Country Competitiveness

Technology and the Organizing of Work

Edited by Bruce Kogut
COUNTRY COMPETITIVENESS

Technology and the Organizing of Work

Edited by

BRUCE KOGUT

New York  Oxford
OXFORD UNIVERSITY PRESS
1993
1

Large Firms, Small Firms, and the Governance of Flexible Specialization: The Case of Baden Württemberg and Socialized Risk

GARY HERRIGEL

The southwest German province of Baden Württemberg has been known for a long time as the home of giant and hugely successful multinational firms, such as car manufacturer Daimler Benz and auto parts supplier Robert Bosch. But in the last several years attention has focused on the dense networks of very successful small and medium-size manufacturing enterprises in the region. The fascination with these producers stems from their capacity to flourish in a highly competitive manufacturing environment characterized by rapid technological change and rising development costs.

This chapter analyses the relationship between the system of dynamic smaller and medium-size producers and large firms within the political economy of Baden Württemberg. It presents a broadly historical and institutional account of the reasons behind the success of small and medium-size producers and points to the institutional contours and governance mechanisms that define and regulate relations between large and small firms. The point of this essay is that the coexistence of large and small firms in Baden Württemberg presupposes a clear set of institutional arrangements, both in the government and in society, that bring order to their mutual relations. Such extrafirm arrangements are the key to the competitiveness of both large and small firms. Moreover, they are subject to continual redefinition and adjustment as both large and small producers make efforts to adapt to changes in their competitive environment. Industrial adjustment in Baden Württemberg is a broadly political process of continually redefining industrial order.

I begin by describing the less well-known dimension of economic life in Baden Württemberg: the small and medium-size firm system. My premise is that the success of these firms rests in a decentralized system of risk spreading that can really
only be understood at the interfirn (regional) level of analysis. I go on to sketch out where that system came from historically. In doing so I also describe the way in which large firms grew out of the system and devote some attention to the problem of the relationship between large firm systems and the decentralized small and medium-size firm industrial systems in the historical period prior to the current one.

Finally, I focus on the changing relationship between large and small firm systems in the present. My argument is that as large firms seek to enhance their own flexibility in the current world market environment, they embark on processes of decentralization that result in increasingly intense interpenetration with small and medium-size producers. This process is transforming and displacing many old problems that have been characteristic of large firm–small firm relations in the past, such as power imbalances in contracting and extraregional capital mobility. At the same time, the process of mutual convergence is creating new problems of system governance that, at least as of now, have no clear solution. The emergence of a new system of production relations in the region, in other words, has given rise to an important set of political debates about how to govern it.

**Decentralized Production Among Small and Medium-size Firms**

Most accounts of Baden Württemberg have emphasized that the small and medium-size producers in this region utilize an interesting combination of organizational and interorganizational principles—contract, authority, trust, networks—to create a dynamically innovative (and prosperous) industrial system. To understand the success of producers, one cannot take either solely the firm or the industry as the unit of analysis. Rather, one has to understand the interfirn dynamic at work at the level of the region as a whole. Key dimensions of production and its administration are decentralized and, quite literally, centerless within the industrial region.\(^1\)

In Baden Württemberg, 99.4 percent of manufacturing establishments\(^2\) and 57.9 percent of manufacturing employment\(^3\) is accounted for by firms employing between 50 and 1,000 employees.\(^2\) There are two central characteristics of these contemporary small and medium-size companies: they are highly flexible and they are very specialized. Their special feature is that they have been extraordinarily successful at applying and utilizing new technologies in traditional areas of manufacturing, such as machinery, electronics, automobile components, textiles, and fine mechanical and optical equipment. The key to their success is the ability to rapidly produce high quality, specialized products, with very short product cycles while simultaneously reducing the cost gap between a standard product and a specialized, custom tailored one. It is possible to say of these producers in Baden Württemberg that they produce an almost infinite array of special industrial products in virtually infinite variety.\(^3\) These characteristics have been fortuitously matched with changing international market conditions that are characterized by more intense competition, rapid technological change, short product cycles, and climbing development costs.

How has it been possible for so many small and medium-size firms to success-
fully combine specialization with flexibility? My argument is that their success is based on a system that socializes risk across a broad array of public and private organizations. Small firms do not have to bear the entire burden developing new technologies; finding new markets; training skilled engineers and workers; and raising capital. Many of the costs of specialization are shared by or embedded in a deep network of organizations and practices in the political economy.

Organizations

EDUCATIONAL INSTITUTIONS

Baden-Württemberg has the largest and most extensive network of universities and training centers in Germany. A three-way division in the educational system exists. First, and at the top, there are the technical universities, such as those in Stuttgart and Karlsruhe. These universities have international reputations for excellence in technological research. Small and medium-size enterprises have some direct contact with the research laboratories in these universities, mostly in the form of contract research. But the relative amount of contract research done at universities by any firms in Germany is fairly small: less than 3 percent of all research contracted out by German firms goes to universities. What the universities do, however, is train doctoral and masters candidates who often go into jobs (with their technological skills in tow) in the surrounding industry.

Second, and in the middle, are Fachhochschulen, or community colleges. These institutes play a much more important role for the small and medium-size enterprises. Often located in the communities in which the enterprises are active, Fachhochschulen provide training, consulting advice, and small amounts of applied contract research for firms. Linkages with the surrounding economy are both formal and informal. Formally, every student that receives an engineering degree from a Fachhochschule must complete a program that involves considerable on-site experience in industrial enterprises. Often small and medium-size firms will sponsor a student’s thesis in their own factory because it deals with a specific technological problem of importance to the firm. Professors are instructed to encourage these sorts of contacts and make it their business to cultivate broad contacts in the local industry. Exchange between the Fachhochschule and the economy about technology is built into this educational process at little monetary cost to the firm.

