

## 1 Introduction: Why Value Chains?

This article is intended to contribute to the process of building a set of tools that will help advance the debate on the shape and trajectory of global economic integration. Discussion of global-scale economic trends is inherently a large and unwieldy topic. Tools are needed to block out some of the 'noise' and allow us to focus on what is important, but we must choose carefully. Those studies that rely solely on macro-level statistics, such as trade and investment, cannot help but render invisible the detailed contours of the world economy. This is especially true when we seek to understand the role of personal and firm-to-firm relationships and the influence of power and politics on the development process, things that I hold to be crucial aspects of political economy and to the crafting of effective economic development policy and business strategy. At the same time, smaller-scale studies of national economies, localised clusters of industrial activity and firm strategy forfeit a comprehensive view of the larger, cross-border structures that exist, or are coming to exist, in the world economy. For this reason, my own work has gravitated toward the study of cross-border organisational structures in particular industries. Industry-level analysis of economic activity, especially one that uses a 'value chain' approach, works well in studies of cross-border economic integration, because it takes a significant but still manageable slice of the world economy as its object of study. What is revealed in studies of industry value chains are the concrete actors in the global economy as well as the linkages that bind them into a larger whole.

A key strength of the industry-level approach is that it is geographically 'scaleable'; that is, what is observed at the local level often has some direct relationship to what is seen at the national, regional and global levels. To be sure, firms and industries are profoundly influenced by the local and national institutional environments in which they are situated, and it is important to try to understand how industries function within particular localities, but it is also true that firms often – and more to the point, increasingly – buy, sell and operate subsidiaries outside of their home locations. The connections, or 'linkages', between firms and subsidiaries operating in and among different locations can provide the comparative

# How Do We Define Value Chains and Production Networks?\*

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insight that can help us to judge, however imperfectly, the impacts that local and national institutions have on the process of economic development.

I believe that the division of labour within value chains and the nature of the network linkage itself – its information capacity, or ‘bandwidth’, connection mechanism, governance style, power dynamics and geographic reach – are extremely important research subjects. What is clear is that macro-level statistics, while they can help us to gain a rough idea about the volume and location of economic activity, provide little insight into the actual shape and texture of global value chains and almost nothing about the nature of inter-firm linkages. We must instead rely on the painstaking collection of qualitative field data, which, when used in combination with macro-level statistics on trade and investment, can lead us to a more fine-grained understanding of global-scale economic patterns and trends.

Still, the limitations of restricting our inquiry to specific industries are real. If we see patterns emerging in the value chains of one industry, do they suggest a larger trend or are the patterns particular to the industry under study? Do the different capital, technological, and human resource requirements of various industries mean that each will make a unique contribution to the process of global-scale economic integration, or are there overarching trends that can be discerned? To understand how and why the cross-border organisational patterns in different industries might vary, we must compare industry value chains. The good news is that a significant body of research now exists that has in one way or another used a value-chain approach. This work has contributed to a better view of the global-scale organisational structures that exist in a wide range of industries. I believe enough work has been done to allow us to begin to take the next step of attempting to compare our findings and perhaps even to craft general theoretical arguments.

Before we begin this effort in earnest, however, we must first agree on a common language. What is included or excluded when we use the phrase ‘value chain’? Do we need additional terms to denote the full range of possibilities? Can we agree on a set of

typologies that will make the debate more efficient by grouping sets of observed practices under common headings? Obviously, we must agree on what the critical dimensions of value chains are before we can have a discussion on how various industries and various places differ along them. In this article I lay out one possible set of critical value-chain dimensions: organisational scale, geographic scale and value-chain productive actors.

