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The geographical organization of production-systems

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Abstract. In this paper it is argued that a radical reorientation of organization theory and of industrial geography is needed, one that overcomes the limitations of studies that consider plant locations, agglomeration economies, geographies of enterprise, systems of cities, linkage analysis, and the like, separately. I call for a unified approach to industrial location and organization, or, rather, to the spatial division of labor and modes of organization. To do this one must first reopen the question of the division of labor and its obverse, the integration of complex production-systems. One must also go beyond the important inquiry by Scott and others, as to vertical integration/disintegration, to consider a wide range of possible means and modes of organization available, including variations on market exchange, several forms of workplaces, a wide range of firm size and scope, territorial complexes from the industrial district to the nation-state, and differing industry alignments. Last, one must treat geography as integral to the matter of organization, rather than as an outcome of preexisting organizational units that make location decisions. The puzzle of geographical organization is presented as a whole, but without yet trying to put it together for any particular sector, place, or time.

A unified approach to industrial organization and location

The problem of industrial organization has puzzled me ever since I was issued my first M-16 in the army, upon which was stamped "Made by General Motors". My youthful discovery of the diversified corporation has remained vivid, as my professional investigations of industrial location have continued to turn up similar puzzles. My studies of the electronics sector have been especially instructive in this regard because, in such an open and dynamic sector, the boundaries keep shifting rapidly as new technologies emerge and as old industries are invaded by microcomputing. Ordinarily one trims off the loose ends of an unruly world and gets on with the business at hand, but at some point it is necessary to pause and interrogate the categories themselves. That is the purpose of this paper.

In most geography and economics, the pieces into which one carves up the industrial system are taken for granted. The meaning of 'the car industry' or 'USX' does not need explanation. Neoclassical economics and Weberian geography 'answer' the question of organization by treating the plant as a production-function, the firm as a single plant, the industry as commensurate with a single product line, and the region as a 'blank slate' upon which to locate. Faced with the obvious discordances of this with reality, students of industrial geography have reintroduced organizational complexity by means of devices such as agglomeration economies, to explain the persistence of cities; the geography of enterprise, to capture the role of large corporations; and systems analysis, to cope with the multitude of interwoven connections among plants, firms, and cities. But none of these diffused lines of attack on the problem is sufficient.

I therefore wish to argue for a radical reorientation of organization theory and industrial geography. This would move beyond studies of plant locations, agglomeration economies, geographies of enterprise, systems of cities, and linkage analysis, considered separately, to a unified approach to the spatial division of

labor and of modes of organization. Just as partial equilibrium (firm-by-firm) analysis in economics will not suffice, there is a need for a general theory of industrial organization and industry location. By this I do not mean an eclectic merger of discordant lines of research, but rather a fresh look at the nature of industrial organization itself, a look that spans the vast gulfs between economics and geography, between industry location and urban studies. In this view, the units of modern industry are not predetermined, but are constructed as a part of the industrialization process. They evolve as capitalists, singly and collectively, wrestle with the division and integration of labor as an essential problem in production and competition. How should production-systems be cut up and put back together? The answers are by no means self-evident, the possibilities rich.

The division and integration of labor in complex production-systems

Past approaches

The division of labor is a fundamental category of classical political economy: everyone knows of Adam Smith's parable of the pin factory (for a review see, Perelman, 1983). Yet it has been neglected in this century, confined to a handful of theoretical explorations (for example, Coase, 1937; Stigler, 1951; Young, 1928). When the issue is raised, common parlance still carries over terms better suited to simple commodity production, the manufacturing era, and to the rise of production by machines and in factories. The classic distinction was between the *social* and the *detail* divisions of labor—the first referring to *commodities* (for example, wagons, corn, shoes) and the second to *tasks* carried out by individual workers within the factory (for example, stamping, pressing, sewing) (see Marx, 1967). The presumption was that the results of detail work add up to a final product ready to sell. Weber (1909) took this presumption for granted and incorporated it into his pioneering calculus of plant and industry location, in which commodity sectors were allocated across the landscape according to regional endowments of markets, labor, and natural resources (skewed by relative access to transport arteries).

In the twentieth century, interest has shifted away from 'division of labor' as a category of economic analysis. Instead, attention has focused on the *unification of production* under the aegis of large corporations, and the study of them has turned to their internal organization and behavior (see for example, Bain, 1956; Chamberlin, 1933; Chandler, 1962; 1977; Cyert and March, 1963; Galbraith, 1967). In recognition of the way large firms internalize several production-steps and different product-lines, new terms gained currency in place of social and detail division of labor, such as *industrial organization*, *vertical and horizontal integration*, and *oligopoly*. But the dominant strain was to treat integration as mere amalgamation of factories and product-lines, in which the effects of corporate bulk on prices and competitive behavior were the ascendant concerns, and which has aptly been called "the quantity theory of competition" (Weeks, 1981). Division of labor as a productive force was virtually forgotten. Young's (1928) attempt to resuscitate Bohm-Bawerk's idea of "roundaboutness" as a developmental force was cut chort by Rose who like Sraffa (1926), saw economies of scale as something entirely internal to the modern factory and firm (Storper, 1987). Neoclassical economists, of course, wanted nothing to do with increasing returns, which conflict with all their tidy assumptions about competition and production-functions. Updates of Weber (1909) followed suit (for example, Isard, 1956; Smith, 1971).

In the 1960s and 1970s, however, a new geography of enterprise grew up that pushed the locational behavior of the giant firm to the forefront (see, Dicken, 1976; Hamilton, 1974; Hamilton and Linge, 1979; Krumme, 1969; McDermott and Keeble, 1978; McNee, 1960; Pred, 1966; 1967; 1969; 1977; Taylor, 1975;

Watts, 1980). People in this school asked telling questions about the way corporate imperatives and decisions move plant location and regional development away from the presumed optima of classical location theory. But it treated the problem of production as basically solved, in order to focus on distributional matters such as flows of profits out of backward regions from the notorious 'branch plant' (for a review see Watts, 1981). In alliance with certain radical economists, these institutional geographers put forth a new vision of the industrial landscape, at sharp variance with the Weberian one of localized commodity sectors. In its place came a 'new spatial division of labor', based on the internal divisions of the giant corporation (Cohen, 1977; 1981; Dicken, 1986; Froebel et al, 1980; Hymer, 1972).

Input–output analysis, reintroduced to economics by Leontief (1951) after it had disappeared with the rest of classical political economy (for example, Marx, 1967; Quesnay, 1758), ought to have put the division of labor back at the center of economic and geographic theory. But it did not. Recognition of intersectoral flows of commodities by Sraffa and his followers (Harcourt, 1972; Pasinetti, 1977; Sraffa, 1960) certainly did help to undermine the neoclassical theory of price, capital, and distribution. However, this revolution in thought has been relegated to a special corner of 'capital theory', where it languishes before the ideological fortress of neoclassicism. The profound implications of input–output analysis for industrial *organization* were not taken up by the Sraffans, who continue to make the simplifying assumption that all products, whether final or intermediate, are produced by independent firms; hence the term 'production of commodities by means of commodities' (all output is exchanged in a commodity form). But not all intermediate goods and services take a commodity form, owing to the different ways they are internalized (or externalized) by firms.

The most important work on complex interaction between different parts of the industrial system has occurred outside mainstream economics, in regional development and urban theory. I refer not to the interminable line of empiricist input–output studies that document in tedious detail the specific commodity relations of places, and that do so without any guiding theoretical vision. Rather, I mean that the notion of intersectoral connection had its primary impact on macroregional theory. In the 1950s and 1960s, urbanization and regional inequalities were attacked by means of agglomeration theory (previously confined to a rearguard idea in Weber and his school). Perroux (1950) and Hirschman (1958) promoted growth poles for regional development; Hoover and Vernon (1959), and Perloff et al (1960) were struck by the continuing force of agglomeration in the formation of US cities; Myrdal (1957) advanced his cumulative causation theory of divergent national development (incorporating a strong dose of Keynesian multiplier analysis); and Pred (1966) brought it all together to explain the rise and persistence of a hierarchical system of cities in the process of industrial development. Despite the great accomplishments of this vision, the older specificities of plant, industry, and firm in Weberian and enterprise studies were swept away by the macroeconomic, which focuses on cities and regions. An effort was made by some location theorists to reconcile Weber with the newer trends by incorporating input–output relations and intracorporate ties in terms of a general theory of 'linkages' and of 'industrial systems' (see for example, Collins and Walker, 1975; Hamilton, 1974). But the implications for industrial location and geographic theory were never advanced much beyond broad generalities.

Pred (1977) subsequently attempted a reconciliation of the city-systems linkage and corporate approaches, and also of regional development and location theory, but he never stepped back to pose the fundamental question regarding multiple organizational forms in complex industrial economies. He was too consumed with

matters of circulation (flows of information, commodities, control, etc) to treat structuring of production as a problem. Soon after, Massey (1978; 1979) called for a revival of *industry studies* in order to back off from the generalities of regional theory and to recover some of the specificity of Weber, while transcending the Weberian obsession with transport and turning from static allocation (according to factor endowments) to the dynamic restructuring of industries and their factor demands. Although this refocusing of industrial geography has had quite salutory effects, it has nonetheless brought things full circle: the organizational mulberry bush is now ringed with plant studies, enterprise studies, regional studies, and industry studies. But the various partial perspectives on organizational geography rest uneasily with one another when added up to a *theory* of geographical organization. Massey (1984) runs head on into the thicket, valiantly taking cuts at it from different angles such as intracorporate hierarchy, interindustry differences, and the layered social practices of specific places. Her trail has been followed by a host of locality studies on the influence of industry, place, and gender on the creation of a complexly differentiated spatial division of labor (for example, Cooke, 1988; Murgatroyd et al, 1985). But for all this, no clear theorization of the capitalist division and integration of labor, in its geographical setting, has been forthcoming.

