

**CHAPTER 18\*****Inter-Firm Relations in Global Manufacturing: Disintegrated Production and Its  
Globalization****Gary Herrigel and Jonathan Zeitlin****Introduction**

This chapter surveys the state of international scholarly debate on inter-firm relations in global manufacturing. It focuses on the evolving strategies of customers and suppliers within the value chains of core manufacturing industries, such as motor vehicles and complex mechanical engineering products. The analysis is divided into three parts. The first part discusses the historical emergence of clustered, flexible and/or vertically disintegrated production (hereafter: disintegrated production) since the 1980s. It contrasts disintegrated production with production within hierarchical, vertically integrated Fordist/Chandlerian firms, arguing that the former has undermined the latter over past thirty years, both in scholarly discussion and to a large extent in

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\* Forthcoming in Glenn Morgan, John Campbell, Colin Crouch, Peer Hull Kristensen, Ove Kai Pedersen and Richard Whitley, eds., *The Oxford Handbook of Comparative Institutional Analysis*, (Oxford: Oxford University Press, 2009+)

the practical orientations of the actors themselves. Two related but distinct variants of disintegrated production are presented: the industrial district/local production system model (ID/LPS) and the lean production/collaborative supply chain model (LP/CSC).

The second part addresses the globalization of disintegrated production. It examines the strengths and weaknesses of the modularity/contract manufacturing approach to transnational supply chains, and then goes on to contrast these to alternative forms of internationalization by multinational customer and supplier firms. Just as disintegration of production was seen to undermine hierarchy within and between firms in the preceding section, here the global dispersal of production appears to be gradually undermining old hierarchies between developed and developing regions. Recomposable hierarchy, collaboration, and mutual exchange increasingly shape interactions between the two types of manufacturing regions.

The subjects of the first two parts can usefully be thought of as historically sequential: vertical disintegration and regionalization occurred prior to extensive globalization of production. Today, however, the analytical distinction between the two has become less sharp as different systems of decentralized producer relations increasingly interact and interpenetrate in ways that generate their own distinctive dynamic. This is particularly true when our focus shifts to small and

medium-sized firms (SMEs). The third part analyzes interactions between production in developed and developing regions, together with the evolution of SME strategies in high-wage regions in response to the resulting challenges and opportunities. The concluding section considers the implications of these developments for power and inequality in global supply chains.

### **Manufacturing Disintegration: Permanent Volatility, the Crisis of Fordist/Chandlerian**

#### **Organization, Industrial Districts and Lean Production**

Much of the recent literature on inter-firm relations and disintegrated production in manufacturing dates back to discussions that began in the 1980s about the crisis of the vertically integrated firm (Piore and Sabel 1984; Hirst and Zeitlin 1991; Harrison 1994; Storper 1997). At that time, both actors and observers perceived that the environment in core sectors of manufacturing in advanced industrial economies had become distinctly more volatile and uncertain. Many factors were advanced to account for this qualitative transformation: macroeconomic destabilization, shortening product cycles, accelerating technological change, the differentiation of consumer taste, the intensification of competition, the globalization of product markets. There is no consensus on what separates symptom from cause in this transformation.

But all arrows point in the same direction: towards the conclusion that producers confront a permanent and ineradicable challenge of increased environmental volatility and uncertainty.

These new environmental conditions have resulted in organizational and strategic consequences for producers. At the most abstract level, debate since the 1980s points to a shift between two opposed ideal types: from the vertically integrated 'Fordist' or 'Chandlerian' firm to decentralized, clustered, networked, lean, flexibly specialized, and/or recombinatory producers. The former characterizes the dominant model of organization and practice prior to the onset of new environmental conditions; the latter the organizational forms and practices that have proved most successful in the new environment. Pervasive environmental volatility and uncertainty rewards continuous innovation. Competition elevates production quality and cost reduction capability to the fore. Flexible and specialized (disintegrated) producers, engaged in ever-shifting collaborative and market exchanges, flourish under these conditions while hierarchical and vertically integrated producers flounder. Put in a more evolutionary idiom, competition from recombinant coalitions of independent specialists gradually drives out firms seeking to integrate those specialties within their own operations.

Disintegrated production emerged along two main pathways during this historical transition. First, vertically integrated producers disintegrated their operations, focusing on core competences and shifting production operations and component design processes out to suppliers (Sabel 1989; Helper 1991; Storper 1997). Second, disintegrated districts and clusters of specialized, cooperative small and medium-sized producers, both old (the Third Italy; Baden Württemberg; Jutland) and new (Silicon Valley), became strikingly competitive in world markets (Saxenian 1994; Herrigel 1996; Kristensen 1992; Kenney 2000; Zeitlin 2007).

Before proceeding further with this analysis, however, a few methodological observations are in order. First, this 'transition' narrative cannot be taken as a reliable empirical guide to understanding historical developments (though it is remarkably prevalent as a meme in the literature). As we have sought to show elsewhere, practices, strategies and organizational forms supposedly characteristic of the 'new' environment could be found well before that environment emerged. The same is true of elements of the 'older' practices and organizational forms in the present (Sabel and Zeitlin 1985, 1997, 2004; Herrigel 2009). The movement in the last 30 years is much clearer in the analytical literature than in practice. There is much empirical evidence showing that large manufacturing firms across a wide range of sectors have disintegrated since the 1970s ( Abraham and Taylor 1996; Lorenzoni and Lipparini 1999; Essletzbichler 2003).

There is even more evidence that conglomerate forms have broken themselves up during the same time period.(Davis et al. 1994; Zenger and Hesterly 1997). But there is also significant variation within sectors. For example, large Japanese and Korean consumer electronics companies are much more vertically integrated than their American or European counterparts (Berger 2005; Sturgeon 2007). Conglomerate forms continue to prosper in the developing world where financial systems are less developed, as for example in the case of the Indian Tata group (Acemoglu et al. 2007). Many regions of specialized producers continue to flourish, such as Silicon Valley, or a variety of Italian industrial districts. But other specialized regions such Prato, Route 128, or the Ruhr have struggled or declined (Grabher 1993b; Saxenian 1994; dei Ottati 2003). Moreover, none of these regions emerged out of whole cloth, and many have histories that go back well into the eighteenth or nineteenth centuries (Herrigel 1996; Sabel and Zeitlin 1997; Zeitlin 2007). Finally, even though there is nothing about any particular national institutional system that prevents the emergence of successful disintegrated or Fordist production, both polar organizational forms allow for significant variation, both by sector and by national economy (Chandler 1990; Herrigel 1996; Storper and Salais 1997).

Thus the analytical types presented in this section are stylizations. They highlight the distinctive features of contemporary disintegrated inter-firm practices. But they are by no means fictitious or

imaginary, since much ethnographic evidence suggests that they inform the dominant orientations of firms and other economic actors about the nature of the environment and the organizational forms regarded as normal or paradigmatic (for a fuller theoretical discussion, see Sabel and Zeitlin 1997: 29-33). But such orientations should not be confused with the actual array of practices 'on the ground'. The Fordist/Chandlerian firm and the contrasting model of disintegrated production should be understood as orientations guiding (but not determining) the actions of firms and other actors. Practice itself is much more diverse, because actors themselves are frequently aware both of the complex dependence of forms of economic organization on multiple background conditions, and possibility of sudden, unanticipated shifts in those conditions. Hence, they often seek to avoid definitive choices between polar alternatives and/or to anticipate in their forms of economic organization the need for future reconstruction in the face of changed circumstances. Actual disintegrated production is thus dramatically heterogeneous, both institutionally and strategically. Moreover, all the various configurations of disintegrated firms must reproduce themselves over time. They encounter challenges, suffer from internal disputes and many are not able to reproduce their success. The contingency of success and the significance of appropriate governance structures for enduring reproduction should be a core focus of any analysis of disintegrated production (Zeitlin 2007).

With these caveats in mind, the aim of this section is, first, to present the basic *orienting* contrast between the Fordist/Chandlerian and disintegrated types of manufacturing organization. The primary focus will be on the shifting boundaries of the division of labor in production: the organizational location of design, development, component manufacturing, and assembly. Having established this basic contrast, we then go to outline the two most common variants of disintegrated production: the industrial district/local production system (ID/LPS) model, and the lean production/collaborative supply chain model (LP/CSC). As we will see in Section 3, these two variants increasingly overlap in actual manufacturing practice. But the two forms remain distinct ways of conceptualizing disintegrated flexibility in production. It is thus useful to draw out the contrast between them two at the outset.

