

the Chinese version of the AN-24 turboprop transport aircraft, has been part of both the PLA Air Force and Chinese commercial flight lines since the early 1970s.<sup>56</sup> The Y-8 military transport is reportedly now also available as a civilian aircraft. Similarly, the Harbin Aircraft Manufacturing Corporation produces the Z-9, a modified version of the Aerospatiale AS365. This aircraft is provided not only to the Chinese military, but also to the “government forestry service, and state-owned general aviation and offshore oil support companies.”<sup>57</sup>

The roots of this situation, however, are again significantly different from those in the West. The Chinese commercial market has long been suppressed. A primary reason for the success of the Chinese conversion effort has been the desperate demand for consumer goods. Chinese defense plants that engaged in commercial production benefited further by the absence of competition, at least in the initial stages. Indeed, the combination of monopolistic control in various sectors, the absence of competitors, and large markets creates a commercial situation markedly different from that of any capitalist economy.

Most Chinese facilities have not achieved integration as defined by the West, however. Indeed, many of the products from the various MMBs are not derived from defense products or even from defense production lines. At least during the initial conversion process, Chinese defense facilities “produced whatever they could lay their hands on, such as electric fans and blankets, meat grinders, kitchen utensils, and even desks and chairs. Most of the products were low-quality, low-grade items with little output value.”<sup>58</sup> Even now, much of the product line of the Ministry of Ordnance is composed of civilian products made at facilities owned by the Ministry but using different equipment from that used for defense production. Al-

though such arrangements keep facilities and workers engaged and may constitute successful examples of *conversion*, they are not examples of *integration*. There is little use of common technologies and equipment to meet both defense and commercial needs; instead, available personnel and, to a certain extent, common facilities are used to meet commercial demands.

## JAPAN

While the PRC has focused primarily on defense production for much of its postwar history, Japan has followed an almost opposite course. At the end of World War II, the United States and the other occupying powers moved to ensure that Japan had no DTIB. They sought to dismantle the remaining Japanese aircraft and shipbuilding industries to prevent the country from becoming a threat to the region again.

The Korean War, however, pushed the United States to reconsider its attitude toward Japanese rearmament. Indeed, in 1950 and 1951, John Foster Dulles sought to persuade Japan to rebuild its military as a bulwark against the PRC and the U.S.S.R. Although then-Prime Minister Yoshida resisted this move, he ultimately agreed to the creation of a Japanese military, euphemistically termed the Self Defense Forces (SDF) in light of prohibitions within the American-imposed Japanese constitution against the possession of armed forces.

Although there was little interest in the reestablishment of a military capable of overseas operations, the Japanese government recognized the potential usefulness of a military industry. The Korean War had pumped enormous resources into the Japanese economy. American orders for military-support equipment, including trucks and landing craft, as well as expenditures for O&M

<sup>56</sup>Jane's *All the World's Aircraft, 1989-1990*, J.W.R. Taylor (ed.) (London, England: Jane's Information Group Ltd., 1989), p. 45.

<sup>57</sup>P. Proctor, “Harbin Uses New Helicopter Program to Advance Global Manufacturing Role,” *Aviation Week & Space Technology*, Feb. 3, 1992, p. 50.

<sup>58</sup>Liang Fang, op. cit., footnote 46, p. 35.

and for housing troops, had sped Japan's economic recovery. Much of the Japanese automotive industry, for example, was revived by the maintenance and rebuilding of American equipment for the Korean War effort. Thus, Japanese industrialists believed that "military production would be the center of Japanese industrial development."<sup>59</sup>

Unlike the Chinese, or even the United States, however, defense production was not made a priority of the defense authorities. Instead, under the Law for Enterprises Manufacturing Aircraft and the Law for Manufacturing Weapons and Munitions, materiel production was placed under the jurisdiction of the Ministry of International Trade and Industry (MITI). These laws required "private firms to provide detailed information about locations, ownership, type of technology used, capitalization, and more to MITI."<sup>60</sup> MITI's Aircraft and Ordnance Division was effectively granted (and retains) oversight for the production of all aircraft and parts, as well as munitions and weapons. These two laws remain the primary laws specifically concerning defense procurement in Japan.

The Japanese could afford to avoid becoming a major military power, in large part, because of the extension of the American security guarantee. Under the 1960 U.S.-Japan Treaty of Mutual Security, the United States effectively extended a unilateral commitment to Japan's security. This security umbrella allowed the Japanese, in turn, to focus more narrowly on economic development without having to worry too much about military security.

The decision not to become a major military power, however, did not eliminate Japan's interest in developing the ability to produce weapons indigenously. Indeed, with the American decision to begin charging the Japanese for defense products in the 1960s, the Japanese, like the Chinese,

pushed hard for local manufacture of most of their equipment to avoid reliance on foreign suppliers. This fear of vulnerability was highlighted by the Japanese drive for *kokusanka*—having domestic systems (i.e., those domestically developed and designed as well as produced) in preference to importing complete weapons. The term *kokusanka* carries with it nationalist overtones, and, according to some observers, is one of the most important elements in Japan's defense-procurement debates.<sup>61</sup>

In addition to bureaucratic and security concerns, Japanese corporations were interested in defense production. Japanese business leaders did not, however, view the Japan Defense Agency (JDA) as simply another market. Rather, the defense budget was considered a means of raising Japanese business's general level of technological expertise. For example, the Japanese Federation of Economic Organizations (*Keidanren*) established the Defense Production Council (DPC), whose "major purpose was to create a better climate of opinion between business and the SDF," in 1965.<sup>62</sup> The DPC was interested in the possibilities of technological innovation within military production, rather than military products per se. Thus, its 900 members numbered few weapons producers.

By the early 1970s, Japanese producers had concluded that commercial technology would be a more vibrant source of technological advancement than military technology. This shift was given additional economic impetus by the formal Japanese enunciation of a policy effectively banning arms exports. With the decision not to allow exports of weapons, any prospect of economies of scale through the focused development of military equipment vanished. To ensure steady revenue, the Japanese defense industry focused on getting

<sup>59</sup>R. J. Samuels, *Rich Nation, Strong Army* (Ithaca, NY: Cornell University Press, 1994), p. 142.

