

## Globalisation, microelectronics, and the demise of the GDR

Olaf Klenke, *Ist die DDR an der Globalisierung gescheitert? Autarke Wirtschaftspolitik versus internationale Weltwirtschaft – Das Beispiel Mikroelektronik*. Frankfurt/Main: Peter Lang, 2001, 154 pages. ISBN 3-631-38204-9, DM ?

Raymond Stokes, *Constructing Socialism. Technology and Change in East Germany, 1945-1990*. Baltimore: Johns Hopkins University Press, 2000, 260 pages. ISBN 0-8018-6391-0, £ ?

Gerhard Barkleit, *Mikroelektronik in der DDR. SED, Staatsapparat und Staatssicherheit im Wettstreit der Systeme*, Dresden: Hannah Arendt Institut für Totalitarismusforschung, 2000, 146 pages. ISBN 3-931648-32-X, DM ?

The state of technology in the Soviet Bloc would, if popular images were taken for the truth, describe a curious arc. In the middle of the last century it would appear as highly advanced, displaying state-of-the-art steelworks, atomic and space technologies, and ICBMs. But by the time of the system's collapse we were far more likely to think of the Trabant or Chernobyl. It could almost appear as if outright technological regression had occurred. And although this conclusion, being based upon a conflation of absolute and relative technological levels, would be misguided, it has frequently been argued that economic development did in fact stall. By way of example consider the proposition by Beverly Crawford (1995: 9), that 'isolation from the [sic] international technological change "froze" socialist economies in a previous industrial era, triggering a decline in both living standards and international competitiveness.' [italics GD].

The studies reviewed here of technological and economic change in East Germany, however, show this picture to be quite misleading. As all three of the books under review here demonstrate, East Germany was far from being frozen in an earlier era. Although at the level of enterprise management a relative insulation from the pressures, and relative deprivation of the resources, that promote innovation and imitation has been widely noted, this was only one aspect of a complex picture. Planners and certain enterprises, especially those oriented towards exports and armaments, were perpetually and in some cases obsessively attentive to cutting-edge developments elsewhere. Inventions and innovations were made and applied, in addition to the imitation of advances made elsewhere. It is true that the record in East Germany and the USSR was more impressive in the 1950s and 1960s – during which major and usually successful shifts of investment into high-tech sectors such as aerospace, petrochemicals, electronics and data processing occurred – than in subsequent decades. Indeed, it was in part Soviet achievements in these fields that explains the embrace by the GDR of Soviet technology in the late 1950s, according to Raymond Stokes (p. 201).<sup>1</sup> But the same drive to match and, where possible, outpace developments in the West was evident in the later period too. One of the services of all three monographs is that they record that the GDR's major technological successes in this later period were not simply in traditional areas but also in cutting-edge fields such as laser technology and space optics (e.g. Stokes p. 5).

All three books, notably those by Barkleit and Olaf Klenke, devote considerable space to the microelectronics industry. This was a venture that has since

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<sup>1</sup> Stokes also mentions the USSR's pioneering form of economic organisation, 'Group Technology' (p. 116). Though supposedly distinctively socialist, it was imitated by companies in countries such as US, UK and FRG, and can be seen as a precursor for flexible production methods that emphasize scope economies.

earned much derision: an attempted 'great leap forward' to match the chip technologies developed in the advanced market economies, it fell flat on its face. Nonetheless, the project had been developed upon solid foundations, including successful domestic electronics and data processing industries, the example of a viable semiconductor industry in the USSR, and a skilled workforce and advanced scientific infrastructure. Nor did it lack rationale. The industry's products, including robots, were rightly perceived as crucial for rationalisation throughout the economy but in particular for the machine tool industry, which produced the bulk of the GDR's high value added exports to the West. They were equally essential to upgrading the Warsaw Pact's military capabilities and exports, particularly with the aim of achieving first strike capability in the context of the New Cold War (Barkleit pp. 53-8) but also with a view to boosting arms sales to Third World conflict zones.

Although a late starter, by the mid-1980s microelectronics was rapidly becoming one of the GDR's top four industries, prompting *The Economist* (20.4.85) to report that 'East Germany has made microelectronics the revolutionary barricade of the 1980s.' By the end of the decade, clubs were proliferating where kids learnt to construct computers out of televisions, typewriters and cassette recorders. A cautious welcome was even given computer games which, according to a contributor at one conference (Mühlbauer 2000), 'possess objective tendencies that enable children to absorb the ideas and values of socialism through play and fantasy.' At the industrial level certain achievements were chalked up. Admittedly, the most admirable were in the copying of imported semiconductors and in the fields of espionage and smuggling of western technology. But the combination of domestic innovation with licit and illicit technology transfer enabled significant progress to be made. Over the course of eight years, production of semiconductors rose by almost 800%. The application of microelectronic components enabled significant productivity growth in a wide range of industrial sectors. But despite massive investment relative to other industries, East German microelectronics persistently lagged its rivals: the FRG by four or five years, and the USA by seven or eight (Havlik 1990 p. 137). Over the course of the 1980s its share of the world market in microelectronics halved, to 0.4% (Altvater/Hübner 1990 p. 16).