### **Fordist/Chandlerian vs. Disintegrated Manufacturing**

The archetypical Fordist/Chandlerian firm was developed for mass production of standardized final goods. Its organization revolved around a logic of hierarchy, role specialization, and control: product development and design were strictly separated from manufacturing, while within manufacturing itself conception was separated from the execution of particular tasks. In order to achieve economies of scale, ensure stability of supply, and maximize throughput, firms vertically integrated their operations. Automobile producers in the United States and Europe, for example,



typically produced 50-80% of value added inside the firm (Kwon 2005). Resort to outside suppliers generally involved purchase of lower value-added parts, specialized equipment (e.g. capital goods such as machine tools), or capacity subcontracting where the blueprints for specific articles were bid out on a short-term basis when in-house facilities for making these items were overstretched. Hierarchy pervaded the chain of development and production. Roles throughout the division of labor were rigidly circumscribed. Authority and leverage were used to control the flow of knowledge and material resources through the production process.

These principles became vulnerable in the new volatile environment because they created rigidity: hierarchy and role specialization undercut communication across locations in the division of labor. A good illustration of how these core Fordist/Chandlerian principles could become quite cumbersome in practice is the product development process in manufacturing. Product life cycles in automobiles during the three decades after WWII, to take a quintessential example, could be as long as 10 years or more. Isolated designers developed new models and ‘threw designs over the wall’ to their comparably isolated manufacturing colleagues. Problems encountered with the designs, if discovered, delayed their roll out significantly as manufacturing had to wait for the designers (or its own engineers) to come up with something that could be produced.

The organization of manufacturing itself further exacerbated these delays. Authority ran through layers of management, while shop-floor worker input was de-emphasized. Problems in the flow of production had to be identified from above, and solutions introduced similarly. This occurred again, and again, throughout virtually all the myriad linked component processes and manufacturing stages in complex technologies. Such intra-firm arrangements made the redesign of products, recomposition of manufacturing processes, and reallocation of jobs extremely cumbersome. Change was costly and took a very long time. Yet (roughly) by the beginning of the 1980s, redesign, recomposition and reallocation were becoming constant and increasingly inescapable for producers. A mismatch existed between the orienting principles of the hierarchical, pillarized, vertically integrated organization and the volatile, unpredictable and rapidly changing character of the competitive environment.

By contrast, beginning in the 1980s, observers noticed that smaller, more specialized and/or less bureaucratic organizations showed remarkable flexibility and capacity for innovation in this volatile environment. Observation of successful cases gradually began to generate an alternative set of orienting principles for manufacturing organization. The successful alternative groupings of producers reversed the Fordist/Chandlerian emphasis on the separation of design and

manufacture and conception and execution. Less organizational hierarchy and less specialization in the division of labor forced design and manufacturing to collaborate in new product development (Clark and Fujimoto 1991; Clark and Wheelwright 1994). Teams or groups of employees with different functional skills emerged as core sub-organizational units (Schumann et al. 1994; Osterman 1999; Helper et al. 2000). They allowed designers and engineers to solicit the input of manufacturing managers and even generally skilled workers when changes in production were required. Such interaction created greater flexibility and helped shorten product development cycles. In many cases, extensive labor involvement in teams created a form of stakeholderism that fostered internal experimentation and risk taking (Sabel 2005a; Kristensen 2008b).

These producers were much less vertically integrated than their Fordist/Chandlerian counterparts. Firms or production units specialized on particular technologies and aspects of development and manufacture. They relied on the complementary inputs of other specialists to offer a complete product to their customers. Collaboration across production unit boundaries proved a competitive advantage. Producers benefitted from the market and technological knowledge of neighboring specialists. They also did not have to carry the costs in manpower and equipment required to produce such know-how (Sabel 1989; Storper 1997; Powell 2001). *Embeddedness* of specialists

in myriad repeated exchanges with complementary partners spread the practice as well as the cost of innovation across the networks (Granovetter 1985; Grabher 1993a). This made it easier (and less costly) for firms to experiment and take risks on new products and technologies, thereby accelerating change in both areas. In addition, the continuous encounter with outside expertise created the possibility for genuinely new ways of thinking about one's own expertise. In this way, repeated interaction among specialists fostered innovation (Amin and Cohendet 2004; Döring and Schnellenbach 2006).

Governance was also distinctive in the new disintegrated arrangements. Whereas in the Fordist/Chandlerian system, hierarchy and market tended to exhaust the mechanisms governing inter-positional and inter-firm relations, disintegrated production tended to be governed by a wider array of intermediate forms. Some of these intermediate forms could be quite formal and institutionalized, as in joint ventures, product development projects, development consortia or supplier upgrading alliances. But in other cases, non-market and non-hierarchical relations among firms were governed either by explicit rules or by informal understandings of trust and mutual purpose. Through a wide array of specific exoskeletal institutional arrangements, these latter governance structures fostered a balance between competition and cooperation among specialists

and thereby allowed for (even encouraged) continuous organizational recomposition (Sabel 1989; Grabher and Powell 2004)

In sum, the alternative disintegrated networks of producers avoided the pillarization of narrow role definitions and strong functional boundaries characteristic of Fordist/Chandlerian firms. Sequencing gave way to concurrency in product development and production. Provisional, revisable roles replaced rigidly specialized ones and collectively shared knowledge replaced hierarchical control and fragmentation. Indeed, in this disintegrated context, governance by the polar mechanisms of hierarchy and market gave way to a variety of intermediate mechanisms.

There is widespread agreement in the literature that current conditions are more congenial to the alternative vertically disintegrated, flexible, and networked forms of organization than to old-style hierarchical Fordist/Chandlerian forms. This does not mean that firms have completely abandoned ambitions towards hierarchy, authority, or control. Such powers are relinquished reluctantly, and opportunities to obtain them rarely foregone. Nor have the price mechanism and arms-length contracting disappeared. The argument is not that such relations or mechanisms no longer exist in the current environment, but rather that hierarchical, role specialized, and vertically integrated organizations are less able to negotiate volatile, uncertain industrial

environments than those based on more horizontal, flexible, and decentralized arrangements.

There is still considerable debate, as we shall see, about the role of authority, control, hierarchy, and market relations within the alternative more disintegrated inter-firm arrangements.

This distinction between the logic of orienting principles and the logic of practice accounts for much of the confusion in academic debates (visible particularly during the 1980s and early 90s) (Wood 1989; Amin and Robins 1990; Harrison 1994). It also accounts for the peculiar character of the aggregate quantitative literature that has attempted to measure vertical disintegration, collaboration, the flattening of hierarchies, across entire industries or even the entire manufacturing sector. Typically, such studies find that the results, while pointing in the direction of disintegration, are mixed. Vertical disintegration has increased, but integration has not disappeared. Collaboration is diffusing, but arms-length competition continues to exist (Fieten et al. 1997; Helper and Sako 1998). Case-study research tends to show the same thing (Berger 2005; Whitford 2006; Herrigel 2009). This should not be surprising. The extreme claims for either pole depended on specific environmental conditions that are not found uniformly in all realms of practice. Actors do not enact orientations blindly; rather they are malleable frameworks or points of reference that actors adapt and recompose as they seek to resolve successive problems in their factories and markets. Moreover, at least one view holds that producers

pursuing collaborative strategies in uncertain environments systematically enter over time into a heterogeneous array of relations (collaborative, arms-length, in-house production, capacity subcontracting, etc.), in an effort to avoid becoming entrapped in local, bilateral ties, while scanning the horizon of potential partners for new opportunities for innovation and cost reduction (Helper et al. 2000; Herrigel 2009; Sabel 2005a)

Predictably, all of this complexity has produced a significant skeptical literature (Lovering 1999; Martin and Sunley 2003; Wolfe and Gertler 2004). Even here, however, it is important to recognize that a bar has been crossed since the 1980s. Skepticism is no longer directed at the viability of disintegrated forms of inter-firm organization in relation to the Fordist/Chandlerian firm. Instead skeptics focus on the limits of the diffusion, or the specific conditionality, of the flexible disintegrated forms. Do the alternative forms appear spontaneously and/or inevitably? Are all variants of decentralized organization equally successful? Is it possible to create successful inter-firm practices everywhere? Such questions animate debate and make for a very robust research program.