Informal exchanges are at least as important in the process of technology transfer as the formal ones. Often the owners of small enterprises will have been educated at the local Fachhochschule and maintain social and professional ties with people in the faculty, former students, alumni, and so on. For example, most of the firms in the German textile machinery industry, a large proportion of which is located in Baden-Württemberg, have connections with the Fachhochschule “Textiltechnicum” in Reutlingen that are constituted and maintained by ties between graduates of the schools and important professors on the faculty. Fachhochschulen in this way act as a local technological resource for the small firms that is extremely important in the process of technology transfer.

The third level of training institution is the Berufsschule, or the vocational training schools. Germany’s dual system of vocational education is world renowned for its ability to produce extremely talented skilled workers. Students
receive intensive classroom training that is systematically supplemented by practical training in factories and workshops. Younger workers are trained in the most advanced microelectronic manufacturing technologies and are required to receive training in CNC (computer numerically controlled) programming.

The point about each of these educational institutions is that they provide services for small and medium-size enterprises that the firms would otherwise have to provide for themselves. Paradoxically, this is more important the further away one moves from abstract high science toward practical industrial and shop floor problems.

TRADE ASSOCIATIONS AND CHAMBERS OF COMMERCE
Business associations are very important in the system. Trade associations, such as the Verein Deutscher Maschinen- und Anlagenbau (VDMA), or the Zentral Verband Deutscher Elektro-Industrie (ZVEI), represent particular sectors of industry, while the chambers of commerce represent all enterprises in the economy at a local and regional level. Other important non-sector-specific associations that are important to small and medium-size firms are the VDI (Verein Deutscher Ingenieure) the association of German engineers; and the RKW (Rationalisierungs Kuratorium der deutschen Wirtschaft), an institution that concerns itself with the technological and organizational problems of small and medium-size enterprises nationwide.

Together, associations of this type provide three important services for small firms. First, they all provide different varieties of market information: statistics, reports on special regional or technological markets, export information, and the like. In this they differ little from trade associations anywhere. Second, associations appraise firms of the different varieties of local regional and federal technological development programs that are available. They act as indispensable mediators of information between industry and the state.4

Third associations, especially sectoral associations such as the VDMA or the ZVEI, coordinate relationships among firms in particular industries. The VDMA, for example, actively coordinates cooperative, so-called precompetitive research projects for member firms. Sometimes the research problem is suggested by a group of firms themselves; other times the VDMA, or one of its subsidiary associations, suggests a project to its members. The association then goes to the appropriate research institute or university and arranges and manages the project. The participating firms pay half the cost of the research, the rest, typically, is paid by the Ministry of Economics in the federal government. The VDMA negotiates all relationships between its members and the state.

In general, the trade associations pay attention to the university and research institute structure in a region. If the region lacks the relevant technological capacity, the associations lobby to have it filled. In the mid-1970s, for example, the VDMA successfully lobbied for the creation of a special research chair and institute for printing technology in Darmstadt, halfway between the significant regional centers of printing machinery production in North Rhine Westfalia and Baden Württemberg.

Another perhaps more significant role of the trade association in coordinating the relationships between small and medium-size firms is in the area of specialization and technical standards. Industrial technologies are often distinguished from
one another through a process of technical standard setting. Continuous change in technology involves continuous change in the relevant standards in products. Rapid change causing product boundaries to overlap can lead to devastating forms of competition—especially among flexible producers—if not somehow checked or coordinated. In the industries in which small and medium-size producers are most dominant, such as the machinery industry, the coordination of competition in the process of technological change takes place within the standard-setting bodies of the trade association. The VDMA has a special committee, known as the Normen-Ausschuss, in which all member firms are active participants.

Standard setting by member firms, with the trade association as a forum, coordinates specialization and ensures that competition remains healthy and beneficial. This practice of using collusion to further the competitive character of the industry is a general feature of most highly flexible regional agglomerations. Observers (and competitors) from an Anglo-american economic culture, who tend to view economic practice as binarily divided between cooperation (typically reduced to collusion) and competition, invariably find their stable intermingling difficult to grasp.

BANKS
Small and medium-size producers in Baden Württemberg have little trouble getting capital for their projects, yet they do not engage to a significant extent with the large universal banks that are classically associated with industry in Germany. They have traditionally turned to local banks—either the state-owned Sparkassen, or the cooperatively operated Volksbanken. During the period of industrialization, these banks were created by local industrialists and craftsmen to pool their funds and gain access to the national credit markets. To a large extent today, they continue to be important sources of capital for smaller and medium-size industrial firms. Heads of local firms often sit on the boards of these banks, so the banks themselves are well attuned to the technological and financial situation of small producers. The presence of knowledgeable local entrepreneurs on the board also provides an important policing function that engenders an incentive for good industrial practice: banks know how to evaluate the technical and business potential of projects and can provide important suggestions concerning how they should be reformulated or restructured.

THE REGIONAL GOVERNMENT
The role of the regional government in the success of smaller and medium-size producers in the Baden Württemberg economy has received considerable publicity. While it has been important, one should be careful not to exaggerate its role. The programs of the state in many ways duplicate the services that are provided by the institutions already mentioned, such as providing technical information, knowledge, and capital. The provincial government Economics Ministry provides direct subsidies to firms for specific technical development projects. The Landesgewerbbeamt plays the important role of coordinating the infrastructure of institutional resources available to firms: education, state-sponsored consulting on technology, export promotion, trade fairs, and so on.

An important new institution, formally private, but in fact entirely owned by
the government of Baden Württemberg, is the Steinbeis Foundation. The primary role of this organization is to match the technological needs of small and medium-size producers with the technological specialties of Fachhochschulen—and even specific faculty members—within the Baden Württemberg region.