## **2 How Do We Define Value Chains and Production Networks?**

### **2.1 Value chain vs. production network: what is the distinction?**

Analysis that takes the entire chain of productive activities into account has been variously referred to as value-chain, commodity chain, activities chain, production network, value network and input–output analysis. While these terms have a great deal in common, an important distinction can be made by contrasting the various ‘chains’ to the various ‘networks’, where a chain maps the vertical sequence of events leading to the delivery, consumption and maintenance of goods and services – recognising that various value chains often share common economic actors and are dynamic in that they are reused and reconfigured on an ongoing basis – while a network highlights the nature and extent of the inter-firm relationships that bind sets of firms into larger economic groups. This distinction is summarised in Table 1.<sup>1</sup>

### **2.2 Organisational scale – how thick and long are value chains?**

Value chains vary according to the organisational scale of activities. Moreover, it is often useful to artificially segment value chains for analytic purposes. In regard to value-chain breadth I propose that the term *value thread* be used to denote a particular, product-based thread of activity that, at a given moment in time, runs through a larger constellation of activities and dynamic configurations embodied in a *value chain*. A value thread can be thought of as a sub-set of a value chain; a simplified snapshot taken within the much more complex and dynamic set of activities encompassed by the chain. To suggest that a value thread is a more static and limited conceptual tool than a value chain is not to diminish its usefulness. It is important to have a tool that will allow the

Table 1: Value chain vs. production network

Name	Definition	Metrics	Other names
1. Value chain	<ul style="list-style-type: none"> <li>the sequence of productive (i.e. value-added) activities leading to and supporting end use</li> </ul>	<ul style="list-style-type: none"> <li>the bundles of activities that various actors do, or do not, engage in</li> </ul>	<ul style="list-style-type: none"> <li>supply chain</li> <li>commodity chain</li> <li>production chain</li> <li>activities chain</li> <li>product pipeline</li> </ul>
2. Production network	<ul style="list-style-type: none"> <li>a set of inter-firm relationships that bind a group of firms into a larger economic unit</li> </ul>	<ul style="list-style-type: none"> <li>the character and extent of inter-firm relationships</li> </ul>	<ul style="list-style-type: none"> <li>value network</li> <li>supply base</li> </ul>

distillation of the essential steps taken to get a particular product to market. Within such a snapshot the concrete activities of the key players can be made extremely clear. Still, it is also important to have a larger, related concept – that of the value chain – that captures the dynamic and exceedingly complex nature of productive activity.

With regard to value-chain length I propose – as a starting point – a nomenclature that segments value chains at the intersection of lead firms and suppliers. Such a segmentation places lead firms (i.e. firms that initiate the flow of resources and information through the value chain by developing and marketing final products) in a somewhat privileged analytical position, but such focus is warranted, I believe, by their actions in initiating and in many cases governing the flow of value creation in the value chains they participate in. Thus, I propose, that the term *value chain* be used denote the entire range of activities required to bring a particular set of products to market, while the term *supply chain* be confined to those activities that arise as a response to the impetus of lead firm(s). This distinction can build on the definition of value-chain breadth offered above to derive *supply thread*, which denotes the productive (i.e. value-added) activities that lead to and support the end use of a particular product or service, and a *supply chain*, which denotes the productive (i.e. value-added) activities that lead to and support the end use of a set of related products or services, less the activities of the lead firm(s). These distinctions are summarised in Table 2.

Value chains and production networks do not exist in a vacuum but within a complex matrix of institutions and supporting industries. At the most basic level, it should be pointed out that value chains, at every stage and in every location, are sustained by a variety of critical inputs, including human resources, infrastructure, capital equipment and services. Figure 1 depicts a generic extended value chain along with these critical inputs.

### 2.3 Spatial scale

A second crucial dimension of value chains and production networks is spatial scale. Gereffi (1999) differentiates his concept of 'global commodity chains' (GCCs) from Porter's (1990) concept of 'value chains', in part, by stating that GCCs embody an explicit international dimension. On the other end of the scale, work on industry-specific agglomerations (Storper and Christopherson 1987) and industrial districts (Piore and Sabel 1984) has drawn attention to the tendency for specialised industrial clusters to form at the sub-national, and even local level. Industrial districts are related to value chains and production networks because they often rely on groups of spatially proximate firms that tend to specialise in a particular component, process or service required to bring a product to market. In such a system, the international nature of the network can be entirely absent, or exist only as a trade link when final products are exported. Clearly, then, the concepts of value chain and production network can be conceptualised without any international

