

# A HISTORICAL PERSPECTIVE ON ARMS INDUSTRY CONVERSION IN EAST-CENTRAL EUROPE

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# **A Historical Perspective on Arms Industry Conversion in East-Central Europe**

Hubert van Tuyll and Jurgen Brauer

## **Introduction**

The arms industry in Eastern Europe is undergoing rapid change. Domestic military requirements have fallen or changed dramatically as new countries have emerged. Foreign markets are disappearing and the subsidies and preferential treatment given arms manufacturers are vanishing. None of the obvious options are likely to prove palatable to the managers of the arms industries.

Continuation of military production at the levels of years past is not a viable long-term option, and none of the former NSWP (Non-Soviet Warsaw Pact) countries appear to be following this route. Permitting the complete collapse of the arms industry is politically and economically unrealistic, however. Conversion of large parts of the arms industry to civilian production purposes is clearly the direction most East European nations are taking. But, as is already apparent, conversion is a painful, long-term, and difficult process, a process that is, in the view of Kenneth Adelman and Norman Augustine, "unblemished by success."<sup>1</sup> It is our view that the choice of options — continuation, collapse, conversion, or some combination thereof — can be profitably illuminated by an examination of the recent history of the East European arms industry, revealing much beyond the function of the industry itself, leading to a different, perhaps improved, certainly fuller, understanding of East Europe during its communist era. A historical study may also reveal constraints and opportunities as Eastern Europe ponders its arms industry conversion options for the immediate future.

## **Historical Background; Adaptation to Change**

Throughout the 20th century East European countries passed through a series of dramatic changes that required constant adjustments on the part of all sectors of the national economies. This is

especially true of the arms industry, which had to meet market requirements as well as government dictates even before the advent of the communist regimes. That the large arms industries in nations such as Czechoslovakia and Poland were able to function through consecutive crises — nazism, communism, demobilization, reconstruction, revision, and perestroika (although success here is still eagerly awaited) — offers a ray of hope for the future. The desire for reform long precedes the perestroika era in Eastern Europe, as evidenced by reform movements in Hungary and Poland in 1956, Czechoslovakia in 1968, and Poland (again), in 1980-81, although these reforms were, in the words of the Polish Institute of International Affairs, "stymied by an unfriendly political environment."<sup>2</sup>

The arms industries that the communist regimes inherited in 1945 (1948 in Czechoslovakia) were well-established, productive, and had a long history of international market success. Armaments production had played a notable role in economic growth in the 1930s.<sup>3</sup> Not surprisingly, arms output in parts of Eastern Europe actually grew during the war.<sup>4</sup> In particular, following World War I, **Czechoslovakia** embarked upon an ambitious arms production program that would soon make it a major producer and exporter of weaponry. Between 1923 and 1939, the country engaged to produce a complete range of weaponry from explosives and ammunition, to small arms, rifles, shells, machine-guns, heavy guns, naval guns, tanks, all manner of aircraft, anti-tank and anti-aircraft weaponry, and so on. Employment reached into the tens of thousands. To take just one example, the Skoda works at Plzen employed 32,000 in wartime 1917, 34,000 in 1936, and 78,000 in 1945. Managers succeeded in ingratiating themselves with German authorities after the March 1939 occupation and produced even more than before.<sup>5</sup> This meant that by 1945 Czech arms manufacturers had successfully dealt with capitalist market conditions, domestic government involvement, and a

foreign hostile takeover.

**Poland** was not nearly as successful, but it did build a reasonably thriving arms industry, mostly through state action. New state concerns were established in the 1920s and 1930s for the manufacture of small arms, ammunition, and vehicles. A substantial attempt to build a heavy-industry arms complex took place in 1935-39, the beginnings of Poland's modern-day heavy-industry legacy.<sup>6</sup>

The remaining NSWP countries had comparatively small domestic arms production establishments. **Hungary** was subject to severe treaty restrictions until 1937. Indeed, the treaties concluding World War I strictly forbade arms imports and exports and limited production of war materiel to a single factory.<sup>7</sup> After 1939, however, the arms industry's production expanded to such major items as tanks and aircraft. **Romania's** arms industry expansion was similarly late — beginning in 1935 — and was at least partly aimed at import substitution. **Bulgaria** was unable to build a significant arms industry before World War II, although weapons were assembled at two locations.<sup>8</sup>

The **communization** of the East European arms industry did not proceed in a uniform fashion. Takeovers were probably a simpler matter in those cases where the industries were already state-managed, such as Poland, Romania, and Hungary.<sup>9</sup> Actions taken immediately after World War II in East Germany, especially including the removal of large quantities of machinery and the dismantling of arms factories, had less to do with long-term policy than with a desire for reparations and retribution.