<sup>60</sup>T. Kataoka and R.H. Myers, *Defending An Economic Superpower* (Boulder, CO: Westview Press, 1989), p. 68.

<sup>61</sup>M.W. Chinworth, *Inside Japan's Defense* (New York, NY: Pergamon-Brassey's, 1992), p. 19.

<sup>62</sup>P. Katzenstein and N. Okawara, *Japan's National Security* (Ithaca, NY: Cornell University Press, 1993), p. 74.

long-term commitments from the government, increasing government funding for defense-related R&D, and, perhaps most important, raising the proportion of the content of Japanese military equipment made domestically. At the same time, elements of the Japanese DTIB were integrated firmly into the CTIB to ensure its continued viability.



The Japanese have license-produced many American weapons, including the P-2J and the P-3C anti-submarine aircraft.

The process of indigenization of Japanese defense production continued apace over the next 20 years. Japanese industry has been very successful in expanding the range of components and systems that are locally produced and used in various weapons. By the 1980s, for example, most Japanese missiles were manufactured indigenously, although many were produced under license. Similarly, the Japanese Maritime Self Defense Force (JMSDF) is almost entirely equipped with locally designed combatants, armed in the main with domestically produced (and often domestically designed) weapon systems. Indeed, in terms of defense products, the Japanese DTIB, like the

Chinese DTIB, produces a wide range of land, sea, and air Systems, many analogous to American systems, as well as military electronics and a space-launch capability. Only in the nuclear weapons arena, in fact, is a Japanese capability entirely absent (although there are few doubts that Japan has the wherewithal to design and build nuclear weapons and delivery systems, or that Japan could convert its civilian nuclear and space programs to military purposes should it choose to do so).

### ■ Japanese Procurement

The Japanese economy is heavily weighted toward civilian production; defense production is relatively minuscule. Japanese defense spending, for example, since the 1970s has generally been under 1 percent of Japanese gross national product (see figure 1). In the 1970s, Japanese defense industries represented only about 0.5 percent of total Japanese industrial output, and in the mid-1980s, that proportion had increased to about 2.0 percent.<sup>63</sup> Only about 0.1 percent of the total Japanese work force (or about 70,000 workers) is directly employed by Japanese defense industries.<sup>64</sup>

The Japanese corporations engaged in weapons manufacture are not preoccupied with defense work. Indeed, few Japanese defense corporations are entirely dependent on defense contracts for their profits, or even for their income. For most Japanese corporate equivalents of American prime contractors engaged in military work during the 1970s, defense contracts represented less than 10 percent of total earnings. By the 1980s, even after a decade of growth in defense spending, less than 20 percent of the revenue of Japanese firms such as Mitsubishi Heavy Industries (MHI) and Kawasaki Heavy Industries (KHI) originated from JDA contacts. Indeed, no major Japanese corporations are purely, or even primarily, defense-oriented. In the case of MHI, for example,

<sup>63</sup> U.S. Congress, Office of Technology Assessment, *Arming Our Allies: Cooperation and Competition in Defense Technology* (Washington, D.C.: U.S. Government Printing Office, 1990), p. 104, and P. Katzenstein and N. Okawara, op cit., footnote 62, p. 66.

<sup>64</sup> T. Aoki, "Japan's Defence Industry," *Military Technology*, July 1986, p. 49.

defense contracts represent only some 14.3 percent of income.<sup>65</sup> The largest proportion of defense business in any major Japanese corporation is held by Japan Steel Works, and it represented no more than 33 percent of the company's total sales in Japan's fiscal year 1989.<sup>66</sup>

Within such large defense contractors as MHI and KHI, moreover, the defense "exposure" is limited to certain divisions. The defense division within a major Japanese corporation may depend on military sales for up to 90 percent of its sales.<sup>67</sup> The divisions themselves, however, are part of an integrated firm, and the facilities under their control are almost certain to be integrated as well. Thus, although MHI's Shipbuilding & Steel and Aircraft & Special Vehicles divisions are especially exposed to the vagaries of defense budgeting, their total revenue represents less than half of the company's income (and not all of the contracts in either division stem entirely from the JDA).<sup>68</sup> The company as a whole remains broad-based.

The Japanese DTIB is not as central to the national economy as is the Chinese DTIB, and the Japanese approach to arms procurement is different from that of the United States. In the United States, there is an emphasis on cutting-edge military performance, sometimes imposing very high costs. In Japan, on the other hand, some analysts have indicated that military roles and missions have been secondary to other considerations.<sup>69</sup> The Japanese focus is not necessarily on the production of the most advanced weaponry per se, nor even on the fielding of superior defense technology. Rather, the Japanese procurement process treats production of defense equipment as an adjunct to the civilian economy. Some observ-

ers suggest that defense production serves as a stable consumer base for new products, a means of gaining (and disbursing) R&D money, and a means of developing advanced technologies and capabilities. Unlike the United States, Japan has chosen to forego the marginal additional cutting-edge performance in order to preserve an up-and-running indigenous base.

Although Japanese weapon systems often contain extremely advanced products (e.g., advanced radar technologies and new composites), the weapons themselves are not necessarily as capable or as advanced as those of their American counterparts. Thus, it has been said that "the JDA fields neither technology nor weapons, but products."<sup>70</sup> For the Japanese, initiating production of given products or spurring research in a given technology is as important a reason to develop weapon systems as the weapons themselves.

The relative weights of the players in the Japanese procurement process also differ from those in either the Chinese or the American situations. The primary characters are JDA, MITI, the Ministry of Finance (MOF), and the Japanese defense manufacturers.

JDA, unlike the Chinese PLA or the American DOD, is the weakest of the players. Unlike MITI or MOF, JDA is not a full-fledged ministry. Rather, it is an agency, a part of the Prime Minister's Office. Not only is it of lower bureaucratic standing, therefore, but it has less control over its own fate than do full ministries. Thus, of the 10 bureaucratic appointments to JDA, at least four are assigned from other ministries. This situation is the result of a deliberate effort to ensure continued civilian control and to underscore the relative unim-

<sup>65</sup>P. Finnegan, "U.S., Europe Part Paths on Defense Challenges," *Defense News*, p. 6, July 20, 1992.