Why, the question arises, did East German firms fail to make a breakthrough in this crucial industry? Why their lag behind West German, American and Japanese rivals? Why did East Germany which, in 1945, belonged to one of the world's most advanced economies thereafter pursue a course of relative decline? What was the balance between systemic and contingent reasons? And, more generally, why did the Soviet Bloc fail to compete? The books under review make useful contributions to answering all of these questions, but especially the third, with which we begin.

## Reparations

Much of Raymond Stokes's volume takes the form of a detailed inquiry into what GDR-specific factors might explain its persistent lag behind its Western twin. Perhaps, he wonders, the answer lies in different initial conditions. In comparison to the FRG, East Germany suffered three disadvantages from the outset: a relative shortage of R&D capacity, a lack of high-quality coal reserves, and a far smaller internal market. Given the GDR's relatively autarkic economic form these were significant, yet, as Stokes argues, they cannot provide more than a small part of an explanation of the different trajectories of East and West Germany. Unlike other parts of Eastern Europe, initial conditions can hardly be invoked as explanation of its later backwardness vis-a-vis West Germany.

Of far greater significance was that whereas the West, allied to a wealthy superpower, benefited from Marshall Aid, the East was plundered, in the name of reparations. These took several forms. One was the dismantling of industries and their transport to the USSR - essentially a form of wholesale technology transfer. **Stokes (p. 22) details some of the industries which were transported eastwards either in their entirety or majority: aluminium, magnesium, magnesium oxide, automobile tires, metallurgy, and the machine-tool, fine mechanical and optical, electrical, cement, and paper industries, not to mention much of the chemicals industry, stockpiles of raw materials, and the contents of bank vaults.** Germany's Soviet Zone, on Stokes's estimate (p. 22), 'lost at least one-third of its industrial capacity across the board, and even more in research-intensive and war-related industries'. **At around a quarter of GDP, reparations represented an enormous outlay, far greater than Germany's payments following the First World War.** In addition, many thousands of East German specialists - including entire teams of scientists with their assistants and technicians - were deported to the USSR in the immediate post-war years, along with vast quantities of technical and scientific information (Stokes pp. 21, 26).

Such was the extent of these forms of plunder that, in Stokes's words (p. 29), Soviet policy threatened 'to kill the goose that laid the golden egg'.<sup>2</sup> A more effective form of surplus transfer was therefore instituted in the form of the SAGs, Soviet-owned enterprises in East Germany. These, Stokes notes (p. 28), accounted for at least a third of East Germany's industrial output and comprised much of its high tech industries, including the entire chemicals sector and much of the engineering and optics industries. Moreover, they represented a payment made twice over, for they were sold 'back' to East Germany, in 1953, at a cost to the taxpayer of 2.5 billion Marks. The SAGs did enable a more efficient transfer of 'golden eggs' to the USSR, and yet the consequence for East Germany was little different to outright plunder, namely to 'deny the fruits of a significant part of the productive capability of Soviet-zone industry to the Soviet zone' (Stokes p. 29).

Despite marshalling such compelling evidence of the extent of Soviet pillage, Stokes resists the conclusion that its effect on the East German economy was obviously and entirely negative. Particularly in a situation of excess capacity, **as existed in many industries in the post-war period**, the loss of physical equipment may not diminish output but, by spurring innovative replacements, may instead promote increased productivity over the longer term. To this extent Stokes concurs with another leading economic historian of the period, Christoph Buchheim (1999). However, where Buchheim views reparations, with the notable exception of the dismantling of half the railway network, as *essentially beneficial* to productivity growth, Stokes's discussion is more measured, placing greater emphasis on the negative consequences. '[B]ecause the scale of the dismantling effort went well beyond removal of "excess" capacity,' he argues (p. 23),

the East Germans started the postwar period severely hampered in vital industrial and technological sectors. Furthermore, they had a severely diminished capability of mustering the capital investment necessary to reconstruct them and a curtailed capacity for research and development both in terms of personnel and organizations.