The problem posed by complex production-systems

Input-output analysis has demonstrated two things irrevocably: that the economy can be divided into hundreds and thousands of production-cells, and that each of those cells takes inputs from many places and sends outputs in many directions. In short, the industrial system has a highly developed division of labor, and everything ultimately connects to everything else. This insight appears to make industrial organization impenetrable. But some of the connections matter more than others; there are technological relationships that lend order to what would otherwise be a random input-output network. It is possible to discern certain shapes, or root and branch connections, that define 'trees' in the thicket of input-output relations. These may be called 'production-systems', or, in larger groupings, 'production ensembles'. Production-systems have a certain technological integrity revolving around a common set of outputs or around a common set of inputs, that rest on a shared technology (such as microelectronics)—the French term is 'filière' for the connecting filament among technologically-related activities. Production-systems are to a degree self-defining, and provide one framework around which the organizational fabric of the economy may be wrapped; hence the cogent argument by Chandler (1977) that large corporations and their management systems evolved to meet certain peculiar technical problems experienced in large-scale or far-flung production, as in the case of the pioneering railroad companies. Nonetheless, the argument cannot be taken too far, for the intertwining nature of production-systems precludes any tidy way of slicing things up and putting them back together.

To emphasize the difficulty, it is useful to consider the many forms which production-systems may take:

(a) *Simple commodity production*: this is the classic social division artisan-like labor; a unified or lightly differentiated labor process, centered on a single commodity meant for final consumption, for example, shoes from the local shop, or milk supplied from a local farm. It hardly exists today, but even in its heyday, the shoemaker usually bought leather as a commodity rather than raising his own cattle and then tanning their hides.

(b) *Sequential production*: most transformations of natural materials into usable items involve several sequential steps, such as the drilling of wells, pumping of oil,

transportation of it to the refinery, cracking, and then separating types of fuel for delivery. If the products of each step are the unique inputs of the next (not the case in petroleum) it is a 'linear' production-system.
(c) *Pyramidal component-assembly production*: these are operations where many parts are brought together to be compiled into a final product, such as a turbine. If component producers do not channel their output into a single assembly process, however, the system is not 'pyramidal' but 'nested'.
(d) *Nested production (joint inputs)*: in the vast majority of cases, production-systems overlap, that is, all intermediate goods do not have unique downstream employment. Steel goes into drill bits, car frames, and ball bearings; ball bearings are used in bicycles, cars, and textile machinery; in turn, cars may be used by pizza parlors, gardeners, and airline companies, for example.
(e) *Nested production (joint outputs)*: the reverse of multiple inputs is multiple outputs from the same input. The example of oil refining is not linear, because the final output is an array of products from the same high-temperature cracking process: fuel oil, jet fuel, gasoline, naphthalene, etc.
(f) *Branched systems*: intermediate products tend to be divided among (1) those going into the next step of a linear sequence, (2) those entering into other production-processes, and (3) those serving as final goods. For instance, fuel oil goes straight to customers, jet fuel is consumed by airplanes, naphthalene becomes plastic feedstock. In other words, branches emerge all along the stem of oil processing, some of which branch yet again. The result, then, is more like a thick forest in which trees of various heights and breadths intertwine.
(g) *Extended production-systems*: before direct production begins there must be work done on creating the product, designing the production-process, initiating the sales campaign, and so on. Closer to the factory floor, there are frequently preparatory or set-up tasks to do before the day or the batch begins. At the other end of the process there is testing, packaging, packing, storage, and shipping work to do. Many goods must be installed, explained, and put in working order outside the factory gates. Periodic repair and maintenance are also needed to keep them operating.

To understand the quandary raised by thinking in outdated terms about the division of labor, one has to look no farther than the unbelievable muddle over the meaning of the word 'services' in the contemporary economy. Some have naively defined services as 'outputs', but this is evidently false because many of these services are inputs to the manufacture of goods. One can then try to define services by occupation, but then many jobs in industrial firms show up as services. Worse still, if a job is done by employees of a manufacturing firm it is counted one way, and if it is subcontracted out to another firm it is counted differently. One can go in circles indefinitely. The only way out is to step back and watch the expansion of the division of labor that is a result of, simultaneously, a vast extension of final products (many of which are taking new and exotic forms, like software); a multiplication of intermediate inputs, whether materials, components, machines, or producer services; and of a deepening of indirect labor (for instance, design, computer programming) in the production of every final or intermediate good or labor service (Cohen and Zysman, 1987; Gershuny, 1978; Walker, 1985a). There is remarkable flexibility to where the lines are drawn between input and output, between commodity and noncommodity, between workplace and firm, or between individual and collective labor. And therein lies our problem.

The pieces of complex production-systems are not just divided up and sent their independent ways on the assumption that their technological input–output imperatives will keep the necessary relations intact. They must also be actively *integrated* so that production may proceed to completion. That is, production-systems must be

physically linked up; their labor processes must be coordinated; and the flows of materials, labor, and information between them must be regulated (Walker, 1988a). The principle is general, and applies within factories, between corporate divisions, across cities, and so on. The first task undertaken in productive integration is *linkage*, or the forging of physical connections between workunits, and to final consumers. The lifeblood of production (flows of materials, information, money and labor-power) must find its way to the various limbs of industry. But mere connection is not enough. The second task necessary for integration is *coordination* of the efforts of various groups of workers. This is an absolutely fundamental condition for the functioning of 'the collective worker'. Oil must not just be sent down a pipeline from well to refinery, and by truck from refinery to gas stations; it must be delivered to a refinery that handles that grade of crude oil, arrive when needed, be processed into the right mix of by-products to meet current demands, moved to the correct areas of use, and delivered to outlets at the right time. Researchers, designers, production engineers, line workers, market executives, and salespeople, among others, must coordinate their efforts in order to produce things that will be competitive and that will sell (MacDonald, 1983). Too often the coordination function is taken for granted, as if the mere fact of being in the same building, the same company, or the same country meant that workers knew what their counterparts were doing. At a Belgian telephone plant, I was told of how poor coordination between project engineering and manufacturing had just resulted in a product losing big money, even though the departments in question were only a few hundred yards apart; the result had been a major organizational shake-up. Third, there must be effective *regulation* of the use of labor, materials, and machines, in accordance with economic calculations of cost, revenue, and profit. Machines must be monitored, materials tracked, workers' activities charted, and the results evaluated. Relative profitability of different products must be ascertained, and sufficient labor must be allocated to various workgroups. It is not sufficient, for instance, to have good coordination between production and sales if the sales force is so understaffed that they cannot serve customers adequately[1].

The scope of integration: the current approach

The question that arises, regarding the integration of production-systems, is how expansive the units of organization ought to be. Or, as Coase (1937) first put it, why is all production not incorporated within a single gigantic firm, or distributed among millions of tiny firms? The real situation falls somewhere in the middle. That is, different production-systems have characteristic degrees of integration and/or disintegration, that is, of organizational *scope*. The problem of scope has been taken up vigorously in recent years by Williamson and others of the 'transactions costs' school (for instance, see Williamson, 1975). It has been brought into geography through the illuminating work of Scott (1983a; 1985; 1986a; 1987)[2]. I shall refer to the now-dominant model as CWS, for Coase–Williamson–Scott. The basics of the model are as follows (abstracting, for the moment, from such crucial issues as the actual modes of organization employed, or the handling of dynamics).

[1] The 'means of integration', or tools by which the tasks of linkage, coordination, and regulation are solved, include such things as the transportation and communication arteries, bureaucratic systems of administration, information handling methods and equipment, and direct worker interaction (simple cooperation). These may be distinguished from 'means of organization', which are relations of social interaction rather than tools in the narrow sense of equipment and techniques for carrying out the tasks of integration.

[2] No mention is made here to Scott's major opus on cities, as this paper was written prior to its publication (1988).

According to CWS, firms have a choice between bringing a production-activity within the bounds of the firm (internalization), or purchasing the necessary output from another firm (externalization). Guided by the goal of cost minimization they must consider: economies of scale, economies of scope, and transaction costs. Economies of scale, it is argued, are greatly overrated as a cause of firm expansion. True economies of scale occur only in cases of technically unitary equipment that yield increasing returns proportional to physical size and scale of operation, such as the case of furnaces, and large integral products, such as ships or airframes. In most cases, however, the unity of product or equipment is not clear-cut, and the matter turns on advantages of joint operation of potentially divisible labor processes and machinery, that is, to *economies of scope*.

Economies of scope occur where it is more efficient to operate two activities in tandem than each in isolation (Coase, 1937; the term was invented by Panzar and Willig, 1977; 1981). These economies are of several kinds. *Technical indivisibilities* involve direct physical connections of machines and materials, as in moving-belt assembly lines, heat transfer from one process to another, liquid flow through a contained system, or different by-products derived from a common resource (Bailey and Friedlaender, 1982). *Concurrent scale economies* occur where related production-processes reach their cheapest output at roughly the same level; if they do not, joining them together will mean running one at suboptimal capacity (unless additional work can be contracted from outside). *Coordinative economies* are those where integration of labor processes, and regulation of material flows, benefit overall production, such as linking R&D closely with manufacturing, marketing a line of products jointly, or realizing the efficiencies of continuous machine operation by providing a regular supply of inputs. The *sharing of technical know-how and working skills* from one process or product to another is the hardest economy of scope to pin down, but it is probably the most important (Caves, 1982). Potato chip makers have all started to produce other sorts of snack foods, such as corn chips, not only because a broader product-line is desirable from the sales perspective, but also because they have proven capable of 'making the jump'. These intangibles repeatedly plague companies that make ill-advised forays into industries they have no mastery of, as when Exxon tried to capture the office mechanization field.

Economies of scale and of scope are insufficient on their own to determine whether related activities should be brought within the bounds of the firm or left to the market. This requires, in addition, the consideration of *transactions costs* (Hennart, 1982; Panzar and Willig, 1977; Rugman, 1979; Teece, 1980; Williamson, 1975). Almost any production-process can be divided into smaller constituents, it is argued, and complex contracts can be drawn up to handle almost any transaction. Just because wool and mutton are joint products of sheep does not mean that shepherds cannot contract out the shearing, or sell lambs for slaughter, rather than doing these things for themselves. This model provides a powerful set of reasons why large size is not always the most efficient, and why small firms can survive by suitable marketing arrangements, as, for example, owning a single mainframe and then leasing computing time. Conversely, markets operate poorly under certain circumstances; direct administration within a firm can be a more efficient mode of integration owing to the ability to command the necessary information and to enforce the required behavior among the participants in the transaction. The balance of economies of scope and transactions costs yields a characteristic degree of integration–disintegration in each industry (Scott, 1983a; 1985; 1987). Scott has gone on to argue that disintegrated production-systems, consisting of many small firms, are the basis for the formation of industrial complexes in cities (Scott, 1986a).