<sup>66</sup>"A Basis for New Growth," *Jane's Defence Weekly*, Aug. 17, 1991, p. 283.

<sup>67</sup>Fujii, "End to Long-Term Stable Growth—Defense Industry at Crossroads," *Nihon Keizai Shimbun*, morning ed., June 25, 1991, p. 13., in FBIS-EAS 91-126-A (July 1, 1991), p. 6.

<sup>68</sup>"Analysis: Mitsubishi Heavy Industries," *Jane's Defence Weekly*, Nov. 18, 1989, p. 1128.

<sup>69</sup>R. Samuels, op. cit., footnote 59, p. 170.

<sup>70</sup>M. Chinworth, op. cit., footnote 61, p. 47.

portance of the military in postwar Japan. It has also meant in many cases, however, that considerations of technological development or commercial opportunity have had more influence on procurement decisions than they have in the American system (see figure 3).

The definition of JDA's strategies and mission is coordinated by the Policy Bureau, which is as likely to be headed by an official of the police as of MOF. The staff departments of the three services (Air, Ground, and Maritime Self Defense Forces) then draw up their budget requests in relation to the guidance promulgated by the Policy Bureau. These requests are then forwarded to the Defense, Equipment, and Finance Bureaus. The latter two bureaus are headed permanently by officials assigned from MITI and MOF, respectively, while the Defense Bureau is headed by a JDA official. The Equipment Bureau determines whether a given product will be produced domestically or purchased abroad, and the Finance Bureau judges all requests relative to JDA budgets. The respective bureau heads often have no background in defense per se, so they are more likely to view requests from their own bureaucratic perspective, rather than from JDA's (although they do coordinate with the Policy Bureau).

In the budget-formulation phase, MITI provides its input. MITI has tended to concentrate on technological development, rather than on defense per se. Its decisions in this regard are informed by its close links with the defense contractors. These links are, in part, formed by its Aircraft and Ordnance Division, which keeps MITI informed about the current capabilities of the Japanese DTIB. MITI is further assisted by various Japanese industrial associations, including the Japan Defense Industry Association (sponsored by JDA and MITI) and the Japanese Aircraft and Space Industry Association (under the jurisdiction of MITI).

MITI is also kept informed of developments and attitudes within the Japanese DTIB by the *Keidanren*, especially the DPC, which continues to advocate essentially the same policies it has pursued since its inception. Since 1989, the DPC has spoken with the full authority of the *Keidan-*

*ren*. MITI's interests in the defense area are aligned with those of the *Keidanren*, and particularly the DPC's—namely, development of advanced, dual-use technologies assisted by defense production and research. MITI and *Keidanren* are also interested in preserving a viable production base.

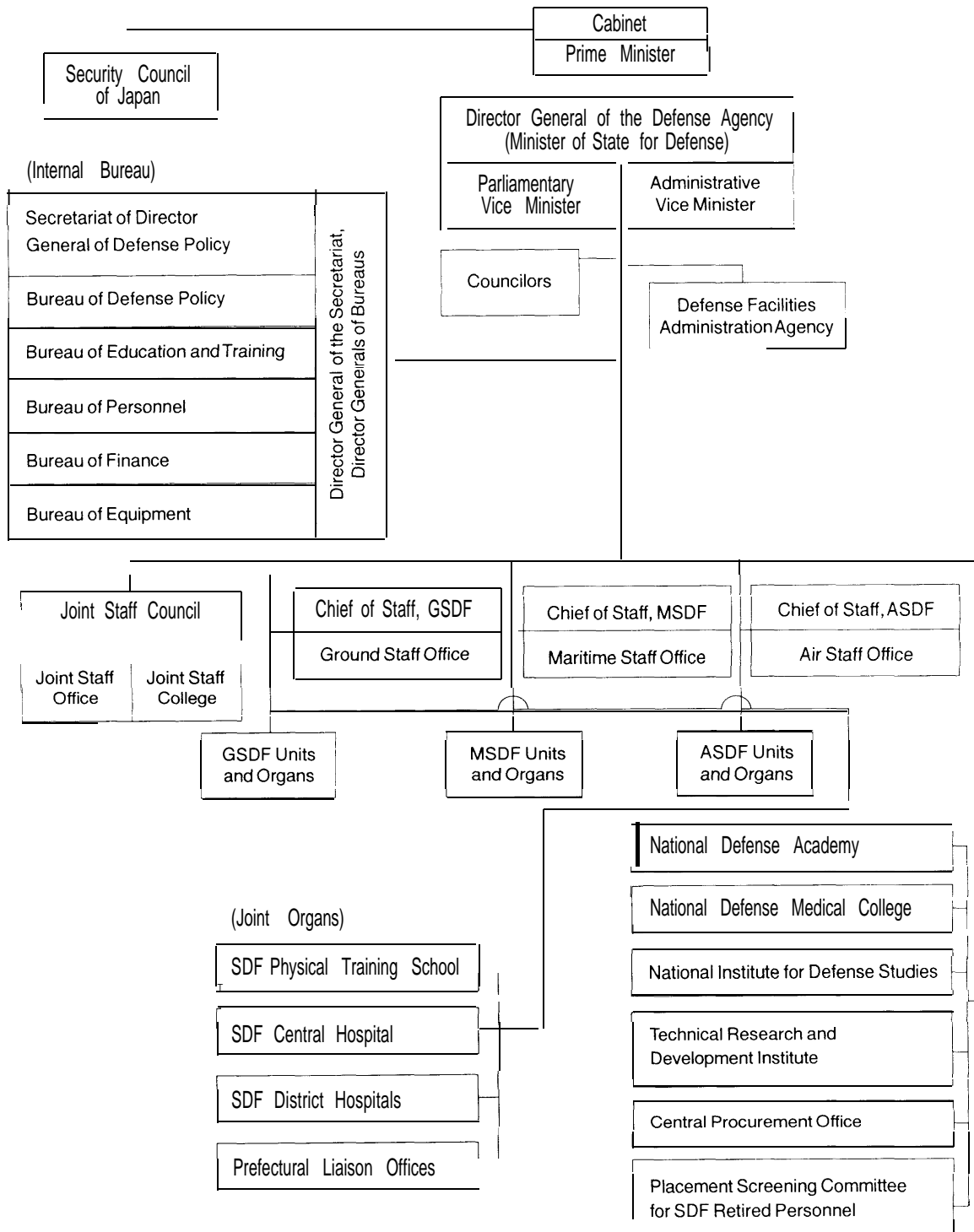
After the resulting differences are resolved within JDA, the requests are forwarded to MOF. The Ministry has generally pursued a hard line on defense requests, seeking to keep defense expenditures at a minimum. When MoF and the other relevant agencies have resolved their differences, the JDA budget is then forwarded as part of the Government Budget Proposal to the Diet and is generally approved without much subsequent comment. The JDA budget is then administered by the Central Procurement Office (CPO).