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<sup>2</sup> Given the socialist rhetoric of the Soviet occupying forces, the situation was not without irony. As Brecht remarked in his diary (in Staritz, 1976: 95), 'The taking possession of production by the proletariat occurs simultaneously with (and, to many, appears to occur for the purpose of) the deliverance of the products unto the victor.'

Stokes's judgement here is broadly consistent with the estimate of Paul Gregory and Gert Leptin (1977) that the Soviet Zone's industrial capacity fell to fifty per cent of its wartime level as compared to a reduction of seventy-five per cent in the Western zones, and with that of Wilma Merkel and Stefanie Wahl (1991 **pp. 10,64**) and Gernot Schneider (1988 **p. 16**), that productivity relative to West Germany had already collapsed to fifty per cent by 1950. An important conclusion follows: the East German economy did not simply *become* less efficient than its western rival, it *began* as such.<sup>3</sup>

Negative effects upon the GDR due to its subordination to Moscow did not cease with the restitution of the SAG's in 1953. By way of example consider, with Stokes (pp. 136-7), the fate of the aviation industry.<sup>4</sup> Although in 1945 one of the most advanced in the world, the entire industry was taken as reparations. This was not merely a material affair. Virtually all of East Germany's aeronautical engineers, scientists, and technicians were relocated to the USSR, where they worked until the early 1950s. It was only following this rupture that a domestic aviation industry was then set up anew, in Saxony. By the end of the decade, having become the country's most expensive industrial project, it employed 25,000 workers. And then suddenly, in 1961, it was shut down. Billions of Marks **of investments** were squandered. How could this have happened? The proximate reason given at the time, the disastrous first flight of a prototype, was one possible answer. But a deeper cause was likely, too. Quite simply, the industry's success depended upon sales to the USSR. There, however, aviation plants were being converted from military to civilian aircraft production in the wake of the recent ICBM programme, which had rendered long-range bombers of lesser importance. The East German industry, being unwanted competition, was shut down.<sup>5</sup>

In the face of tales such as this it appears obvious that the worst of the GDR's relationship with the USSR resulted from coercive reparations and Moscow's direct political influence in favour of its own industries. In fact, in the long run, Moscow's *benign* roles as impresario of the Comecon trading network and as customer for East German goods may have been more deleterious still. As a guaranteed market for manufactured goods many of which were produced at lower quality than world market leaders, the USSR contributed to a blunting of competitive pressures on GDR exporters. On this point Stokes (p. 127) summons the argument of Joachim Radkau, that

the most enduring damage [to the GDR] arose not out of the actions the USSR carried out that had the effect of making the GDR's life difficult, i.e. dismantling and unequal trade treaties. Instead, the enduring damage arose from the things that made the life of the GDR all too comfortable: through the USSR's purchase of outmoded machines that had no chance of being sold in western markets.

More generally, as Klenke observes (p. 31), although the GDR's trade ratio eventually reached a fairly high level, the bulk was with its Comecon partners, and this trade was primarily of a complementary sort, giving rise to comparatively weak competitive effects.

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<sup>3</sup> Charles Maier has even concluded that (1997: 85), 'Given the rate of Soviet extraction from the East German economy until 1950 and, conversely, the fact that West Germany enjoyed considerable subsidies from the British and American occupiers and thereafter Marshall Plan aid, it is not clear that the differing performances can be attributed to differences in the economic system.'

<sup>4</sup> See also Prokop 1993: 140-1.

<sup>5</sup> Something **not** dissimilar happened to the British aircraft industry in a later period. It was unable to compete with US rivals that were fed fat by Pentagon orders (Krugman 1994: 238-9).

## The Challenge of Globalisation

The various consequences of its subordination to Moscow may go a considerable way towards accounting for the GDR's economic backwardness relative to the FRG. Yet this leaves the more general question of the technological backwardness of the Soviet Bloc as a whole begging. The standard approach is to look for systemic faults, notably with the system of central planning. Rigid bureaucratic structures, 'soft budget constraints', and state ownership of industries, it is argued, encouraged the squandering of resources and discouraged risk-taking and innovation. Technological and economic backwardness were the inevitable result.

