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Roles and Sectors

KWANGYANG BAY, on Korea's southeast coast, is not a traditional tourist attraction, but it does draw foreign visitors. They come to see a steel plant, acknowledged by industry experts to be unique in the world.[1] With 250 tons per charge BOF converters, a 2.7-million-ton continuous caster directly connected to the hot strip mill, and computerized process controls throughout, the Kwangyang plant is a steel engineer's dream (D'Costa 1989, 40–43). Kwangyang also fulfills Korea's aspirations to become a major power in the world steel industry, aspirations that took shape two decades earlier with the formation of the Pohang Iron and Steel Company Ltd. (POSCO).[2]

When President Park Chung Hee broached the idea of a large-scale integrated steel plant with the World Bank and Western corporate leaders in the 1960s, the experts said it made no sense for Korea to contemplate becoming a serious steel producer. Korea had no iron ore, it had no coking coal, it had no tradition of heavy industry (at least not in the south). Korea had better stick with its comparative advantage and work on making its cotton textile industry more competitive. Park Chung Hee was stubborn and eventually managed to leverage war reparations from the Japanese into a deal that included both financing for POSCO and technical assistance from Nippon Steel (generally considered the world's most efficient producer).

The risk of setting up such a giant venture, which at $3.6 billion was the largest single investment attempted in Korea at that time, was "assumed entirely by the state" (Amsden 1989, 292). Over the course of the 1970s and 1980s, POSCO proved not only that Korea had an unpredicted "comparative advantage" in steel, but also that the usual association between state ownership and high-cost, money-losing operations was not inevitable. POSCO was one of the world's biggest producers, surpassing all U.S. firms even before the Kwangyang plant came on line (D'Costa 1989, 4). More important, it was one of the world's lowest-cost producers, able to make a profit while selling hot-rolled coil in Korea for half the U.S. list price (Amsden 1989, 317) and able to capture more than half of the market for imported steel in one of the world's most competitive markets—Japan (D'Costa 1989, 129).

POSCO's eventual performance more than repaid the extensive state subsidies that had gotten it going (see Amsden 1989, 296–97). Its low-cost, high-quality steel was crucial to the emergence of key industries like shipbuilding and autos. It contributed to the growth of Korea's exports by exporting 30 percent of its output. Finally, it became an important source of innovative technological knowledge. When U.S. Steel (USX) wanted to modernize its Pittsburgh, California, plant in 1986, it formed a joint venture with POSCO to take advantage of POSCO's design expertise (Amsden 1989, 291–92). Within Korea, POSCO served as a model of a well-managed company. It also branched out, helping found in the late 1980s the Pohang Institute of Technology, which was touted, even in the academic bastions of Seoul, as having the potential to become "Korea's MIT." Finally, in 1989 POSCO decided to build on its extensive experience with computerization and form a new subsidiary, POSDATA, which will provide value-added network (VAN) services to other businesses (*Electronics Korea* 3, 5:57–58).

POSCO represents an extreme form of state involvement. Going against the apparent logic of the market, the state created the sector on its own, substituting its own entrepreneurial initiative for that of private capital, then managing the production directly through a state-owned enterprise. While enough POSCO stock has been distributed now to make it officially a "private" company, it still has no real private competitors within Korea, nor is it likely to.

POSCO demonstrates that the most intrusive forms of state involvement can sometimes be successful in promoting industrial transformation, but it hardly provides a basis for generalizing. To begin with, it is an undertaking by an archetypal developmental state. Equally important, it is an undertaking in a sector where the diffusion of process technology and the relatively stable character of product technology have allowed more space for the state to act as an entrepreneur.

If POSCO shows that "more" involvement is not necessarily correlated with less transformation, there are other examples that demonstrate that reliance on less intrusive forms of state involvement, like regulation, is no guarantee that less developmental damage will be done. The textile industry, the locus classicus of private entrepreneurship, provides some of the best examples of how even modest state involvement can go deeply awry.

In 1985 Delhi Cloth Mills (DCM), one of India's most venerable "big business houses," filed a petition to close down its Bara Hindu Rao textile mill in New Delhi (*Financial Express*, October 30, 1988, 1). The mill was a classic example of a "sick" firm, inefficient and making heavy losses. In addition, it was a nonconforming use according to the Delhi Master Plan and therefore would have had to be shut down anyway, barring amend-

ment of the plan (*Economic Times*, November 13, 1988, 1). Finally, there were problems of "discharge of toxic effluents," which made its continued operation in the densely populated Delhi district undesirable to say the least.

The response of the Delhi administration was steadfast refusal to allow a shutdown. It seemed to define its primary role as protecting textile workers from the dislocation of industrial change. There was fear that "if the mill was allowed to close down . . . then the other mills in the Capital—like those of the Birlas and Swatantra Bharat Mill—would also demand permission for closure" (*Financial Express*, October 30. 1988, 1). Yet the state seemed to lack the capacity to facilitate better uses for the site, new job-creating investments by the company, or new opportunities for the workers.

Four years later the case was still unresolved. The plant should have been statutorily closed down according to the master plan, but the Delhi administration still refused to allow closure. By this time the textile workers themselves were irate. Afraid that further delay might cost them the "golden handshake package" (amounting to several thousand dollars per worker) that they had been promised if the plant were allowed to close, union leaders argued that "the administration's stand makes a mockery of the pro-worker philosophy of the Congress party" (*Economic Times*, March 2, 1989, 1). The Delhi administration remained steadfast in its refusal nonetheless. When the Delhi high court ruled that the plant should be allowed to close, the administration vowed to take the matter to the Supreme Court.

The Delhi administration and the Park Chung Hee regime both violated the "natural logic of the market" and were therefore practitioners of state intervention. By any reasonable measure, Park Chung Hee engaged in "more" intervention than the Delhi administration. Founding POSCO involved allocating billions of dollars to a particular industrial activity and retaining control over how those massive resources were used for a period of decades. By founding POSCO the state opted for the role of "demiurge," a creator and manager of capital in its own right, taking responsibility for the course of sectoral transformation into its own hands. The Delhi administration was simply trying to be a good custodian, enforcing rules intended to keep powerful private economic actors from doing damage to the less powerful.

Should we conclude that more intervention is better, at least in the sense of being more likely to foster industrial transformation? Obviously not. The consequences of state intervention depend on what kind of intervention is attempted by what kind of state in what context. Arguing about whether one state has intervened "more" than another misses the

point. *How* do different states get involved? What roles do they play or adopt? What consequences do these choices have?

Focusing on "sectors," that is, complexes of productive activity that result in a related set of products, makes it easier to see differences among states. Comparing what Korea did in steel and what India did in textiles may tell us more about differences between steel and textiles than about differences between Korea and India. Looking at how two states become involved in the same sector makes it easier to compare roles and strategies.