Whether arms production in Eastern Europe declined after World War II remains controversial, but there is agreement that any production decline was short-lived. US intelligence reported in 1949 (7 months before the Korean War) that East German factories were "employed to capacity" making

war materiel for the Soviet Union.<sup>10</sup> Polish military industry was "recreated immediately" after the war, but the economic situation slowed development considerably, and some Polish leaders did not want to manufacture armaments at all.<sup>11</sup>

Interestingly, 40 years of Soviet domination did not affect the regional balance of arms production very much. Czechoslovakia and Poland entered the era of Communism with the 1st and 2nd largest arms production complexes, and they left the era in the same positions. This suggests that there must have been certain non-ideological factors which explain the arms industry's survival and relative stability through these changes.

Communization meant inclusion in a transnational network known, after 1949, as the Council for Mutual Economic Assistance (CMEA). The Soviet Union was clearly primus inter pares in this network, and apparently manipulated for its own benefit many of the "specialization agreements" that provided the legal basis of the network for its own benefit. The CMEA is generally viewed as having had a negative effect on the NSWP economies. Development of industry and infrastructure were distorted.<sup>12</sup> Specialization agreements failed to promote economic integration.<sup>13</sup> CMEA trade policies also limited NSWP trade with the West,<sup>14</sup> which would clearly have harmed chances for technological progress and market development.

The immense regional demand for arms certainly benefitted arms industries at the time. In 1988, 60 percent of all Comecon trade, including arms, was with other members.<sup>15</sup> Whether this will become a basis for future regional development is unclear. Poland hopes to improve the arms industry situation "by closer cooperation with producers from the Prague-Budapest-Warsaw Triangle," and managed to sell 63 percent of its arms exports for 1991 to the former USSR. Even so, Poland's East European neighbors bought a smaller proportion of Polish arms exports than did NATO!<sup>16</sup>

The CMEA may have hindered technological development of the arms industry, as the Soviet Union dominated research and development and preferred to make the most sophisticated equipment itself.<sup>17</sup> For example, East Germany abandoned military aircraft production altogether, and Poland was compelled to halt the production of sophisticated jet fighters.<sup>18</sup> Industrial diversity remains significant, however, albeit in spite of, not because of, the CMEA. Member states did not lightly abandon major industries to regional policymakers. Poland successfully fought the attempt to shut down its aircraft industry entirely.<sup>19</sup> NSWP arms industries, especially those of Poland and Czechoslovakia, developed their own variants of many Soviet designs. In addition, the relatively small and backward Bulgarian arms industry was allowed to develop a military electronics industry which, however far it may lag behind Western competition, certainly represented a great technological step forward for Bulgaria.<sup>20</sup> Romania declared its independence from the WTO/CMEA structure in 1969 (although Romanian behavior was iconoclastic by Bloc standards at least since 1963).<sup>21</sup> Czechoslovakia's L-29 and L-39 aircraft were so impressive that they became the standard model for the entire Warsaw Pact.<sup>22</sup> Arguably weapons production in East Germany suffered under the CMEA, but this is hardly a problem for the future, as the former GDR focused on the manufacture of highly specialized electronic equipment instead and engaged in far more R&D than its WTO neighbors.<sup>23</sup> The coordination of the NSWP arms industries via the CMEA, WTO, and individual and earlier treaties, did not, in our opinion, significantly harm these industries. Slower technological progress was more than compensated for by the huge WTO market.

**Reconstruction and growth** was clearly in progress by the early 1950s. Following a period of rebuilding, **Poland's** arms industry entered a period of modernization that extended throughout the 1960s. Its industry was "the most 'sovietized'." The military-industrial connection was modeled on

Soviet notions, i.e., a full integration of all things industrial toward military needs. In stark contrast to East Germany, immediately after World War II Polish "ammunition factories, armories, and airplane-repair installations were reconstructed." The argument in favor of a Korean-War explanation for rapid Polish arms industry expansion is strong. Following the outbreak of war in Korea (1950), the arms industry was significantly modernized and expanded.<sup>24</sup> **East Germany**, however, as already mentioned, developed a much more specialized, high-technology oriented military industry that focused on research and development while engaging in non-arms defense-related production. Costs and benefits are difficult to calculate, especially as the GDR received the largest Soviet subsidies of all NSWP countries.<sup>25</sup>