The CWS model provides, for the first time, a unified approach to division and integration of labor processes, and also some powerful analytic tools to prise out the secret of why some industries are more concentrated than others and of why cities continue to grow. Nonetheless, I have some important objections to the theory as it stands. To begin with, CWS does not allow for any structure of technical interdependence between the various pieces of production-systems. In the formal representations of Scott (1983a; 1985), every activity can be depicted in terms of independent cost curves. But, except for the case of concurrent scale economies, it is impossible to treat economies of scope in terms of the coincidence of independent cost curves; integration of activities is desirable in most cases precisely because various processes are interdependent, and not merely coincident in their level of efficient output. Sheepshearing is usually done by sheep raisers, in fact, because of the carry-over of know-how as to proper handling of the animals, the state of the particular flock, the best time for shearing, and so forth.

Furthermore, transactions costs are structured by the technical and social characteristics of product and of production-methods. To continue with our example, it may be hard to draw up a contract for sheepshearing because only the shepherd knows the identity and location of the sheep out on the range—yet unconfined grazing is essential to sheep raising. Crucial variables in the model of transactions cost, such as rate and quantity of transactions or type of information required, are established by the nature of the product and process. Scott (1983a; 1985) tries to take this into account in a simple two-sector model, which contrasts 'batch production' industries (with low throughput and variable input–output relations) with 'mass production' industries (with high throughput and standardized linkages). The first tend towards disintegrated production, the second towards integrated production (standardized product and production-methods control the type of transactions faced by the firm). This model is an oversimplification on several fronts—one of which must be mentioned immediately: production-systems do not generally follow a linear sequence of processes such that all inputs and outputs are standardized bundles moving into one end of the factory and out of the other. The common misuse of the term 'vertical integration–disintegration' in the CWS literature is indicative of the lack of attention to actual production-systems, very few of which fall into the strict sequential processing category. As a result, every industry consists of large firms, small firms, large factories (with some large departments and some small ones), small plants, clustered production, and dispersed production—as Scott's own research shows (Scott, 1983b; 1984a; 1986b; Scott and Angel, 1987).

But we very quickly get ahead of ourselves here, because a principal shortcoming of the CWS model is its failure to consider, in their own right, the several levels of integration and of modes of organization.

Means and modes of organization

The problem of integration is much bigger and thornier than is recognized in the CWS model. Similarly, the ways by which integration is achieved are more numerous than generally acknowledged, and the tapestry of industrial organization far richer. The field of industrial organization needs to be vastly broadened in order to include the full dimensions of the division and integration of labor, and we have to cut across a wide domain of economics and geography to take it all in. My treatment must therefore be suggestive rather than exhaustive in establishing a range of possibilities.

I shall distinguish five different *means of organization* of production-systems, each represented by various *modes of organization*. There is organization by means of exchanges and contracts, which encompasses spot markets and subcontracting;

organization by means of property rights, including ownership of various types of firms; organization by means of physical enclosure, including factories and other kinds of workplaces; organization by means of spatial access, embracing various scales of territorial production-complex; and organization by means of competition, the level at which industries are defined. Another fundamental means of organization, which I must ignore for reasons of space and time, is by finance, and the various kinds of investment and monetary ties that bind. 'Means of organization' refers to the key social–technical forces binding together bits and pieces of production, be they forces of spatial propinquity or laws of property. The workplace is the most direct evidence of the need to bring workers, materials, and machinery together at a single point. The firm allows the legal control of diverse empires of workplaces and allows their direct administration. Markets provide for the transfer of objects (and labor power) from one legal owner to another, through commodity exchange. Territorial complexes allow the meshing of incredibly diverse systems of workplaces, labor markets, and of living space, within loose conjunctures, often under distinct governance by city, state, or national political systems. Industries bring order to the competition among commodities and capitals. I shall develop these definitions further in the discussion below.

'Modes of organization' on the other hand, refers to the particular institutional forms adopted, such as the distinction among firms between the corporation and the partnership. These institutions put limits on social action and guide it down certain channels. Institution is a very simple and unexceptional concept when it comes to such things as Eastman Kodak Corp. or one of its factories, and even Britain can be thought of as being composed of many large institutions such as its legal system or language; but ordinary discourse provides few levers for thinking of 'the city of Chicago' or 'the appliance industry' as a living institutional complex that regularizes social relations in a way that allows production (and life in general) to proceed in a reasonable way. Nonetheless, an institutional fabric of established social relations, rules of behavior, channels of interaction, and the like operates in these situations as well—albeit in a more loose and informal manner.

The CWS model, and most theory about industrial organization since at least the time of Marx, is almost wholly confined to the choice between the market and the firm (internalization versus externalization). In this approach, the market is the realm of commodity exchange (or contractual relations) and the firm is the realm of administration (or command relations). The distinction between firms and workplaces is not made, nor between kinds of workplaces. Industries are taken for granted as being the envelope around the production-system, and competition is seen chiefly as a cost-reducing drive among commodity producers. In Scott's work of course the city emerges as a productive context in its own right, but this insight needs to be taken even farther.

If the argument is to make sense, it will be necessary for the reader to let go of some old and deep ways of thinking about such taken-for-granted categories as 'the shipping industry' or 'Portland'. On one point I am particularly insistent: *it is impossible to separate the organizational from the geographical*, much less to treat industrial location as the simple outcome of organizational forms or decisions. I contend that *spatial relations stand on their own as means of integrating production-systems*: space is that basic to human action (Soja, 1980; Urry and Gregory, 1985). Hence all forms of organization are inherently spatial to some degree, and the workplace and territorial forms are spatially constituted from their very pediment. Capitalism without workshops and cities is as ridiculous an idea as capitalism without firms or industries. Capitalist organization is constituted in and through spatial relations.

Organization by means of absolute space: the workplace

The workplace is the most palpable mode of organization: the site at which labor and means of production are brought together. The dominant forms of workplace are closed venues, absolute spaces enclosed by walls. Closed workplaces are of three kinds: the home (out-working, artisan shops, domestic labor), the workshop (small workgroup, simple division of labor), and the factory (large collectivity, many units or departments, advanced detail division of labor, etc). Infrastructural industries consist of distinct *nodal* workplaces, such as railyards or power plants, embedded in fixed networks of distribution. Conventionally defined in relation to manufacturing, these categories have their parallels in office work, wholesaling, and in retailing. Direct connection and access are the chief integrative tools of the workplace. The workplace not only juxtaposes machine with machine and worker with object, but it also brings people into close proximity with each other on a day-to-day basis and thus facilitates social cooperation. The workplace makes use of enclosed space as well. The workshop or factory is a place of containment and confinement, a piece of turf where the boss rules; the home is a place where men generally rule over women, in which they are both equally captive to property and responsibility. The workplace is also a symbolic and a social world in which the capitalists' hegemony is usually reinforced. In short, the workplace is a system of labor control (Burawoy, 1985; Marglin, 1974).

The factory is perhaps the preeminent symbol of modern industry. The industrial revolution of the late eighteenth century brought about the rise of the factory proper—an event of incalculable historic consequence for the lives of working people, the level of productivity in certain sectors, and for the space economy (Marx, 1967). Still, the factory did not sweep all of industry before it. Britain throughout the nineteenth century remained a nation of workshops (Samuel, 1977), as did the USA (Montgomery, 1967). Factory production only became general in the twentieth century (Nelson, 1975). Domestic work largely died out in advanced capitalist countries, but there have been some notable revivals in the areas of garments, electronics, and even insurance (for example, see Baran, 1986; Rainnie, 1984; Siegel and Markoff, 1985). More important are the millions of workshops embedded in the industrial matrix: machine shops, store-front offices, boutiques, etc. In fact, the average size of manufacturing workplaces has been shrinking in recent years, as observed in the dismantling of the great motion picture studios (Storper and Christopherson, 1987). Small workplaces are useful in many niches of the division of labor, and there is no justification for ascribing small size to backwardness. There are any number of small productively competent print-shops, software houses, brokerages, and breweries.

The scale and scope of activities within a single workplace can vary widely. At the one extreme are such leviathans as Henry Kaiser's Richmond (CA) shipyards that employed 125000 people during World War 2, or Henry Ford's River Rouge plant, once employing 35000 people, and which took in coal and iron at one end and put out automobiles at the other. The act of bringing so many different labor processes and workers together under one roof is a major accomplishment. Why would capitalists want to create large factories? One reason is the scale of the product (for example, airplanes or ships are most easily constructed in one spot). Another is the need for continuous flow of liquids and gases (as in integrated chemical complexes). Integrated assembly lines of the Fordist type also require large factories to operate in. Before electric motors, belt-driven machinery had to be kept close to the prime mover. Nonetheless, although such 'mechanical' reasons are important, the need for communication and interaction between workgroups may

be even more significant (Sayer, 1986; Walker, 1988a). Easy oversight of workers at their various tasks is another reason for having large factories (Marglin, 1974). Indeed, factories have made it possible to install advantageous production-methods, such as an extended detail division of labor, assembly lines and steam engines—causality does not run all one way, from technology to organization (Marx, 1967).

Large factories have drawbacks however. Their existence depends, in the first place, on the industrialist having sufficient power and organizational capability to build, staff, and successfully operate such an entity. What a few individual capitalists were able to do in eighteenth century England was impossible at the time in France without the help of the king. Clever mechanics or engineers may not be up to the task of creating a large factory, or may not care to undertake it; so they keep to small-shop modes of organization. A principal drawback of the factory, from the owners point of view, is the massing of hundreds of workers in a single place, where they can develop a strong sense of their collective power. Capitalists commonly second-source, subcontract and split up factories in order to evade organized labor (Bluestone and Harrison, 1982; Clark et al, 1986; Murray, 1983). Product and process changes also contribute to shrinkage of the factory, as in the growth of minimills that process scrap, use electric arc furnaces, and produce speciality alloys at the expense of huge basic steel complexes. In this case, inertia and inflexibility have much to do with the challenge to large plants (which are now making a comeback). Small plants (whether in small or large firms) can allow for a higher degree of responsible autonomy for groups of workers and managers, and hence more flexibility in the face of rapid technological and/or market change[3].