In the course of this process, Japanese defense efforts appear to be aimed at several goals. One is the development of technologies, with a particular emphasis on domestic production. Another is the preservation of a viable defense base per se, and a third is the development of equipment for JDA. To support these goals, the Japanese have sought maximum leverage from the resources committed to the DTIB and the CTIB by integrating the two as much as possible. These efforts have been facilitated by government policies and corporate structures that draw few distinctions between commercial and defense efforts, particularly at the component and subsystem levels.

## ■ Comparison of Japan with the United States

The Japanese have clearly undertaken a very different approach toward the defense-acquisition process than either their Chinese or their American counterparts. This is due, in part, to the relatively unique Japanese defense situation. Japanese defense considerations, for the most part, are dominated by the United States. Japanese forces need only concern themselves with self-defense in the most local sense, that is, defense of the Home Islands. Even that role is supported by significant U.S. forces. In the nuclear arena, for example, the

FIGURE 3: Organization of the Japan Defense Agency and Self-Defense Forces



Japanese are wholly dependent on American forces. Similarly, Japan relies on the United States for guarding Japan's sea lines and for some logistical support.

Japan's approach toward its arms industry is reinforced by the international situation around Japan. Few states directly threaten the Home Islands. Although the post-World War II era had seen both Beijing and Moscow characterized as the primary threats to Japanese sovereignty, this was in the context of the ideological confrontation of the Cold War. Even then, in neither case was there likely to be an invasion of the Home Islands, at least absent a wider, global conflict. With the passing of the Cold War, even the nominal threats posed by the Soviet Union and the PRC have receded.

Japanese planners have had the luxury of focusing primarily on economic, rather than defense, concerns. They have been able to make actual war-fighting capabilities a lower priority than building a technological and industrial base that strengthens the economy and ensures the existence of a defense base. This approach has been reinforced by the development of very strong links between Japan's corporate and government segments. The Japanese DTIB has, therefore, avoided some of the aspects of segregation that hinder the American DTIB.

### ***Acquisition Laws and Procedures***

The United States and Japan have developed different bodies of acquisition law. The United States has sought to ensure accountability of defense dollars through extensive, and often unique, accounting requirements. These regulations, in many cases the consequences of past efforts to limit waste, fraud, and abuse, frequently impose a criminal penalty for failure to delineate and abide by the separation of commercial and defense investments, equipment purchases, and other expenditures. As a result, they serve to segregate the

DTIB and CTIB by imposing on defense firms additional costs for doing business.

Japan has taken a different approach. Although the Japanese government has nominally insisted on separating defense and commercial projects within corporations, the barriers between the two elements are often very porous. This situation has been possible, in part, because of the intimate relationship between Japanese government and Japanese industry. Indeed, the greatest example of Japanese integration involves the interaction between the public and private sectors, rather than between the DTIB and CTIB.

In some cases, JDA (with the acquiescence of MITI and MOF) actually purchases items to foster the development of aspects of a given industry. Thus, for example, the National Defense Academy commissioned a "shock wind tunnel" from Ishikawajima-Harima Heavy Industries (IHI) for testing ultra-hypersonic vehicles at high Mach numbers. The tunnel has been useful both in developing Japanese space launch vehicles and, for IHI, in obtaining valuable experience in developing basic technologies.<sup>71</sup> This experience will presumably benefit IHI's commercial as much as its military business.

Such cooperation is also evident in JDA-funded R&D. Although JDA funding is supposed to be restricted to military-related items, it often is not. As a recent director-general of JDA's Technical Research and Development Institute (TRDI) acknowledged, "We tend to let the firm . . . use the information and technology as they wish. Sometimes firms will use the jigs and test equipment provided by our funding at the production stage (or for other activities), but it is not usually so easy to do this."<sup>72</sup>

Another example of close Japanese corporate-government relations involves production contracts. By value, 85 percent of Japanese procurement contracts are sole-source awards. Another 14 percent is awarded through limited competi-

<sup>71</sup>IHI *Engineering Review*, April 1993, in JPRS-JST-93-070-L, Sept. 13, 1993, p. 42.

<sup>72</sup>R. Samuels, op. cit., footnote 59, p. 194.

tion, in which all the designated companies usually win some portion of the final production runs. Only 0.21 percent, by value, of contracts are awarded in unrestricted competition.<sup>73</sup>

With both sole-source and limited competition, prices and bids can be based on market costs when comparable products are available from which cost data can be drawn. In light of the pervasiveness of dual-use technology in the Japanese DTIB and CTIB and the relative separation of R&D from production in the costing phase, it is not surprising that procurement contracts based on market costs are possible even in instances where the contract is for a military program. When there is no commercial cost counterpart, the contracts have a profit margin that peaks at 6.5 to 10 percent, and costs are calculated on a cost-plus basis in which a combination of elements is used. These include:

- materials costs,
- direct labor costs,
- other direct costs,
- indirect manufacturing costs,
- general managerial and sales expenses,
- direct sales costs,
- interest payments,
- profits,
- packing costs, and
- transportation costs.<sup>74</sup>

The Japanese do not require extensive, separate, special documentation of costs incurred for any of these procurement contracts. Rather, they apparently rely on “generally accepted accounting practices” or on Japanese cost-accounting standards. Moreover, the Japanese Central Procurement Office follows a very liberal depreciation policy, which includes a tendency to allow accelerated depreciation on facilities involved in the

production of defense-related items even when those facilities may also be involved in production of the same items for commercial purposes. Production contracts nonetheless apparently offer one means for the DTIB to recoup costs incurred by R&D.