By looking at roles and sectors across the board, this chapter sets the stage for the next three chapters, which compare what Brazil, India, and Korea did in a particular sector—information technology. I will begin by setting up some heuristic categories of state involvement, some roles that can then be used to characterize state involvement in different sectors. Then I will look at how roles vary across sectors. Finally, I will explain why the information technology sector is particularly pertinent if we want to understand state involvement in the contemporary global economy.

This chapter builds on the last chapter's discussion of state structures. Without a modicum of bureaucratic coherence no role will be played effectively. Predatory states have neither the will nor the capacity to effect industrial transformation, so they drop out of the discussion. Developmental and intermediary states may adopt similar roles, but which roles they adopt and how well they play them depends in large measure on their structural characteristics. Embedded autonomy makes it easier to play most roles and creates an affinity for particular kinds of roles. Lack of it creates problems in playing most roles. Looking at the implementation of roles is the best way to see structural capacities come into play. Structures create the potential for action; playing out roles translates the potential into real effects.

Roles

In developmental states and intermediate states alike, the tenure of individual incumbents and the legitimacy of the state as a whole depend on fostering the growth of new industrial capacity. What roles might achieve this goal? Regulating production is a classic option, and there are a variety of ways to play the role of regulator. Alternatively, the state can make and sell goods itself, taking on the role of producer. Or the state can focus on "maximizing induced decision making"[3] by trying to draw private entrepreneurial forces into a new sector, which I call playing the role of

midwife. Having helped bring new entrepreneurial groups into a sector, the state can focus on nurturing them and promoting their further evolution. I call this process of cultivating, nurturing, and prodding the entrepreneurial forces that have been awakened "husbandry."[4] Together, midwifery and husbandry create the social foundations for new sectors. Nonetheless, the role of regulator remains the most universal and the best place to start.

All states formulate rules and try to enforce them. Barring thoroughly perverse content, any consistent, predictable set of rules is a collective good. Constructing and enforcing rules is a function that not even the mythical miminalist state can avoid. Usually, however, rules go beyond the minimalist prescription of eliminating force and fraud in exchange relations. The character of the collective good then depends on content. Some rules are primarily promotional, aimed at providing stimulus and incentives. Others take the opposite tack, aiming to prevent or restrict the initiatives of private actors.

Custodians are regulators. They provide caretaking in the sense of protection and policing. They prevent proscribed behavior. The mininimalist state plays the custodial role, but custodial behavior extends well beyond minimalist proscriptions. At the beginning of the 1970s the Indian state with its "license, permit, quota raj" was particularly renowned for playing the custodian.[5] It was preoccupied with preventing private capital from engaging in undesirable or inappropriate activities, not with stimulating capitalists to take new risks.

Custodial rules are not the only form of state regulation.[6] Rules can be spurs as well as reins. They can be used for promotion as well as policing. Rules can focus on signaling and encouraging private actors rather than constraining them. For example, fiscal regulations may be designed to compensate for the difficulty of appropriating returns from innovation or to encourage investment in risky "sunrise" sectors. Even regulations that are ostensibly custodial and proscriptive may have promotional facets. Creating a protectionist "greenhouse" restricts the behavior of importers and foreign investors but spurs local capital to take the risk of entry.

While promotional strategies usually include a regulatory component, the custodial role is not a promising transformational tool. When the state deals with a new sector by playing the role of custodian, preoccupation with policing overshadows the developmental potential of regulatory rules, and possibilities for transformation are lost.

Just as all states play the role of regulator, all states play the role of producer, taking direct responsibility for delivering certain types of goods. Like the role of regulator, the role of producer can be played in different ways. As long as the product is infrastructural goods or "social overhead capital,"[7] the state as producer is a traditional role. State provision of transportation, communication, power and water supplies, and other standard kinds of social overhead capital has almost as long a tradition behind it as state provision of regulation. All are goods assumed to have a sufficiently collective or public character so that they would be undersupplied by private producers.

The role of **demiurge** takes the role of producer further. When the state decides to play demiurge, it becomes involved in directly productive activities, not only in ways that complement private investments but also in ways that replace or compete with private producers. The label, which equates the state with a mythological creator of material things, is meant to capture the extraordinary faith in the state's productive capacity that is implied by replacing rather than complementing private capital.[8]

Playing the demiurge implies strong assumptions about the inadequacies of private capital. Local capital is presumed incapable of becoming a "transformative bourgeoisie," of initiating new industries and sectors. Transnational capital is presumed uninterested in local development. If local capital is indeed unable, and transnational capital is in fact unwilling, to develop a new sector, then taking the role of demiurge may be the only way to move industrial development forward. In hindsight, it made sense for Korea to build an integrated steel plant in the 1960s. Neither transnational nor local companies were likely to undertake the task, and its subsequent "linkage" effects were important in stimulating industrial growth in other sectors. The same scenario is plausible in other sectors. Nonetheless, becoming an independent agent of accumulation is a risky choice.

Once embraced, the role of demiurge has an expansionary logic. It is expansionary partly for ideological reasons. John Waterbury (1993, 260) lays out the utopian vision that made the role of the demiurge attractive to Third World state elites: "a dynamic, carefully and rationally planned, state enterprise sector could, as far-sighted helmsman of the economy, mobilize scarce resources, stimulate markets, adopt new technologies, and rapidly lift the entire economy to a level of self-sustaining industrial growth." However attractive, such visions encouraged expansion far beyond the state's real capacity to produce effectively.

The demiurge role is also expansionary for organizational reasons. State-owned enterprises (SOEs) are the concrete embodiments of the role of demiurge. Like private firms, SOEs tend to grow and diversify. A firm created to initiate endeavors apparently beyond the capacity of local capital may end up competing in sectors where no such rationale applies, or even producing commodities indistinguishable from those already offered on the market by the private sector, defending its market share at the expense of private entrepreneurs. From inside the state apparatus, temptations of institutional aggrandizement may be hard to distinguish

from possibilities for promoting transformation. What are presented as requisites of further sectoral transformation may in fact be the organizational interests of the demiurge.

Expansion increases the risk of bringing state firms into sectors where they are unlikely to perform well. The annals of the demiurge are littered with massive and conspicuous enterprise failures. It is a politically risky role as well. If private capital sees state firms taking away profitable territory, the state pays a price in terms of its legitimacy with the very groups whose support is essential to the overall transformative project.

Both custodian and demiurge grow out of negative conceptions of the private entrepreneurial class: as primarily requiring restraint in the case of the custodian and as incapable of entrepreneurship in the case of the demiurge. More optimistic assumptions are also possible. Capacities of the local entrepreneurial class can be seen as malleable instead of given. Greater optimism about the vitality of private capital leads to different roles.