**Czechoslovakia's** military durables production reached an estimated 13.2 percent of the entire Czech machinery output in 1967 (a figure that fell below ten percent after 1968), reflecting the industry's quadrupling during the Korean War. Even in 1987, Czech arms production involved more than 100 enterprises, employing some 73,000 workers in the manufacture of weapons. More than 60 percent of the resulting production was destined for other WTO members. Czechoslovakia also had a substantial vehicle industry, which served military and civilian needs alike.<sup>26</sup>

In contrast, **Hungary's** military production absorbed perhaps only one-third to one-half of one percent of GNP, and less than one percent of "global machinery output" between 1970 and 1979. Production was limited to small arms, some vehicles, and some specialized equipment.<sup>27</sup> **Romania's** unusual relationship with its communist neighbors led it to develop a fairly diverse arms industry, with connections to non-WTO countries.<sup>28</sup> The small arms industry of **Bulgaria** mostly produced Soviet equipment (as well as some Czech Skoda trucks). Bulgaria did develop an electronics industry for

aerospace purposes, but it had no aerospace industry as such.<sup>29</sup>

Even if conversion continues, success in the arms **export market**, as in the case of Western Europe and the United States, appears vital to maintain some arms production lines and raise capital. The experience of communist Eastern Europe in the international weapons trade is significant. The NSWP arms exporters were among the world's leaders (but far behind the USA, the USSR, and France), as Tables I-III on page 8 indicate.

This high level of arms exports was not only the result of Soviet-inspired military aid policy for although WTO military aid to developing countries almost doubled between 1970 and 1975, exports more than tripled. In fact, military aid as a share of exports to the developing countries actually fell from 6.7 percent in 1970 to 4.0 percent in 1975.<sup>30</sup> If it had been hoped that East European financial problems might be eased as a result of closer third world ties, then military aid as a means of opening the way for non-arms exports proved a successful strategy.<sup>31</sup>

Much of the export trade, however, consisted of 'captive markets' (discussed below). Hence the region's arms makers can hardly rely on exports for survivability or profitability.<sup>32</sup> Romania did find foreign co-producers after its ties with the CMEA were loosened.<sup>33</sup> It thereby escaped Soviet military-technological domination, but did not gain enough from its foreign contacts to become truly advanced in military technology.<sup>34</sup> Romania's achievements were modest; only Hungary exported less. On the other hand, Romania imported very little in the way of armaments (\$30 million in 1985, comprising 0.29 percent of imports, while arms exports equaled 3.53 percent of the total<sup>35</sup>), suggesting that the Romanian military-industrial strategy of import substitution implemented in 1969 possibly worked.

**Table I<sup>36</sup>: Arms Exports, 1985**

<u>Country</u>	<u>Rank 1</u>	<u>Rank 2</u>
Czechoslovakia	4	3
Poland	5	4
GDR	10	13
Bulgaria	12	10
Romania	13	11
Hungary	19	17

Rank 1 = International rank, total value of arms exports

Rank 2 = International rank, ratio of arms to total exports

**Table II: Warsaw Pact Arms Exports, 1969-77**

Country	69	69	73	73	77	77
	\$	%	\$	%	\$	%
WTO	2233	4.9	7844	11.1	7540	7.4
Bulgaria	8	0.3	6	0.2	10	0.2
Czechoslovakia	178	3.3	307	3.8	600	6.0
GDR	16	0.2	66	0.6	90	0.7
Hungary	0	0.0	40	0.7	60	0.8
Poland	243	4.8	307	3.6	240	1.5
Romania	0	0.0	40	0.8	40	0.6

*Note:* \$ = constant 1977 million dollars; % = arms exports as percentage of total exports

**Table III<sup>37</sup>: Warsaw Pact Arms Exports, 1978-1986**

Country	78	78	82	82	86	86
	\$	%	\$	%	\$	%
WTO	18930	10.8	22590	11.9	19940	10.0
Bulgaria	104	0.9	399	3.2	348	2.6
Czechoslovakia	1406	8.1	701	4.0	1036	5.0
GDR	118	0.5	172	0.7	207	0.8
Hungary	104	0.8	129	1.0	188	1.3
Poland	962	4.5	1024	6.2	1036	5.1
Romania	104	0.9	862	6.9	170	1.4

*Note:* \$ = constant 1984 million dollars; % = arms exports as percentage of total exports

### **Historical Background: Problems**

The East European arms industry, then, has experienced considerable change, and has survived, and sometimes flourished. While this suggests an advantage within the arms industry in adaptation to new markets and methods, it must be understood clearly that the industry benefitted in the Communist era from extensive subsidies, a variety of captive markets, and a preferred position within each national economy. The real issue for students of arms conversion here is whether the industry's managers became so used to these privileges that neither they, nor the industry, is capable of adaptation anymore.