The Steinbeis Foundation's role, like that of the other institutions of the state, partially duplicates services that are already performed by other institutions in the economy, such as the chambers of commerce and the sectoral trade associations. It is an important role, nevertheless, in the sense that most resilient systems of political economic organization benefit from redundancy. The institutions are concerned with spreading the risk that firms are confronted with. The more that risk can be dispersed across institutions, the greater flexibility the individual participants have.

A similar logic of redundancy is at work with technology subsidy programs provided by the Baden Württemberg government. The state makes a relatively small amount of money available to small and medium-size enterprises (1.1 billion DM in 1984) and then distributes the money through more than sixty different special subsidy programs. Firms obviously cannot rely on the state to keep them competitive when the state is engaged monetarily in such an insignificant way. Nor can the state reasonably claim that its programs are responsible for the successful adjustment of small and medium-size firms in the economy (though at times the government has made hyperbolic statements in this direction). In fact, small and medium-size firms receive financial and technical input from a broad variety of sources, each individually quite small, but taken together amounting to a considerable opportunity for firms with good ideas in need of investment funds. Redundancy in this form obviously serves as a form of insurance for firms. But it also is a kind of incentive. In putting together financing deals or research projects, firms must make their ideas more precise to persuade enough of the different agencies to actually support them.

Redundancy is the key summary characteristic of the institutional infrastructure in which the decentralized system of production in Baden Württemberg is embedded. The fragmented, overlapping, and seemingly redundant character of the public and private institutional network in Baden Württemberg is, paradoxically, the most efficient way to provide services to decentralized production.

Practices

COLLABORATIVE SUBCONTRACTING

Collaborative subcontracting is a relatively new practice among small and medium-size firms in Baden Württemberg, but it has been integral to their current success. Given the volatility of the current environment with rapid technological change, short product cycles, and increasing development costs, subcontracting is a way to reduce the level of fixed costs that any single firm must carry. But, importantly, it also allows firms to enjoy the benefits of the technological know-how and experience of their suppliers. Most firms think of subcontracting as a strategic act of partnership in which two parties enter into mutual and equal exchange of know-how and service. Systematic collaborative subcontracting depends on, but also creates,
a broad, decentralized pool of know-how in the region that is in principle accessible to all who are active in it.

Collaborative subcontracting is a practice that socializes risk at the same time that it pools resources. At the limit, the practice of subcontracting completely eliminates hierarchies between firms. That is, a system in which there are clearly identifiable end product producers who are distinct from pure subcontractors no longer exists. Instead, an unending series of relationships between constantly innovating firms, a decentralized system, takes its place. The decentralized system in Baden Württemberg has not gone this far yet, but there are areas within the region, such as the Black Forest, or the Hohenzollern regions around Tüttlingen and Sigmaringen, that approach it.

OPENNESS
Firms within the decentralized system of production in Baden Württemberg are all acutely aware of the limitations of their own in-house know-how. They realize that to retain their autonomy and independence within the system, they must accept their dependence on the system itself. Firms continually seek to enhance what they know through contact with subcontractors, customers, banks, the state, Fachhochschulen, and so on. Firms know that the only way that they will be able to survive is by continuously bringing in know-how, enhancing their ability to keep up technologically, and ultimately offering a continuous array of new products.

It is worth mentioning that since everyone has an interest in the continuous reproduction of the system of exchanges at all levels, the system itself begins to engender trusting behavior among firms. This trust follows from the character of the exchange. In many cases the exchange of know-how between firms cannot be explicitly specified—what gets transferred is often ineffable or discovered only in retrospect. A price can be assigned to a product, which can then be exchanged through the system of contracts that are protected by law. But the ineffable exchanges cannot be priced in any practical way, nor can they be conveniently defined in contract form. This amorphousness does not make them any less crucial for the profitability of the firm, however. The existence of trust between producers, therefore, is important functionally for the healthy reproduction of the system. Among small and medium-size producers in Baden Württemberg, opportunism is limited as much by mutually held conceptions of honor and trust as it is by the policing qualities of law and contract.

SELF-POLICING THROUGH FEAR
The practice of diligent worry among small and medium-size producers stems from the same set of concerns that encourage them to be open to new information. Firms realize that their future independence is completely dependent on their ability to continually come up with a marketable new product or service. This awareness makes them open to information from outside the firm, but it also causes them to be constantly attentive to weaknesses in the broader system. As it were, fear is one way that the system polices itself. Firms and trade association members worry that the amount of information in the system concerning certain new technologies is insufficient, so they seek to devise ways to amend the system (make contacts with firms abroad that are experienced with the technology or the market in question,
acquire monies and services from supporting institutions, bring in experts, etc.). In that many firms and many members of the surrounding institutions do this, there is, inevitably, redundancy, but there is also change and adaptation. These dynamics are the strength of the system.

**Highlights**

The four organizations and three practices just discussed together describe reasonably well the dynamic system of small and medium-size manufacturers in Baden Württemberg as it exists today. Of all that has been said, two characteristics of this risk socializing system should be featured. First, the firm is not the central unit of analysis in the operation of the system. That is, to understand the way that small firms succeed in Baden Württemberg, one cannot simply look at the balance sheets of the firms themselves. Rather, one has to view the system as a whole. It is much greater than the sum of its parts.

Second, the analytical point just made is literally true, in most cases, about the actual products that firms produce. That is, the products of any given Baden Württemberg firm are typically the outcome of a long string of decentralized, subcontracting relations; know-how transfers; research projects; state promotion schemes; and so on. The boundary line between firm, industry, and society in the production and administration of goods is virtually impossible to define precisely.