Instead of substituting itself for private producers, the state can try to assist in the emergence of new entrepreneurial groups and to induce existing entrepreneurs to take on more challenging endeavors. This puts the state in the position of being a kind of **midwife**. Hirschman's ideas of "maximizing induced decision making" are most closely embodied in this role. K. Y. Yin's "textile entrustment scheme" is a classic example.[9] Yin's midwifery lowered risks, increased anticipated returns, induced entrepreneurship from local capital otherwise unwilling to take the plunge, and thereby got Taiwan's formidable textile industry rolling.

If promoting a new sector is the goal, acting as a midwife is likely to be easier and less risky than creating state-owned productive capacity. Of course, playing the role of the midwife leaves the state dependent on private response. The more daunting the technical and economic requisites of production in a particular sector, the harder it will be to lure private actors into it. The less developed the local entrepreneurial class, the smaller the range of sectors they can be expected to enter. Midwives can make a difference, but they are, after all, auxiliaries.

A variety of techniques and policies can be utilized in playing the role of midwife. Most of them involve reducing the risk and uncertainty entailed in entering a new sector or a new kind of endeavor. Even ostensibly custodial behavior can be adapted to serve purposes of midwifery. Erecting a "greenhouse" of tariffs, import prohibitions, and investment restrictions in order to protect infant sectors from external competition is the most obvious example. Providing subsidies and incentives is likely to be part of the midwife role. More subtle strategies may also work. Signaling that the development of a particular sector is considered important can create a generalized expectation of support that has an effect well beyond specific incentives or protections.

In principle, midwifery can also involve inducing transnational capital to make deeper commitments to local development. In practice, most states have a strong preference for energizing local entrepreneurs. Transnational capital becomes part of the strategy when local capital cannot do the job on its own. Bargaining with transnational capital to ally itself with local capital is one possibility. A direct alliance between state enterprises and transnationals is another. If neither of these two suffice, creating conditions that will induce independent TNC entry still remains an alternative. Whatever the techniques and whatever the nature of the capital involved, the aim of midwifery remains the same: inducing private capital to play an entrepreneurial role that it would otherwise be reluctant to undertake, thereby creating organizational and institutional resources committed to new sectors or new kinds of endeavors.

Ensconcing new entrepreneurial groups in a promising sector is a good beginning, but not the full transformative job. Local firms must continually respond to global changes in technology and markets. New entrants can easily fall by the wayside. Once persuaded to enter a sector, firms need encouragement and assistance to move ahead as the sector changes. Otherwise the fruits of midwifery will be lost. New entrants are as vulnerable as seedlings or foundling stock. They require a modern version of the old agrarian skills and techniques associated with husbandry.

Husbandry, like midwifery, can take a variety of forms. It may be as simple as signaling the prospect of state support for firms that venture into the more technologically challenging areas of the sector. It may be as complex as setting up state enterprises to take over riskier complementary tasks, like research and development, without which private firms cannot move forward. Whatever the techniques, husbandry involves a combination of support and prodding.[10] In some respects it is less demanding than midwifery because there are already private counterparts in the sector to work with. It is more challenging for the same reason. The existence of a directly interested private sector increases the risk of "capture."

Taken together, these four roles provide a framework for labeling the involvement of particular states in particular sectors. They are not mutually exclusive. To the contrary, they often appear in combination. The state may act as custodian and demiurge in the same industry, or combine both with midwifery. The combinations and their consequences depend in turn on the sectoral contexts.

Sectoral Variations

Sectors[11] are more than just arenas for observing specific kinds of state involvement. Their techniques of production, forms of industrial organization, and "modes of governance" vary systematically.[12] Consequently,

each sector presents distinctive constraints and opportunities for state involvement. Whether a role or combination of roles fosters the growth of a particular sector depends on the state's capacity to play the roles in question, but it also depends on whether the blend of roles fits the sector.

In a classic comparative analysis, Jones and Mason (1982) found systematic variations across sectors in the extent to which states took on the role of producer. They argued that these variations reflected the "revealed institutional advantage" of state-owned enterprises. Underlying "revealed institutional advantage" was the balance between "market failure" on the side of private enterprise and "organizational failure" on the side of the state.

Market failure was assumed to be associated with high barriers to entry and consequent lack of competition. Organizational failure was rooted in the necessity of decentralized decision making. Jones and Mason concluded (41) that several characteristics gave SOEs "institutional advantage": Firms in the sector are typically large relative to product and factor markets. Firms are capital intensive. The sector overall has high forward linkages, produces standardized commodities, or is based on high-rent natural-resource exports.

Jones and Mason's argument implies that we should expect common patterns of state involvement in the same sector, even across states with different characteristics. Looking at specific sectors makes it clear that this is indeed the case. From Austria and France to Jamaica and India, state enterprises play a more prominent role in steel and minerals than in textiles. Sectoral specializations obviously constrain state strategies, as Michael Shafer (1994) and other have argued persuasively,[13] but the aim here is to show how the state's capacities and choices interact with the characteristics of sectors.

The structures and traditions of a state and its historical experience in particular sectors create predilections for some kinds of involvement and a congenital ineptitude for others. Like any organization, the state apparatus will tend to do what it knows how to do, even if what it knows how to do is not what it ought to be doing.[14] Sectors congruent with the state's "talents" will be more likely to emerge and survive than others. Over time the state's affinity for certain combinations of roles will affect the country's productive profile.

This leads us back again to constructed comparative advantage and the international division of labor. I argued in the first chapter that certain sectors are globally privileged in the sense of providing higher returns and better opportunities for growth.[15] If we add to this the idea that the emergence and survival of any sector depends in part on the state's ability to assume a blend of roles congruent with the sector's needs, then the state's capacities and choice of roles help determine a country's ability to improve its position in the global economy. The success of "constructed comparative advantage" will depend on the state's willingness and ability to play roles that grow sectors offering "multidimensional conspiracies in favor of development." This possibility is precisely what makes looking at state involvement in the information technology (IT) industry so interesting and important.

To understand why some roles and not others are helpful in constructing comparative advantage in a particular epoch, it is first necessary to understand how roles vary across sectors. I have chosen to look at a small but diverse set of sectors: mineral extraction, steel, textiles, and autos. They illustrate the historical variation of roles across sectors. They also make it clearer how the institutional nature of the state and the changing character of the global economy interact with sectoral characteristics to favor certain roles and frustrate others.

Mineral extraction provides an important baseline. Extractive industries are the locus classicus of the state as demiurge. From the oil fields of the Middle East to the copper mines of Africa and Latin America, extractive industries have been sites in which the state has acted in the stead of a local entrepreneurial class, creating state-owned enterprises and taking the burden of development on itself. Minerals provide the most transparent cases of state involvement in sectoral transformation.