### **Varieties of Disintegrated Production**

Next, however, we need to parse the alternative disintegrated principles of production a bit more carefully. Though as a generic matter, all forms of flexible disintegrated production share the above qualities, there are a wide range of variants of flexible organization identified in the literature (Grabher and Powell 2004; Smith-Doerr and Powell 2004). Within manufacturing, two distinct models of disintegration and flexibility emerged in the wake of the crisis of the Fordist/Chandlerian firm. As with the principles of disintegrated production in general, each of the alternative models of flexible production was rooted in empirical cases of competitive success in the face of volatility. The first is the industrial district/local production system model (ID/LPS); the second is the lean production/collaborative supply chain model (LP/CSC). Today, the two models increasingly interpenetrate, but they have distinct origins, both in academic discussion and empirical experience.

The ID/LPS model received a great deal of initial attention in public debate (Brusco 1982; Piore and Sabel 1984; Pyke et al. 1990). This was surely related to the fact that it very nearly inverts the Fordist/Chandlerian model. In place of giant, hierarchical, integrated firms, industrial districts are geographically localized clusters of small and medium-sized producers, interrelated by complementary and ever recombining specialties. Actually existing industrial districts vary widely, and there is significant conceptual debate about how to define them (Whitford 2001;



Zeitlin 2007). At one end of the spectrum, we find extremely specialized regions where clusters of interrelated firms produce a single type of product, e.g., pottery, bicycles, cutlery, woven textiles, shoes, packaging machinery, etc. At the other end, the clusters are less specialized on particular end products. In such systems, complementary specialists generate a broad and changing array of finished goods and intermediate components, such as industrial machinery, motor vehicles, semi-conductors, consumer electronics, software, or biotechnology products (Crouch et al. 2001, 2004).

Whether specialized or diversified in industrial composition, however, the distinctive features of the ID/LPS model, at least initially, were the fluidity of roles among producers and spatial agglomeration. Fluidity or malleability of producer roles within the value chain in ID/LPS regions made for a distinctive mixture of collaboration and competition. Producers played multiple roles (customer, supplier, collaborator, arms-length price taker, competitor, etc) in multiple contracts both at the same time and over time. This made it difficult to establish consistent relational hierarchies: assembler, developer, and coordinator roles were unstable, provisional, shifting, and often simply enacted jointly. The spatial element within successful disintegrated regional economies involved, at one level, intense and frequent face-to-face exchange and common cultural understandings among producers. At another level, more

importantly, sharing a common geographic space facilitated the creation of a shared extra-firm infrastructure for the provision of collective goods: institutions for training, finance, technical assistance, interest representation, dispute resolution etc. Without such institutions (however constituted) to govern competition and cooperation, and facilitate continuous recomposition, successful collaboration within ID/LPS regions has generally proven fragile and short-lived (Storper 1997; Bellandi 2006, 2009; Zeitlin 2007 ).

The LP/CSC model traces its genealogy back to the Japanese automobile industry (Cusumano 1985; Nishiguchi 1994; Fujimoto 1999). There, producers did not follow the vertically integrated path of Fordist mass production (Womack et al. 1990). Instead, the division of labor in automobile production remained disintegrated with large final assemblers, such as Toyota, directing and collaborating with extended chains of suppliers in the development and manufacture of their final products. Lean production had many striking advantages over traditional hierarchical forms of manufacturing organization. Crucially, it pioneered the radical integration of design and manufacture, known as ‘simultaneous engineering’. Multifunctional teams of customers and suppliers designed a product and developed the techniques for its manufacture simultaneously in iterated rounds of conceptualization and experimentation. This practice radically reduced product development times and shortened product cycles. It also

became possible to modify products quickly and add variety (Chanaron et al. 1999; Helper et al. 2000).

In addition, LP/CSC pushed collaborative team organization throughout the entire supply chain (Kochan et al. 1997; Adler et al. 1999). By giving teams self-governing autonomy (their own budgets, production targets, scheduling responsibility) and by utilizing formal mechanisms for group self-monitoring (mandatory intra-group benchmarking, local quality control, systematic error detection), LP/CSC made it possible to simultaneously improve production quality and lower total production costs (Helper et al. 2000). In contrast to the Fordist/Chandlerian 'push' logic, where production was driven by market forecasts, materials and parts ordered well in advance, and finished product placed in inventory waiting to be sold, LP/CSC followed a 'pull' logic. Customer orders prompted downstream teams to mobilize their upstream counterparts, in effect pulling material through production to final assembly. By delegating responsibility for quality and work flow directly to downstream teams, lean producers radically minimized inventory, work-in-progress, waste, and redundancy throughout the production process (Hines et al. 2004).

The LP/CSC model shared many features with the ID/LPS model. Both relied on the continuous blurring of boundaries between design and manufacture and between conception and execution in production. Both were significantly disintegrated, with independent producers collaborating across firm boundaries to exploit complementarities and achieve flexibility. But LP/CSC was distinctive in a number of ways. Unlike ID/LPS, the logic of lean production focused on value chains within industries rather than spatial relations among agglomerations of producers. Although lean production networks were also regionally clustered to some extent, with just-in-time suppliers located close to assembly plants, the linkage logic was not primarily spatial. As a result, collaboration could extend beyond particular regions and continue to be governed by the logic of LP/CSC. Moreover, in classic Japanese LP/CSC inter-firm relations, roles were more stable, since suppliers occupied positions in ‘tiers’. The fluidity and ambiguity of roles among firms characteristic of the ID/LPS was much less pronounced in the initial Japanese version of LP/CSC, though even in the latter suppliers could be ‘promoted’ to higher tiers (or demoted to lower ones) based on their relative performance in previous product cycles. Finally, LP/CSC was distinctive in that cross-boundary collaboration, both within and across firms and teams, focused not just on technology and product development, but also on cost reduction. Organizational recomposition through continuous improvement processes—benchmarking, kaizen, self-analysis in error detection, etc—was a systematic feature of the LP/CSC model. In striking contrast to the

flexibility generated by the informal mix of collaboration and competition driving the ID/LPS model, LP/CSC relied on formal procedures that forced producers to evaluate their own practices and forced them to reform in the interest of product innovation, quality improvement, error detection, and/or cost reduction (MacDuffie 1997; Sabel 2005a).

### **The Globalization of Disintegrated Production: Offshoring, Multinationals, and Multiple Logics in Transnational Supply Chains**

Soon after disintegrated production emerged in the advanced industrial economies, it began to globalize. The process began in the 1970s with lighter, simpler, labor-intensive products like garments, footwear, and some electronics, but by the late 1990s had engulfed a wider range of industries, including heavier, more technologically complex, capital-intensive sectors, such as motor vehicles; aerospace; industrial, construction, and agricultural machinery; electrical equipment; steel; and pharmaceuticals (Feenstra 1998; Arndt and Kierzkowski 2001).

Globalization both intensified and modified the process of disintegration in production. The internationalization of disintegrated production is animated by two dynamics. Though they are analytically distinct and have separate origins, these dynamics have become increasingly interconnected, with very significant consequences, as we shall see below.

One dynamic is the increasing cost pressure facing customers and suppliers in high-wage regions. Firms are constantly forced to reduce their costs, even as they maintain or even improve the quality and sophistication of their products. These contradictory pressures have driven the trend toward vertical disintegration in production, as firms focus on ‘core competences’ and rely on specialists for everything else. The same pressures are now driving production across borders. Both customer and supplier firms are increasingly establishing production operations (or finding suitable contractors) in lower-wage environments to relieve cost pressure on their product palettes. In this way, production in low-wage environments for delivery to customers in high wage regions can be understood as a kind of pressure-release valve (in German, a *Ventile*).

The other dynamic driving the offshoring of production is the pursuit of access to foreign markets. Lead firms move to developing countries (especially large ones like China, India, or Brazil) to serve the local market more easily—in particular by adapting designs to local needs and even developing unique products for those markets (Buckley and Ghauri 2004; Ghemawat 2007). Suppliers follow lead firms to these new production locations in order to retain their key customers. Lead firms want the reliability of veteran collaborators as they attempt to produce in offshore markets. They also want the flexibility that more global suppliers are believed to provide. Global suppliers, on this view, can draw on know-how and capacity from around the

world; they can also use scale as a means of exerting leverage with their own suppliers to achieve lower costs.