**Subsidy** enabled the industry to progress technologically, to provide arms to domestic military establishments and ideologically friendly third-world governments at low or no cost, and to build enough capacity to expand during wartime. The Soviet Union furnished \$87 billion in trade subsidies between 1960 and 1980, some of it to compensate for East European military spending and arms production.<sup>38</sup> (The total amount of subsidy, Soviet and domestic, to each national arms industry is not known.)

Any highly subsidized industry will suffer correspondingly as its subsidies are removed. The higher the subsidy, the higher the incentive not to be prepared for change, and the longer it takes to retrain the work force and convert to other production. The former military workers' incomes need to be subsidized while they are being retrained, but the resources to do this are reduced during the period of conversion from command to market economics. The dilemma posed is that subsidies need to be cut to make resources available for the development of the civilian economy, but on the other hand, subsidies cannot be cut until that same civilian economy is developed.

The industry also suffers from its long reliance on the four types of **captive markets**: (1) the

home market; (2) the WTO market, especially insofar as it was regulated by CMEA specialization agreements; (3) the pro-Communist third world market, which received much equipment free of charge (a cost not necessarily born, however, by the arms industry); and (4) the re-export market, consisting of items shipped from the Soviet Union to a NSWP country, and then to a third world nation. While the existence of captive markets did permit a much higher level of production, the wealth gained was not necessarily plowed back into the arms industry.<sup>39</sup> Arms exports to the third world were used for a variety of economic and political purposes, including bolstering Soviet/WTO foreign policy, not just for the financial benefit of the arms industry.<sup>40</sup> The WTO and home captive markets created a demand for obsolete and near-obsolete equipment, thereby artificially supporting production by old, low-technology factories. Thus, the largest arms-producing NSWP countries, Poland and Czechoslovakia, failed to completely modernize their military establishments.<sup>41</sup>

Even the historically most successful NSWP exporter faces problems. In **Czechoslovakia**, as it then was, President Vaclav Havel was forced to delay the phasing out of defense production, because of the need for export income<sup>42</sup> and the devastating impact his plan would have had on Slovakia, which contained 75 percent of Czechoslovak arms production.<sup>43</sup> Slovak vulnerability is particularly high. The WTO captive market absorbed half of Czechoslovakia's military output, including much Slovak-based tank production.<sup>44</sup> There is no realistic alternative market for this production, except possibly Middle Eastern powers Egypt and Syria, to which weapons and training were supplied on a huge scale in the 1970s.<sup>45</sup> Within the WTO, declining captive markets do mean no longer being a captive, i.e., pressure to import arms also declines. This is important, because Czechoslovak arms imports procurement rose at a faster rate after 1968 than domestic procurement.<sup>46</sup>

**Poland's** arms production was even more WTO-oriented than Czechoslovakia's. Domestic

demand has fallen catastrophically, as the Ministry of Defense's budget has dropped by about 75 percent. Furthermore, the army plans to withdraw 850 tanks, 700 APCs, 900 guns and mortars, and 80 fighter jets from service. While the former USSR remains Poland's largest customer, the total value of exports to that region has "collapsed." The former WTO countries are still major importers, but not on the pre-perestroika scale. An arms embargo has been placed on shipments to 14 countries, including nations which might actually become purchasers (Iran, Syria), even though "[t]he export of arms, military equipment and services is one of the most profitable forms of export".<sup>47</sup> The partial loss of the domestic captive market is particularly devastating, because Polish domestic procurement had risen at a stupendous pace in the last decade before perestroika (7.3 million Zloty in 1974, 68.9 million Zloty in 1984).<sup>48</sup>

The extent of the captive market problem for the lesser NSWP producers is influenced by the extent to which production was geared to technologically advanced equipment or limited to licensed production of Soviet materiel. Producers of the latter are least likely to have modern factories which can be converted with minimal investment. **East Germany** provided mostly technical assistance to both WTO and third world countries, rather than actual weaponry.<sup>49</sup> **Romania** had a relatively small domestic market, as its military spending was low,<sup>50</sup> but its industry was developed to avoid dependence on Soviet imports, which in fact shrank significantly. **Hungary** discovered that its arms exports suffered from a "poor competitive position" and from the inability of third world customers to pay. This is unfortunate, because Hungarian arms producers are quite export-dependent, as non-ruble exports as a share of total arms sales had been growing steadily over the last two decades, from only 5.4 percent of total sales in 1971-75 to 15.5 percent in 1986-89, and Soviet purchases had increased even more dramatically as a share of Hungarian arms sales, reaching 41.5 percent in