After establishing a baseline case in mineral extraction, I will look at variations in industries that have been important in Brazil, India, and Korea. As a basic industry, steel, like mineral extraction, is a site where state enterprises have proliferated. The production of basic inputs is not, however, an industrialized replica of the extractive pattern. Technology is already too important for the state to operate on its own. The more technologically challenging production becomes, the more the state comes to depend on its relations with transnational capital.

A look at consumer goods, specifically textiles and autos, increases the range of sectoral variation. In textiles, where Jones and Mason would predict the role of demiurge to be problematic, the state indeed eschews direct production in favor of a regulatory role, either in its custodial form or as a tool for midwifery. Autos also leave little space for the demiurge, but custodial regulation is not really an option either. Inducing the emergence of the sector is the task, not trying to control an existing entrepreneurial structure. The problem is that global control of technology and markets makes it almost impossible for local producers to survive on their own. Midwifery must focus on building alliances with transnational capital.

Taken together, these four sectoral vignettes offer concrete illustrations of the importance of sectoral differences. They also show that sectoral characteristics are not static. Each sector changes over time, and the

forms of state involvement must change accordingly. Changes in the overall characteristics of the global industrial order, reflected most concretely in the changing strategies of transnational capital, affect what roles work in a given sector. Finally, these vignettes show how the institutional character of the state affects the way a role is played. Playing the right role poorly is as bad as playing the wrong role.

Mineral Extraction

Mineral extraction has often been claimed as a traditional prerogative of the state, but for twentieth-century Third World states, initial involvement usually took the form of regulating the industry.[16] Regulation demanded less capacity than actually running the industry. At the same time it provided the basis for cultivating technocratic expertise within the state apparatus.

The organizational capacity acquired by playing a regulatory role paved the way for efforts to play the demiurge. In Chile, the Copper Department's twenty years of experience in monitoring copper TNCs was the foundation for taking over production (see Moran 1974, 123–25). In Jamaica, the accumulated experience of a small nucleus of talented technocrats in the Jamaica Bauxite Commission and the Jamaica Bauxite Institute enabled the state eventually to take an ownership role in the industry (see E. H. Stephens 1987; Stephens and Stephens 1986).

The growth of state capacity is only half the story. State initiatives depended on the absence of private initiative. The capital requirements for participation in international mineral exports were well beyond what local capital could muster. The global structure of incentives facing extractive TNCs did not point to maximizing local returns in Third World countries. TNCs were reluctant to expand output and resisted integrating vertically through the construction of local refining and processing capacity.

The result was an "empty space" in the sector. In David Becker's words (1983, 229), "there was 'empty economic space' in the mining sector which local private enterprise could not fill and which transnational enterprise, constrained by oligopolistic and market forces, did not wish to fill." This "empty space" plus the gradual accretion (and diffusion across states) of expertise and capacity combined to produce a proliferation of state-owned mining companies.[17]

In many cases, the demiurge delivered. Becker's analysis of Peru in the 1970s is a case in point. After Cerro del Pasco, Peru's oldest copper TNC, withdrew in 1974, Centromin, Cerro's state-owned successor, tripled production relative to the TNC's peak output. It modernized old mines,

added new refining capacity, and managed Cerro's old operations with a skill that produced a substantial improvement in profits (156). At the same time, the new state-owned enterprises invested in expanded refining capacity, including a zinc refinery that answered the "long-term prayers" of the small-scale, private-owned mines that produced zinc (222).

Unfortunately, the beneficent cycle in which involvement enhances capacity, allowing adoption of a more active role, which in turn fosters transformation, is only one version of the mineral extraction story. Other work suggests that the cycle can be vicious instead of virtuous, especially in the absence of a minimal level of generalized state capacity.

Michael Shafer's (1983) analysis of Zaire and Zambia is the best example.[18] It shows how involvement attempted in the absence of adequate initial capacity may not only fail to produce sectoral transformation but end up undercutting the state's institutional integrity. According to Shafer, "the real variable is political—whether the state possesses the trained personnel to run such operations and the strength to deny the temptation to manipulate them for short-run economic and political gains" (119).

In Zaire and Zambia, which enjoyed neither "strong, autonomous state institutions nor sufficient cadres of trained managers and technicians" (97), the role of demiurge brought disaster. In both Zambia and Zaire, declining efficiency (along with a deteriorating international market) eventually turned the mines into a drain on the central treasury. The World Bank estimated the cost in the 1980s of required rehabilitation and expansion for African producers in general at $1 billion a year, a figure far larger than mining cash flow (Shafer 1983, 106).[19]

Karl's work (forthcoming) on petroleum exporters provides a complementary version of how the state's institutional capacity interacts with sectoral characteristics. In her analysis, the state may develop sectorally specific capacities in bargaining with oil TNCs and eventually managing their operations, but it does not develop "the skills and talents that arise from the penetration of public authority to the far corners of the land in search of revenue" (230). The fiscal linkage to petroleum encourages unlimited expansion of the state's role along with a "general relaxation of fiscal discipline" (155), while at the same time creating tremendous incentives to rent-seeking efforts that focus on the state. Overall, petroleum generates demands without building commensurate capacity, leaving the "petro-state" vulnerable to the consequences of shifts in the international market.

Extractive industries offer more than edifying illustrations of how sectoral and institutional factors interact. They also illustrate the constraining power of the global context. Even when Third World states control the mines, vertically integrated TNCs still control global markets. Once

TNCs have no more ownership stake in Third World mining operations, they have every incentive to develop alternative sources of supply over which they can exercise full control (even if these alternative sources have higher production costs).

In the early 1970s Moran (1973) raised the specter that state-owned firms might be marginalized by the dominant TNCs and forced to bear a disproportionate share of the burden of the risks of global trade. According to Shafer, this is exactly what happened to African copper producers. He points out that during the worldwide recession from 1974 to 1978, total Western copper production continued to rise by 4 percent a year while Zaire's and Zambia's output was falling by 6 and 8 percent annually.[20] In minerals, sectoral characteristics make a demiurge response natural at the local level, but transnational alliances are the prime requisite for success at the global level. Steel suggests a similar lesson.

Steel

Steel is the archetypical basic commodity, an archetypal home for state-owned enterprises, and another good site for understanding the attractions and pitfalls of the demiurge role.

As they moved toward industrialization in the 1960s and 1970s, developing countries found themselves exporting vast amounts of iron ore while importing vast amounts of iron and steel.[21] Yet by some estimates, Third World sites were likely to have a cost advantage in producing steel.[22] Third World planners also wanted to take advantage of steel's exceptional levels of backward and forward linkages (Hirschman 1958, 106). With strong arguments for local steel production and a weak response from both local and transnational capital, direct production by the state made sense.