Despite the opportunities offered by defense production contracts, competition for them by Japanese corporations is not necessarily cutthroat. As one Japanese executive noted, the Japanese and American approaches toward awarding prime contractorship are very different. In the Japanese case, “Battles between businesses to win [production] contracts are almost unheard of.”<sup>75</sup> This is hardly surprising because defense contracts are almost never awarded in a “winner-take-all” fashion. “Even firms losing out on bids as prime contractors for major programs often end up with a significant piece of business as subcontractors,” according to one analyst.<sup>76</sup> Because these contracts tend to be for extended periods of time, even the loser is likely to recoup initial investments.

Another difference between Japanese and American acquisition procedures, which allows greater integration in the Japanese case, involves Japanese R&D. Unlike in the United States, the primary source of JDA power is through the allocation of R&D, rather than production, contracts. Administered by TRDI, R&D contract awards are directly related to weapons-production contracts; winning the former almost guarantees the latter, if the weapon system is approved for purchase. Thus, the most intense competition in the Japanese DTIB is usually for R&D contracts. As with production contracts, however, JDA “often designates a few firms to submit proposals at the development stage for new projects.” (See figure 4).<sup>77</sup>

<sup>73</sup>M. Chinworth, op. cit., footnote 61, p. 56.

<sup>74</sup>M. Chinworth, op. cit., footnote 61, pp. 55-56.

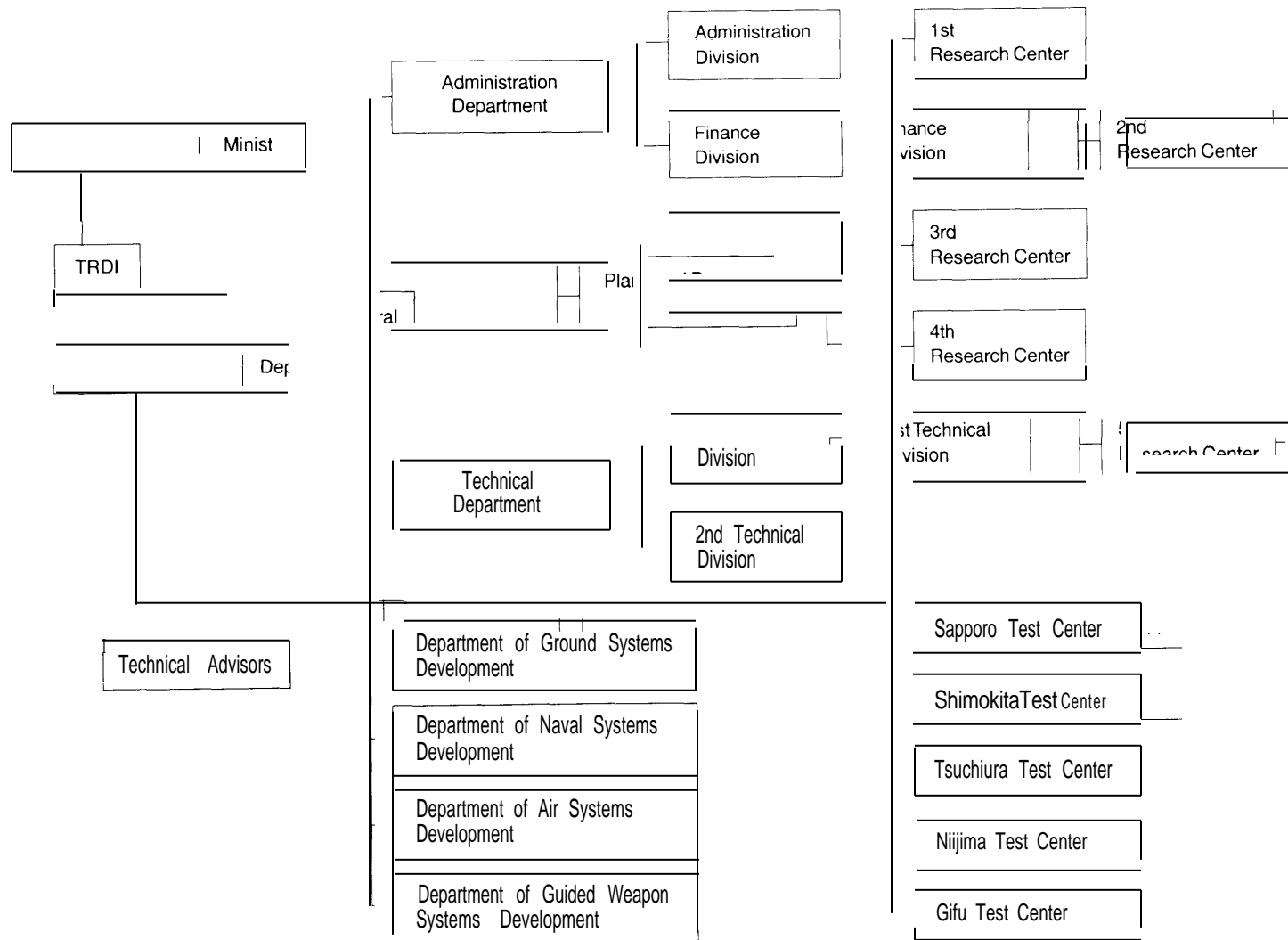
<sup>75</sup>“In Self Defense,” *Business Tokyo*, February 1988, p. 52.

<sup>76</sup>M. Chinworth, op. cit., footnote 61, p. 57.

<sup>77</sup>A. Alexander, *Of Tanks and Toyotas: An Assessment of Japan's Defense Industry*, RAND Report N-3542-AF (Santa Monica, CA: RAND, 1993), p. 20.