Taken separately, these two dynamics generate considerable complexity in the division of labor between high and low-wage regions. Their interaction not only generates even greater complexity, but also very surprising, and even counter-intuitive results. Where globalization strategies are succeeding, production becomes more sophisticated in lower-wage environments and more secure in high-wage ones.

How this is possible will gradually become apparent as the analysis proceeds through three steps. First, we will look at the strong claims for the emergence of a new production paradigm and a new global division of labor advanced by proponents of the modularity/contract manufacturing approach to supply-chain restructuring. Their arguments for a radical break between design and manufacture and the emergence of a stable hierarchy between developed and developing regions will be shown to be sharply limited. Not only is this logic circumscribed even in those industries where actors self-consciously pursue modularity, but it does not apply to many manufacturing sectors, which continue to be characterized by 'integral' rather than modular product architectures (Ulrich 1995). Second, we will examine the progress of offshoring within integral

architecture sectors such as motor vehicles and other complex mechanical engineering products from the perspective of firms seeking to reduce their costs. A distinctive feature of this process is the continuing interpenetration of design and manufacture throughout the supply chain. The complex dynamic between developed and developing countries that has emerged from this dimension of the offshoring process, we argue, appears to be destabilizing what was once considered a stable hierarchy between developed and developing regions. Third, we show that this emergent complexity and uncertain hierarchy of relations between regions and players within the manufacturing supply chain is further exacerbated by the second driver of offshoring noted above: lead firms' efforts to enter new markets and the resultant imperative for suppliers to follow their customers. Each of these offshoring dynamics creates complex spatial and organizational allocations of competence and capacity; together they generate an intriguing multiplicity of firm strategies and resource allocation logics. The rest of this section focuses primarily on the strategies of large multinational lead firms and their suppliers. Section 3 considers the strategies high-wage SMEs and the regions that support them are pursuing to cope with these same pressures of globalization.

### **Separation of Design and Manufacture, Cost-Driven Disintegration, and Offshoring: The Limits of Modularity**



Within the dialectic of innovation and cost reduction driving productive disintegration in production, it was a logical step for firms to look to offshore locations with lower labor costs as a way to achieve quick cost reductions. Much of the initial literature on transnational supply chains focused on the apparel and consumer electronics sectors, where firms seemed to have had dramatic success in leveraging offshore cost differences in production (Gereffi and Korzeniewicz 1994; Borrus et al. 2000; Bair 2005). Those studying the sectors claimed that a distinctive new dynamic was emerging around the possibilities for reorganizing the global division of labor in production. Indeed, several authors argued that the dynamics in these sectors pointed to the emergence of a new model for manufacturing as a whole, which we will call the modularity/contract manufacturing (M/CM) model (Sturgeon 2002; Garud et al. 2003; Langlois 2007).

Distinctive about the sectors in which the M/CM model was pioneered is that large lead firms drove disintegration in the division of labor while at the same time maintaining a rigid divide between design and manufacture. This eliminated the need for the collaborative and recombinatory relations characteristic of the disintegrated model described in the previous section. Relations between designing customers and manufacturing suppliers were based on a clear and extreme division of roles which, at the limit, could be governed through arms-length

market exchange. This, it was claimed, created the possibility for dramatic spatial separation of design and production. Design and value added, according to this view, tended to concentrate in high-wage environments, while manufacturing, as a low value-added activity, gravitated to locations where labor and other costs were also lower.<sup>1</sup>

The key to this strategy, particularly in electronics, was the creation of modular product architectures, based on standard technical interfaces between the overall design and its constituent components or subsystems (Baldwin and Clark 2000; Langlois 2003; Schilling 2003). By developing products with stable, codified interfaces between internal functional elements, lead firms could focus on design and hand off production of standardized components to independent suppliers. Those supplier firms (so-called ‘contract manufacturers’), in turn, were responsible for organizing production on behalf of the lead firm, seeking out the cheapest locations and coordinating the flow of components around the world (including final assembly in some cases). Such contract manufacturers worked with multiple lead design firms at the same time, filling their capacity by producing high volumes of differently designed but standardized modules in locations where labor costs were extremely low. Sturgeon’s ideal type of these ‘modular production networks’ was concentrated in what he called ‘product-level electronics’

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<sup>1</sup> Though as we will see immediately, control over manufacturing operations in those regions very frequently stayed under the control of independent developed country multinationals.

(televisions, computers, cell phones, personal digital assistants, etc). But similarly sharp divisions between design and manufacture could also be observed in others sectors as well, particularly apparel, footwear and bicycles. There, in addition to modularity (bicycles), the manufacturing process was labor-intensive and the product simple enough (apparel) to allow for the separation between design and manufacture (Gavin and Morkel 2001; Sturgeon and Lester 2001; Gereffi 2005a).

The M/CM perspective (Humphrey and Schmitz 2002; Bair 2005; Gereffi et al. 2005) envisages an emerging global hierarchy in which lead firms in rich countries increasingly abandon manufacturing for the exclusive control of knowledge, design, and marketing. For their part, developing regions struggle to lure footloose contract manufacturers in order to ‘upgrade’ their infrastructures of physical and human capital, and gain access to know-how and value added that will one day permit them to generate their own contract manufacturing operations. The clear boundary between design knowledge (and brand value) on the one hand and manufacturing know-how and expertise on the other, establishes a fixed hierarchy among stages of the value chain, even as producers, regions and economies are able to upgrade within it.

In this literature, Taiwan, Israel and Ireland have emerged as leapfrog cases, political economies capable of springing over the barriers dividing developed and developing regions through adroit state intervention. But such barrier hopping does not change the underlying spatial logic of relative costs relating design to manufacturing. Once the Taiwanese, for example, hopped over the design barrier, on this view, they began shifting their own manufacturing to contract manufacturers in lower-cost regions in China (Breznitz 2007). Design and manufacture map onto a specific conception of what it means to be developed and not yet developed. In the M/CM perspective, such hierarchy is a natural and inescapable feature of capitalism. Countries advance their position along a know-how and value hierarchy until they reach a point where it is possible to abandon manufacturing entirely.

These hierarchical lead firm/contract manufacturer arrangements have become a significant feature of global production (Kenney and Florida 2004; Berger 2005; Gereffi 2005b). There has also been significant manufacturing job loss in high wage regions, some of which can be traced to offshoring (Bronfenbrenner and Luce 2004; Marchant and Kumar 2005; Boulhol and Fontagne 2006; Mankiw and Swagel 2006). For all of that, however, M/CM does not seem to be becoming the dominant model for global disintegrated production as its early scholarly proponents claimed.

Manufacturing and design remain mutually dependent among producers in both high and low-wage contexts (Brusoni et al. 2001; Prencipe et al. 2003; Sabel and Zeitlin 2004).

Regarding modularity, firms appear to be acutely aware that the separation of design from manufacturing can lead to so-called ‘modularity traps’, where irreversible commitments to a specific product architecture and set of technical interface standards results in a loss of system-level knowledge and capacity to participate in the development of the next new architecture on the part of component specialists (Chesbrough 2003; Fixon and Park 2007; Baldwin 2007). Thus, even within electronics, only a relatively small percentage of products have a genuinely modular character: estimates of contract manufacturers’ share of the global cost of goods sold in this sector range from 13-17% (Sturgeon 2002; Berger 2005). In the rest of electronics, the characteristic inter-firm collaboration of the disintegrated model plays an important role and the customer/supplier division of labor between design and manufacture is more complex. Indeed, the turbulence and rapidity of change in product markets and technologies seems to have undercut producers’ capacity in these supposedly modular sectors to achieve stable codification systems (Berggren and Bengtsson 2004; Ernst 2005; Voskamp 2005). Sturgeon himself now acknowledges that “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...the hand-off of design specifications is becoming more complex and less standardized”, thereby requiring “closer collaboration in the realm of product design” between customers and suppliers (Gereffi et al. 2005: 95).