The ubiquity of such arguments notwithstanding, they only make sense as explanations of the *crisis* of the Soviet Bloc, and show little understanding of the preceding decades of boom. Klenke points out the fallacies of such 'stopped clock' reasoning, recalling that during an earlier period it was the prospect of the West being overtaken, and the perceived advantages of planning over the market, that tended to be emphasised. For Klenke, the counterposition of plan and market that characterises orthodox explanations is overly rigid. Underlying the differences between planned and market economies he proposes a deeper unity: that both systems are composed of units of capital, the accumulation of which is determined, fundamentally, by global economic and military competition.<sup>6</sup> The Soviet system, he argues, (**p.25 and *passim***), was but an extreme case of a general and widespread intertwining of capitals and nation states, especially in weaker sections of the world economy (including Eastern Europe), over the first two thirds of the twentieth century. It was military competition from a position of backwardness during an epoch of autarchy that stamped the Soviet economies with their typical characteristics: relative autarchy, a high degree of industrial concentration, an emphasis on heavy industry, and a high savings ratio. Central planning, Klenke proposes, was a format that proved relatively well adapted to organizing the conditions for capital accumulation in backward economies during a period of relative autarky. Far from stalling technological change, planning could be a reasonably effective mechanism for directing capital into sectors that promised long-term profitability or were of strategic significance. As Alec Nove has put it (in Klenke p. 25), 'with all its defects the system had an overwhelming advantage: that of enabling the leadership to concentrate resources on its priorities, without being deflected by considerations of profitability, private-enterprise interests, or the pressure of public opinion.'

Klenke argues that system-immanent explanations cannot stand up to serious scrutiny as an explanation of Soviet-bloc economic backwardness; they cannot explain either the earlier period of boom or the timing of the shift to crisis. The onus is then on the critic to present an alternative explanation. This he does through a novel re-working of an otherwise familiar thesis, namely that the Soviet Bloc's economic decline may be explained primarily through its exclusion from processes of economic internationalisation. Klenke proposes that the very dynamic of capital concentration that enabled a greater or lesser degree of fusion between states and 'national capitals' in the earlier period continued into the 1950s and 1960s, but primarily in the form of the proliferation of business beyond national boundaries. In this period the western

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<sup>6</sup> Klenke's case is made largely by theoretical argument and historical analysis, but some quotes from East German officials illuminate his thesis. Consider this assertion by the vice-president of the GDR's State Planning Commission (p. 22): 'In principle the planned economy represents an attempt to transpose the economic rationality of capitalist enterprise onto the national economy as a whole.'

world economy was reorganised along liberal lines. Trade flourished, as did the expansion of multinational companies (MNCs) and cross-border mergers. Operating across borders affords multinational companies the ability to draw upon even greater resources than national monopolies and to concentrate specific activities in the value chain in sites with the strongest perceived country-specific advantages. It enables greater scope in the areas of horizontal and vertical integration, and the location of production closer to markets. Scale economies resulting from distribution to the wider world market are especially important in industries where technological complexity imposes high development costs – the ability and incentive to innovate is thus related to the size of the market. Transnational operations also facilitate technology transfer and a faster exchange of innovations. And, of course, MNCs benefit from the competitive nature of the world political order. Relationships with multiple states enable them to profit from transfer pricing, to bargain for inducements (such as tax concessions) from governments, and to invest selectively, e.g. in countries where consumer protection, union organization or labour regulation is weak. Together, these mechanisms serve to boost profitability, contributing to virtuous circles whereby extra profits are fed back into R+D, advertising, and productivity improvements.

It was above all the 'globalisation' of the American-led West that, from the 1960s onwards, began to challenge and increasingly undermine the Soviet system. The latter was structurally resistant to the trend. Trade was mediated through export and import licenses and administered by cumbersome foreign trade organizations. Their limited position in external markets was expressed in nonconvertible currencies which, in turn, hindered international integration. Trade aversion was compounded by the fact that the major Western states, beginning in the late 1940s **and lasting until (and to an extent, beyond) détente**, generally treated the Soviet economies as 'least favoured nations'. A key tool in this was the list of embargo goods drawn up by COCOM (*Coordinating Committee for Multilateral Exports Control*).<sup>7</sup>

A point that is noted by Klenke but emphasized by Stokes (p. 132) is that the same period of internationalisation also saw a shift away from industries where vertical relations predominate (steel, cement, bulk chemicals) and towards those for which the concentration of production is less important and flexible, horizontal links between units are more essential (electrical engineering, fine chemicals, toolmaking and computing) (**cf. also Winiecki 1986 p. 325**). This trend, Stokes argues, was not especially well suited either to central planning, with its strict limits on enterprise independence, or to the corporate autarky of the East German *Kombinate*.