1986-89.<sup>51</sup> The domestic market was not a significant captive unit, however, as the Hungarian military purchased most of its equipment from other WTO nations.<sup>52</sup> **Bulgaria** had a rather limited home market to begin with, considering its modest defense spending, and announced in 1989 that it would scrap 200 tanks, 200 artillery pieces, 20 aircraft, and 5 warships.<sup>53</sup> Exports were greater than might be expected, totaling some \$400 million in 1985, but much of this was done in a proxy role, suggesting that a good deal of this market was "captive." In addition, imports usually exceeded exports, so the value of the foreign arms trade to Bulgaria was dubious.<sup>54</sup>

Finally, the arms industry in Eastern Europe has to live without its **preferred position**, which gave it the right to call upon supplies, materials, and capital, at the expense of other industries. Civilian production was subordinated to military needs.<sup>55</sup> Classification as an arms-producing enterprise was a "privileged status."<sup>56</sup> Until 1989, Polish defense industry had "absolute priority in the material-technical supplies and in obtaining low-interest bank credit." A variety of tax exemptions existed as well. Defense production could call upon the country's best engineers, scientists, and equipment.<sup>57</sup> Transfer of materiel and personnel to defense work even took place within factories.<sup>58</sup> Nowadays, "arms producers have lost all their privileges which they have enjoyed in the past period." "Most" privileges have been canceled.<sup>59</sup>

### **Prospects: Conversion and Continuation**

Market forces and policy decisions are steering much of the East European arms industry toward conversion. Half of all defense plants in Czechoslovakia, Poland and Hungary have been slated for conversion (or closure).<sup>60</sup> Whether the industry's historical adaptability provides a basis for conversion is as yet unclear.<sup>61</sup> **Reorienting management** may be the most difficult task. Some have called for

wholesale removals of existing managers: "bulldoze the management, not the factories."<sup>62</sup> In some cases, however, the number of managers will have to rise, not fall. Many defense concerns were not complete companies, but rather factories fulfilling ministerial orders.<sup>63</sup> Such organizations simply lack the in-house expertise for survival in a market economy.

Conversion of factories will be a drain on **scarce capital**. Poland did manage to rebuild its arms industry after World War II, but this only reminds us of a command economy's ability to force some sectors of the economy to give up capital to build up preferred industries. This is no longer possible. Nor has the end of the Cold War loosened a flood of capital. "Contrary to some illusions and popular beliefs (shared sometimes even by experts), there are no 'peace dividends' accruing from present conversion in Eastern Europe. In fact, the case is just the opposite; the conversion ... is a very costly process ..."<sup>64</sup> "Lack of capital ... can be very difficult to overcome, especially in conditions of costly changes in the transitional period." Conversion is "more expensive" than adjustment or diversification. Conversion of arms manufacturing equipment for civilian production "involves higher costs in comparison with civilian conditions of production." Capital could be raised through sale of manufactured goods, bank credits, complete privatization, and "cooperation with a foreign investor."<sup>65</sup> Whether these sources can generate enough capital for rapid, short-term conversion is questionable.

Conversion is vital to avert economic — and hence political — chaos in states with political systems of rather recent vintage. Since foreign investment and credits are unlikely to emerge until basic problems are resolved, "local factory managers have to do the job largely by themselves ..."<sup>66</sup> The historical experience of the industry suggests that it is feasible. Arms production will not cease entirely. The very fact that the East European arms industry has survived to this date suggests that

the demand for weapons production is real. The region remains unstable and cannot afford to import all its weaponry. The industry can be expected to fight production phaseouts, as happened in Czechoslovakia and Poland.<sup>67,68</sup> But it is economically impossible to maintain or regain Warsaw Pact-era production levels. Technology is inadequate for export competitiveness, because most R&D took place in the Soviet Union; the other NSWP countries "did not develop their own national capacities for military research and development." Self-sufficiency existed in production, but not design.<sup>69</sup> The East European arms industry's post-war history suggests that it will continue to exist, but on a much smaller scale, focused on local requirements and, when feasible, exports.