Table 2: Value chain organisational scale

Name	Definition	Metrics
1. Value thread	<ul style="list-style-type: none"> <li>the productive (i.e. value-added) activities that lead to and support the end use of a particular product or service</li> </ul>	<ul style="list-style-type: none"> <li>the bundles of activities that various actors do, or do not, engage in</li> </ul>
2. Supply thread	<ul style="list-style-type: none"> <li>the productive (i.e. value-added) activities that lead to and support the end use of a particular product or service, less the activities of the lead firm</li> </ul>	<ul style="list-style-type: none"> <li>the bundles of activities that suppliers do, or do not, engage in</li> </ul>
3. Value chain	<ul style="list-style-type: none"> <li>the productive (i.e. value-added) activities that lead to and support the end use of a set of related products or services, including lead firm(s)</li> </ul>	<ul style="list-style-type: none"> <li>the bundles of activities that various actors do, or do not, engage in</li> </ul>
4. Supply chain	<ul style="list-style-type: none"> <li>the productive (i.e. value-added) activities that lead to and support the end use of a set of related products or services, less the activities of the lead firm(s)</li> </ul>	<ul style="list-style-type: none"> <li>the bundles of activities that suppliers do, or do not, engage in</li> </ul>

dimension whatsoever. Still, it is the combination of industry reorganisation – into new value-chain and production-network configurations – with the process of economic globalisation that has resulted in some of the most dynamic examples of recent industrialisation. I'm thinking here of cases such as Taiwan's electronics industry, which has come to manufacture a substantial share of the world's personal computer and personal computer-related products in close coordination with lead firms and component suppliers located in the United States, Europe and Japan. Moreover, many Taiwanese electronics firms are located in the Hsinchu Science Park in an arrangement that looks very much like an industrial district. What is exciting about such examples, at the theoretical level, is that the concept of the industrial district can be neatly 'nested' within arguments about globalisation, as long as the global aspect of the analysis takes a strong value chain and production network approach. This

approach proves the dichotomy of the global vs. the local that has been put forward by some (Sabel 1989; Shoenberger 1994) to be false and instead sees the local as *situated in* the global. Within this framework, we can posit that some global-scale value chains and production networks act as mechanisms to weave together various specialised industrial clusters, giving rise to a *network of clusters*.

While the local is clearly embedded in the global, and vice versa, it is still useful to have nomenclatures that cover the entire range of spatial scale. Table 3 presents such a scheme, with value-chain and production-network structures increasing in scale from local, to domestic, to international, to regional and finally to global. The term 'region' is somewhat problematic in that it has historically been applied to arrangements both at the sub-national and supra-national levels (e.g., the