Workplaces with different spatial forms have diverse geographic effects, which are quite independent of other modes of organization such as large companies or territorial production-complexes. Small workplaces are highly prone to congregating in dense production-complexes, as Scott has shown. Factories are also a principal cause of industrial clustering. They bring together hundreds, or thousands, of workers in one place, and establish the economic base for surrounding residential areas and for secondary processes of urbanization. Yet different types of factories have different consequences. In Richmond, CA, for instance, nineteenth century explosives plants, in which only single Chinese men were employed, left a very different imprint than the twentieth century Chevron refinery and Pullman Sleeping Car plant in which white people with families were hired. Still later, Kaiser's immense shipyard came and went so fast that no trace is left except the social legacy of a black ghetto, formed by the influx of southern recruits. Richmond's Santa Fe railyard was different still, a part of a system of workplaces strung like beads along strings of transcontinental railways that brought industrialization to thousands of middle-size towns in the USA (Vance, 1986). Because they leave so faint a mark on the land, industries such as shipping that have mobile or nomadic workplaces hardly appear in the lexicon of location theorists.

[3] In many industries, however, workers are not bound to a closed or fixed venue. These venues may be called 'open workplaces'. There are *mobile* workplaces, such as airplanes or ships. *Nomadic* workplaces which occupy a site for a time and then move on, as in building construction, lumbering and on-location filming. Some workers, such as railway repairers, park rangers, or harvest laborers, do their jobs by ranging freely over *extended* workareas. And finally there are those such as traveling salespeople and photocopier repair people whose work takes them to far-flung homes, cities, and workplaces, or what might be called *unlimited* venues. All these create special problems for the capitalist, as well as for the geographer. There are limits to capitalist control in 'factories in the fields', and we have very little in the way of theory to deal with the role of open workplaces in industrialization.

Organization by means of exchange: markets and contracts

Markets: The beginning of generalized commodity exchange was the historical starting point of capitalism; and markets were the first form in which economic integration was achieved beyond the local region. Markets existed before there were firms, factories, or industries in the modern sense. They are so much a part of capitalist life that they appear as a sort of primordial æther; but they do not exist apart from specific institutions, legal systems, and contractual relations. There are therefore many types of 'market', not one universal market. A local farmers' market is one sort of arrangement, the Chicago Corn Exchange is quite another. Markets are socially constructed practices and institutions, serving specific purposes and places, built up over long periods of time, and subject to modification or even abandonment as needs change (see for example, Braudel, 1982; Porter and Livesay, 1971; Pred, 1984).

The neoclassical concept of the market, owing to Leon Walras, is nothing more than an idealization of a French village square into which all parties enter, make their offers, and leave satisfied; prices form, markets clear, the deed is done. It is not hard to think of counterexamples: a Defense Department cost-plus contract, a photocopier lease-buy agreement, or a labor contract with a gang-boss who hires the workers. The only thing these have in common is the exchange of a commodity (a good or a labor-service), for a certain amount of money, between contracting parties. Beyond this, just about every other characteristic is 'up for grabs' and subject to the most ingenious variations (Williamson, 1975). Market transactions depend on variables such as the number of bidders (degree of competition), the number of sellers (for example, as in joint ventures), number of buyers (for example, for public goods), number of commodities (for instance, in tied purchases), time of sale (for example, of extended service agreements), time of delivery (with possible termination clause), form and terms of payment (extension of commercial credit, goods versus money, etc), time of consumption (for example, as in the case of limited use permits), continuity of transactions (for instance, off-the-shelf spot markets versus long-term fixed contracts), and quality standards (with rejection clauses). There can also be noncommodity transactions involving deeds (such as for house sales), labor-service contracts, and the like.

Markets are distinguished by transactions between parties that are relatively individualized, voluntaristic, formally equal, and temporally constrained. They allow for remarkable flexibility through a changing mix of participants and commodities, and through sharp mobilization of personal energies via competition and the pursuit of self-interest. Nonetheless, the market mode is beset by certain difficulties. The principal limits to the formation of stable, workable market-exchanges are uncertainty (incomplete information, an uncertain future); small numbers (few parties, irregular transactions); bounded rationality (inability to handle all information and contingencies); and opportunism (misrepresentation, reneging) (Alchian and Demsetz, 1972; Williamson, 1975). As a result, commodities may not be available as needed, monetary payments may not be forthcoming, critical information may be withheld, labor processes may be poorly coordinated, and capital flows may be blocked. In short, neither linkages nor regulation among the parts of the division of labor may be sound enough for production to proceed in a stable and effective manner. This ineffectiveness and instability flows from limitations on the exercising of power, lack of permanence, poverty of knowledge, and indirectness in the relations among capitalists. Competitive individualism has its drawbacks as a way of organizing social action; and markets can be a weak integument for complex production-systems.

Given the complexity of market transactions and the perils that lie in wait, an army of intermediaries such as stockbrokers, import-export houses, department stores, and rental agencies step in to help transfer the commodity (or title, or loan) from seller to buyer. These are the commercial capitalists (merchants), who make their money from the promotion of exchange itself (Marx, 1967). Some of these, such as Sears, and Safeway, are among the largest corporations in the world[4]. There are licensing agreements that allow one industrial firm to sell (and even produce) another's products (usually across national boundaries), and there are also franchise dealerships, normally granted by large firms to numerous small retailers. (These sorts of 'contract selling' agreements should not be confused with production subcontracting.) The limitations of market are also commonly overcome in three other ways: development (and enforcement) of contract law; institutionalization and oversight of transactions by bodies such as the Chicago Board of Trade, the Securities and Exchange Commission, or the San Francisco longshore hiring hall; or the physical congregation of traders in a single place, as in the merchant halls of Antwerp or the New York Stock Exchange.

Merchants are notorious clusterers, and most big capitalist cities began with, and still thrive on, mercantile activity (Braudel, 1982; Kriedte, 1983; Pred, 1966; Vance, 1970). Also, merchant houses, department stores, and the like effectively create closed workplaces (as do merchant halls and stock exchanges) where traders gather not just to do business, but to develop personal trust, have access to the best information, and to have their activities easily overseen by others. Regulatory institutions such as the Bank of England, the Federal Reserve Bank, and the Chicago Mercantile Exchange Board also draw traders to them by virtue of the need for access to such power over money, information, and industry rulemaking. The effective reach of contract law is bound by place and nation. The open-market mode of organization must therefore, somewhat surprisingly, be considered a geographically localizing force, and because market institutions (and cultures) last for many years, even centuries, they lend a regional specificity and rigidity to the market mode of organization, that is little noted by neoclassical economics. At the same time it is clear that improved market institutions, from the International Monetary Fund to fixed exchanged rates, have promoted the global expansion of capitalist trade, and have thereby encouraged the spread of capitalist production to far corners of the earth. The net result is to help create a network of highly concentrated urbanized and industrialized places strung together over long distances, which may be most easily visualized by comparison with the former effect of railways and railyards (compare with Pred, 1980; Vance, 1977).

Subcontracting networks. 'Putting out' is the oldest specifically capitalist form of organizing production, and it predominated in many parts of Europe in the eighteenth and nineteenth centuries (Harvey, 1985b; Kriedte, 1983). Thought to have passed from history, it is nevertheless to be found today in automobiles (Friedman, 1977; Holmes, 1986), garments (Rainnie, 1984; Scott, 1984a), films (Storper and Christopherson, 1986), computers (Bakis, 1977), agriculture (Friedland et al, 1981), insurance (Baran, 1986), semiconductors (Gordon and Kimball, 1986; Siegel and Markoff, 1985), aerospace (Scott, 1983b; 1986b), machine tools (Sabel and Zeitlin, 1985), and so on. It is widespread in Japan (Watanabe, 1972), Italy (Brusco and Sabel, 1983; Murray, 1983; Sabel, 1982), and Spain (Belil, 1985),

[4] Williamson and the 'transactions cost' school minimize the role of merchants, and along with it the crucial effect of established merchant houses on the structure of transactions costs. The business of commercial capital is, in one sense, to establish markets that allow exchanges that would not otherwise be possible between isolated parties.

and is more firmly rooted in Germany, France, Britain, Canada, and the USA than previously recognized (Bakis, 1977; Holmes, 1986; Sabel, 1982). It is prevalent, too, in the informal economies of Third World cities (Portes and Walton, 1981).

Subcontracting is the orchestration of production by a lead capitalist who 'puts out' segments of a complex production-system to many suppliers, under specific product or labor-service contracts. This usage is restrictive: marketing of the final output must be by the lead firm (no subcontractee produces a complete commodity); there are restrictions on timing, quantity, etc (production is on demand rather than in anticipation of demand); an enduring relationship between firms is required (at least until the primary contract is fulfilled); and some degree of direct involvement of the lead firm in the production-process of the subcontractor must be allowed for (such as the provision of blueprints, or for on-line quality checks). Auto suppliers, such as the Budd Company or Goodyear Tire and Rubber Corp., are not ordinarily subcontractors, even though certain specifications are given as to the size of the order, the mix of tires, performance standards, etc. Modern subcontracting is dominated by industrial firms. Merchant subcontracting lives on nonetheless, chiefly in the form of supply networks to giant wholesalers and retailers (such as Cargill Co. or K-Mart Corp.), but also in the form of armies of smaller merchants who 'put out' work (for example, as in the leather trades of Italy, or as in the production of specialized electronic components in Britain).

Subcontracting is principally concerned with the organization of complex production-systems. Unequal exchange, dependency, or unbalanced firm size are not the central issues, despite the excessive attention given to them in the literature (see, Belil, 1985; Holmes, 1986). There is coercion at work, but this is always the case under the rule of capital, whether it is exercized against workers or against other firms. Moreover, subcontracting is not to be associated with industrial backwardness and absolute exploitation of workers. Many subcontractors are, in fact, larger than the lead firm, diversified in their contracts, and expert in a particular field (Sabel, 1982).