### Notes

1. Kenneth L. Adelman and Norman R. Augustine, "Defense Conversion: Bulldozing the Management," Foreign Affairs 71 (Spring 1992): 26.
2. Katarzyna Zukrowska, "From Adjustments to Conversion of the Military Industry in East Central Europe (PISM Occasional Papers No. 27)" (Warsaw: Polish Institute of International Affairs, 1991), 13. The quoted phrase covers two Soviet invasions and one declaration of martial law.
3. M. Hauner, "Military Budgets and the Armaments Industry," in E. A. Radice and M.C. Kaser, eds., The Economic History of Eastern Europe, v.2, Interwar Policy, the War, and Reconstruction (New York: Clarendon Press of Oxford University Press, 1986), 99; E. A. Radice, "General Characteristics of the Region," in Economic History of Eastern Europe, v.1, Economic Structure and Performance Between the Two Wars (1986), 54.
4. E. A. Radice, "The Development of Industry," in Interwar Policy, 416-451.
5. Hauner, "Military Budgets," 67-89.
6. Hauner, "Military Budgets," 101, 102, 105, 106, 108-109.
7. Hauner, "Military Budgets," 94.
8. Hauner, "Military Budgets," 74, 91, 93-97. Additional information on the pre-war Romanian arms industry can be found in E. Lethbridge, "National Income and Product," 594; Alice Teichova, "Industry," 310; and Radice, "General Characteristics of the Region," 272, all in Radice and Kaser, Economic Structure and Performance.
9. Polish private arms manufacturers had experienced very little success, hence the Polish industry was almost entirely a "non-market" industry. In Romania, the manufacture of explosives was a state monopoly, and helped to concentrate Romanian industry into large units. Radice, "General Characteristics," 55-56, 272; Teichova, "Industry," 305, 306, 310; Hauner, "Military Budgets," 107, 110-111.
10. For the view that the industry was partially converted to civilian durables, see W. Brus, "1953 to 1956: The 'Thaw' and the 'New Course'," in Economic History of Eastern Europe, v. 3, Institutional Change Within a Planned Economy (1986), 47. The East German arms production claim can be found in CIA Research Reports: Europe, 1946-1976 (Frederick, MD: University Publications of America, 1982-87), 9 December 1949. Brus's known personal experience in Poland must be contrasted with the anonymity of the CIA's source (and the report might have been based on no more than an interpolative estimate).

11. Michael Checinski, "A Comparison of the Polish and Soviet Armaments Decisionmaking Systems" (Santa Monica, CA: RAND, January 1981), 3.
12. Checinski, "Warsaw Pact - CEMA Military-Economic Trends," Problems of Communism (March-April 1987), 15-16; Ulrich Albrecht and Randolph Nikutta, Die Sowjetische Rustungsindustrie (Opladen: Westdeutscher Verlag, 1989), 261-62.
13. Keith Crane and Deborah Skoller, "Specialization Agreements in the Council for Mutual Economic Assistance" (Santa Monica, CA: RAND, February 1988 (R-3518)), vi.
14. Andrzej Korbonski, "Foreword" to Michael Marrese and Jan Vanous, Soviet Subsidization of Trade with Eastern Europe: A Soviet Perspective (Berkeley, CA: Institute of International Studies, 1983), xvi, xvii.
15. The Economist World Atlas and Almanac (New York: Prentice-Hall, 1989), 201.
16. Alex McLoughlin, "East-West Joint Ventures: A View from "High-Tech" Industry of Problems and Potential in Conversion of the Defence Industrial Sectors in Central and Eastern Europe and the States of the Former Soviet Union, background paper for the NATO-C&EE Defence Conversion Seminar, Brussels, 20-22 May, 1992, 3; Katarzyna Zukrowska, "The Dilemmas of Polish Arms Industries in the Period of Systemic Changes," Polish Institute of International Affairs, background paper for the NATO-C&EE Defence Conversion Seminar May 20-22, 1992, 1, 7.
17. Checinski, "A Comparison," 15-16.
18. A. Ross Johnson, Robert W. Dean, and Alexander Alexiev, "East European Military Establishments: The Warsaw Pact Northern Tier" (Santa Monica, CA: RAND, December 1980).
19. Eugene K. Keefe, et al, Area Handbook for Poland (Washington, DC: GPO, 1973), 188.
20. E. G. Jones, Guide to Science and Technology in Eastern Europe (Harlow, Essex: Longman, Francis Hodgson, 1979), 16; Checinski, "Military-Economic Trends," 16.
21. Alex Alexiev, "Romania and the Warsaw Pact: The Defense Policy of a Reluctant Ally" (Santa Monica, CA: RAND, 1979); Kennedy National Security Files (Frederick, D: UPA, 1987), May 11, 1963.
22. Albrecht and Nikutta, Sowjetische Rustungsindustrie, 259; Steven J. Zaloga, Modern Soviet Armor: Combat Vehicles of the USSR and Warsaw Pact Today (Englewood Cliffs, NJ: Prentice-Hall, 1979), 19.
23. See Korbonski, "Foreword," xix, xx.
24. Checinski, "A Comparison," v, viii, 3, 4, 5. See also Keefe, Poland, 301-302.