Figure 1: The extended value chain with inputs

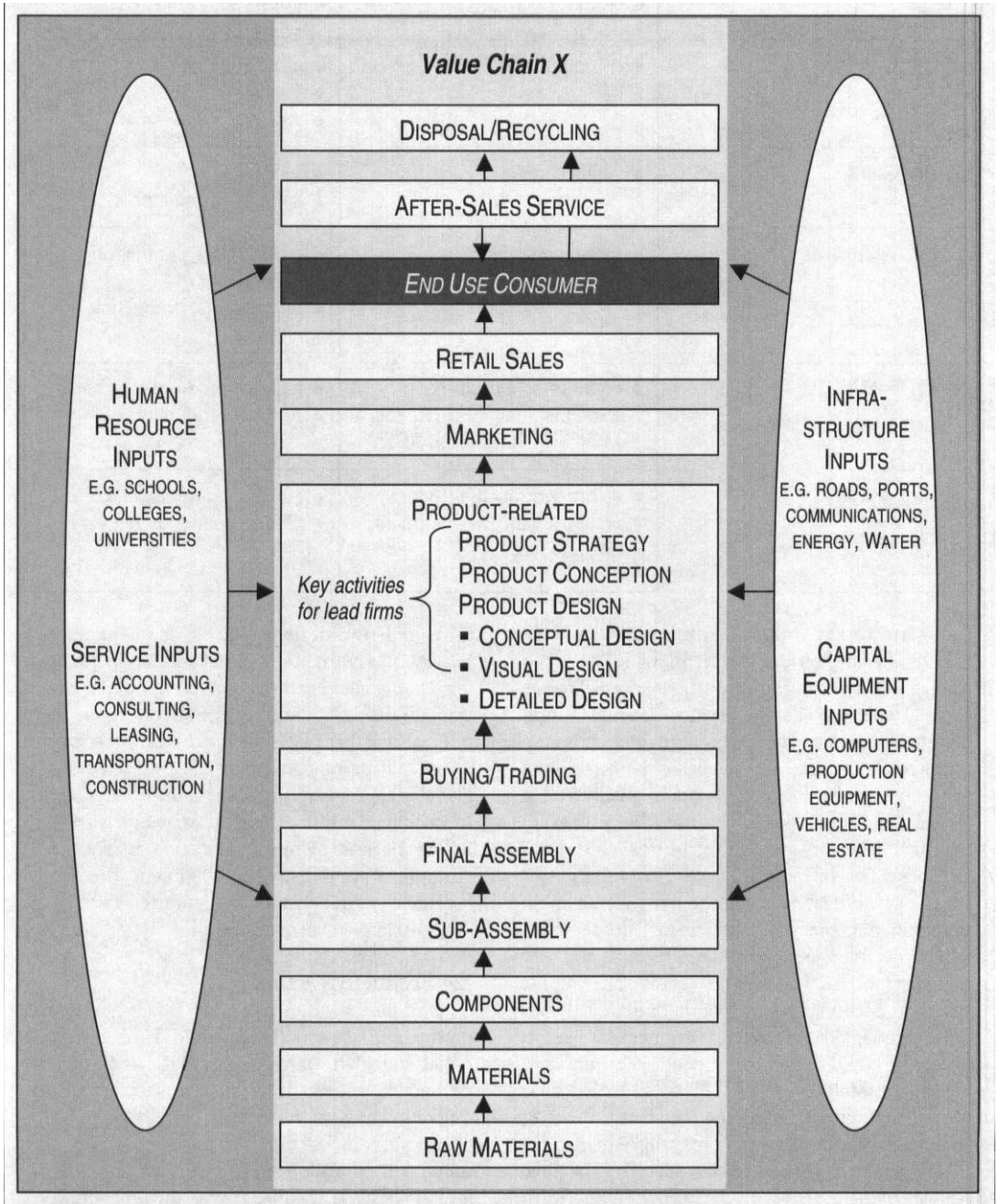


Table 3: Value chain/production network spatial scale

Name	Scale of operations	Other names
1. Local	<ul style="list-style-type: none"> <li>● commute area, SMSA</li> </ul>	<ul style="list-style-type: none"> <li>● industrial district</li> <li>● specialised industrial cluster</li> <li>● regional economy</li> </ul>
2. Domestic	<ul style="list-style-type: none"> <li>● single country</li> </ul>	<ul style="list-style-type: none"> <li>● supply base</li> <li>● national production system</li> </ul>
3. International	<ul style="list-style-type: none"> <li>● more than one country</li> </ul>	<ul style="list-style-type: none"> <li>● cross-border production network</li> <li>● international production network</li> </ul>
4. Regional	<ul style="list-style-type: none"> <li>● confined to a multi-country trade bloc (e.g. NAFTA, EU, MERCOSUR, ASEAN, AFTA)</li> </ul>	<ul style="list-style-type: none"> <li>● regional production system</li> <li>● regional production network</li> </ul>
5. Global scale	<ul style="list-style-type: none"> <li>● actors coordinate activities across at least two continents or trade blocs</li> </ul>	<ul style="list-style-type: none"> <li>● global commodity chain</li> <li>● global production network</li> </ul>