**Origins of the System and the Role of Large Firms**

The account given of the decentralized system of small and medium-size producers in Baden Württemberg will inevitably have provoked two questions in the minds of skeptical readers (or, perhaps more precisely, of anyone who knows anything about Baden Württemberg): Where did the system come from? and What about the large firms? I contend that the answers to both of these questions are linked together in the economic history of the region.

The regions now contained within the state of Baden Württemberg have always been populated by large numbers of specialized small and medium-size firms. The extrafirm institutions described in the previous section (Fachhochschulen, vocational training, cooperative banks, Landesgewerbeamt, etc.) all emerged in the nineteenth century (though the role of some, such as the trade associations, did not take their present shape until the twentieth century). The story of industrialization in southwestern Germany is yet to be adequately written, but the few studies that exist show that there was a great political effort throughout the nineteenth century to shape the emergence of industry in a way that preserved its small and medium-size, decentralized character.8

Baden Württembergers today tend to attribute the special character of their economy to the absence of raw materials and a special cultural propensity to tinker within the population. I would emphasize instead the character of inheritance in agriculture (partible inheritance) and the way that this practice shaped the emergence of the labor market. Partible inheritance allowed large numbers of people to
own land, but it resulted, ultimately, in highly fragmented and less productive holdings. To help these people get by, centuries ago the regional government began to encourage industrialization. The state engaged directly in, or sponsored the activities of a merchant in, the putting out of industrial work to small holders in the countryside. The mercantilistic-directed putting-out system enabled people to stay on the land and engage in small-scale industrial work as by-employments. The more the system succeeded, the more difficult it became to change it and collect the dispersed laborers to place them in factories.

Over time, the decentralized producers in the putting out system became as important to the government as the government became to them. The prosperity of both, and ultimately the entire political and economic character and stability of the region, depended on the perpetuation of the decentralized system. When the British entered world markets with their factory produced wares at the beginning of the nineteenth century, Badeners and Württembers (such as Ferdinand Steinbeis, after whom the foundation is named, who headed the first technology promotion agency in the Kingdom of Württemberg) struggled to find ways to make their decentralized system adapt to the machine age. The system of specialized production that combines technological sophistication with flexibility and the risk spreading organizations and practices previously described is what they came up with.

Up until early in the twentieth century, this political economic system of decentralized industry in southwestern Germany was virtually free of large firms. Only in the periods leading up to the two world wars (when the central government in Berlin fostered the growth of large firms for defense needs) and then dramatically after the Second World War (when the European Economic Community created a set of market conditions that permitted mass production) did large firms begin to become a significant part of the political economic landscape in Baden Württemberg.

The most significant change came after World War II when the new environment encouraged local firms to break out of the system of decentralization and begin mass producing. The automobile and automobile components industries in Baden Württemberg grew extremely rapidly in this period, and the leading firms were clearly following mass production strategies. The significance of the shift can be seen in the fact that by the beginning of the 1980s, nearly a seventh of the regional economy’s total product was related in some way to the automobile industry (Muenzenmaier 1984). Firms in other industries broke out of the decentralized system as well, especially in electronics, fine mechanical and optical equipment, and textiles and apparel.

During these middle decades of the twentieth century, the distinctive feature of the emergence of a large-firm sector was that the large mass-producing firms began to make important changes in the role that firms, as institutions that organize production, played in the regional political economy. In order to stabilize their sources of supply and to protect the proprietary character of their products, large mass-producing firms began to internalize most of the functions provided by the organizations in the decentralized economy and abandon many of the practices that had been so important in making the decentralized system work.9

Their desire to control these functions internally, rather than leave them to the
traditional extrafirm institutions, was related to their character as mass producers. Because in those pre-microelectronics days they produced standardized products in large quantities on relatively inflexible machinery, the large firms were extremely vulnerable to rapid changes in their markets. To prevent the emergence of competitors that would cause them to make expensive changes in their plant and equipment ahead of schedule, they internalized product development and paid careful attention to limit the dissemination of technological know-how. To protect themselves from unwanted disruptions of supply, they internalized much of production. The result was the emergence of a new system of industrial organization that existed outside of the old system of decentralized production. The new system was firm based and focused on centralized control of resources. It drew the boundary lines between firms, industries, and society quite clearly, and it energetically resisted any forms of intrusion, by the state or other organizations, in the way that private firms exercised control over production. This tradition of liberal hostility to the role of government and secondary associations in the governance of production and its administration continues to be a key dividing line between large and small firms.\(^\text{10}\)

Despite the fact that the principles of organization that governed these powerful new mass-producing firms shared little with those that governed the preexisting decentralized system of production, the latter system was not forced out of existence by the growth of large firms. The small and medium-size firm system survived as a niche within the mass production system of post-war German Fordism. There are, I believe, three reasons for this.

1. Many industries in the region never moved into mass production. This non-occurrence is particularly true of capital goods producing industries, such as machine tools, because the growth of mass-production firms created a demand for special purpose capital goods that could not be mass produced. Large firms attempted to make their production processes as efficient as possible by automating them. And they called upon machine-tool producers and others to construct the often one-of-a-kind mechanical contraptions needed for automation. The result was that such firms remained relatively small and continued to rely on the principles of organization and practice, as well as the extrafirm institutions, that had characterized the earlier decentralized system.

2. Despite their efforts to internalize production and product development as much as they could, mass-production firms, especially in Baden Württemberg, used many suppliers, primarily because the economy was rich with them. Concern about the stability of supply was not as great in an economy densely populated with potential supplier firms because if one firm was unable to deliver an order, it was always possible to turn to one or several others.