25. Korbonski, "Foreword," xi-xxvi; Keith Crane, "the Soviet Economic Dilemma of Eastern Europe" (Santa Monica, CA: RAND, May 1986 (R-3368-AF)), passim.
26. Keith Crane, "Western Leverage and East European Military Spending" (Santa Monica, CA: RAND, 1987): 26; Joseph Fucik, "Defence Conversion and Armament Production in the Czech and Slovak Federal Republic" (background paper to the NATO -- C&EE Defence Conversion Seminar, Brussels, 20-22 May, 1992), 10; Deborah Skoller and Keith Crane, "Specialization and Cooperation Agreements Within the Motor Vehicle Industry of the Council for Mutual Economic Assistance" (Santa Monica, CA: RAND, February 1988 (N-2575), 49-52. Fucik states that production in 1953 was 374 percent of the 1950 level, and that the industry's share of "engineering production" rose from 4 percent to 27 percent. Fucik, "Defence Conversion," 9.
- 27.4 Keith Crane and K. C. Yeh, "Economic Reform and the Military in Poland, Hungary and China" (Santa Monica, CA: RAND, 1991), 79; Crane, "Western Leverage," 26, Table 8; Roger Kanet, "NATO-Warsaw Pact Rivalry in the Third World Arms Market" (paper prepared for Naval Warfare Studies, Naval War College, Newport, RI, March, 1984), 5; John Owen, ed., Brassey's Infantry Weapons of the Warsaw Pact Armies (London: Brassey's, 1979), 12; William J. Lewis, The Warsaw Pact: Arms, Doctrine, and Strategy (New York: McGraw Hill and Institute for Foreign Policy Analysis, 1982), 354.
28. S. E. de Banzie, et al, compilers and translators, The RUSI Soviet-Warsaw Pact Yearbook 1989 (Coulson, Surrey, UK: Jane's Defence Data, 1989), 275; Alexiev, "Romania and the Warsaw Pact," 11-12; Lewis, The Warsaw Pact, 300; Zaloga, Modern Soviet Armor, 33; Friedrich Wiener, The Armies of the Warsaw Pact Nations: Organization, Concept of War, Weapons, and Equipment (Vienna: Ueberreuther, 1981); Michael J. H. Taylor, ed., Soviet and East European Major Combat Aircraft: Including the World's Non-Aligned Nations (London: Tri-Service Press Ltd., 1990).
29. Wiener, Armies of the Warsaw Pact, passim; Skoller and Crane, "Specialization and Cooperation Agreements," 46,48.
30. Data calculated from Central Intelligence Agency, Handbook of Economic Statistics (1978 and 1981); CIA, Communist Aid to Less Developed Countries of the Free World, 1975 (1976).
31. Ihor Gawdiak, Czechoslovakia: A Country Study (Washington, DC: GPO, 1989), 337-38. Interestingly enough, however, Poland allegedly furnished no military aid at all.
32. This can be seen in data collected in Albrecht and Nikutta, Sowjetische Ruestungsindustrie, 256-257.
33. See Crane and Yeh, "Economic Reform," 52; Hauner, "Military Budgets," 79 (noting that the Czech Omnipol organization dates from 1934); and Alexiev, "Romania and the Warsaw Pact," 10; Gawdiak, Czechoslovakia, 355.