More importantly, there appear to be many sectors within manufacturing where the technical capacity of lead firms to design modular product architectures is extremely limited. This is true of many complex metalworking sectors, such as automobiles, construction machinery, agricultural equipment, and virtually the whole vast capital goods area of mechanical engineering (Herrigel 2004; Whitford and Zeitlin 2004; Whitford 2006). In such ‘integral’ architecture products (Ulrich 1995), technical sub-systems interpenetrate and their interfaces cannot be easily standardized, either from model generation to model generation, or across a palette of common product offerings (MacDuffie 2007). Lead firms in these sectors typically do not seek to break products down into fixed modules defined by a one-to-one mapping between a function and the physical devices that embody it, but instead engage in a process of iterated co-design with component suppliers, in which complex wholes are provisionally parsed into parts whose subsequent development then suggests modifications of the initial overall design, which are then provisionally parsed again, and so on. At any given moment, suppliers may be engaged in manufacturing ‘black box’ parts defined by the interfaces of a particular product architecture, but

the most capable (and best remunerated) are also expected to assist their customers in redefining those interfaces for cost reduction and performance improvement in the next design iteration (Sabel and Zeitlin 2004).

Integral product architectures are no barrier to vertical disintegration or globalization—indeed many of the archetypical cases of disintegrated production described in Section 1 were found in these sectors, in both IS/LPS and LP/CSC versions. But if manufacturers of such products want to exploit the cost advantages of offshore production locations, they must do this in ways that take account of the continued indispensability of inter-firm collaboration. This has led to a different offshoring dynamic and, ultimately, to a mutually dependent global division of labor between developed and developing regions

### **Offshoring, Collaboration, and the Destabilization of Spatial Hierarchy**

The offshoring process in integral-architecture manufacturing unfolded in a distinctive sequence. Initially, lead firms and their suppliers sought to purchase simple, standardized components from offshore producers. Developed country suppliers, when they were able to do so, shifted production of their mature components—parts that had already been designed and that went into aftermarket or replacement markets—to offshore locations. These were arms-length purchases of

low value-added components. Such practices resembled the old-style subcontracting of Fordist/Chandlerian firms, except that instead of procuring parts locally, firms now sought out producers in lower-wage countries. But in the more disintegrated context this kind of offshoring represented an urgent effort to relieve cost pressures. For a time, such practices suggested to some that the radical separation of design from production characteristic of the modular technologies might be applicable in these sectors as well (Sturgeon and Florida 2004).

Unremitting cost pressures on both customer and supplier firms coupled with the inescapability of architectural integrality in product development, however, soon overwhelmed such simple arms-length *Ventile* strategies. More complex strategies to create offshore outlets for cost reduction, involving new and collaboratively developed products, began to emerge (Dicken 2003; Ghemawat and Ghadar 2006). The impetus came initially from powerful final assembler firms in the automobile and complex machinery industries, which insisted that their suppliers develop lower-cost offshore production capacity for new co-designed components (Berger 2004)<sup>2</sup>. Larger supplier firms dutifully shifted new and existing production capacity to lower-wage environments in order to retain their customers' business. This did not necessarily involve closing production

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<sup>2</sup> Large final assemblers often encouraged their suppliers to set up operations in lower-cost regions because they were themselves doing so with their own component production. GM's Delphi and Ford's Visteon, for example, had extensive operations in Mexico and central Europe well before the two parent companies spun off their component divisions into independent companies.



facilities in high-wage environments. Instead, it meant the creation of new and more sophisticated supplemental capacity offshore. Indeed, many suppliers gradually realized that having a sophisticated 'outlet' in a lower-wage region made it possible for them to blend home and offshore production to make lower overall bids on collaborative projects with their customers. Paradoxically, offshoring has thus enabled suppliers to solidify their market position 'at home and abroad' as producers of high value-added specialized products (Herrigel 2007).

This shift in the strategic character of offshoring has initiated a dynamic process of capacity and know-how re-allocation that appears to be radically redefining the division of labor between high and low-wage regions. What is emerging is neither the radical spatial separation of design and manufacture forecast by the M/CM school, nor a traditional comparative advantage model of high value-added manufacturing in high-wage locations and lower value-added manufacturing in lower wage locations. Instead, emergent practice increasingly blends design and manufacture capabilities and high and low value-added processes across global production locations. Different wage levels play an important but not decisive role in this new logic of competence and capacity allocation. (Berger 2005)

At one level, there is still hierarchy between regions in these sectors. Product design and initial production ramp up of a component or sub-system are performed in high-wage contexts, along with especially high value-added production runs that can be efficiently automated or that have lower volumes but more value content. Once the large series process is up and running (six months/one year for complex products such as ball bearing units), it is then transplanted to the low-wage location.

But at another level, this process of technology transfer has begun to undermine the very hierarchy it presupposes. The transplantation of production processes results in the diffusion of current manufacturing practice to low-wage facilities. Increasingly, the machinery park in the low-wage location converges with that in the high-wage location<sup>3</sup>.

A key additional point of slippage in this new division of labor is the location of development and design capacity. Again, such capacity is still mainly located in high-wage regions, with their concentration of engineering know-how and experience with the recursive integration of development and manufacture. But significant restructuring of these competences has occurred within supplier firms across existing high-wage manufacturing locations. This is easiest to see in

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<sup>3</sup> Much of the following material is based on interviews conducted by the authors and their colleagues in the Global Components research project ([www.globalcomponents.org](http://www.globalcomponents.org)) in the US, Germany, Central Europe, and China between 2006 and 2008.

the case of bigger multinational suppliers with broader product palettes and multiple divisions, such as the large automobile suppliers Magna, ZF, Kolbenschmidt-Pierburg, Mahle, Schaeffler, or Robert Bosch. Such firms are increasingly locating competence for the development of specific products in distinct plants in specific high-wage locations. For example, a German piston producer concentrates development capacity for different models aimed at different end users (diesel, passenger cars, commercial vehicles, etc.) in different locations (south Germany, north Germany, France).<sup>4</sup> Such newly specialized locations are called ‘lead plants’ or ‘centers of competence’. Lead plants assume responsibility for developing and ramping up the new generation of product and production technology (ramp up) for their particular type of piston. They are also responsible for transferring the new product and equipment needed to manufacture it to all the low-wage production locations in which the multinational supplier operates (in the piston case, the Czech Republic, Mexico, Brazil, and China). They send know-how and provide on going consultation to these offshore plants to help them get up to speed on the new processes and products.

As an initial step, this division of labor places manufacturing capability in the low-wage region, while retaining development and production, in an integrated way, in more specialized high-

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<sup>4</sup> This example is taken from global components research interviews. Interviews were conducted under the promise of strict confidentiality, so the firm must remain anonymous

wage locations. Significantly, however, this hierarchy is not fixed. There is a slippage, resulting from unavoidable functional spillovers of know-how and competences to new production locations. Transferring new products and processes involves, among other things, training offshore engineers in the lead plant's own special competences in order to enable the latter to optimize production in the offshore location. The existence of a competent and increasingly experienced corps of engineers in low-wage locations also makes the process of 'handing off' production more efficient and allows for its subsequent optimization. It is difficult for firms to maintain completely 'headless' or 'know-how-less' manufacturing-only facilities in offshore locations. Some development capacity is indispensable for the smooth operation of production.

Finally, in most cases, multiple lead plants in high-wage regions maintain relations with the same offshore production facility. Low-wage region production facilities, as a result, have become remarkably diversified, with an array of products that in high-wage locations is increasingly manufactured—at least initially—in separate locations. In the case of the German piston maker, the Brazilian, Czech, and Chinese facilities can produce nearly the entire product range manufactured in all the firm's European plants, while the Mexican facility, although less diversified than the Brazilian, Czech and Chinese sisters, is still more diversified than any western European production site within the MNC. In this way, benefits of productive diversity

historically characteristic of plants in high-wage regions—synergies among seemingly unrelated operations, possibilities for using manufacturing techniques developed in one process on a wholly different product, etc.—are now extended and concentrated in low-wage locations.

**Opening New Markets and Following the Customer: Multiple Logics, Multiple Regions, Multiple Plants, Multiple Hierarchies**

The division of labor within multinational supplier firms between high-wage ‘lead plants’ with integrated development/production capacities and modern low-wage ‘high-volume production’ locations is one important trend shaping the globalization of disintegrated manufacturing. But it is not the only logic shaping the distribution of production and competences and among plants, even within such multinational suppliers. In addition to the logic of cost reduction, the allocation of production capacity within multi-product and multi-plant firms is also driven by pursuit of proximity to customers.