Subcontracting offers a supple compromise between open-market transactions and internalization within a single firm (Belil, 1985). It implies stronger linkages, coordination, and regulation than the open market, but is still formally defined by contractual rather than authority relations. The subcontractor is legally independent (unlike the subsidiary) and free to undertake other contracts at the same time (unlike the regular employee). Yet lead firms may direct subcontractors through the provision of materials and equipment, and by giving product and process specifications and designs, by licensing of patents, training of personnel, providing on-line monitoring, spot-checks of management, and by the loan of specialized workers, etc. Subcontracting overcomes certain deficiencies of the open market (for example, uncertainty, fragmentation) and certain problems of the firm (for example, labor relations, managerial overhead). The advantages of subcontracting for both parties are many. For the contractor, it can mean (compare Holmes, 1986):

(a) expansion of capacity to meet a sudden upsurge in demand;
(b) ability to draw on special expertise, skills, or patents of subcontractors;
(c) the lowering of overhead costs for factory space, fixed capital, inventories, direct supervision, safety equipment, etc;
(d) greater exploitation of labor, owing to lower wages and benefits, longer hours and poorer working conditions in subcontracting firms;
(e) more accurate targeting of labor submarkets, breaking up of collective resistance, and the tying of workers into more paternal relationships in small firms;
(f) the stabilizing of the flow of production through exclusive contracts, multiple sourcing, shifting orders, 'just-in-time' controls, etc;

(g) the achieving of tighter control over production than through pure exchange;
(h) they have principal control of revenues from sales, and favorable financial transactions with subcontractors (loans, late payments, etc).
It is helpful to many subcontractors as well, whose business might suffer because of:
(a) lack of marketing capacity (outlets expertise, name recogniton, etc);
(b) lack of finance for equipment, materials, etc;
(c) lack of technical capacity, owing to lack of R&D, patents, etc;
(d) lack of management skills.

The need to enter into subcontracting networks speaks of the inability of individual firms, particularly smaller ones, to put together more than a few pieces of complex production-systems internally or through more casual market linkups. Subcontracting provides a viable alternative, in many cases, to absorption by big firms, or to bankruptcy. Of course, there are also disadvantages. For lead firms it can, among other things, mean
(a) too little control over production, material flows, and over the labor force;
(b) leakages of profits;
(c) failure to develop in-house production-capabilities;
(d) managerial headaches.
For subcontractors the possible drawbacks are notorious:
(a) lack of marketing alternatives;
(b) loss of control;
(c) financial dependence;
(d) drain of profits to the lead firm.
For both there is always the danger of overcommitment to long-term contracts. For capital in general, it is hard to mobilize capital flows and to monitor returns for dispersed systems of small firms, and this is why something like the 'venture capital' market of Silicon Valley has arisen.

The spatiality of subcontracting is a subject of intense scrutiny at present with considerable supposition as to whether subcontracting necessarily demands geographic concentration. This relation seems to be borne out by cases such as out-working for the garment industry, in big cities (Rainnie, 1984; Scott, 1984a), and the clustering of subcontractors around IBM plants, as in Montpelier (Bakis, 1977). Spatial access is advantageous as it provides the close interaction and oversight that subcontracting often demands. Nonetheless, long-distance subcontracting is common, too, as in the cases of Fiat Group, seeking out firms in Central Italy (Murray, 1983); Boeing Corp., subcontracting with Southern California parts suppliers (Erickson, 1975); or personal computer makers subcontracting disk drives to Taiwan (*Business Week*, 1986a). Indeed, subcontracting often allows precisely the kind of reliability in exchange relations that makes distance tolerable. Thus, the clustering manifested by 'aerospace' or 'electronics' must be understood in broader terms than relations of contracting and exchange, as these do not take into account the production conditions. For example, a common error is to see 'just-in-time' (JIT) methods of production-coordination and of inventory control as coincident with subcontracting, but the first is a method of production-*integration* and the second a mode of production-*organization* (for discussions see, Sayer, 1986; Schoenberger, 1987). The JIT system appears to be more strongly agglomerative in effect than sub-contracting, and indeed probably encourages the formation of subcontractual relations, instead of open-market buying in order to assure performance.

Organization by means of ownership: firms and agencies

Firms. In early trade there were only individual merchants, personally responsible for business, whose transactions were carried out in their homes, in coffee houses,

and in exchanges. As merchants formed partnerships or syndicates, and as their activities grew in volume and extent, they needed a way to regularize and delimit their business operations (Tigar and Levy, 1977). The firm thus evolved as a legal shell under which assets could be assembled, contracts drawn up, workers employed, and capital accumulated. First, the modern firm is an entity with which other capitalists can do business: it has an ongoing existence, legal rights and obligations, an address, etc. Most of the law of contracts is written for firms, which have become the transcendent legal 'individuals' of modern capitalist society. Second, the firm is a container for capital in its various forms. Large numbers of diverse assets (machinery, inventories, buildings) can be brought together, or spread across the face of the earth, without having to be assigned to particular people. Money capital can be accumulated in corporate accounts for the further use of the business, without first being dispersed to owners or other individuals. Third, the firm is an employer, which has the right to hire and fire and to set the terms of labor within its bounds; it is a legally circumscribed place wherein capitalists may exercise their right to exploit labor-power. Fourth, the firm is an administrative structure created to organize production, handle external exchanges, manage assets, and exercise class control. Last, the firm is the central actor (but by no means the only one) in the competitive battle among capitalists.

The focus on large firms in modern geography has much to do with the well-known advantages that a large size offers to capitalists. Size arises partly from economies of scale in production. Larger firms are better able to administer large operations and to integrate them with materials supplies and market outlets, in order to maintain volume and continuity of throughput. Large firms are therefore on average more capital intensive than small ones (Marris, 1979). But the large firm is *not* coincident with the large factory. Diversified corporations do not depend upon production-economies as much as they depend upon financial and proprietary advantages, and they also combine large and small workplaces in their empires. A large financial size makes firms better able to raise capital for large and promising investments, to borrow at lower rates, to 'ride out' bad times, to stabilize profits by averaging them over many diversified investments, to move investment rapidly to new areas, and so forth (Marris, 1979; Taylor and Thrift, 1982). The average profit rates of large firms are not higher, but they are more stable than those of small firms; hence their greater chances of survival. Big companies also succeed in the competitive race by virtue of their ability to generate new technologies in R&D laboratories, to develop and retain experience (know-how) over long periods and diverse activities, to buy small companies that have 'beaten them to the mark' in a new technology, to 'protect their flanks' from challengers by guarding materials supplies and market share, and by their ability to take advantage of a competitive edge by moving into far-flung areas of the world, and so forth. In other words, they can 'internalize' (gain and retain proprietary control-over) the means of competitive advantage. Last, those who once get ahead in the race to accumulate tend to stay ahead, and they tend to 'swallow' those who lose out in the competitive wars (Marris, 1979; Marx, 1967). The growth paths of firms can therefore be modelled as random walks, which generate a widely uneven size distribution, and are a systematic evolutionary result of dynamic competition, starting from equivalence (Nelson and Winter, 1982).

The scope of activities encompassed by single firms is exceedingly wide. Some are as small as single workshops, and fill specialized product or task niches within an industry, whereas others span several industries and have facilities all around the world (for data see Eatwell, 1971). An erroneous presumption of models of industrial organization (for example, of oligopoly, dual economy, and of product

cycle) is that every firm within an industry is doing the same thing, and that small firms are younger or less successful versions of larger companies (see for example, Averitt, 1968; Bain, 1956; Markusen, 1985; O'Connor, 1973; Vernon, 1966). Large and small firms often perform very different functions within production-systems. Even as New York pulses beneath its corporate towers, schools of small firms busy with their own concerns swirl about the giant pilings of industrial behemoths. Most small firms survive by doing things large companies do not want to do or cannot be bothered with: for instance, serving local markets, making highly specialized products, and exploiting marginal labor-forces. Small firms do not ordinarily go head to head with the giants, and even large firms have divisions working in specialized areas. In the semiconductor industry, for example, as well as the better known random-access memory chips there is a wide variety of chip technologies and product niches, from bubble memories to integrated circuits designed specially for autoignitions. As a consequence a complex patchwork of firm strategies and sizes has emerged (Schoenberger, 1986; Truel, 1980). Production-systems involving component assembly are a haven for small firms. The typical airplane engine has 10000 parts, made mostly in small batches (Storper, 1982). The automobile industry, which looks at first glance like a corporate desert, includes a vast array of parts suppliers, varying in size from tire moghuls to tiny producers of ball bearings (Friedman, 1977; Schoenberger, 1987). The chemicals industry, on the other hand, includes innumerable downstream plastic fabricators, and pesticide formulators (Commoner, 1976). Niches are only found through experimentation: they are not simply 'there in outline' waiting to be filled. (This is true in ecology as well. See Rose et al, 1984.) The US microelectronics industry has been pursuing such avenues with zeal recently, as commodity lines have become glutted with competitors, and technology of chip design and production is allowing greater product diversification at reasonable cost (Schoenberger, 1986).

The diversity of companies active in the computer industry offers a good example of what has been described above. IBM dominates the industry, but mostly through its position with mainframes. No one firm can do it all, not even the fabled Big Blue (*Business Week*, 1984; 1986a; Sobel, 1983). DEC now holds sway in minicomputers, where Wang, Control Data, and Hewlett-Packard also operate. Within that realm, Wang stresses office uses, whereas DEC is the long-standing leader in scientific computing. Cray and Amdahl do battle with IBM in super-computers. In microcomputers, companies such as Apple, Sun, and Tandy have a solid grip on market share, despite the impact of IBM; and many more, such as Leading Edge and Compaq, have made their fortunes by making cheaper versions of the IBM PC series. AT&T has entered the fray in the hope of challenging IBM on its own ground, at the same time IBM is investing heavily in telecommunications.