Another, more systemic, reason for the tendency of large firms to use suppliers has to do with the relationship of mass-producing firms' investment strategies to the business cycle. The worst possible cost situation a mass-producing firm can have is when its very expensive production machinery has to lie idle. To avoid the amortization expenses it would incur from such a situation, firms generally tried to set their own production capacity somewhere below what the market would bear in a period of upturn. This way its production could be relatively continuous even if
demand in the market, with the business cycle, was moving up and down. During peak periods, then, mass-producing firms tended to try to expand their capacity through the use of subcontractors. Baden Württemberg, being rich in potential subcontractors, tended to draw significant business of this kind to it, not only from endogenous mass producers, but from mass producers from other (more northern) regions of Germany where the base of subcontractors was not as plentiful.11

It is important to emphasize that this practice of subcontracting differs quite substantially from the collaborative subcontracting practices currently characteristic of exchanges among small and medium-size firms mentioned previously. These firms use subcontractors as sources of know-how and manufacturing expertise that they themselves do not have. In the mass-production system, subcontractors were simply employed on short-term contracts to supplement the already existing capacity of the core firm. In particular, due to the importance of protecting the proprietary character of the firm’s product, virtually all subcontracts were given out for manufacture only. Development and design was performed by the subcontracting firm and supplied to the subcontractor.

3. The third reason why the emergence of the mass-production system did not eliminate the older decentralized system and its institutions is that the period of time when mass production as a strategy was clearly superior to all others was relatively brief. Conditions favoring flexible small and medium-size producers began to appear again as early as the mid 1970s. In 1975, Baden Württemberg passed a Mittelstandsförderungsgesetz (Law for the Promotion of the Industrial Middle Classes) that was designed to revive the traditions of state small and medium-size industry technology transfer. In 1978, the government established a special export promotion agency for small and medium-size producers in Baden Württemberg. The Steinbeis Foundation was created in 1981. These changes were signs that the substructure of small and medium-size firms in Baden Württemberg was coming back to life. The more volatile and uncertain the technological and market environment became, the better the position of the flexible and specialized Baden Württemberg firms became.

Large Firms and Decentralized Small and Medium-size Production in Contemporary Baden Württemberg

The current situation in the world economy has created a whole new set of problems concerning the relationship between large firms and the small and medium-size enterprises in Baden Württemberg. As for the smaller specialized firms, the competitive environment for large firms was also tremendously altered over the course of the 1980s by new developments in technology, increased international competition, shrinking product cycles, and rising development costs.12 Large corporations today, just as small firms, are driven to change their product palettes more frequently and apply new technologies to their products or in production about which they have little prior knowledge or experience. They find, invariably, that they are compelled to look to outside specialists to help them keep abreast of technology and stay competitive in their markets.
Automobile companies, for example, now find that they must integrate microelectronics and advanced plastic technologies into their products within a product cycle time that is only a third as long as it was in the heyday of mass production. To accomplish this updating, the major German producers—Daimler Benz, BMW, VW—are each experimenting with subcontracting and collaborative manufacturing practices. BMW, for example, now purchases between 50 and 75 percent of its production costs; 80 percent of its purchased parts involve some form of collaboration with its supplier. Moreover, in interviews it became clear that the firm is prepared to subcontract the production of virtually any part of the automobile if it drains the firm of valuable resources for development and can be done more cheaply outside. Several managers in purchasing revealed that the company was even debating giving the production of trademark engine components such as cylinder heads over to outsiders.\textsuperscript{13}

The experience of the automobile industry is being reproduced across firms and industries in Baden Württemberg. Levels of vertical integration within large firms are falling dramatically and the number of collaborative subcontracting arrangements is increasing rapidly (Cooke and Morgan 1990). The result is that large firms are not only beginning to interpenetrate with the smaller producers through the establishment of collaborative and subcontracting relationships, they are increasingly adopting principles of organization and practices typical of the small and medium-size firm system.\textsuperscript{14}

This process of interpenetration or “mutual convergence”\textsuperscript{15} between the two systems of production is interesting for the problems of governance to which it does and does not give rise. On the one hand, the spread of decentralizing production practices among large firms is tending to make obsolete many problems that traditionally had been associated with large firm–small firm relations in the period of old-style mass production. Fears of strategic power imbalances in contracting and of the consequences of large firms’ capital mobility, for example, once considered to be a threat to small firms and regional systems, now appear to be increasingly misplaced. On the other hand, the mutual convergence of the two systems has given rise to a series of other problems of governance (especially regarding the proper role of the government in the regional economy) that if not resolved could prove potentially destabilizing to the system of decentralized production in Baden Württemberg.

In the following discussion of the problems eliminated and generated, it should be clear that the argument attempts to draw out a coherent model of clear tendencies within the region and in no way intends to imply that specific examples of older and contradictory practices cannot be found.

\textit{Problems Eliminated}

\textbf{POWER IMBALANCES IN CONTRACTING}

At the core of the current adjustment situation, in both large and small firms, is the phenomenon of collaborative subcontracting. The old decentralized system among small and medium-size firms with its important extrafirm institutions and the two practices of openness and fear always involved extensive subcontracting. Such dispersion in production, as explained at the beginning of this chapter, is a way to
reduce risks and pool resources. The shift to subcontracting and collaborative manufacturing on the part of large firms involves not simply an intensification of existing practices as it does for small firms, but a dramatic departure from past practice. The shift is an indication of the fact that large producers can no longer control their environment the way that they used to do. This fact has completely redefined the relations of power within the contracting environment between small and large firms.

In the old environment, large firms typically engaged in mass production. Product cycles were relatively long, and development costs as a result were less of a strategic problem. Mass-producing firms controlled the evolution of technology in their markets. In this situation, large firms always used suppliers from a position of strength: they were used to supplement capacity during upturns or simply for the supply of standardized, low value added goods (e.g., standard screws or flanges). For their part, the old style suppliers were weak and vulnerable. They contributed nothing to the development of technology in the large firm, usually engaged in short term contracts, and competed fiercely with other suppliers for their sales.