FIGURE 4: Organization of the Technical Research and Development Institute



The Chinese and Japanese Arms Industries

These R&D contracts, however, only rarely cover the entire cost of R&D; they represent seed money. An R&D contract is usually targeted on a given area of interest, such as electronics or aerospace. For JDA, this provides an opportunity to exert some influence over what technologies are explored and developed, with more of an emphasis on militarily useful capabilities. For MITI and other elements of the Japanese DTIB and CTIB, though, the emphasis is on developing dual-use, high-level technologies, with an emphasis on commercially remunerative possibilities. Thus, in contrast to the United States, “TRDI focuses on basic research and development up to prototype stage whereas the private sector either continues the R&D process up to production or is involved in deriving a military application from civilian technology.”<sup>78</sup> The objective with defense contracts in both R&D and production is as much to establish a technological niche or a production line for eventual supply of the Japanese CTIB (and beyond) as it is to produce for JDA. Japanese firms have a correspondingly greater interest in seeking out commercial applications for products and processes than do their American counterparts.

Japanese firms are aided in developing commercial applications for technologies by Tokyo’s acquisition and accounting policies, particularly in the area of technical data rights. Although some acquisition regulations are nominally counterparts of the American Federal Acquisition Regulations (FAR), several analysts have noted that there are few restrictions, either imposed by the government or by corporations, on the flow of information and personnel between divisions within a company. Although all data and patents produced from government-funded research are nom-

inally the property of the Japanese government, they are almost always left in the hands of the developing corporation. Indeed, unlike MITI, JDA does not attempt to determine the state of a given contractor’s technological base in order to determine JDA’s portion of ownership. In fact, TRDI alone has less than one-quarter of nearly 2,000 patent applications resulting from TRDI-supported research. In many cases, firms will not even inform JDA of potential commercial applications resulting from TRDI-sponsored or -supported research, nor does JDA try to determine what the applications could be.<sup>79</sup>

The Japanese accounting requirements appear to have exerted far fewer pressures on segregating their DTIB from their CTIB than have the American requirements on segregating the U.S. DTIB and CTIB. In the area of data rights in Japan, it appears that there has, in fact, been significant commingling of R&D resources and personnel at the workbench level. Toward this end, **JDA has not pursued ownership of technical and intellectual information, even in cases where it has helped fund development.** Instead, it has allowed the corporations to profit from both the development of such technologies and their subsequent sales. This approach is similar in some respects to the kind of industrial-government cooperation currently sought in the United States by the Department of Energy, the Advanced Research Projects Agency, and the National Institute of Standards and Technology.<sup>80</sup>

### ***Military Specifications and Standards***

Military specifications and standards also appear to be less of a barrier to integration in Japan than in the United States. For the Japanese, the primary concern is with the product itself, rather than with

<sup>78</sup>R. Drifte, *Arms Production in Japan* (Boulder, CO: Westview Press, 1985), p. 35.

<sup>79</sup>R. Samuels, op. cit., footnote 59, p. 194.

<sup>80</sup>For further discussion of American efforts such as the Cooperative Research and Development Program and the Advanced Technology Program, see U.S. Congress, Office of Technology Assessment, *Assessing the Potential for Civil-Military Integration: Technologies, Processes, and Practices*, op.cit., footnote 1.

the means of its production. Japan has therefore not developed an extensive body of military specifications and standards dictating how defense goods and services are produced. Rather than creating a separate set of military specifications, JDA is apparently comfortable with using the standards promulgated by the International Organization of Standards and will accept them or compliance with DOD military specifications and standards as sufficient.<sup>81</sup>

The Japanese have often succeeded in producing American-designed equipment to American standards even though they have not specified precisely how that equipment is to be produced. Of course, having a previously established standard rather than a domestically set one maybe a factor in obviating the need for a domestic military specification. It may also be, however, that Japanese quality control on the civilian side is sufficient to fulfill military requirements, at least for some technologies, products, and services. Japanese carbon-fiber composites manufactured by Toray, for example, appear to meet both commercial and military requirements. The composites are produced on a single line, according to one observer, "without distinguishing commercial from military applications. Only quality assurance procedures are different."<sup>82</sup> This is apparently true for much of the Japanese DTIB: separate testing and quality-control facilities but common production lines for commercial and military goods and services.

### ***Militarily Unique Technologies***

The Japanese have little interest in militarily unique technologies. They have chosen instead to emphasize the development of more dual-use-capable technologies. The financial incentives are certainly weighted in that direction, particularly in light of the Japanese ban on exporting weapon systems. At the same time, Japanese definitions of militarily unique technologies seem to be fairly



*The Japanese Maritime Self Defense Force's ships are built to domestic designs.*

narrow, that is, the Japanese do not consider many technologies to be militarily unique.

For Japan, pursuing technologies that have both military and commercial uses makes greater financial sense than pursuing technologies that are primarily military in application. In the absence of a major military establishment, development of militarily unique technologies would impose prohibitively high costs. Avoiding excessive development of militarily unique technologies also benefits commercial establishments because there are fewer barriers between commercial and defense contracts. Defense contracts may, therefore, serve to tide corporations over during lulls in commercial demand. Available facilities and work forces in the Japanese shipbuilding industry, for example, have been kept busy with JMSDF orders when their order books have not been filled by commercial demand.

Finally, the Japanese perspective that there are few militarily unique technologies, coupled with the structure of government subsidies of military technological research, allows Japan to use weapons research programs as one way to provide experience in important areas, such as systems integration, or to provide an initial demand for

<sup>81</sup> C. M. Aquino and C. D. Vollmer, *Japan's Defense Market*, UP001RDI (Logistics Management Institute Report), p. 20.

<sup>82</sup> R.J. Samuels, *op. cit.*, footnote 59, p. 306.

future commercial technologies, as with gallium-arsenide chips. Both of these considerations were motivating factors for Japan's FS-X and various missile programs. In the view of some analysts, disseminating the subsequent experiences gained from such programs through both the commercial and defense sectors is facilitated by the interlocking structure of Japanese conglomerates.