Ordinarily, computer companies do not manufacture all of their own components. Microcomputer makers frequently do nothing but assemble the final product (*Business Week*, 1986a). IBM is noted for its degree of internalization, including the world's largest semiconductor operations (until about 1960, IBM made more money through the production and the sale, via tied purchase agreements, of punched cards than from business machines!); but even IBM has 'gone outside' to make its PC, to buy a share of Intel (a leading maker of integrated circuits), and to purchase Rolm (a company with specialized knowledge of communications networks). Downstream sales arrangements are equally diverse. IBM sells almost entirely through its own direct sales-force; Tandy personal computers are sold through the distribution outlets of its parent, Radio Shack; and Apple computers are sold through a variety of independent outlets; and Itel grew fat for a time simply by leasing IBM computers.

The firm can be distinguished from other modes of organization by things such as the degree of direct power of the capitalists over their employees, and by the use of formal administration; but the contrast is frequently overdrawn between the despotism (administrative decisionmaking) of management and the anarchy (automatic adjustments) of the market. This sharp dichotomy elides the way that the world outside the firm needs to be managed, and the 'world' inside the firm needs to be regulated to conform with external competition and the rules of exchange. On the inside, management has introduced such devices as divisional organization, profit centers, and ad hoc work teams, to try to emulate market conditions of profit equalization, competition, and small firms within the large corporation (Chandler, 1962; 1977; Harvey, 1982). On the outside, firms have tried to stave off competition, combine proprietary technology and know-how, market a wider variety of goods, and so forth through such strategies as merger, subsidiaries, part-ownership, interlocking directorates, cross-licensing, and joint ventures (Herman, 1981). The variety of such arrangements is staggering: *Business Week* recently distinguished nine different ways of 'teaming up' in the information processing field: by acquisition, equity position, joint venture, original equipment manufacturer agreement, technology development agreement, technology exchange or licensing, joint product-development, marketing agreement, and agreement between manufacturers (*Business Week*, 1984, page 90). Despite its achievements, the large firm as a mode of organization is beset with contradictions. For example, diversification has the merit of opening new markets, lessening risk, achieving economies of scope, and so on, but it comes at a cost in organizational coherence and competence in manufacturing; the business press is therefore rife today with stories of overextended companies busily shedding divisions and subsidiaries in order to 'get back to basics' (*Business Week*, 1986b). Similarly, profit centers can provide a good way of getting a hold on costs, and of achieving flexibility in the face of bureaucratic sclerosis; on the other hand, internal competition may wreak havoc on integration. At one point, Citicorp discovered that Wall Street operators were making money by arbitraging between its commercial and investment banking groups, which had different price quotes!

The geographic consequences of the large corporation have been the subject of a vast literature (for overviews see Dicken, 1986; McDermott and Taylor, 1982). I do not intend in this paper to grapple with this head-on (see Walker, 1988c). What must be said here is that far too much has been attributed to the corporation per se in terms of the determination of spatial outcomes. Although it is entirely plausible that large enterprises have discernible effects on the spatial division of labor, very little has been proven in this regard [for example, see the review of research in Watts (1980; 1981), also the critical assessment in Hayter and Watts (1983)]. What can be said unequivocally is that they have facilitated productive developments such as the 'global reach' of investment around the world, dispersal of plants to far corners of nations and the globe, the expansion of the division of labor along its several dimensions, advances in the science-based industries, extension of marketing techniques and outlets, and concentration of capital. But these things have gone on outside the large corporation as well; they are general conditions of capitalist development and industrial advance. Moreover, the causal powers for industrial geography of such aspects of production and circulation as technological innovation, rapid circulation of capital, or exploitation of cheap labor, cannot be assigned willy-nilly to the large enterprise *as a mode of organization*, as is so frequently done (for instance, see Clarke, 1985; Teulings, 1984). Despite the evidence on the spatially dispersed production-complexes of Ford Motor Company or IBM (see Bakis, 1980; Thrift, 1986), the degree to which even the largest corporations can be captive to the fate of industrialization in particular places is

also striking. General Motors Corporation remains a thoroughly mid-western US company, and Bethlehem Steel Corporation has declined along with the Pittsburgh-centred US steel industry, whereas the Fortune 500 is replete with electronics firms newly arisen in Silicon Valley or movie producers set deep in the productive complex of Hollywood. Clearly some fresh thinking is needed about the relation of firms to the spatial division of labor.

State agencies. Production can in some instances be owned and operated by government agencies. Internationally one finds the most disparate practices as to which industries are classified as private or public sector. Common candidates for nationalization are the postal service, telephones, airlines, and oil. The degree of government ownership and control of operations also varies considerably, from minority shares to majority control and to line agency. The prevalent theories of 'natural monopoly' and 'public goods' are virtually useless for explaining which spheres of production will be brought under the public thumb. The dominant capitalist practice has been to confine government ownership and operation as much as possible to production areas that capital could not or would not do because of scale, difficulty of collecting revenues, or sustained losses (for example, the replacement of large-scale private irrigation schemes in the USA, or the nationalization of steel and railroads in Europe), and so on. In other cases, national prestige plays a role, as in the case of airlines. Sometimes the working class has 'a hand' in nationalization, as in the formation of the National Health Service in Britain. But such criteria are eminently political, as is demonstrated vividly by the eagerness of conservative governments to dismantle nationalized industries in the USA and United Kingdom, while equally right wing capitalist states in Korea, Singapore, or Brazil take charge of industrialization through extensive state ownership and direction.

State ownership offers an alternative legal framework under which production can operate, but it does not sunder the enterprise absolutely from the capitalist economy. Nationalized industries usually produce goods for the open market, and they often compete fiercely across national boundaries. Deregulation in the present era is causing them to compete domestically, too, as in the arena of express mail in the USA. Financially they have a greater cushion against unprofitable operations, but unless their subsidies work clearly to the benefit of private industry and national prosperity (as in Californian irrigation, German railroads, or Brazilian roadbuilding) they are liable to receive strong challenges for privatization from the conservative faction of the business class, as occurs under the governments of Prime Minister Thatcher and of President Reagan. State operation brings government politics into the picture more directly, but there are many ingenious ways to insulate against popular input and to keep the capitalist class in the key positions, as observed in the Port Authorities or Water Districts of the USA (Walsh, 1978). Last, finance capital circulates freely through government operations, such as in public works or mortgage insurance, in a way that elides the boundaries of public and private investment quite thoroughly (Harvey, 1982).

Organization by means of spatial propinquity: territories

The prevailing approach to industrial geography is to regard location patterns as the *result* of prior organizational forms and decisions. In Weberian theory the calculus of siting decisions of single plants is worked out; in enterprise theory the intrafirm logic of giant corporations is sought; in oligopoly theory it is argued that the behavior of a few large firms determines location. Even the CWS school regards city formation as the outcome of vertical disintegration of industries—even

though there is feedback, from the urban complex, that facilitates the further disintegration of production into small firms and/or plants (Scott, 1986a; 1987). Against all these views, I take the position that 'territorial complexes' of industry stand on their own as modes of organization.

It is truly astonishing that the territorial dimension is so widely considered an epiphenomenon of industrialization. It is impossible to render a cogent history of the industrial revolution without situating it in the particular context of Britain and then following its geographical spread across Europe and North America (Pollard, 1981). Within nations, industrialization has always been profoundly regionalized, from the rise of the English Midlands to the overwhelming weight of California in the high-technology industries today (Glasmeier, 1985; Gregory, 1982). Indeed, California's gross domestic product (GDP) is now greater than that of the entire United Kingdom. And what is capitalism without the city? Merchant capitalism was inextricably bound up with London and Amsterdam in the seventeenth century (Kriedte, 1983). Industrialization in nineteenth century France was virtually identified with Paris; in England, with Manchester and Birmingham; and in the USA, with such cities as Lowell, Philadelphia, and New York (Harvey, 1985b; Pollard, 1981; Vance, 1977). Today, an astounding 50% of the industrial output of all Latin America is produced by just three cities, Buenos Aires, São Paulo, and Mexico DF (Portes and Walton, 1981); and greater Los Angeles boasts a GDP as large as that of India! (Soja, 1986). Evidently, territorial complexes must be put at the center of industrialization.

The territorial complex is an extensive worksite that brings disparate production activities into advantageous relation with each other, and on a larger scale and scope than the individual workplace, the firm, or the stock market. Territorial formations are fundamental to the operation of industry because they offer additional means of integrating production-systems, above and beyond those means found via the use of single workplaces, market contracts, and market institutions, or via particular legal entities of ownership and operation. Those means are essentially spatial in nature. Three principal aspects of spatial interaction are at work here: *simple propinquity* minimizes the costs and effort of movement, maximizes access, and pools resources; *locational fixity* of infrastructure and of daily life provides a built environment of resources, lowers uncertainty and the information costs of access, channels movement, and reduces social distance; *geographic boundaries* limit movement, turn social interaction inward, and solidify (and differentiate) social relations. In very general terms, territorial complexes not only lower tangible costs (for transport for example) or provide easier communication and 'face-to-face' contact, but they also allow information sharing, pooling of labor and of fixed capital, stabilize physical and social relations, help people identify with each other (and against 'foreign' competitors), and generate distinct cultural practices over time, among other things. To be sure, territories are extremely loose, open, and 'disorganized' modes of organization, compared with the factory or the firm. They have much in common with markets, in that the institutional fabric of both is very thinly drawn, it operates heavily on voluntary interaction, has few formal rules or administrative apparatuses, it allows extremely flexible interactions among many parties, and so forth. Although cities, in the form of organizational modes, may be hard to theorize, their material presence in everyday life is actually simpler to grasp than that of, say, General Motors. Territory even slips easily into academic inquiry, as such geographic labels as 'Route 128', 'Wall Street', or 'The Sunbelt' regularly attest. The problem, then, is with theorizing the organization of geographic industrialization in a cogent way.

I shall try to concretize these brief abstractions in a treatment of three modes of territorial organization: cities, regions, and nation-states.

Cities. Cities are dense clusters of production-activities, people, and infrastructure (built environment). Industrialization and urbanization are inextricably linked (Scott, 1986a). Industrial development means, in most cases, factories or workshops; concentrations of workers and their families; housing; secondary commercial activities; and an infrastructure of roads, waterpipes, electricity, and public buildings. Once in place, towns and cities draw more people and industry to them.