34. Gawdiak, 355.
35. ACDA, World Military Expenditures 1987, 30-31, 36-37). Romania exported no arms until 1972. ACDA, Worldwide Military Expenditures 1969-1978, 148.
- 36.4 DA. World Military Expenditures and Arms Transfers, 1987 (Washington, DC: Government Printing Office, 1988), 30, 36.
37. ACDA, World Military Expenditures and Arms Transfers, 1987 (Washington, DC: GPO, 1988), 87-125.
38. Korbonski, "Foreword," xviii.
39. Lajos Hethy, "Defence Conversion and Economic Transformation in Hungary," working paper submitted by Hungarian Ministry for Foreign Affairs to the NATO - C&EE Defence Conversion Seminar, Brussels, 20-22 May 1992, 6.
40. Gawdiak, Czechoslovakia, 337-38.
41. Richard C. Martin, "Warsaw Pact Force Modernization: A Second Look," in Jeffrey Simon and Trond Gilberg, eds., Security Implications of Nationalism in Eastern Europe (Boulder, CO: Westview, 1986), passim.
42. In 1981, Czechoslovak arms exports totalled 15.5 percent of all machinery exports. Keith Crane, "Military Spending in Czechoslovakia, Hungary, and Poland," 12 Journal of Comparative Economics (December 1988): 536.
43. Kenneth L. Adelman and Norman R. Augustine, "Defense Conversion: Bulldozing the Management," 71 Foreign Affairs (Spring 1992): 38.
44. Adelman and Augustine, "Defense Conversion," 38; Zaloga, Modern Soviet Armor, passim; Gawdiak, Czechoslovakia, 237; Albrecht and Nikutta, Sovjet Rustuengsindustrie, 258.
45. Trond Gilberg, "Eastern European Military Assistance to the Third World," in John F. Copper and Daniel S. Papp, eds., Communist Nations' Military Assistance (Boulder, CO: Westview, 1983), 82-83.
46. Crane, "Military Spending," 530.
47. Zukrowska, "The Dilemmas of Polish Arms Industries," 1, 3, 4, 7,8; Zukrowska, "The Polish Arms Industry," 5, 9, 10.
48. Crane, "Military Spending," 532. Figures do not appear to be adjusted for inflation.

49. Korbonski, "Foreword," xix; Gilberg, "Eastern European Military Assistance," 83; Wheeler Soper, Appendix to Gawdiak, Czechoslovakia.
50. U.S. Congress, Joint Economic Committee, "East European Economies Post-Helsinki: A Compendium of Papers Submitted to the Joint Economic Committee, Congress of the United States, August 25, 1977" (Washington, DC: GPO, 1977), 270.
51. Hethy, "Defence Conversion," 6, 10, 12.
52. Crane, "Military Spending," 531.
53. J. F. Brown, Eastern Europe and Communist Rule (Durham, NC: Duke University, 1988), 500; "Two More Liaison Pact Nations Cut Arms," Jane's Defence Weekly (11 February, 1989), 207.
54. Gawdiak, Czechoslovakia, 338; ACDA, "World Military Expenditures 1969-78," 125; ACDA, "World Military Expenditures 1987," 30, 36, 93.
55. Crane and Yeh, Economic Reform, 13, 37, 40. Of the Soviet industrial-military complex, Adelman and Augustine say that it "worked as well as it did because it was politically favored and thus generously funded. It received a hefty budget, any needed raw materials and the best and brightest scientists and engineers. It attracted the ablest managers, who received the highest salaries, biggest bonuses and newest dwellings. Its workers lived in the most comfortable apartments of any workers in this once-touted "worker's paradise." Adelman and Augustine, "Defense Conversion," 32.
56. Zukrowska, "Dilemmas of Polish Arms Industries," 3.
57. Pavel Wieczorek, "The Polish Arms Industry in the New Political and Economic Reality (PISM Occasional Papers No. 23)" (Warsaw: Polish Institute of International Affairs, 1991), 4, 6.
58. Checinski, "A Comparison," 4-5.
59. Zukrowska, "Dilemmas of Polish Arms Industries," 1, 15.
60. Adelman and Augustine, "Defense Conversion," 37.
61. Poland doubts that knowledge about past conversion / reconversion will be helpful. Zukrowska, "Adjustments to Conversion," 15-16.
62. Adelman and Augustine, "Defense Conversion," 41.
63. Adelman and Augustine, "Defense Conversion," 37.

64. T. Palankai, "Conversion Problems of Hungary," International Conference on Conversion, International Institute for Peace, Vienna, January 25-28, 1992, 2-3, quoted in Hethy, "Defence Conversion," 7.
65. Zukrowska, "From Adjustments to Conversion," 8, 16, 17, 18.
66. A. Kennaway, "The Conversion of Military Factories to Civilian Production," NATO-C&EE Defence Conversion Seminar, Brussels, 20-22 May 1992, 1.
67. Adelman and Augustine, "Defense Conversion," 37, 38.
68. Wiczorek, "Polish Arms Industry," 7.
69. Zukrowska, "From Adjustments to Conversion," 6, 7.