### ***Emphasis on Military Performance***

Military performance, in the sense of cutting-edge military capabilities, has been less important for Tokyo decisionmakers than has ensuring that a Japanese DTIB remains in existence. Toward this end, Japan has been prepared to accept high costs for indigenously manufactured weapons, even when cheaper counterparts are available from abroad. The Type 90 tank, for example, costs several times that of an American M-1A1, due at least in part to its much smaller production run.

In general, Japanese weapons show little evidence of being superior to foreign systems in terms of their performance. The Japanese F-1 fighter of the 1960s, for example, despite high costs, showed no performance advantage over the F-104 or the F-4, both of which entered the Air Self Defense Force (ASDF) at approximately the same time as the F-1, or the Anglo-French *Jaguar*, upon which the F-1 is modeled.

Higher weapons costs are accepted because of the incentives under which the Japanese DTIB and the overall defense structure are operating. The Japanese rank production of cutting-edge military equipment, with a preponderance of militarily unique technologies, relatively lower than does the United States. The primary Japanese interest, instead, is the development of dual-use technologies, particularly those that might have great financial rewards as well as potential military applications. The F-1 gave the Japanese at least some experience in the design of an aircraft, particularly systems integration. The American secu-

rity guarantee has allowed the Japanese to focus on the development of the commercial aspect of advanced product and process technologies, particularly their efficient production, rather than on the military aspects. MITI, for example, places much greater emphasis on developing superior technologies than on building better weapons.

### **■ Integration of Levels of Production**

There is much more interplay between the commercial and defense sectors in Japan than there is in the United States. Indeed, it is probably safe to say that the Japanese DTIB is firmly embedded within the CTIB. This would seem to be the case, moreover, at all three levels of analysis—the sector, firm, and facility levels.

The degree of integration of Japan's civilian and military efforts is not necessarily solely the result of deliberate policy choices, but rather is the function of several factors, including, as noted previously, the presence of American support throughout the postwar period, limited military budgets, political discomfort with military exports, and a different perception of the nature of the government-industry interaction. The result is a different DTIB from that found in either the United States or the PRC.

### ***Sector Level***

At the sector level, the Japanese have pursued a de facto integrated approach, as industrial sectors emphasize dual-use. For most sectors, defense represents less than 1 percent of total sales, and only the ammunition and aircraft manufacturing sectors have sales to JDA exceeding 5 percent of total sales. In contrast, in the United States, major portions of certain industries' sales are made to DOD, such as radio and TV communications equipment (42 percent of sales), industrial trucks and tractors (45 percent), and shipbuilding and repair (77 percent).<sup>83</sup>

<sup>83</sup>U.S. Department of Commerce, Economics and Statistics Administration, Bureau of Economic Analysis, National Income and Wealth Division and Government Division, "National Income and Product Account Tables," *Survey of Current Business*, August 1993, pp. 52-119.

Japan's interest in dual-use technologies, both in products and processes, is not new. In the 1950s, IHI obtained a vacuum heat-transfer furnace for high-precision forging for the J-47 military engine. Other Japanese corporations subsequently purchased license-built copies of the furnace (manufactured by IHI) for automotive and machinery manufacture. Thus, high-precision forgings became pervasive in Japanese industry, rather than being restricted to military-engine manufacturing. In other defense-related industrial sectors, TRDI's R&D and contract-award processes (as described previously) were designed specifically to provide incentives for the development of commercial as well as defense applications. For example, Japanese producers of carbon composites manufacture them not only for the FS-X, but also for fishing rods and golf club shafts.<sup>84</sup> By providing seed money but no guarantee of defense production, the Japanese government has effectively channeled corporations into developing in a commercial manner certain advanced technologies that MITI and JDA jointly believe are worthy of interest.

The skills and technologies involved in such high-technology areas as composite materials and aerospace are considered to be of such potential usefulness to the overall Japanese economy, and particularly the CTIB, that they must be developed domestically. Development of a domestic aerospace industry, for example, has long been a Japanese objective. The FS-X was originally conceived as a way to facilitate this development, with particular emphasis on systems-integration capabilities. Foreign components would be used only after Japanese sources had been exhausted. The originally planned aircraft would have been much more expensive than the current design (based on the F-16), but only marginally more capable than modified F-16 fighter aircraft pur-

chased directly from the United States. The acquisition of the relevant skills, however, was believed to be sufficiently important to justify the enormous cost differential.

Similarly, the Japanese have sought to design and build their own missiles. Domestic development of an autonomously guided air-to-air missile, a Japanese version of the American Advanced Medium-Range Air-to-Air Missile (AMRAAM), has been accorded high priority by MITI and JDA. Successful domestic design and production of this air-to-air missile, according to one source, is considered "absolutely necessary even if the product is not used by the Air Self Defense Force."<sup>85</sup>

In the R&D process, Japanese corporations find it in their own interest to pursue an integrated approach. In particular, given that even successful military R&D programs may not guarantee a sale to JDA, a corporation will have great incentives to find additional uses for products from R&D programs in order to recoup the initial investment. Indeed, one analyst reported that "business practices in commercial development figure prominently in defense-related R&D. Many of the practices evident in commercial business are carried over into defense research, development and production as well."<sup>86</sup> One aim of Japanese defense R&D is the production of commercial products. TRDI, in essence, hopes to promote the use of private sector expertise in order to conduct R&D in advanced areas of technology. At the same time, corporations hope to use TRDI funds as a subsidy for their research.

Such efforts are further supported by the Japanese system of O&M. The Japanese, like the Chinese, have not developed the elaborate depot structure that the United States has, in part because of the small equipment holdings of the Self Defense Forces. It would be uneconomical for the

<sup>84</sup>Takashi Hata, "Will FS-X Take Off?" *Air World* (Tokyo) (January 1993), in JPRS-JST 93-068-L (Aug. 30, 1993), p. 20.

<sup>85</sup>*Nikkei Sangyo Shimbum*, Aug. 14, 1993, p. 1, in JPRS-JST-93-071L, Sept. 21, 1993, p. 34.

