While the search for paths of sustainable development in the global economy is an inherently difficult and elusive objective, our task is greatly facilitated by having a clearer sense of the various ways in which global value chains are governed, and the key determinants that shape these outcomes.

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NOTES

- 1 While 'internationalization' refers to the geographic spread of economic activities across national boundaries, 'globalization' implies the functional integration and coordination of these internationally dispersed activities (Dicken, 2003: 12).
- 2 We do not suggest that the theory developed in this paper can explain all governance patterns observed in global value chains. The theory should be used as a complement to, not a substitute for, the rich detail and complexity that can be observed in global value chains, especially their historical, geographical, and sectoral specificity.
- 3 Similarly, Hummels *et al.* (1998: 80–81) use the term 'vertical-specialization-based-trade' to refer to the amount of imported inputs embodied in goods that are exported. 'Vertical specialization' of global trade occurs when a country uses imported intermediate parts to produce goods it later exports.
- 4 'Explicit coordination' is a term is used by Clemons *et al.* (1993) to refer to non-market forms of coordination of economic activity.
- 5 This work drew on the analysis of Palpacuer (2000) on core and complementary competences in value chains.
- 6 Work on the apparel industry (Gereffi, 1999) and on commodity exports from Africa (Gibbon, 2001) also showed a variety of contracting arrangements.
- 7 An indication of the range of studies is provided by the collection edited by Gereffi and Kaplinsky (2001).
- 8 For a discussion of grades and standards in the food industry, see Reardon *et al.* (2001). For a more general discussion of modular product architectures and its implications for industry structure, see Baldwin and Clark (2000).
- 9 The development of product and process standards and their implications for value chain governance are discussed by Nadvi and Wältring (2002).
- 10 Low informational complexity without codification generates two combinations that are unlikely to occur regardless of supplier competence, high or low. Furthermore, if there is low complexity and a high possibility for codification, and suppliers still do not have the capabilities to meet the requirements of buyers, then it is likely that they will be excluded from the chain. While this

- does not generate a global value chain type, *per se*, it is a situation that is quite common, and with requirements for suppliers increasing, perhaps increasingly likely to occur (Sturgeon and Lester, 2004). This case is important insofar as it opens up a discussion of the problems facing developing country suppliers and policies for industrial upgrading.
- 11 Product architectures generally vary from integral to modular. In integral product architectures, the functional elements of a product are tightly linked and optimised for a particular configuration. In modular product architectures, by contrast, the physical building blocks (or sub-systems) of a product are loosely coupled and designed to be relatively independent of one another because of standardized interfaces and visible design rules, which permit some components and sub-systems to be disaggregated and recombined into a large number of product variations (see Baldwin and Clark, 2000; Schilling and Steensma, 2001; Ulrich, 1995).
 - 12 This discussion is based on Galvin and Morkel (2001).
 - 13 In the Asian context, the full-package model was also known as original equipment manufacturing (OEM).
 - 14 Kenya is the largest exporter of fresh peas and beans from Africa to the European Union and by far the most important supplier to the UK market. This section is based on the work of Dolan and Humphrey (2000, 2004).
 - 15 This discussion is based on Sturgeon (2002).
 - 16 This process is not driven solely by the efforts of suppliers. Value chain actors clearly co-evolve. Lead firm strategies to simultaneously increase outsourcing and consolidate their supply-chains have created a set of highly capable suppliers that, in turn, make outsourcing more attractive for lead firms that have yet to take the outsourcing plunge (Sturgeon and Lee, 2001). Similarly, the evolution of global value chains emanating from one national or local context, especially if successful, provides an example that often generates a reaction in value chains rooted in other places.
 - 17 A high priority for the future will be the development of methods for measuring the key variables in the model. Effective proxies for transactional complexity, level of codification, and supplier competence must be identified and tested in the field.

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