Such unequal relations were a direct result of the large firms' desire and capacity to control the development of its technology. Indeed, truly important technologies and development work were produced in-house where the firm could ensure that know-how would not seep out of the firm to competitors. Significant engagement with suppliers in a way that involved the transfer of know-how was considered dangerous because the supplier could potentially use the know-how against the firm: give it to a competitor or use it itself to become a competitor. A firm engaged in mass production with a very long product cycle was not interested in leaving itself open to such risks. The desire and the capacity to control the evolution of technology in a mass production environment militated against collaborative relations with suppliers.16

Now, since the new environment makes it virtually impossible to keep abreast of, much less control, all aspects of newer product technology (regardless of a firm's desire to do so), large producers find it prudent to draw on outside specialists for significant portions of production, development, or both. Specialist suppliers are consulted as sources of know-how and expertise. Both the large firm and the specialist supplier transfer know-how to each other to ensure that they quickly arrive at an adequate solution to the contractor's needs. In the new environment, control is no longer the primary strategic concern in subcontracting: arm's-length relations give way to intimacy; control over technology, to openness and cooperation.

Finally, once the large producer has determined that it cannot control the evolution of all of the technologies that are necessary to remain competitive in its business, there is an incentive to spread subcontracting relations with specialists as widely as possible. The absence of control means that the producer must be able to react in unforeseeable ways to the market. A broad range of relations increases the available pool of know-how for the producer. Large firms with many specialist subcontractors can keep abreast of new developments in technology without having to invest their own capital and attention in developing it all. This strategic orientation is fundamental to the traditional system of relationships that has long existed among smaller firms in Baden Württemberg.

A paradigmatic case for how large firms are changing in this way in Baden
Württemberg is the Robert Bosch Corporation.\textsuperscript{17} The firm has adopted a strategy of transferring its own know-how in certain technologies to outside firms to free resources to product development in other areas it considers more strategic. By transferring certain operations to suppliers, however, Bosch is by no means capitalizing on the development of technology in those areas. On the contrary, because the technology in the businesses in which Bosch competes (specialized auto parts, microelectronics, consumer electronics, specialized machinery) is continuously changing, it is not possible for Bosch to define precisely which specific technologist will (need to) produce in the future. It seeks, therefore, to remain abreast of developments in as many areas as possible. It does so by cultivating a broad array of intimate relations with subcontractors, and, logically enough, not exclusively in Baden Württemberg, but throughout Germany, Europe, and the world. Such supplier-collaborators provide Bosch with information about developments in their specialties, and Bosch in turn, provides the specialists with know-how in areas relevant to the specialists (Sabel et al. 1989). The benefits for Bosch are clear, but the benefits to the region of its linkage through Bosch to a worldwide network of technological information is often underappreciated.\textsuperscript{18}

This system of decentralized know-how transfer can only work if no single firm controls the process of exchange. Thus, Bosch attempts to prevent subcontractors from becoming dependent on Bosch for business. The company goal is that any given subcontractor should conduct only approximately 20 percent of its business with Bosch. The rest the subcontractor must find from other producers and the experience it gains from this diverse work, Bosch’s reasoning goes, provides a valuable store of potentially useful know-how and expertise for Bosch. Here it is clear that Bosch has discovered the principle of openness that is at work in the industrial district that surrounds it.

Conversations with people in other larger firms in Baden Württemberg, such as IBM, Hewlett Packard and even Daimler Benz, reveal that they are pursuing subcontracting strategies resembling Bosch’s.\textsuperscript{19} Given this occurrence it is entirely possible that the extension of subcontracting by the large firms will blend (though certainly not effortlessly, see the discussion of problems generated) into the actively expanding networks of subcontracting relationships among small and medium-size supplier firms, particularly if the Bosch model is pushed to its logical conclusion. On this view, the massive internal resources and stores of know-how of the large firm—research and development laboratories, easy access to high-level university research teams and resources, contact with technological specialists world wide, and the like—would enter the decentralized system of exchange as one more redundant input of know-how and institutional capacity in the system of decentralized production.

**LARGE FIRMS AND CAPITAL MOBILITY**

These changes in the power relations between small and large firms with respect to subcontracting in the new environment have been paralleled by (and, partially, have given rise to) changes in the balance of power between large producers and the regional economy as a whole. In the classic age of dependent and vulnerable subcontractors and dominant mass-producing large firms, the economic and industrial
health of a region was dependent on the continuing willingness of large firms to invest there. If a large firm, such as Bosch or Daimler Benz, were to decide to shift all of its production of a given product out of the region, the dependent suppliers would have no alternative strategy for production. Lacking in know-how and vulnerable to begin with, the supplier firms would be faced with the choice of bankruptcy or following the large producer out of the region. Regional governments, unwilling to suffer the consequences of either option, as a result typically went to great lengths to provide large firms with incentives to keep production in the locality.20

In the new environment, both the capacity of large firms to make credible their threat to leave, and the capacity of small and medium-size producers to survive without them have changed. And, as a result, the room for autonomous maneuvering for the regional government has increased. Large firms have trouble making credible threats to shift production entirely out of a region such as Baden Württemberg, which is densely populated by highly specialized and flexible small and medium-size producers, because they are uncertain enough about the future evolution of technology and markets that they are unwilling to completely abandon the resources of know-how that the smaller specialist firms make available. The capacity of large producers to remain competitive in a technological environment that they cannot control depends on their being able to cultivate and maintain access to a decentralized network of technological information. This situation does not preclude efforts on the part of large firms to globalize: just as they have an interest in cultivating access to information locally, so do they in cultivating access to information in markets in other regions. Their interest, now, in an environment without control over the evolution of technology, is in the acquisition and transfer of information, regardless of its location. The only point is that interest elsewhere does not involve neglect at home.21

For the same reasons, small specialist firms, embedded in dense decentralized networks, do not feel threatened by efforts on the part of large firms to establish global operations. They not only know that the local large producer relies on them for technological expertise, they also benefit from investment in the region on the part of foreign multinationals seeking to gain access to the resources that are located within the region. So it is not at all surprising, for example, that all opinion polls of small and medium-size producers in Baden Württemberg, conducted by trade associations, chambers of commerce, and the regional government, show universal enthusiasm for the completion of the European Economic Community’s common market in 1992.