Multinational corporations (MNCs) operating as lead manufacturing firms in complex integral-architecture sectors such as motor vehicles and mechanical engineering have gradually begun to expand operations into developing regions in an effort to compete more effectively for local market share. These strategic investments have been driven both by the relative saturation of

developed country markets and by the rapid emergence of technologically sophisticated demand in developing economies such as Brazil, India, and China, as well as newly capitalist regions such as Central and Eastern . Many lead firms in these sectors (e.g. Ford, Caterpillar, John Deere, Volkswagen, BMW, Hyundai, Toyota, PSA, Volvo) had entered such markets in the past following a product life-cycle model (Wells 1972): i.e. offering older or mature versions of products developed for and long produced in their home regions. But increasingly they and many other major producers recognize the need to develop products more specifically adapted to the particular needs and demands of emerging market users. This involves the creation of significant production capacity in developing regions, as well as the transfer of technological know-how to local subsidiaries there. Manufacturing MNCs also increasingly need to upgrade the skills and technical capacities of their personnel in developing country locations (Depner and Dewald 2004; Ivarsson and Alvstam 2005)

Lead firm MNCs cannot pursue these globalization strategies without the collaboration of their suppliers. The increasing disintegration of production makes the expertise of home country suppliers indispensable for the competitiveness of their customers. Such expertise, moreover, is not immediately available among indigenous suppliers in developing regions, even rapidly growing ones like India or China. Thus, multinational customer firms have encouraged their

suppliers to globalize along with them (Depner and Bathelt 2003; Depner and Dewald 2004; Voelzkow 2007)

In this way, globalization literally involves the transfer of the collaborative logic of disintegrated production governing inter-firm exchanges in developed regions into developing country contexts. This creates a distinct logic of globalization for suppliers, quite different from the cost-reduction logic described in the previous section. This alternative logic drives multinational producers to enhance the activities of existing offshore operations and/or to add complementary capacity to them in an effort to satisfy the local demands of their customers. Lead firms, for example, find that they can expand capacities and competences in their existing offshore manufacturing operations to service offshore markets as well as to reduce costs in their own home market.<sup>5</sup>

The result is that multiple global divisions of labor are superimposed on the global allocation of work among plant locations within multinational customer and supplier firms. Low-wage production locations are allocated high-volume work across a broad spectrum of the mother

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<sup>5</sup> Thus the Audi engine plant in Győr, Hungary, originally established as a low-cost manufacturing location sending engines back to the home assembly facility in Ingolstadt and to sister company VW's assembly plant in Wolfsburg, Germany, has developed new foreign assembly operations to service other local plants (e.g. the Octavia and Taureg assembly works in Mlada Boleslav, Czech Republic, and Bratislava, Slovakia respectively).

firm's product palette, leading them to become highly diversified. Customer demands for local supply likewise tend to expand their production capabilities. In addition to high-volume work, these plants are increasingly able to produce in shorter series and accommodate special requests from their customers. The development capacity that such facilities acquire in order to facilitate the hand-off of manufacturing operations from high-wage regions, then becomes extremely valuable in adapt other products to local customer needs.

A similar logic is affecting the structure and capabilities of lead plants in high-wage regions.

Each lead plant, at a minimum, has the capacity to develop and ramp up a specific product or range of product to high-volume manufacture (e.g. small pistons for passenger cars).

Development and production is highly integrated in such plants, which can engage in experimental, prototype production as well as very small series, customized, and batch-type operations. They also run highly automated high-volume production lines, where the automation plays a significant role in the creation of product value. At the same time, in unsystematic ways, these lead plants retain a more diverse set of competences in order to accommodate local customer demands for the full palette of component types. Thus, for example, a lead plant for small pistons in France may retain some production capacity for larger pistons to accommodate demand from big local customers for the latter. Since the small-piston lead plant has no local



development competence for large pistons, it effectively allocates control over some of its own local production capacity to another lead plant (the one with development competence for large pistons). The small-piston plant's non-core large-piston production is then supervised and serviced by the engineers and developers from the lead plant for large pistons. Thus, in order to accommodate the contradictory and unpredictable demands of new product development, fluctuating series size, and customer demands, lead plants in high-wage regions, despite extensive offshoring and concentration on core competences, are also becoming remarkably diversified.<sup>6</sup>

The image that emerges from this stylized description of the interaction of different logics of global production allocation (cost reduction and new market entry/follow the customer) is that of a delicate multi-regional balancing game. Efforts to concentrate technological competence in particular plants, the continuous pursuit of cost reduction, the desire to maximize production runs while accommodating increasing product variety, and the need to respond to often contradictory customer pressures (to produce offshore and produce locally) are all constantly in play and combined in different ways.

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<sup>6</sup> There are of course limits to such diversification: lead plants do not manufacture wholly different products from other divisions of a large firm; thus piston plants do not produce fuel-injection systems.

The result of these logics and their interaction is to erode rigid hierarchies between developed and developing regions. Competences may be formally concentrated, yet they inevitably spill over and bleed out from one location to another. Capacity is allocated and re-allocated, separated and recombined. Hierarchy is not eliminated: there are still 'leaders' and 'followers' or 'supporters' within the intra and inter-firm division of labor. But such hierarchies are now increasingly recomposable, with the same actors occupying different roles in different contexts ('lead plants' both lead and follow). As a result, the major difference between high and low-wage locations is that the former have larger concentrations of development competence and deeper integration between design, engineering, and production in particular specialized areas. But both types of location exhibit growing integration between development and production, and both operate in support relations with other facilities with greater competence in particular areas. As development competence bleeds out into emergent market locations, high-wage locations are likely to receive know-how from low-wage locations about production areas outside their own core competences. Even now, high-wage plants regularly receive some capacity-balancing work from low-wage sister plants running at full capacity, which are unable completely to fulfill their own customers' orders. In this model, producers and firms do not become 'developed' by abandoning manufacturing. Rather, development involves the continuous capacity to integrate and reintegrate design and manufacturing within and across firm and unit boundaries in an

environment characterized by chronic uncertainty and urgent pressures for innovation and cost reduction.

**Coping with Disintegrated Production on a Global Scale: Small and Medium-Sized Firms  
and High-Wage Regions**

An important undercurrent in this discussion of multiple globalization logics is that, apart from the early enthusiasm for modularity/contract manufacture, none of these logics of the globalization of disintegrated production involve or foresee the elimination of manufacture within high-wage regions. The continued existence of valuable expertise and human capital, proximity to customers, needs for short-term flexibility in the global allocation of capacity within MNCs—all make manufacturing ‘sticky’ in the developed world (Markusen 1996). Regardless of where production and design occur, they retain many of the features of disintegrated production analyzed in the first section of this chapter. MNC lead firms and large suppliers collaborate on design and manufacture around the world, but they also collaborate with more locally based small and medium-sized suppliers in each of the regions in which they operate. Uncertainty and the imperatives of innovation and cost reduction exert a centrifugal disintegrating pressure on the division of labor in production both globally and locally. This section focuses on the strategies

that SMEs in high-wage regions and the local institutions that govern their relations have adopted to cope with the pressures of globalization.

The activities of MNCs described in the previous section generate a particular kind of market environment for SMEs in high-wage regions. Innovation and cost-reduction capability are the coin of the realm in disintegrated production. Specialized SME suppliers can take advantage of productive disintegration when they are able to bring know-how in these areas to the table. SMEs must be able to contribute value in larger processes of inter-firm collaboration. They also must be highly flexible, quick-response producers, capable of meeting short lead times (between finalization of order and delivery of finished parts). Finally, where MNC lead firms and the lead plants of MNC suppliers are interweaving various products in various series sizes from various locations across their production facilities, SME suppliers to these firms must be able to produce a mixture of components in fluctuating volumes. These general market characteristics have given rise to three developments among high-wage SMEs and regional governance institutions that modify the model of disintegrated production outlined in the first section of this chapter.