Cities are to be explained in terms of economies of agglomeration. Agglomeration 'distorts' any plant-by-plant calculus of location, although Weber (1909) did his best to elide this discordance in his theory. This unwelcome fact is rediscovered, it seems, once a generation: by De Geer (1927) as the "manufacturing belt", by Perroux (1950) as "growth poles", by Pred (1966) as "cumulative causation", and by Scott (1986a) as "disintegrated production complexes". In classical agglomeration theory an explanation for urban concentration is sought in terms of markets and transport costs. Spatial proximity lowers transport costs, and so broadens the number of buyers and sellers within easy reach; this in turn provides sufficient demand for economies of mass production, and provides minimum economic thresholds for specialized producers. Agglomeration also maximizes worker access to jobs, and employer access to labor pools. In a dynamic setting, agglomeration economies generate a 'virtuous circle' of capital and labor in-migration to core regions, and a vicious circle of out-migration from stagnating peripheral areas; hence they are the basis for uneven regional development (Myrdal, 1957; Pred, 1966).

We can add to this portrait of agglomeration economies (compare with Harvey, 1985a; 1985b; Pred, 1966; Scott, 1983a; 1985; 1987; Webber, 1972). Exchange is benefitted by the city, which makes comparison easier, and which pools diverse buyers, sellers, and information; it is where you go to be on top of action, and to find the merchants, brokers, and others who are in the know about market conditions (this is especially useful in uncertain or rapidly changing markets). Spatial proximity also lets buyers and sellers get to know and trust each other personally, and to complete specialized or extended transactions with each other. Spatial concentration aids interworkplace integration by facilitating worker interaction, managerial oversight, information transfer, evaluation, and feedback, across disparate parts of related production-activities. The city keeps firms on top of technological change by allowing them to stay abreast of the latest information, to draw on a pool of the most knowledgeable workers and managers, to work on the specific problems of customers, and to find the most diverse and creative suppliers of components and solutions. Cities are great labor markets consisting of the most varied skilled workers, whirlpools of humanity, drawing in immigrants from the country and from distant lands to replenish the stock of cheap, pliable, and diligent workers; they also tend to draw too much labor and to keep a surplus available. Cities are vast built environments where the producers (and the workers) share the overhead of collective infrastructure, such as major transport terminals, roadways, water supplies, and the ready supply of industrial and office buildings. The city is the principal nexus of the money economy, where seemingly everything may be bought or sold, and it is the center of credit and loan-capital (financiers tend to cluster together, for they want to be as near as possible to the summit of the industrial landscape). Different cities also manifest particular cultural and political characteristics, as with the flavor given to Pittsburgh by its steel and European immigrant neighborhoods in contrast to the military, resort, and Mexican elements in San Diego.

Cities, then, serve as huge production-complexes, allowing a degree of integration to be achieved with a minimum of central control and a maximum of flexibility. They are, in that sense, a highly suitable form of social organization for the anarchic side of capitalism. Industries have repeatedly dominated national and even world trade from a base in a single city: silk in Lyons, cutlery in Sheffield, guns in Birmingham (England), securities in New York, commodity trading in Chicago, mining equipment in San Francisco, aerospace electronics in Orange county, movies in Hollywood, shoes in Lynn, and raisins in Fresno (Piore and Sabel, 1984; Scott, 1987). (The blindspot masking the amount of production taking place in big cities, such as Paris and New York, is explicable in large part in terms of the dispersion of production into small workshops and firms.) Most industries are clustered in urban centers of their own, with outlyers in other major cities (for example, automobiles in Detroit and Los Angeles). The specific sites at which centers of industrial growth develop are usually less important than the way agglomeration eventually tips the balance against competing initial sites, as in the way Silicon Valley surged ahead of other early starters in the semiconductor industry, for instance Phoenix and Dallas (Scott and Storper, 1987).

At the same time, cities also have their institutions of order, such as the land market, municipal governments, and special authorities (compare with Harvey, 1985a). Most city-based industries have been regulated by councils set up by local firms, such as the Santa Clara Valley Manufacturers Association (Siegel and Markoff, 1985), the Lyons silk industry's 'board of arbitration' (Piore and Sabel, 1984, pages 33–34), or, in larger cities, multiindustry groups, usually led by local merchants and banks, such as the Merchants and Manufacturers of Los Angeles, or the Bay Area Council (see Heiman, 1988; Logan and Molotch, 1986; Wiley and Gottlieb, 1982). Moreover, the vast implantation of physical infrastructure and social life that takes place in a city itself imposes a rigidity that must be periodically overcome if industrial change is to take place, as illustrated by the continuing efforts at 'redevelopment', from Hausmann to the present (Harvey, 1985b).

Regional complexes. It will not suffice to identify single-industry complexes with individual large cities, as Scott generally does, or to gloss over the variety of cities by referring always to 'urbanism' in the abstract, as Harvey is wont to do. City systems form a network down whose channels flow deep and swift currents of goods, labor, information, and money (Bourne and Simmons, 1978; Pred, 1977; 1980). Major transportation and communication arteries make good these linkages, but so do the filaments of personal knowledge, institutional ties, and cultural practices. As a result, systems of cities, consisting both of the largest metropolitan areas and of relatively small industrial towns, have long integrated regional and national development (Meyer, 1983; Muller, 1977; Pred, 1980; Vance, 1970). Conversely, most large cities are themselves made up of systems of nodes or specialized districts. Industries are not spread willy-nilly around the metropolitan area because it is generally too big for ready access and because, beyond simple proximity, the *effective* paths of commerce and of productive intercourse depend on a specific social and institutional fabric, that is gradually built up in a limited area as in the portion of the San Francisco Bay Area known as Silicon Valley (Walker, 1987). Distinct labor-submarkets are a major aspect of such districts, contrary to what is often thought about the universality of cross-commuting in big cities (see for example, Scott, 1984b; Soja et al, 1983; contrast with Muller, 1981).

We can distinguish four varieties of regional territorial complex. One type is the *large metropolis*, such as greater London or Chicago, which contains a number of industries and their subregional complexes. A perfect example is the product

districts within Philadelphia's textile matrix: in the 1920s one found knit goods in Germantown, carpets and spinning in Manayunk, and underwear and seamless hose in the suburbs (Scranton, 1983; see also, Muller and Groves, 1979; Scott, 1986a; 1986b; Scranton and Licht, 1986; Soja et al, 1983). Generalized metropolises are to be clearly distinguished, in my view, from more specialized cities and towns such as Troy (stoves) and Cohoes (textiles) (Walkowitz, 1978). Another kind of regional complex is the *city-satellite system*, in which a number of small towns in the general region of the dominant metropolis are tied to it in essential ways, as in the case of the textile and shoe towns scattered around Boston in the nineteenth century (Pred, 1980), or the mining towns around Northern California and Nevada which for thirty years were the jewels in San Francisco's gold and silver crown (Pomeroy, 1965). A third form is the *cluster of towns*, in which no town is overwhelmingly dominant, such as occurs in the textile region of North Carolina or in the case of the metalworking towns of the Connecticut Valley, where jet engines are produced (Storper, 1982). The fourth and largest regional complex is the *manufacturing belt*, of the kind that developed across northeast America; in the Rhine and Ruhr, in West Germany; and in the Seine Valley, in France (De Geer, 1927; De Vries, 1984; Pollard, 1981).

The nation-state. The efficacy of national territories as instruments of industrial integration should not need belaboring. National governments have, of course, enormous powers to establish the legal framework within which productive activity takes place, from the laws of contract to the laws of incorporation—although this ability is modified by strong federal systems as in the United States of America. Governments help to shape the fortunes of national industries by imposing tariff and other barriers which inhibit the free movement of commodities and obstruct foreign competition. In fact, an overwhelming majority of trade remains internal not international. Labor markets are infrequently international in scope. Each nation still has cultural practices in business and in consumption that are strongly idiosyncratic. Currencies are nationally based, and capital markets always come with government restrictions on movement. National economic planning has occasionally been undertaken to mould the overall direction of development, and almost all countries invest heavily in general infrastructure and subsidize favored industries.

Although with time capitalism has spread industrialization over increasing portions of the globe, there remains a fundamental tension between international and national industrialization (Lipietz, 1987). As a result, most industries have been implanted into several countries, not just into one global center, and these competing sites grow up to do battle in the international arena. 'National champions' persist in a number of world markets (including automobiles, aircraft, telecommunications, and computers) so that the geographic distribution of those industries is rendered more dispersed and multicentric that they would otherwise have been had national territory and national interest never entered into the picture. Nonetheless, the variety of national territories, in terms of size, government activism, cultural practices, and the like, is so great—from Singapore's tightly managed urban-export economy, to the far-flung, inward-oriented, and largely laissez-faire system in the USA—that the impact on geographic patterns of industrialization is difficult to generalize.

Organization by means of competition: industries

The term 'industry' is extraordinarily slippery. A factory is manifestly a thing; a firm is a legal entity; but what existence does an industry have? An industry is a congeries of firms and of parts of firms (plants, divisions), and it embraces several

related production-systems. But because production-systems are deeply intertwined, the boundaries between industries cannot be drawn sharply, nor is there a clear measure of the strength of relationships within each industry. "What economists, management experts and others think of as industries often are merely collections of products and services that bear some relationship to one another ..." (Sobel, 1983, page 139).

To begin with, industries might be defined in terms of major commodities: steel, cans, paint, etc. But several problems arise. Every such category can be broken down into literally thousands of different commodities, with only vague generic similarities. The construction industry, for example, includes the building of houses, of commercial and office buildings, roads and bridges, dams, and of factories, etc, and each of these categories can be broken down further: single-family homes, apartment buildings, town houses; freeways, suspension bridges, small roads, driveways, and small grading jobs; and so forth. These different jobs are usually done by different companies with distinct skills, but there is considerable overlap (for instance, Kaiser Engineers builds roads, bridges, and dams); so do these form one industry or many industries? The grey areas at the borders of construction are wide too: does the constructing of hospitals and rapid transit, also undertaken by Kaiser Industries in the past, put the company in the medical services or transportation industries?