For its part, the regional government in Baden Württemberg has learned quickly how to take advantage of this situation, both for the benefit of producers in the region and to strengthen its own position. It undertakes trade expeditions throughout the world, particularly to market areas where Baden Württemberg producers are weakly represented, such as the Pacific Rim and Eastern Europe. It subsidizes trade shows in these markets, assists in the arrangement of joint ventures, and institutes formal programs of technology transfer. At the same time at home in Baden Württemberg, the regional government has reserved large tracts of scarce development space, zoned for industrial use, in the densely populated region exclu-
sively for Far Eastern investors. The local government has grasped the paradox that the more globalization it can encourage on the part of its own producers and the more investment from foreign multinationals it can attract to the region, the greater its own latitude to conduct industrial and technology policies for the benefit of local producers will be.

**Problems Generated**

Though the mutual convergence of the large and small firm systems of production in Baden Württemberg has resulted in the dissolution of several important problems that had plagued relations between small and large producers in the past, the interpenetration of the two systems is not without problems. I want to suggest that the current set of developments poses very important problems concerning the future governance of the interpenetrated systems that are only now beginning to be addressed in Baden Württemberg. Specifically, the problems I have in mind concern the future role of government in the region.

Traditionally, the large firm system and the small and medium-size producer’s decentralized system have harbored fairly contradictory conceptions of the proper role for the state in industrial life. In the decentralized system of small and medium-size manufacturers in Baden Württemberg, government has traditionally played a very important role in the organization of production and its administration. It is an important extrafirm institution and a key source of redundancy in the system. In this system, to use a more technical language, government is a node in the complex production network in the region. The large firm system that emerged in the post-World War Two period, however, viewed the government with considerable reserve. Those elements of production that the large firm system did not seek to control directly through vertical integration, it generally preferred to leave for the market system to organize. State interference in the direct affairs of production has been consistently rejected with great ideological contempt. Large firms prefer to keep the state out of their networks.²²

These conflicting perspectives on the proper role of the state in the organization of production were possible to reconcile in the period of mass production because the boundaries between the large firm system and the small and medium-size system were fairly clear. The state’s traditional role in the affairs of the small and medium-size producer system could be viewed as “Mittelstandsförderung” (promotion of small and medium-size independent producers) or “Mittelstandspolitik” (policy for small and medium size independent producers) more generally; that is as something clearly distinct from the affairs of large firms. But, as large firms intensify their subcontracting practices and decentralize their operations, the boundaries that once distinguished the affairs of small and medium-size producers from those of large producers are becoming blurred. Will this emerging mutual integration of the large into the small result in a set of conflicts around the proper role for the state in the administration of production and its administration?

There are some signs that this is the case. The governor of Baden Württemberg throughout the 1980s, Lothar Spaeth, was an extremely aggressive advocate of a strong role for government in the regional economy. In his view (which still seems
to be representative of the government administration that has replaced him), the
current economic environment creates the need for the government to assume the
responsibility for the cultivation and extension of a regional infrastructure of information. Informatics systems, telecommunications systems, research institutes, trade associations, independent producers, and all areas of emerging technology need to be brought together and interlinked, he argued, and it is folly to believe that market processes alone will accomplish this. Moreover, the more current trends progress, the more important regional governments become vis-à-vis other, in particular national, levels of government. The needs of regional networks for stable channels of know-how transfer and for the financing of information must be met by the state, and the local state is the only government body in a position to do this. In Spaeth’s view, this logic is intensified by all tendencies toward European integration (Spaeth 1988, 1991). Unsurprisingly, most of the other organizations within the system of small and medium-size firms, such as the chambers of commerce, tend to agree with Spaeth’s assessment that there are new and expanding infrastructural needs in the traditional decentralized system. But, they are eager to ensure that the state’s capacity to shape process in the system does not expand in a way that limits their own.33

Against these voices are those of the national level industrial associations representing the interests of large German business, large corporations themselves, and the national level banks that are tied to the corporations. These groups regard the aggressiveness with which local governing bodies engage in the local economy with considerable concern. They are interested in having a healthy infrastructure of dynamic specialist firms but cannot understand why the market is incapable of maintaining that infrastructure. Interference with the market only prolongs the life of inefficient producers by providing them with access to information and financing that they would otherwise never acquire and that they anyway cannot take advantage of appropriately. Moreover, the engagement of the Spaeth government in export promotion is disruptive to the existing, national level and private channels of export infrastructure that have for years served the purposes of Germany’s major exporters (i.e., of large firms).

This debate has been developing in Baden Württemberg since the middle of the 1980s. It is being conducted in a systematic and continuous way and shows no sign of either resolving itself or falling into polarized crisis. Nevertheless, at the limit, there are two possible ways in which this conflict can be resolved. In one scenario, the movement of large firms into the system of decentralization will result in a transformation in their understanding of the proper role of government and other extrafirm institutions in the flow of industrial resources. Liberal rhetoric about the market will be abandoned and a new rhetoric emphasizing the need for continuous cooperation between public and private actors in the maintenance of a decentralized system will take its place. In another, alternate, scenario, the large firm’s traditional interest in leaving to the market all aspects of production that they do not themselves directly control will lead them to advocate policies that would undermine the key institutions of extrafirm support that are essential to the survival, and independence, of the small and medium-size firms.