### **Interpenetration of Industrial District/Local Production System and Lean Production/Collaborative Supply Chain Models**

With the growing exposure to global logics of competition, innovation, cost reduction, and capacity allocation, the principles of ID/LPS and LP/CSC have begun increasingly to interpenetrate. Most strikingly, the role fluidity and ambiguity characteristic of ID/LPS has begun to mix with the formal self-reflection and attention to both product innovation and cost reduction of LP/SCS (Sabel 2005a). The ability to perform a variety of roles has become an indispensable competitive competence within disintegrated production. Even in sectors where tiering still exists—e.g. automobiles and complex industrial machinery—producers within the supply chain increasingly occupy a variety of positions over time. Indeed, in entering into a relationship, neither the customer nor the supplier can have a clear idea of how the specific content of their tie will evolve. Will it be an intimate collaboration? Will collaboration fail and the customer ask for some other more arms-length service? Will other collaborators turn out to be necessary for the successful construction of a component system? Will the initial supplier lead the collaboration, or the new supplier do so, or will the customer direct it all? These things are increasingly difficult to predict *ex ante*. The character of a tie with even a single customer can vary substantially over time and a series of discrete contracts. As a result, both customers and suppliers must be prepared to play a variety of roles (Kristensen 2008a, 2008b; Kristensen et al. 2008; Herrigel 2009). This is a core practice in the ID/LPS model of disintegrated production, but marks a departure from the originally more hierarchical LP/CSC model.

At the same time, all collaborators, regardless of their role, find themselves under continuous pressure to reduce their costs and improve the quality and content of their products and services. For this, it is widely recognized that the formal mechanisms of self observation (kaizen, five-why error detection analysis, benchmarking, etc) associated with the LP/CSC model of disintegrated production have become indispensable (MacDuffie 1997; Hines et al. 2004; Sabel 2005a). Many large customer firms insist that their suppliers develop these capabilities (MacDuffie and Helper 1997; Sako 2004). Indeed, many large customer firms have developed extensive internal supplier development organizations to teach their suppliers how to deploy these mechanisms of self-analysis (SEA 2008) The dissemination of these lean practices has also become an important goal of public institutions in many industrial clusters (Whitford and Zeitlin 2004; Kristensen et al. 2008). Such formal mechanisms facilitate cooperation and help ensure that its trajectory will be cost effective. These key practices of the LP/CSC model have begun to diffuse broadly, even among SME specialists within industrial districts and regional clusters where they were never central (Fieten et al. 1997; Whitford 2006). Thus, for example, collective benchmarking and training in quality assurance standards and related techniques have been among the most widely demanded services in Italian industrial districts over the past decade (Sabel 2004b; Zeitlin 2007)

### **Cooperative Globalization of SMEs**

In the context of dramatic cost competition and the globalization of their customers, SME supplier firms and specialists from high-wage regions have begun to globalize. This process occurs in two main variants. The first involves regional clusters of specialists who collectively produce and assemble all components of a product. Italian industrial districts for shoemaking, ceramic tiles, or packaging machinery, which organize the offshore production of crucial processes or lower value-added products illustrate this trend (Camuffo 2003; Bellandi and Di Tommaso 2005; Cainelli et al. 2006). The other variant is internationalization of SME suppliers to MNC lead firms and suppliers in integral-architecture manufacturing sectors. Typically, in these cases groupings of firms form an alliance to follow their customers into foreign markets (Herrigel 2007). The reasons for both variants of SME globalization, however, are the same as those that have driven the globalization of larger firms: cost-reduction pressures and customer demands for proximity of key collaborators in new locations.

In many cases, SMEs from high-wage regions seek to relieve cost pressure in their home markets either by identifying suppliers in low-wage regions or by establishing their own production facilities in those places. Such moves follow the trajectory outlined above regarding MNC suppliers: initially firms outsource offshore the simplest operations, then they establish their own

production in low-wage regions, often simply to accommodate customer demands that they develop such capacity.

Either way, such moves are difficult for SMEs and are frequently undertaken in cooperation with external partners. This is particularly the case when it comes to identifying appropriate suppliers or locations in low-wage environments. Often, SMEs use network ties with larger customer firms to identify attractive potential suppliers or joint-venture partners in low-wage regions.

Sometimes, SMEs will hire foreign nationals who know the terrain in their home country and can therefore help in setting up the offshore operation and managing the inevitable problems of communication, logistics, and quality assurance. In other cases, a number of non-competitive SMEs in related lines of manufacturing may cooperate in such offshore ventures. The Global Components project found a case of nine very small family-owned American metalworking firms, each with a related but non-competing proprietary product, which pooled their resources to contract with a firm in Shanghai to identify, audit, certify, and monitor appropriate Chinese suppliers for them (Herrigel 2007). In the case of Italian industrial districts, these tasks may be performed by agents of large groups created by SMEs in the district or by public agencies representing the regions (Bellandi and Caloffi 2008). German SMEs frequently work with the



offshore branch of the German Chamber of Industry and Commerce to identify appropriate offshore regions and suppliers (Depner and Bathelt 2003).

SMEs from high-wage regions are much more severely challenged when it comes to the second driver of offshoring: following the customer into low-wage markets. Here the SME often simply lacks the financial leverage to establish on its own the higher-volume production facilities in offshore locations that their mostly large MNC customers require. Nonetheless, SMEs feel compelled to globalize for fear that if they did not, they would lose key customers. In order to make such moves, SMEs therefore seek out partners. This can involve outright merger between firms. But in a surprising range of cases, cooperation has taken very interesting alternative forms.

Take the example of the strategy pursued by a small German family-owned manufacturer of industrial springs. The company has been a specialist spring producer for over 120 years. In 2005, the company ‘became part of’ a larger group of spring and stamped metal parts producers—all of whom were small or medium-sized, specialist family-owned firms just like themselves. The participating specialists were not all from the same place, but all came from traditional regions in Germany of specialized SME production (Herrigel 1996). The original spring family owns a proportional interest in the group, which is a limited liability corporation

(GmbH), not a joint-stock company (AG). The owner family participates with the other families in the development of overall group strategy. The formation of the group has resulted in an internal rationalization of production capacity and competence among member firms. Exchange of information and experience among group members is ongoing and systematic. The group tries to optimize the specialties of its members on an ongoing basis.

In effect, this process has resulted in the creation of a ‘lead plant’ system very similar to the one described above for larger MNC component suppliers, though in this case each lead-plant is one of the original SME specialists. The lead plants service jointly established production locations in foreign regions—the Czech Republic, China, the USA, and Latin America. As with the large MNC suppliers described above, each of those foreign locations produces the complete range of product offered by the group. As a result, the foreign locations are far more diversified production facilities than the lead plants in the high-wage regions themselves. And there is continuous know-how spillover between the lead plants in Germany and the subsidiaries abroad. The new collaborative entity is essentially a globalized specialization cartel of SME spring producers and precision metal stampers. The alliance pools the resources and competences of its members in order to provide production and financing leverage to one another at the same time that they are able to exchange technical, customer, and market know-how. The aim of the group

is to create open flows of information and know-how about technology, product application, customers, and markets in order to foster new product and new application development among all participating members

Analogous groups have emerged in Italian industrial districts. They differ from their German counterparts in that the members of the group are regionally concentrated, and may comprise the gamut of specialists needed to produce the end product(s) manufactured in the district (shoes, apparel, ceramic tiles, etc). These groups leverage the offshoring of production in the district and coordinate the allocation of capacity on a global basis among local members and offshore suppliers. They also play a key role in orchestrating technological innovation, product development and design, and international marketing among participating firms. In comparison to the German cases, Italian groups often have an even looser property structure, though they may be organized by larger 'leader firms', which take equity stakes in key suppliers. Depending on the degree of formalization of ownership ties, these ensembles of firms are variously referred to in the Italian literature as 'district groups', 'pocket multinationals', or 'open networks', (Corò and Micelli 2006; Chiarvesio et al. 2006; Brioschi et al. 2002; Colli 2002; Lazerson and Lorenzoni 1999).

SME globalization is also occurring quite extensively in Scandinavia, particularly in Denmark. Indeed, over 50% of the Danish workforce is employed in firms with at least one foreign subsidiary, and over 34% of those workers are employed in firms with fewer than 650 employees (Kristensen et al. 2008). The range of possible variants of SME cooperation on a global scale is thus extremely great. This is a promising area for future research.