Like most Third World countries, Brazil, India, and Korea responded to the obvious logic by initiating state-owned steel companies. Their shared success at becoming major steel producers demonstrated the potential of the demiurge strategy. The rise of state steel firms went together with rapid industrial growth. As time wore on, however, country differences began to overwhelm sectoral similarities. Differential success depended on both the relative efficiency of the state organizations involved and the state's ability to combine the demiurge role with midwifery in the form of alliance building.

Brazil was one of the first LDCs to set up state-owned production. The genesis of Brazil's Companhia Siderúrgica Nacional (CSN) fit the "empty space" model. Local capital was unable and foreign capital unwilling to invest in steel. Belgo Mineira, the foreign subsidiary that was the country's largest pre–World War II private producer, was reluctant to expand its capacity on the eve of World War II (Baer 1969, 95), and U.S. Steel declined to invest (Wirth 1970, 112; Baer 1969, 111), so Getúlio Vargas used the threat of assistance from Germany to extract sufficient U.S. funds to found the CSN in 1941 (Evans 1979, 88–89).

In India some of the world's best-quality iron ore created a promise of comparative advantage (Kelkar 1990, 57). There was already a growing gap between the output of the private sector and the country's demands in the early 1950s. The private sector's penchant for expansion was, to be sure, dampened by the official designation of steel as a sector to be developed by the state,[23] but even in the absence of official discouragement it is doubtful that the private sector would have been able to expand fast enough to meet demand.[24]

Korea was the last of the three to take up the challenge of becoming a steel producer, but it epitomizes the success of state steel. As the description of POSCO that begins this chapter indicates, Pohang Steel has not only grown, but grown with impressive efficiency. Despite the high capital costs associated with more recently constructed plant, it is "on average still the world's lowest cost producer" (D'Costa 1989, 135). Korean prices range from 56 to 70 percent of U.S. costs, depending on the product (D'Costa 1989, 135, table 5-13). The company's low costs make it a formidable exporter to both Japan and the United States. Perhaps even more important, the local availability of low-cost, high-quality steel has allowed Korea to compete in downstream manufacturing industries in a way that it was never able to do before. Pohang Steel is a crucial element in Korea's ability to win shipbuilding contracts[25] as well as being an important element in the success of Korea's auto exports. All of this was, of course, accomplished by ignoring international experts' almost unanimous disapproval of the idea of implanting integrated steel capacity in Korea.[26]

Pohang demonstrates that the demiurge strategy can be a powerful instrument for industrial transformation, but it is not alone. During their initial periods of expansion, state-owned steel companies in India and Brazil were also relatively efficient contributors to their countries' overall industrial expansion.[27] Studies of the performance of these industries in the 1950s and 1960s indicate that they not only were providing a badly needed industrial input but were doing so relatively efficiently.[28]

By the end of the 1980s, Brazil and Korea were part of state-owned Third World steel's general thrust to become a force in the world market.[29] The central thrust of state steel's entrepreneurship was still in the classic linkage role of supplying downstream domestic producers whose demand was growing even more rapidly than production.[30] Nonetheless, the most impressive feature of state steel's expansion was its capacity to

export. Exports from both Korea and Brazil mushroomed over the course of the 1970s and 1980s until each of them had surpassed the United States as a steel exporter, with most of their exports going back to the advanced industrial economies.

Unfortunately, while Brazil, India, and Korea share a common claim to success as far as the growth of output is concerned, the experience of state-owned steel in Brazil and India also shows how the organizational and institutional problems of the state can all too easily undercut the effectiveness of the demiurge, even in a site where the state has "institutional advantage."

Problems of efficiency in Indian steel reached mythic proportions over the course of the 1970s and 1980s, undercutting the industry's ability to satisfy domestic demand and putting export expansion of the kind achieved by Brazil and Korea out of reach.[31] Even a sympathetic observer like K. Krishna Moorthy (1984, 268), was forced to admit that "Despite the great promise it showed in the years of its infancy, Hindustan Steel Ltd. over the years became . . . the symbol of monstrous inefficiency in the public sector."[32] By the end of the 1980s, state steel was in such bad shape that the head of the Bureau of Industrial Costs and Prices, whose duty it was to keep track of the industry's progress, recommended increased private-sector entry into the industry as a way of stimulating better performance (Kelkar 1990, 57). The demiurge had had its day.

State steel's problems reflected the overall organizational problems of the Indian state. Just as the government bureaucracy in general suffered from a lack of effective embeddedness, steel's central bureaucracy was too far removed from day-to-day operations.[33] The same tendency for the general institutional problems of the state to be reflected in the specific maladies of the sector is evident in Brazil.

The fragmented character of the Brazilian state apparatus and the tendency of the state to sacrifice its own agenda to the interests of its private allies helped undercut the efficiency of state steel in Brazil. Fragmentation led to indecision and delay in the programming of capital investments.[34] This in turn led to exorbitant capital costs and financial charges.[35] As part of the fight against inflation, state regulators dictated prices that subsidized private users downstream (many of them TNCs) at the expense of the financial health of state-owned steel companies.[36] Brazilian steel did benefit from the state's general willingness to construct alliances with transnational capital. Like Pohang, Brazilian state steel managed to tap the production technology of efficient Japanese producers like Nippon and Kawasaki.[37] International alliances were not, however, enough to make up for the problems created by fragmentation and short-sightedness of the state apparatus as a whole. The financial hemorrhaging passed

the critical point, and by the end of the 1980s Brazil was thinking about putting its steel companies onto the auction block in hopes of turning them over to the private sector.[38]

Steel shows three things. First, under certain historical conditions in certain sectors, the demiurge can indeed generate transformation. Second, even in a sector where production technology is well established, international ties are still crucial. Finally, and most important, operational problems of state actors in specific sectors are likely to reflect the general institutional problems of the state apparatus as a whole.[39]

Textiles

Textiles could hardly be more different than steel. While textile production has been critically shaped and sometimes even created by state involvement, the role of producer is not the source of transformative influence. Instead, the regulatory role is the key. Sometimes regulation is used for purposes of midwifery and husbandry, as in K. Y. Yin's entrustment scheme.[40] Sometimes it is used for purely custodial purposes, as in the case of the Bara Hindu Rao mill that opened this chapter.

Korea is a classic case of using regulatory mechanisms for purposes of midwifery and husbandry. State support and greenhouse protection played an important role in fostering the emergence of the industry in the period following the Korean War. During the 1960s the issue was whether local entrepreneurs would be able to transform themselves from domestic producers into internationally competitive exporters. Would the state be able to husband the fragile entrepreneurial resources that had emerged, or would local firms fall behind the curve of global technological change and stagnate?