Either scenario leaves us with a very different political economy than the one
we have known up to now. The former nonliberal world would have to make its peace with the continued existence of important concentrations of capital in the shape of—albeit decentralizing—corporations. The latter liberal world (currently being glorified with the collapse of central planning in Eastern Europe) would have to invent alternative mechanisms for the socialization of risk, or suffer the consequences—and wrath—of a vulnerable and betrayed industrial middle class.

Conclusions

In the end, however, all that can be said about the current, fascinating, process of organizational and industrial transformation in Baden Württemberg is that it will be political in the broadest possible sense. I believe that this characterization is generally true in industrial organization, but in this essay I make the point that it is especially true in current relations between disintegrating large firms and dynamically innovative and decentralized systems of small and medium-size firms in industrial districts such as Baden Württemberg. The arrangement of the extrafirm institutional and practical environment in which small and medium-size producers operate and over which much of the political struggle will take place is at least as important in understanding success in the current environment as is the internal organization of individual firms. The more that larger firms strive to disintegrate and socialize their risks and their acquisition of know-how, the more attention to such extrafirm institutions and practices will become important in the study of industrial organization.

Current trends in the world industrial environment indicate that the division of labor is becoming increasingly inter- and extrafirm in its organization. Questions concerning the character of development in the new division of labor and the way in which it changes, consequently become increasingly political. The present analysis suggests that to understand the character of current changes, one has to see that producers seek not only individual profit, but an orderly environment in which they can do so.

Notes

I would like to thank Bruce Kogut for valuable suggestions in the completion of this paper.

1. Good accounts of Baden Württemberg are given by Philip Cooke and Kevin Morgan (1990), Ms. Hans Maier (1987), and Charles Sabel et al. (1989). For general discussions of the various mechanisms involved in such systems, see Charles Sabel (1989), and Jeffrey L. Bradach and Robert G. Eccles (1989).

2. For firms with more than five employees (Goelz 1990).

3. Closer case studies of the competitive strategies of producers in Baden Württemberg can be found in Herrigel (1989).

4. This and all subsequent information on the workings of the VDMA come from inter-
views conducted with the association in Frankfurt and Stuttgart in 1984–85 and 1986. There is also a dissertation on the VDMA by Hajo Weber (1984).

5. On the development of this system, see chapter five of my MIT dissertation (Herrigel 1990). See also the discussion by Weber (1984).


8. The following historical argument about Baden Württemberg has been drawn from my MIT dissertation (Herrigel 1990, chap. 2, 5).

9. This process is outlined in chapter five of my dissertation (Herrigel 1990).

10. On the liberalism of postwar German large corporations, see the work of V. R. Berghahn (1985). See also the critical discussion of Berghahn’s views in my dissertation (Herrigel 1990, chap. 5, 6).

11. On the logic of this kind of dualist subcontracting, see Michael Piore (1980). For Baden Württemberg specifically, see Jürgen W. Hutzel (1981a, 1981b).

12. Few dispute these characteristics of the present environment. For arguments about their genesis and consequences, see Michael Piore and Charles Sabel (1984), Alain Lipietz (1985), and David J. Teece (1987) for a sampling of perspectives.

13. For a case study of this phenomenon, see Charles Sabel, Horst Kern and Gary Herrigel (1990).

14. For more detailed description of this process see Sabel, Kern and Herrigel (1990).

15. The term has been used by Charles Sabel to describe this process, see Sabel (1989).

16. For a discussion of the way in which this system worked at Daimler Benz during the 1950s and 1960s, see my dissertation (Herrigel 1990, chap. 5).

17. The strategy of this company has also been described in Sabel et al. (1989).

18. See, for example, the rather skeptical assessment of nonlocal sourcing by Baden Württemberg large firms in the paper by Cooke and Morgan (1990).

19. Interviews at IBM, summer 1990 and winter 1989, and at Hewlett Packard, fall 1987. The single best study of developments in the German electronics industry is that being conducted by Volker Wittke and Ulli Voskamp at the SOFI Institute in Götttingen. See Ulli Voskamp, Klaus Peter Wittemann, and Volker Wittke (1989) and Wittke (1989a, 1989b). Cooke and Morgan (1990) discuss similar changes at Daimler Benz. Their otherwise excellent paper is bizarrely contradictory on the matter of the disintegration of large firms. On the one hand they point out that it is happening, and, moreover, on a European-wide basis, in the automobile, engineering, and electronics firms they look at in their case studies. Yet on the other hand, they somehow think that it must not be happening if disintegrating large firms do not use exclusively local suppliers.

20. A classic treatment of this phenomenon is the earlier work of David Harvey. See his radical classic, *The Limits to Capital* (1982). Further elaborations on the theme appear in his *The Urban Experience* (1989), which also contains an extremely interesting discussion on the transformation of that old model.

21. This is a point frequently overlooked, often because analysts tend to conceive of the activities of the corporation along the lines of the old model rather than that of the new one that appears to be emerging. A paradigmatic case of work that mixes old principles and new environmental conditions in the analysis of globalization and the corporation is found in Ash Amin and Kevin Robins (1990).

22. See the discussion in Berghahn (1985) and, of course, the classic portrait of German business-government relations given by Andrew Schonfield in his *Modern Capitalism* (1964).

23. Interview with Chamber of Commerce, Grossraum Neckar, July 1990.
References