San Francisco Bay 'Region' on the one hand and the NAFTA 'Region' on the other). In Table 3 I try to resolve this by denoting sub-national arrangements as 'local' and reserving the 'regional' label for supra-national trading regions. The term 'global' is also problematic because of its totalising character. For a value chain or production network to qualify for the 'global' label does it need to be everywhere, in every country, in every region or every continent? Obviously not. In Table 3 I try to clarify this in two ways. First, instead of using the term 'global' in an unmodified manner, I instead use 'global scale', which denotes world-scale reach, but not any necessary volume of activity or total geographic coverage. Second, I set the condition that activities must be integrated across two continents at least in order to qualify for the global-scale moniker. Elsewhere (Sturgeon 1997, 1999a, 1999b), I have argued that we are seeing the emergence of set of 'global suppliers' whose customers have demanded that they have a presence in at least each of the three largest market areas: Asia, Europe and North America. While it is likely that many actors see operation in each of the three major trading regions as the mark of a truly global firm, it is also true that many lead firms and suppliers coordinate activities

across only two of these regions, and it would be a mistake to say that these firms are not operating at a global scale. Furthermore, many value chains extend outside of the three major regions, so there is a real risk that places such as South America and Africa will be rendered invisible in discussions of global-scale value chains and production networks. In working to reduce this risk, we would do well to follow the lead of researchers such as Dolan and Humphrey (2000), who document the fresh-vegetable value chains that connect farmers in Africa to large retailers in the UK.

## 2.4 Productive actors

A third crucial dimension of value chains and production networks that could benefit from a better-specified terminology is that of the productive actors. How do we talk about the different kinds of firms that participate in value chains and production networks in a way that minimises confusion and maximises our analytic leverage? This is an especially vexing problem when industry-specific terms are applied to more general arguments. An example is the term 'original equipment manufacturer' (OEM), which is widely used in both the motor vehicle and electronics

industry. In motor vehicles, the term is applied to firms such as Ford and Toyota because these are firms that develop and assemble (i.e. manufacture) vehicles that are based on 'original' designs. Suppliers, which are typically referred to as belonging to first, second or lower 'tiers', have historically provided parts and sub-assemblies according to the design specifications spelled out by the OEM. In this industry, retaining the use of the OEM moniker for firms such as Ford is still a tolerable practice because, thus far, the OEMs have retained a significant portion of manufacturing in final assembly. Still, first-tier suppliers have increasingly taken on a greater role in the conceptualisation and design of major vehicle systems and sub-components (or modules). In this system we might ask: 'Where in the value chain is the originality of products determined?' If a consumer makes a choice to purchase a vehicle largely based on the attributes of its interior – the seats and other 'comfort systems' – it may well be due to the innovative 'original' design and manufacturing activities of large interior systems suppliers such as Lear, Johnson Controls or Delphi.

In the electronics industry the situation is even more extreme. Many brand-name firms retain their OEM moniker even as they completely abandon their in-house manufacturing and sometimes even post-architectural product-design activities. Thus we are left with the bizarre situation of referring to companies such as Dell Computer, which has almost no internal manufacturing capacity and does very little detailed design work in-house, as an OEM. It is interesting to note that the use of the term OEM grew up at a time when one could be relatively certain that a firm that designed and marketed a product was the same firm that manufactured that product. The point is that the locus of activities in a value chain can shift faster than the industry-specific terminology, leaving anachronistic and inaccurate terms such as OEM in wide use. This is more than a semantic problem. The false homogeneity of a term such as 'OEM' that is used across several industries, misleads us into grouping firms with what might be important analytical differences, such as Dell and Ford, into a single analytical category.

But there is an opposite problem as well, one of false heterogeneity. There are industry-specific

terms that are different but denote roughly the same scope of activities. The problem here is that the heterogeneous terms that are used in specific industries might mask similar patterns of value-chain and production-network structure that exist or are emerging across industries. An example is the various terms that are used to refer to highly competent suppliers that take on entire sub-sets of related activities for their customers. In the realm of manufacturing services, there is a group of suppliers that have emerged in many industries that provide complete bundles of manufacturing-related services for their customers, including investment in production facilities (in both domestic and international settings), component and material sourcing, the manufacturing process itself, quality assurance, in-bound and out-bound logistics, etc. Such firms are referred to as contract manufacturers in the electronics and pharmaceutical sectors, full-package suppliers in the apparel sector, and systems or first-tier suppliers in the motor vehicle sector, even though they occupy similar terrain within the value chains and production networks of their respective industries. Even within the world of electronics contract manufacturing, the terms differ by location. The term contract manufacturer is widely used in the United States and Singapore, and the term OEM-supplier is widely used in Taiwan. Again, the danger with the false heterogeneity of industry-specific and place-specific terms is that we will miss the larger trends that may be emerging in the structure of value chains and production networks across various industries.