When the industry's exports surged in the early 1960s, it became clear that the project of husbandry was succeeding. Export success depended critically on a "sharp rise in subsidies" provided by the state (Amsden 1989, 66). Export-promotion measures included preferential loans, tax and tariff exemptions, and social overhead and administrative supports (Y. B. Kim, cited in Amsden 1989, 68). Without such subsidies, Amsden argues, Korean textile manufacturers would not have been able to compete with the Japanese in export markets. Exports were not only subsidized, they were also used as the price of admission to the highly protected and lucrative domestic market.[41]

Given the extent of state intervention, long-run success depended on making sure that husbandry did not devolve into clientelism. A focus on export markets where competitive pressures were inescapable helped, but there was still the danger that the oligopolized domestic market would

devolve into a stagnant, state-supported, price-fixing cartel. This possibility was dramatized in 1973. The Textile Industry Association was subjected to the largest audit and inspection of any private association in Korea's history, resulting in the dismissal of over one hundred government officials (on grounds of having accepted bribes from the association) and the resignations of most of the association's board of directors (E. M. Kim 1987, 185).

Once it was clear that a comfortable but stagnant clientelism would not be tolerated, the industry took a more Schumpeterian tack. Government-subsidized profits were invested in modernized plant and equipment, new synthetic fibers capacity,[42] and improved production techniques, gradually enabling the industry to wean itself from reliance on subsidies.

India's state has been no less involved in textiles than Korea's, again principally via regulation rather than direct production. The thrust of Indian regulatory policy has, however, been almost the mirror image of Korea's. The custodial role has dominated at the expense of midwifery and husbandry.

The opening vignette describing the plight of the Bara Hindu Rao mill is a typical case. The ostensible aim of custodial regulation was preserving jobs. Prohibitions on the dismissal of workers (World Bank 1987b, 52) were combined with measures designed to ensure that inefficient producers were not threatened by the expansion of more modern, competitive plants. To protect the small-scale sector, the total number of looms in the organized (large-scale) sector was frozen in the mid-1950s. Consequently, the organized sector's share of industry output plummeted.[43] At the same time, capacity licensing regulations ensured that more efficient producers could not absorb the capacity of less efficient ones (Lall 1987, 114). Strict limits were also imposed on the possibility of replacing old-fashioned spindles with modern open-ended rotors.

Custodial regulation was quite effective in slowing the pace of modernization in the industry.[44] It was also effective in increasing the local price of cotton textiles relative to world prices[45] and decreasing the domestic availability of woven cloth per capita.[46] Finally, it produced an almost complete stagnation of exports. The value of textile exports scarcely rose between the beginning of the 1950s and the beginning of the 1980s.[47] Thus, the country's share of world textile exports declined despite the fact that Indian wages by the end of the 1970s were a small fraction of Korean wages.

In the long run, the prevention of modernization and the stagnation of output undercut the goal of protecting textile workers' jobs. Furthermore, the perverse consequences of custodial regulation ended up pushing the state to play the role of demiurge in an industry whose characteristics in no way suggested "revealed institutional advantage." Indira Gandhi's government, for example, ended up nationalizing thirteen closed textile mills in Bombay in 1984 as a last-resort attempt to preserve jobs (Rudolph and Rudolph 1987, 90).

Brazil lies somewhere in between Korea and India. As in Korea and India, the historic emergence of the textile industry depended on the state's willingness to exercise it regulatory powers on the industry's behalf, principally in the form of erecting a "greenhouse" to protect it from external competition. In contrast to Korea, Brazil was unable to impose a weaning process on the infant industry it had helped create. It lacked the autonomy required to move from midwifery to husbandry. Instead, industrialists clung to their privileges, escaping the winds of Schumpeterian change, and remained relatively minor contributors to Brazil's manufactured exports.

Textiles make it clear that midwifery is not enough. Firmly established local capitalists can become entrenched opponents of change instead of allies in a transformative project. Established capital is much more likely to look to the state as a source of security than to welcome prods to move in new directions. Only a capable and determined state apparatus that retains autonomy in relation to the sector is likely to succeed at husbandry.

Automobiles

Automobiles share with textiles an affinity for regulatory strategies rather than direct involvement in production,[48] but building alliances with transnational capital is crucial to midwifery. TNCs are crucial because rapidly evolving product technology, tightly held by a few internationally dominant producers, is the key to participation. Midwifery revolves around bargaining with TNCs. They must be induced first to enter, then to increase local content, then to export, ideally all in alliance with local firms.

Alliances and greenhouses went together in autos. As in textiles, the erection of a greenhouse to protect local production was a universal feature of state policy toward autos throughout the 1970s and 1980s. Successful NIC exporters, like Korea's Hyundai, were beneficiaries of protection along with technologically antiquated domestic producers like India's Birla group.

Brazil was a Third World pioneer in establishing local auto production. Even though the industry that was implanted in the 1950s took the form of 100 percent foreign-owned TNC subsidiaries, the state's role was still crucial.[49] Without the state's ability to present organizationally con-

vincing assurances of protection from external competition and further support when necessary, transnational auto companies would have found the prospect of investing in full-fledged local production somewhere between too risky and completely nonsensical.[50]

Having been induced to enter, the TNCs found life inside the Brazilian greenhouse very profitable during the 1960s and 1970s. The auto industry became a major contributor to Brazil's "economic miracle," eventually reaching an output of a million cars a year, spawning a large local parts industry with a substantial proportion of local ownership, and becoming one of the most important contributors to Brazil's manufactured exports.

India, like Brazil, was a pioneer in the local auto assembly, but it characteristically tried to minimize the participation of transnational capital. Ignoring the problem of technological obsolescence and eschewing any aspirations to participate in global markets, India was content to create a greenhouse and allow a locally owned, technologically stagnant industry to supply the domestic market based on licensing of technology rather than ongoing alliances with TNCs. Only much later, in the 1980s, did India begin to consider developing alliances, most prominently in the form of a state-TNC alliance between Maruti Udyog and Suzuki (see Chatterjee 1990; Venkataramani 1990).

As in other manufacturing industries, Korea started later than India or Brazil. By the 1970s and 1980s, however, it was "the developing world's automotive success story" (Doner 1992, 401).[51] Korea's exports of assembled autos dwarfed those of other NICs, and export success was being accomplished with an exceptionally high proportion of local content.[52]

The state's involvement in the creation of this industry took a variety of forms. To begin with, it helped to create the organizational foundations on which the industry is built by fostering the growth of major chaebol like Hyundai and Daewoo. Without this generalized midwifery, the specific trajectory of local auto production development would have been impossible. When the industry was getting started, the state used its regulatory power to push for "rationalization," limiting both the number of firms competing in the industry and the number of models being produced (Doner 1992, 410–12).[53] At the same time, it actively signaled that the industry was worth investing in.[54] Finally, the state was involved in bargaining with TNCs over technology transfer, prices for imported inputs, and equity participation.