The US Census Bureau organizes its Standard Industrial Classification (SIC) as a nested system that begins by making broad cuts, and then breaks each industry into progressively smaller categories (for example, 3 is manufacturing, 35 is machinery, 354 is metal working machinery, and 3541 consists of machine tools and cutting)[5]. But not all these categories jibe with everyday notions of what constitute 'industries'; some are better defined at the 'three-digit' level, others at the 'six-digit' level (Shepherd, 1979). Moreover, the SIC system runs into difficulties because most commodities are intermediate, not final, goods and services. Worse yet, production-systems are not usually closed sequences of inputs and outputs, nor are they pyramids of components and assembly (see pages 380 - 381). As a result, some SIC codes appear to center on end use (for example, 'transportation equipment'), others on material base ('nonferrous metals'), some on the method of processing ('chemicals'), and others on component parts ('aircraft engines' and 'airframes'). In short, it is all rather ad hoc (Kraushaar and Feldman, 1988). For example, should pesticides be grouped with the oil industry (feedstock), the chemical industry (chemical processing), farm implements (tools of farming), metals (not petrochemicals), or home care products? If the oil refining industry has its R&D done by a separate firm that licenses its technology to the oil companies, and if its plant construction has been done by a small group of engineering firms such as Fluor Corp. and Bechtel Group (Freeman, 1982), why are the second group of firms considered part of a separate industry but the first group not? Furthermore, lines quickly become obsolete as products and production-systems change over time. The Census Bureau is always struggling to catch up with industrial shifts (Cohen and Zysman, 1987). Owing to technical change in microcircuitry, watches have become an offshoot of electronics; chips are becoming computers; microcomputers are becoming as powerful as minicomputers; mini-computers are doing the job of old mainframes; computers are central to telephones—voice and data communications have all been digitized, chips are doing the switching and filtering, and the whole

[5] To illustrate, a sample breakdown of SIC codes: 35 machinery; 351 engines and turbines; 353 construction equipment—3532 mining machinery, 3533 oil field equipment, 3534 elevators and escalators, 3535 conveyors; 354 metal working machinery—3541 machine tools and cutting, 3544 specialty dies, 3546 power hand tools, 3547 rolling mill machinery.

thing may eventually run on light energy or by use of superconductors. What, then, are the boundaries of the electronics industry(ries)? (for an overview of the electronics industry, see Dosi, 1984).

Industries cannot be defined by describing the firms that make them up, either. Obviously, many large firms cross over industry boundaries, further muddling the census data. But even the firms themselves are not always sure which industries they are operating in. This has been a recurrent dilemma for IBM; its name went through a series of transmogrifications: Tabulating Machines, Computing-Tabulating Corporation, and finally International Business Machines—all before computers were widely heard of. Such problems in recent years have become worse: "One could never be certain just what elements went into the making of the variegated industry based upon the gathering, processing and transmission of information. Depending on how one defined it, IBM appeared either as a giant among pygmies or, in one view, the runner-up to AT&T" (Sobel, 1983, page 304).

Industries involve more than commodity production. They are arenas of capital investment and of competition (Walker, 1988b). Because of the turmoil of disequilibrium growth, capital faces a real difficulty in determining the proper costs to produce commodities (that is, the value of the commodity), and also in determining relative rates of profit across industries. This presents the corporate director, bank lender, or securities investor with a puzzle: how to know whether to move from 'steel' into 'biotechnology', or from 'textiles' into 'optics'?; how to know whether your 'fibres' division is performing up to the industry's standard of efficiency, volume, and profitability? No one can survey the whole of the economy all the time. Capitalists are compelled to create a framework within which the parts of the division of labor can be sensibly focused upon. Firms can only play this role to a limited degree. Firm-by-firm comparison is an utterly daunting and often unnecessary exercise. Besides, the key technologies that undergird differential rates of profit and growth unfold across broad cross-sections of industry (Walker, 1985b; 1988a; 1988b). It is not enough to know that Tectronix is 'hot'; investors want to know if disk drives or personal computers are 'hot'. A principle function of industrial groupings is thus to regulate the competition between firms and the flow of capital across the economy. Firms, and their divisions, compete for the introduction, production, and sale of commodities, and thereby they establish standards for cost and quality (value) of various products and an average rate of profit in a limited sphere of the economy. Capital then moves across these spheres in search of the highest rate of average profit and for the best investment opportunities. (This does not imply that profit rates are equalized within or between sectors—see Farjoun and Machover, 1983; Walker, 1988b.) To see the 'targeting' process at work one has only to look at successive quarterly 'corporate scoreboards' reported by *Business Week* magazine; one can watch the way the industries are redefined over time to capture an economy on the move (note that this publication does not rely on census categories). It is for this reason, too, that one can reasonably refer to banking or to real estate as 'industries', even though they have, strictly speaking, no real commodity output.

The concept of 'industries' is a modern one, going back no earlier than 1800 (Williams, 1976). It required national and international markets so that, for example, Indian cottons could be compared with English ones, or so that cottons could compete both with Lyons silks and Flemish wools as generic 'textiles'. In 1800, beer was produced almost everywhere in North America by households and small breweries, with little competition or market formation; there was a beer manufacture but not a modern industry. Furthermore, an industry requires that capitals go head to head. The creation of the stock market, in order to raise capital for railroads,

was probably the first institutionalization of a truly national industry, because it allowed comparisons to be made of firms, throughout the whole country. Several methods have been tried over the years to bring a greater measure of order to industries, so that competition, costs, profit rates, investment potential, and technological change might be kept within reasonable bounds. One experiment was the horizontal merging of small product-line companies into single diversified companies with a huge market-share. Before International Harvester, for example, there was no 'farm implements industry' as such, but a diffuse welter of makers of plows, harvesters, hand tools, and so forth. Taken to its extreme, the creating of trusts blanketed whole commodity sectors, such as tobacco, cans, steel, and oil. Perhaps industries might best be organized on a one-firm basis, with capital competing only *between* industries. Nonetheless, simple horizontal concentration was not very effective (Chandler, 1962), and what emerged in most sectors was oligopoly. Ever since, oligopoly and diversification have been wrestling with each other for dominance. Investment banks invented by financiers such as J P Morgan, were central to the formation of stock markets, trusts, and to the modern corporation, and they continue to guide investment and to keep watch over the performance of industrial companies. Outside the USA, commercial banks have also played a principal role in the organizing of industries through holding companies, interlocking directorates, and so forth (Herman, 1981). Another form of external industry management is the trade association, which also arose from an experiment of the late nineteenth century (Galambos, 1966). Although these associations have little direct power over companies, they do allow the industry to present a united political front, to undertake joint research projects; to share information and services, and to engage in industry-wide labor recruitment, wage bargaining, and strike management. The state has also entered the picture on occasion. In the USA, for example, the War Industries Board (of World War 1), the National Recovery Act (1933-34), and the Office of Price of Administration (in World War 2) were powerful methods of regulating competition and production in periods of emergency (and they all relied heavily on the relevant industry trade associations). Today we see experiments to develop new technolgies in industry-wide or regional consortia, such experiments as the European Economic Community's Esprit and Eureka projects in electronics, the Midwest states' Advanced Ceramics and Composites Partnership, or Reagan's proposed national effort on superconductors. Japanese methods of intraindustry and state regulation are presently much admired (Johnson, 1982).

Our view of industries today owes much to the successes and failures of such experimentation with order. The practical success of the oil giants in integrating the petroleum industry has led most people to consider everything from wellhead to gas pump as one 'oil industry'. Despite the best efforts of IBM, the semiconductor and computer industries retain their separate identities. The big steel companies have completely subsumed iron-ore mining in the USA, but neither they nor the oil companies have succeeded in bringing coal completely 'under control', and so it remains a separate industry. Ford's giant River Rouge complex, producing at one site everything that went into a car, ultimately did not prove as viable as an 'automobile industry', confined chiefly to assembly.

Industries are fundamental units of organization and location. Their emergence, growth, and restructuring over time describe one of the basic vectors of the geography of industrialization and provide one of the most important angles of entry to locational analysis (for example, see Markusen, 1985; Massey and Meegan, 1978). Although industries are often empirical nightmares, this does not abolish the need to grasp theoretically their somewhat elusive structure. Cities and regions

also have shadowy boundaries and shifting forms, but geographers have nonetheless pushed on in the hope of grappling successfully with the Hydra's heads. The differential constitution of industries (as sets of giant factories or as arrays of small workshops, as integrated multinationals or as disintegrated firms, as urban complexes or as national champions, as steelmaking rather than as a steel-coal nexus) would appear to have had a significant effect on the geography of industry, as well as on industrial geographers' approach to their research subjects. Yet we really know almost nothing about how the actual organization of industries—as opposed to their technological base, labor relations, and so forth—influences their geography. The only observation I would hazard at this time is that industries are not constructed everywhere simultaneously but, like industrialization as a whole, emerge from definite locales, that they spread from there to bring new competitive loci under their wing, often operating within regional or national contexts for a long time, and that they are less influenced by the world market than we often suppose. What has often been ascribed to the growth of large corporations in terms of 'milking' uncompetitive acquisitions, as one department-store chain did to Filene's in Boston, is more likely a result of the geographic extension of competition, through the formation of truly national or international industries for the first time (compare with Bluestone and Harrison, 1982).

Conclusion

In this paper I have sought to provide a framework for rethinking industrial organization, in such a way as to overcome the limitations of each of the separate geographic organizational 'cuts' that have previously been developed in the literature. I have argued that to overcome these limitations one must face the problem of division and integration of productive labor head on, consider a wide range of possible modes of organization, and treat the geographic dimension as fundamental to the matter. Obviously much more could be, and has been, said on every issue thus touched upon, but the intent has been no more than to lay out the *general problem* in as clear a fashion as possible. Several essential matters have not been dealt with here. The problem of production has been treated in a rather static manner, and further consideration of its dynamics is called for. Similarly, a bare 'menu of choice' has been laid out as if capitalists could freely select a slice of subcontract, a morsel of corporation, and a nice pot of urbanism to solve their integrative difficulties. The historical, collective, and often quite unexpected manner by which actual organizational ensembles evolve is not captured. Finally, no weight has been assigned to any of the organizational forms in the overall geographical organizational matrix of modern capitalism, or to the practices of any of its particular industries or nations. These matters, and others, await further consideration.

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