We need to link our terms not to firms, sectors, or places but to the specific bundles of activity that firms are engaged in. Table 4 summarises my attempt to do this, based largely on my experience in researching the apparel, electronics, and motor vehicle industries, but it is clear that more input is needed from those familiar with industry-specific terms that denote supply-chain position in a greater number of industries. Obviously, there are many other types of value-chain actors; I have included only a few of the most important. In Table 4 I start with the integrated firm, which engages in the entire range of value-chain activities, from product strategy through to component manufacturing (retailing, historically, has been not been an activity widely engaged in by integrated firms). Large, diversified, globally operating integrated firms can be seen as

Table 4: Value chain/production network actors

Actor	Scope of activity	Other names	Firm examples
1. Integrated firm	<ul style="list-style-type: none"> <li>● product strategy</li> <li>● product definition</li> <li>● design</li> <li>● manufacturing</li> <li>● sub-assembly</li> <li>● component manufacturing</li> <li>● marketing, sales and distribution</li> </ul>	<ul style="list-style-type: none"> <li>● modern corporation</li> <li>● dinosaur</li> </ul>	<ul style="list-style-type: none"> <li>● Phillips</li> <li>● the 'old' IBM</li> <li>● the 'old' Ford</li> </ul>
2. Retailer	<ul style="list-style-type: none"> <li>● sales</li> <li>● marketing</li> <li>● value-added packaging and system integration</li> </ul>	<ul style="list-style-type: none"> <li>● marketer</li> <li>● distribution</li> <li>● reseller</li> <li>● value-added reseller (VAR)</li> </ul>	<ul style="list-style-type: none"> <li>● Amazon.com</li> <li>● Sears</li> <li>● Gap</li> <li>● Banana Republic</li> </ul>
3. Lead firm	<ul style="list-style-type: none"> <li>● product strategy</li> <li>● product definition</li> <li>● product design</li> <li>● end user sales</li> <li>● end user marketing</li> </ul>	<ul style="list-style-type: none"> <li>● brand-name firm</li> <li>● OEM</li> <li>● anchor firm</li> </ul>	<ul style="list-style-type: none"> <li>● Dell</li> <li>● Nike</li> <li>● Smart/Daimler</li> <li>● the 'new' Ford</li> <li>● the 'new' IBM</li> </ul>
4. Turn-key supplier	<ul style="list-style-type: none"> <li>● complex parts and services</li> <li>● process R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>● system supplier</li> <li>● OEM supplier</li> <li>● first-tier supplier</li> <li>● contract manufacturer</li> <li>● full-package supplier</li> <li>● global supplier</li> </ul>	<ul style="list-style-type: none"> <li>● Celestica</li> <li>● Solectron T</li> <li>● TSMC, UMC</li> <li>● Dana, Delphi</li> <li>● UPS, Fedex</li> <li>● Arthur Anderson</li> </ul>
5. Component supplier	<ul style="list-style-type: none"> <li>● discrete elements (component parts and services)</li> </ul>	<ul style="list-style-type: none"> <li>● lower-tier supplier</li> <li>● specialised supplier</li> <li>● sub-contractor</li> <li>● commodity producer</li> </ul>	<ul style="list-style-type: none"> <li>● Intel, Microsoft</li> <li>● BF Goodrich</li> </ul>

production networks unto themselves. Such firms were identified by Alfred Chandler (1977) as 'modern corporations' but, due to the rapid vertical disaggregation of many of these firms and the poor performance of those who have retained their integrated stance, more recent commentary has labelled them 'dinosaurs' (Fine 1998).

In recent years, integrated firms such as Ford and IBM have been aggressively shedding large segments of their vertical enterprises. In the late

1990s both Ford and General Motors (GM) spun off the bulk of their component divisions as independent suppliers named Visteon and Delphi. In the same period, IBM's logic semiconductor division was renamed IBM Microelectronics and began to sell semiconductors on the open market that embodied technologies that had previously been exclusively reserved for use in IBM products. IBM also spun off its largest product-level manufacturing group and an independent electronics contract manufacturer named Celestica.