The success of the state's ambitious automotive plans did not mean that it had made the industry as it chose. Embeddedness and autonomy went together and private response was as important as public initiative.[55] Likewise, it proved impossible for even the "developing world's

success story" to avoid dependence on TNCs technology. There were no wholly owned foreign subsidiaries like those that dominated the industry in Brazil, but even Hyundai, the most successful and the most nationalist of the local chaebol, ended up closely tied to Mitsubishi,[56] while Daewoo, the second most successful firm, was 50 percent owned by General Motors and depended completely on GM for its export markets.

Looking at autos underlines the extent to which the consequences of state strategies are dependent on a global context. Korea's success in negotiating alliances, rather than having to rely on wholly owned subsidiaries as Brazil did earlier, depended on a global environment in which TNCs had become convinced that international alliances, even with Third World firms, made strategic sense. The kind of alliances that Korea built in the 1980s would have been impossible for Brazil to construct in the 1950s. At the same time, successful alliance building also depended on "adroit state interventions" (Doner 1992, 425). The prior midwifery that produced plausible partners was crucial. So was the state's ability to articulate and defend a cohesive position. The global context creates a changing array of opportunities, but taking advantage of them requires institutional capacity effectively implemented through a variety of roles.

Implications of Sectoral Variation

State involvement varies systematically across sectors. What roles states try to play depends on the technological and organizational characteristics of the sector. How well the roles are played and with what consequences depend on each state's institutional characteristics.

Jones and Mason were on the right track in suggesting that sectoral characteristics like economies of scale and the relative importance of technology help create "institutional advantage" for different kinds of state involvement. States are most likely to take the demiurge role when barriers to entry are large (making entrepreneurship by local capital problematic) and technology is not closely held by a few global firms (making independent entry by the state possible). Lower barriers to entry, as in textiles, make local capital a feasible source of entrepreneurship and midwifery a realistic possibility. Tightly held technology, as in autos, makes bargaining and alliances with TNCs a necessary part of both midwifery and husbandry.

Trying similar roles does not mean producing the same outcome. All states played the role of demiurge in steel. Korea's demiurge was far more efficient and effective. Brazil, India, and Korea all tried to direct the development of their textile industries through various kinds of regulatory

strategies, but only Korea was able to master the sequence of midwifery and husbandry. Sectoral characteristics define what roles are likely to work; the nature of the state determines whether a role can be carried out.

State structures and capacities make a difference, but states are not the only actors involved. Sectoral transformation depends on the interaction of states and local firms. Both operate in an environment profoundly constrained by the prevailing strategies of transnational firms. Private capitalists are anything but passive clients of state policies. State policies may lure them into new sectors but they become protagonists in their own right, with their own interests and agendas. The textile industry is the best single illustration. Having provided the protected environment that nurtured the growth of local textile firms, both Brazil and India found the firms that populated the sector quite capable politically of preventing further transformation of the industry. Even Korea came close to having its textile policies undercut by the vested interests of firms that were historically its "clients." How roles play themselves out depends on the changing character of state-society relations.

Global constraints also place compelling limits on what sectoral roles are possible. From minerals to autos, local sectoral strategies must continually contend with limits imposed by the way production and markets are structured globally. As the organizers of global markets and proprietors of state-of-the-art technology, TNCs are the most obvious embodiment of global constraints. Their changing stance vis-à-vis local strategies offers a good indication of how limits are shifting over time. As seen most clearly in autos, one decade's impossible bargain may be another decade's dominant strategy.

Looking at minerals, steel, textiles, and autos generates an appreciation for how state involvement works in specific sectors. Extrapolating this appreciation to the information technology (IT) industry remains a challenge. As the late twentieth century's most likely source of "multidimensional conspiracies in favor of development," it was an obvious target for state initiatives. Yet it was an industry where formulas from other sectors seemed difficult to apply.

The Challenge of Information Technology

As long as basic industries like steel were considered most central to the Third World's developmental agenda, there was an analytically comfortable, if not always practically attainable, correspondence between state-building and industrial transformation. Development planners who had the ill luck to operate in the 1970s and 1980s, instead of the 1950s and 1960s, faced a global economy that frustrated easy prescriptions for state

involvement. Diverse manufactured exports, not increasing capacity in basic industrial inputs, were the new locus of the "multidimensional conspiracy in favor of development." The increasing importance of services, not just as adjuncts to manufactures but as international commodities in their own right, further confused the picture. Small wonder that the neo-utilitarian formula—get the state out of the economy—had growing appeal. Right or wrong, it was a clear program of action.

The information technology sector was the quintessential crystallization of the contradictions of state involvement. The combination of computer hardware, software, components, and peripherals that constituted information technology had a strong claim to being the master industry of late-twentieth-century development. Informatics was permeating the production process in all sectors and accounted for a growing share of output in all advanced industrial economies. From the late 1950s to the early 1980s, the share of computer production in the U.S. GDP increased fourfold (Flamm 1987, 29). By the end of the 1980s, the top one hundred information systems producers had combined sales of over $250 billion, two and a half times larger than the figure at mid-decade (*Datamation* 36, 12: 22; 33, 12: 28).

Electronic data processing not only was a sector of exponentially increasing weight in the world economy, but also represented the late-twentieth-century embodiment of technological change. The real cost of computing power has declined at a rate of 20–25 percent per annum consistently over the last thirty years (Flamm 1988b). In comparison, the rate of technical change in cotton textiles during the original industrial revolution was tortoiselike.[57] Since IT products are primarily capital goods, not consumer goods like cotton textiles, the productivity increases they generate diffuse across other sectors.

Any vision of improved position in the international division of labor must include increased participation in information technology—if not as a producer, then certainly as a user. What does this mean for strategies of state involvement? When moving up in the international division of labor meant amassing workers for the mines, the state's role was clear. When it meant amassing capital to build a steel mill, there was still a case to be made. When moving up means fostering an industry that depends on agilely exploiting rapidly changing international technology and staying on top of a lightning-fast product cycle, what is the state's role? The most obvious answer is the neoliberal one: states lack the agility necessary to enter as direct producers and the perspicacity to act as effective midwives; regulation will drive away the TNCs around which an IT sector must be built and is the antithesis of what local entrepreneurs need anyway.

It is not necessary to be a neoliberal true believer to argue that the dawn of a global economy in which information technology is the leading

sector means the sunset of state involvement. Anyone moderately skeptical of the efficacy of state involvement can see the logic of the argument. Regardless of whether state involvement has made a contribution to the development of earlier industries, the characteristics of the late twentieth century's new leading sector make it seem that the time has come for the state to get out of the business of trying to reshape industry.