### **Regional Policy for the Globalization of Disintegrated Production**

Globalization places great pressure on the regional governance structures that have historically been indispensable for the sustained competitiveness of disintegrated production clusters. Unlike the firms that they serve, the governance institutions and practices in regions where disintegrated production has been embedded cannot easily shift their operations offshore. They must focus on keeping the operations that remain in the high-wage regions competitive and capable of participating in the fluid roles and formal self-monitoring processes of global competition. This has not been an easy adjustment. Several very significant regional clusters of disintegrated production, such as Prato in Italy, or (arguably) the traditional American automobile complex in Michigan, Ohio, and Indiana, have been largely overwhelmed by these globalization processes. They were not able to establish regional governance practices that could facilitate dynamic disintegrated globalization (dei Ottati 2003; Honeck 1998). Globalization of production, finance,

and marketing can create asymmetries of access to technology and information, thereby undermining existing mechanisms for containing opportunism and balancing competition and cooperation (Zeitlin 2007). Further, the globalization of disintegrated production generates demands for new public goods among regional and industry producers, which existing institutional infrastructures are unable fully to supply or even anticipate (Sabel 2005b; Bellandi 2006). Currently, there is enormous experimentation across Europe and North America around these issues. Failure exists, everywhere it threatens, but there are also intriguing examples of success (cf. also Crouch et al. 2001, 2004).

A central feature of many regional processes of governance adjustment has been the development of public or public-private collaborations for upgrading the manufacturing supply base (mentioned above). These kinds of extra-firm efforts aim at enhancing the core skills that SMEs require to participate in contemporary disintegrated production networks: the development of technical know-how, the ability to perform multiple roles, and the capacity to engage in continuous self-analysis for collaboration and cost reduction. A wide variety of institutional arrangements for this purpose already exist in different national and regional settings (Whitford and Zeitlin 2004; Herrigel 2009; Kristensen 2008b). Yet, efforts to create a pro-active, supportive architecture for the globalization of SMEs from high-wage regions remain very incipient. Public

and extra-firm efforts trail behind the informal efforts supporting globalization outlined above, such as large multinational lead firms giving their SME suppliers tips on reliable offshore interlocutors and production locations, or SMEs collaborating amongst themselves to accomplish similar tasks. One interesting, but limited, example of public support in this area is the role of the German International Chamber of Commerce in offshore regions. This agency does not identify specific commercial interlocutors for globalizing SMEs, but does provide them with extensive market information about offshore areas. Perhaps most importantly, it helps SMEs deal with foreign bureaucracies when they move offshore.

More elaborate and multidimensional examples of pro-active regional support for disintegrated globalization are only now being discovered. Perhaps the best-attested case is Bellandi and Caloffi's (2008) account of recent initiatives in Italian regions, especially Tuscany. They focus on the identification of 'cluster to cluster' public goods—common trade protocols (ERPs), educational facilities, technical languages and specific business services—between Italian industrial districts and what they call 'proto-industrial districts' in China.<sup>7</sup> At the Italian federal level, an intergovernmental body has been created, the *Comitato Governativo Italia-Cina* (Italy-China Committee), which has sponsored an array of trans-territorial projects between the two

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<sup>7</sup> The authors note that there are also cluster building policies sponsored by the Italian Federal Government between Italy and Russia: "Task Force Italy-Russia on Industrial Districts and SMEs" (Bellandi and Caloffi 2008).

countries, and there have been several regional-level ‘China Projects’. Bellandi and Caloffi describe one of these, between the tanning and leather district of Santa Croce sull’Arno in Tuscany and an array of shoemaking regions and specialized towns located between Shanghai and Guangdong in China. At home, the Santa Croce district was crucially supported by a leather tanning trade association, the *Associazione Conciatori* (ASCON), which “carries out lobbying activities, represents their associates in several contexts, supports the realization of promotional activities, organizes training courses, promotes the creation of loan consortia, looks after the procurement of raw materials and provides other specialized services” (Bellandi and Caloffi 2008: 11). With the support of its members and the regional government, ASCON identified an array of complementarities between its members and Chinese producers—opportunities for the sale of Italian leather as well as for cooperation on key technologies (anti-pollution and water purification) that were crucial for the creation of transnational supply chains. Extra-firm institutions seeking pro-actively to exploit opportunities created by globalization thus successfully generated mutual benefits and synergies between the clusters of regional specialists.

Bellandi and Caloffi’s examples of pro-active support for regional globalization efforts are striking. They represent what Sabel has called the shift in industrial districts from “worlds in a bottle to windows on the world” (Sabel 2004b). Yet, the identification of opportunities for high-

wage regions created by globalization are still often overshadowed by expressions of anxiety and distress about potential threats. Increasingly, however, similar discussions to those in Italy are occurring in many manufacturing clusters dominated by competitive and dynamically adjusting SMEs. The Wisconsin Manufacturing Extension Partnership, for example, which has played a crucial role in coordinating supplier upgrading and cooperation with large MNC customers, has recently begun discussions about pro-actively supporting the globalization of regional SMEs (interview). Analogous cooperative efforts have been identified in Norway and Denmark. (Kristensen 2008b; Kristensen et al. 2008) This is a core area for future research on the governance of inter-firm relations as the globalization of disintegrated production continues.

### **Conclusion**

This chapter has provided an overview of the main issues regarding inter-firm relations and supply chain dynamics within what we have called disintegrated production. It has focused primarily on the changing character of relations among producers and between regions over the past 30 years. Disintegrated production emerged as a dominant alternative orientation to the hierarchical Fordist/Chandlerian model in manufacturing. Its key distinguishing feature is intense and ongoing collaboration between design and manufacture in the context of increasing fragmentation of the division of labor within and across firms. Production units have become



smaller, and frequently transformed into separate legal entities. Their relations are continuously recomposed through collaboration and negotiation, rather than market signals or hierarchical directives. Relations among collaborating producers, furthermore, are often governed by an array of extra-firm practices and institutions designed to balance cooperation and competition and facilitate continuous recomposition of roles and capacities. These relations characterize practices within developed and developing contexts as well as those that bridge both milieux.

Perhaps the most controversial element within studies of disintegrated production concern the power relations governing the supply chain. Our own view is that the chronic uncertainty and resultant fluidity of relations in disintegrated production reduces structural power imbalances across the community of producers. In the old Fordist/Chandlerian subcontracting world, power relations were structurally stable: suppliers were a community of proximate producers dependent on one or a few local vertically integrated customers for work. Such large manufacturing customers, in turn, viewed themselves as a privileged prince capable of producing prosperity for their underling suppliers, but ever conscious of the need to do so with a firm and strict hand (Kwon 2004; Whitford and Enrietti 2005). In the new world, power remains a central dimension of customer-supplier relations—especially in cases where role definition is relatively clear *ex ante* and/ or arms-length ties are in play. But even in the latter cases, there is the crucial

difference that neither the customer nor the supplier views their power advantage as stable or secure: leverage is contextually defined and constantly shifting in both local and foreign contexts as roles and strategies are redefined.

Where roles are ambiguous and ties are collaborative, power in the sense of asymmetric leverage is still more elusive. Iterative co-design of innovative products and joint definition of competences create mutual dependence that increases switching costs and stimulates commitment to joint problem solving and dispute resolution.<sup>8</sup> So, in an important sense, the new mixture of close collaboration and open networks in the disintegrated supply chain has reduced structural power imbalances within the community of producers.<sup>9</sup>

A similar argument can be made about mutual benefits from exchange within disintegrated production. Collaboration can provide the parties with mutual benefits. This need not benefit all parties equally; nor does the existence of mutual benefit imply the absence of power relations in the collaboration. Collaboration can occur despite power asymmetries, with benefits nonetheless accruing to all parties. Players enter into exchange relations because they see the possibility of

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<sup>8</sup> For an important recent synthesis, see Gilson et al. (2008).

<sup>9</sup> There are also governance problems that emerge within the new serially collaborative relations. For a discussion see Whitford and Zeitlin (2004); Sabel (2004a).

gain. This is true of market exchanges and it is true of collaborative exchanges. Power and equity are orthogonal in this regard.

The one certainty about power and reward in disintegrated production is that it is unstable and inconsistent. This is true of relations in the workplace. It is true of inter-firm relations along the supply chain. And it is true of relations between developed and developing regions. Roles and relationships, both global and local, are in a constant state of recomposition. Actors, firms, and regions that have developed pro-active strategies and supporting institutions for participating in this process of continuous reorganization are most likely to succeed in the current international environment.

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