In 1999, three years and 18 acquisitions later, Celestica's 20,000 employees generated US\$5.3b. in revenue by serving a wide customer base including Cisco Systems, Dell Computer, EMC Corporation, Hewlett-Packard, IBM, Lucent, Nortel Networks, and Sun Microsystems from 31 manufacturing sites in the US, Canada, Mexico, the UK, Ireland, the Czech Republic, Thailand, Hong Kong, China, Malaysia and Brazil.

It is this split, between those firms that define and market products, such as Gap, Dell Computer, Ford, and Daimler's Smart Car division (the Smart Car is assembled almost entirely of supplier-manufactured systems and sub-assemblies), and those firms that provide a wide range of customers with global-scale production services, such as Celestica, that has led me to the next two categories of value-chain actors presented in Table 4: the lead firm and the turn-key supplier. Lead firms are so-called because they usually initiate the flow of new products through the value chain and help to drive the organisation and geography of their production networks by demanding that their suppliers engage in new activities and invest in new places. Such a role is usually associated with a great deal of power. In rare cases, however, the locus of power can lie elsewhere in the chain, with large retailers such as Walmart or even component suppliers such as Intel and Microsoft, for example. When retailers take on the role of setting product strategies, participating in product development (e.g. by selling private labels) and building and directing their own production networks, as many have done (Gereffi 1994), I would argue that that they have joined the ranks of other lead firms in the apparel industry such as Nike and Gap – firms that have increasingly, conversely, come to sell products through their own retail outlets. This last point brings up two important caveats to the scheme presented in Table 4, that a given firm's scope of value-chain activities is not static, and that the activities of large firms can and do span categories without necessarily earning them the label of integrated firm.

Turn-key suppliers are so-named because they provide a full-range of services without a great deal of input by lead firms. Lead firms provide instructions, perhaps, on *what* to make, but it is largely up the supplier *how*, and sometimes even *where* products are made. I derive the term turn-key from

the electronics industry, where highly functional contract manufacturers, particularly those that take the financial and operational responsibility for in-bound and out-bound inventory flows, are referred to as 'turn-key contractors'. The term is inherently somewhat awkward but, even worse, there is some danger of false homogeneity. In factory construction, companies that build fully-equipped production facilities, and even hire workers in some cases, are said to be providing their customers with a 'turn-key facility'. In the realm of corporate computer systems, system integrators and value-added resellers that purchase, install, and integrate hardware and software for their customers are said to be providing their customers with a 'turn-key enterprise computing system'. While the meaning of the phrase 'turn-key' in these two examples is very similar to the meaning in the electronics case (factories, computer systems, and manufacturing services are all provided to their customers in a ready-to-use form: just turn the key), the industry-specific contexts of electronics manufacturing, factory construction and computer systems can distract from the topic at hand: value chains and production networks. It would be better to find a new term that captures the highly functional and financially powerful character of the new breed of – increasingly global – suppliers that have grown up to serve the new breed of devverticalised lead firm. One interesting thing to note about turn-key suppliers is that they have grown, in part, by widening their activity range in the value chain. This allows them to provide a 'full-package' of goods and services (or, as is often said in the electronics sector, a 'total solution') to their customers. Thus, as many lead firms have 'devverticalised' by outsourcing activities previously performed in-house, a set of large and highly functional turn-key suppliers has grown up to serve them by integrating vertically – within strict limits – allowing the aggregation of economies of scale and scope that often exceed their customers by a wide margin (Sturgeon 1997, 1999a, 1999b).

The nomenclatures and typologies laid out in this article should be considered a starting point. General acceptance of a set of abstract terms and typologies can only result from a long process of debate and refinement. It is hoped that this article can make a small contribution to such a debate. Clearly, there is no one 'right' way to think about

value chains. It is my hope that we can agree at least about which terms are interchangeable and which

have quite different meanings, and thus engage in a more fluid conversation even if we each move forward with our own favourite set of terms.

## Notes

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1. I am indebted to Florence Palpacuer for helping me to clarify this distinction.

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