However sound the logic, the conclusion was hard for aspiring NICs to accept at the beginning of the 1970s. Without intervention, even advanced Third World countries looked destined for exclusion from what was likely to be the master industry of the twenty-first century. What were the odds of private entrepreneurs entering the sector without some kind of state prodding and support? Accepting traditional versions of the theory of comparative advantage would leave the NICs with low-paying, foreign-controlled assembly operations on the lagging edges of the industry. Forswearing state involvement came uncomfortably close to forswearing a productive place in the world of information technology.

Becoming a good user was an alternative, but even this option was vexed. Information technology products were not commodities, like steel I-beams or bolts of cloth, that could be easily inserted into a wide variety of environments without adjustment. To be used well, informatics had to be incorporated into local cultural and organizational patterns. Unloaded at the dock and wheeled into local offices, informatics goods were likely to end up gathering dust as expensive desk ornaments. Countries with local producers, who understood local cultural and organizational patterns and had a strong incentive to make the technology fit, would have a big advantage in becoming good users. The problem of fit was only the beginning. With demand for information technology in advanced industrial markets growing faster than most firms could keep up with, it was unclear how a country with 1 or 2 percent or less of the global market was going to get any attention at all from global suppliers.

Looking at the behavior of industrialized states made it even harder for Third World technocrats to accept the idea that the state should wither away. States in developed countries had been deeply and continuously involved in the development of the sector since its inception. From Japan's fifth-generation project to Europe's ESPRIT to Sematech in the United States, the state was intimately involved in trying to shape the development of informatics in advanced industrial countries.[58] As Kenneth Flamm (1988b, 10) put it, "The bottom line is that government plays a central role in investments in computer technology around the world. . . . The practical significance of the ubiquitous role of government in technology investments is that such involvement is one of the rules of the game everywhere." Obviously, the obstacles to successful involvement by developed states were much fewer than those facing Third

World states, but their example still made it harder for Third World states to eschew the effort.

Forsaking explicit efforts to stimulate the growth of local IT industries was hard for noneconomic reasons as well. On the one hand, depending on foreign suppliers for essential electronic data-processing equipment was any general's nightmare. On the other hand, participation in the informatics sector had an appeal for social reformers. Given its growth and research intensity, informatics, broadly defined, is the most important worldwide generator of good jobs for those with technical training. Its absence stimulates "brain drain." Invigorating it is one of the best strategies for expanding technical employment. For countries that see the lack of a "modern middle class" as central to their political and social problems, informatics has an allure that goes beyond the economic.

All of this makes the IT industry a fascinating case for anyone interested in states and industrial transformation from a comparative institutionalist perspective. Since it is an arena apparently rigged in favor of neo-utilitarian presumptions, any evidence gathered here that the state can play a transformative role is particularly telling. Moreover, if most involvement in the information technology industry is not likely to work, but ambitious states are likely to get involved in any case, then IT is an ideal arena for focusing attention on variations in *how* states intervene. Given the lack of any obvious formula for success, the question of "how" is also likely to be answered in ways that reflect internal state structures and state-society relations. For anyone interested in showing how state structures affect roles, the IT industry is too good an opportunity to pass up.

What forms of state involvement should we expect to find in the IT industries of Brazil, India, and Korea? The general characteristics of the Brazilian, Indian, and Korean states presented in chapter 3 certainly have implications for what should happen in the IT industry. Likewise the affinities between sectoral characteristics and roles that have been discussed in this chapter are a source of expectations as to what might go on in information technology.

Based on the discussion in this chapter, playing the role of demiurge in information technology would seem to be almost ruled out, especially in countries like India and Brazil, which had trouble sustaining a directly productive role even in an industry like steel, where state enterprises were the rule rather than the exception. Custodial regulation would seem completely inappropriate, except as a minor theme in the context of an overall emphasis on midwifery. IT should demonstrate the relative efficacy of midwifery and husbandry, despite the obvious obstacles to playing those roles well. Midwifery, however, would have to involve a large component of alliance building with TNCs.

If these expectations are confirmed, Korea should have a clear advantage. The natural affinity between the structures of embedded autonomy and engaging in midwifery and husbandry works strongly in Korea's favor. The Indian state, whose ambivalent relations with the private sector make it hard to play the midwife or engage in husbandry, would seem at a serious disadvantage. Sticking to the roles it has preferred in other sectors—the custodian and the demiurge—would certainly be disastrous. The Brazilian state is hardest to predict. Its past record of working closely with TNCs and its generally closer relations with the private sector should make an alliance-oriented midwifery more natural, but its relative lack of overall bureaucratic coherence would still constitute a disadvantage.

As the twenty years of informatics policies described in the next three chapters will show, such expectations, generated from simple distinctions among structures and roles, are a surprisingly useful starting point for analyzing the IT sector. Some of them are wrong, but they are still useful. What the next three chapters will also show, however, is that the process of industrial transformation is much more dynamic than a simple framework of structures and roles suggests. State involvement is not a one-shot process. As surely as states shape the emergence of IT sectors, emerging IT sectors force a redefinition of state involvement.

5

Promotion and Policing

AT THE END of World War II, Britain, the home of Alan Turing and other pioneers of computer science, had a comparative advantage in the computer industry as great as that of any country in the world except for the United States. In fact, according to Kenneth Flamm (1987, 159), "In 1950 British computer technology matched or surpassed that of the United States in many respects."

Forty years later, at the beginning of the 1990s, the last major British computer company, International Computers Limited (ICL), was purchased by Fujitsu, a company that in 1950 had been a small supplier of communications equipment to Japan's state-owned telecommunications monopoly. The demise of ICL as an independent firm was only the most dramatic of a series of symptomatic events that signaled Britain's inability to sustain internationally competitive informatics firms. As the 1980s closed, the country's leading computer companies had gone bankrupt one by one or been bought out by foreign firms.[1] Somehow Britain's apparent advantage had been squandered.

Fujitsu's success was as emblematic of the changing position of the Japanese industry as ICL's failure was of the decline of British prowess. In 1990 three of the top five information technology firms in the world were Japanese (*Datamation* 37, 12: 11). Yet in 1950, when British prospects appeared so promising, no industry expert would have picked Japan as a future power in the world informatics industry. Even in the early 1960s, Japanese computer companies were considered "mosquitoes" relative to the American "elephant" (IBM).[2] Somehow, over the course of the ensuing thirty years, comparative advantage was constructed.

State involvement was only a piece of the story of Japan's rise and Britain's demise as informatics powers, but it was a piece nonetheless. The divergent paths of their IT sectors are linked to quite different forms of state involvement in the computer industry. Taken together, Britain and Japan provide an interesting backdrop against which to consider the attempts to foster information technology sectors in Brazil, India, and Korea.

Britain's approach had two primary features.[3] First, like the United States, Britain assumed that industrial policy should be an adjunct to de-