<sup>86</sup>M.W. Chinworth, op. cit., footnote 61, p. 39.

SDF to spend scarce resources on creating an elaborate depot structure to support its relatively limited forces. Powerful elements of the Japanese bureaucracy have opposed the creation of such a structure. MOF, which has begrudged every yen spent on defense, has had little interest in seeing additional budgetary line items dedicated to the SDF. MITI, too, has opposed the development of an independent maintenance capability because it has not wished to see the development of a separate authority for defense production or maintenance in light of its responsibilities under the two weapons-manufacturing laws. This combination of factors has served to block the creation of an elaborate depot structure.<sup>87</sup>

Responsibility for the maintenance of most military equipment is divided between the military units and the manufacturer. Units are primarily responsible for basic upkeep and relatively minor repairs. All Japanese depot-level O&M, on the other hand, is the responsibility of the various

manufacturers. Indeed, this is a primary source of profit for certain defense contracts; the prime contractor, in one case, won all the overhaul and repair work.<sup>88</sup> Japanese corporations are happy to conduct maintenance operations because of the added opportunity to recoup initial costs that such operations provide.

The prime contractors for various engines, for example, are responsible for the engines' upgrading and rebuilding. The ASDF's J-79s, for example, which power Japan's F-4 Phantoms, are rebuilt by IHI, their manufacturer.<sup>89</sup> Similarly, the new Ground Self Defense Force Command System is expected to provide a steady income of several billion yen annually for many years to come for the primary and subsidiary contractors, based on both production and upkeep, including subsequent upgrades.

This situation, however, has not necessarily proven completely satisfactory from JDA's perspective. Inventory control, for example, appears to be a problem.<sup>90</sup> At the same time, JDA apparently lets contracts for the purchase of such low-technology items as automobile tires and other items, rather than purchasing them directly from the commercial sector. To resolve these situations, however, it was suggested that more maintenance-related work be assigned to the private sector, effectively making it even more integrated.<sup>91</sup>

#### Finn Level

At the firm level, Japanese corporations engaged in defense work are mostly integrated, insofar as they seek both defense and commercial work, and try to use their resources to meet both commercial



*Japanese prime contractors upgrade and rebuild the engines on the A) Self-Defense Force's F-4Js.*

<sup>87</sup> R. Samuels, op. Cit., footnote 59, p. 147.

<sup>88</sup> Ibid., p. 313.

<sup>89</sup> "JDA Defense Research, Contracts Outlined," in Foreign Broadcast Information Service East Asia daily report (hereafter FBIS-EAS) 92-098-A, May 20, 1992, p. 25.

<sup>90</sup> Naoski Usui, "Japan Will Streamline Acquisition Process," *Defense News*, August 19, 1991, p. 3.

<sup>91</sup> Ibid.

and defense needs. As noted previously, no major Japanese defense corporations are entirely dependent on defense contracts for their profits, or even for their income. Even the divisions within the major defense contractors seek to diversify their customer base, which can include commercial areas. Thus, Kawasaki Heavy Industries is seeking to apply the technology involved in aircraft production, especially in reducing wind resistance, to the production of linear railcars.<sup>92</sup> Similarly, MHI's Nagoya Controlled Propulsion System Laboratory, responsible for license production of the Patriot system, "is now seeking markets for jet engines and hydraulic systems used in aircraft doors."<sup>93</sup> Such efforts are not limited to aerospace and other high-tech areas; other Japanese weapons makers have also sought to expand their product lines. The ammunition manufacturer Asahi Seiki Industries Co. hopes to develop a market for its advanced-press technology, which it derived from the production of cartridges and bullets. Such efforts are facilitated by the absence of imposed barriers, which would separate commercial and defense operations.

Conversely, Japanese manufacturers of civilian goods often apply their technology to the production of military items. The primary producers of Japanese rocket fuel, for example, are the large Japanese paint manufacturers, including Nippon Oil & Fats, Asahi Chemical Industry, and Nissan Paint. The reason for this conjunction is that their product line already contained nitrocellulose. Thus, "the paint industry achieved a breakthrough . . . on rocketry."<sup>94</sup> Indeed, virtually every major Japanese corporation does some defense manufacturing, although, as noted previously, in only a few cases is the income gen-

erated a significant portion of corporate revenue.<sup>95</sup>

Firm-level integration involves more than products, facilities, and equipment. Japanese personnel, too, are trained to have an expertise that is application-specific, encompassing all relevant portions of the field. In this manner, they can move from defense to commercial projects with minimal retraining. Engineers, for example, are exposed to all aspects of a given sector—aeronautical engineering, design, and electronics. They will then be moved as project requirements demand. According to one analyst, "In 1981, for example, the top officials of the MHI Nagoya Works Second Technology Department (former designers of the T-2 trainer) supervised eleven divisions and projects that included all structure and design for civilian and military projects."<sup>96</sup> Similarly, when MELCO was developing its active phased-array radar system, it dispatched engineers from its radar group to its semiconductor division so that they could gain the skills involved in gallium-arsenide chip fabrication, then returned them to the radar section with their new-found knowledge.

This is not to suggest that the Japanese have deliberately chosen to pursue a more integrated approach, or that they have necessarily done so purely based on commercial considerations. As some analysts have noted, because the Japanese apparently consider that few of their technologies are militarily unique, free flow of information and personnel makes a great deal of economic sense. Many Japanese corporations have the view that most technologies offer at least some potential commercial opportunities. This viewpoint is further reinforced by the generally tightknit nature of

<sup>92</sup>Nonichi, "Changing Defense Industry," in FBIS-EAS, p. 7.

<sup>93</sup>Keisuke Sawada, "Defense Industry Perplexed by Post-Cold War Budget Cuts," *Tokyo Shimbun*, morning ed., June 25, 1992, p. 3, in FBIS-EAS-92-127-A, July 1, 1992, p. 5.

<sup>94</sup>Kokubo, private translation, November 1986.

<sup>95</sup>P. Katzenstein and N. Okawara, op. cit., footnote 62, p. 67.

<sup>96</sup>R. Samuels, op. cit., footnote 59, p. 291.