On the basis of these considerations, Klenke suggests that the crisis of the Soviet economies cannot be attributed to central planning as such, but primarily to their inability to adapt to the deepening international division of labour under evolving conditions of global competition. Structures that had evolved with some success in an earlier historical conjuncture began to become obstacles to competitiveness as the ability to gain market share and organise production on a transnational basis became an ever more crucial divider between winners and losers in the world economy. From around the mid-1970s the Soviet economies became beset by what David Coates (2000, p. 270) has termed a 'self-sustaining cycle of underperformance'. Coates is referring to the vicious circles whereby economies, once weakened, tend to weaken further. Typically, low profitability releases diminished funds for investment; competitiveness

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<sup>7</sup> Cocom membership comprised all NATO countries except Iceland, plus Japan. Other countries such as Austria, Sweden and Switzerland, though not members, tended to comply with Cocom rules. Its effect was enormous. Jan Winiecki has argued (1988: 145) that 'if STEs "undertraded" with the West in earlier years, it was probably more the result of extensive COCOM embargoes on precisely those products that industrialising [Soviet economies] were most interested in buying' than of structural trade aversion.

suffers accordingly, leading to higher interest rates, foreign exchange shortages and reduced imports of the capital goods necessary to raising productivity. In the case of import substitution economies such as the GDR this sort of cycle meshed with another, which could be termed a 'self-sustaining cycle of underspecialisation'. Here, the production of an enormous range of products with correspondingly short production runs - as goods were sold largely only to domestic and Comecon markets - enabled only low levels of specialisation. Accordingly, technologies utilised tended to be relatively backward and costs high. Returns were therefore too low to fund the scale of investment required to provide an escape from the vicious circle.

### Two Paths To Internationalisation

The undermining of the Soviet system in economic competition with its western rivals did not occur overnight. Rather, the challenge continually shaped the aims and ideas of policymakers from the 1960s onwards. Forced to match the scale, resources and reach of the world's leading firms, the Soviet economies were obliged to reform and adapt. Some form of increased internationalisation was all but inevitable. One possibility was to foster this within Comecon. The logic here was widely recognized, but perhaps best expressed by Walter Ulbricht in 1964 (in Marsh 1973 p. 54):

The technological revolution objectively demands the internationalisation of economic and scientific cooperation. From this stem new tasks for the CMEA which have not yet been mastered. The great monopoly groups of Western Europe have spread across national barriers due to pressure from American competitors, in their search for technical progress [...]. Our party considers these progressively developing questions to be of extraordinary urgency.

Ulbricht proposed that the CMEA act as a framework for administering national export specialisation and pooled R&D. To some extent various forms of integration were developed. Dozens of joint ventures between Comecon firms were established. In 1969 an integrated strategy for the computer industry was initiated (see below), while from the early 1970s a 'Soviet-world car', the Lada, was manufactured from components produced throughout Comecon.

As with international trade, however, the internationalisation of production under Comecon auspices proved problematic. Given the stark economic divide between Comecon's advanced and backward nations, a process of relatively equitable integration along the lines of the EU was never realistic. The domination of the zone by Moscow was a further obstacle: East European states feared that a greater division of labour would mean greater dependence on the USSR (Bunce 1985 p.15). Cooperation, moreover, was hampered by the same general problems as intra-Comecon trade: that prices were politically fixed, and that currencies, even the 'transferable' rouble, were non-convertible. But, because integration could only occur through coordination of the respective national planning apparatuses, the greatest hindrance was national egotism. Economic nationalism proved strong, for reasons of 'economic' as well as 'national' security. Specialisation, as Marie Lavigne observes (1991 p. 95), 'is a risky undertaking as it may lead countries to forsake vital elements of their industrial base, leaving these to partners who may then not be able to meet their obligations.' But while similar **fears and** egotisms afflict international cooperation in, say, Western Europe, there far more power is devolved to the firm, or upwards to the EU, both of which levels are at a remove from the nation state.

Conflict between Comecon members over the distribution of costs and benefits was endemic. All three works under review give illuminating examples of this. Barkleit details an instance of 'cooperation' between the GDR and the USSR in which the former was obliged to deliver vast quantities of manufactured goods for a joint project while the latter invested a diminutive amount. Elsewhere (p. 28) he details the tensions over a joint project developing electro-optic systems, in which the Soviet side attempted to burden its German partner (Carl Zeiss Jena) with the major risks involved. All three authors pay particular attention to the secrecy and egotism of the USSR's military-industrial complex which prevented a high level of cooperation in R&D even with its loyal German ally.<sup>8</sup> As a result the GDR tended to find itself delivering high tech goods to the USSR but largely excluded from forms of cooperation in which technology transfer flowed the other way.

National egotism (or good business sense) frequently entailed prioritising dealings with the 'non-socialist abroad' over those with Comecon partners. Growing trading and other links with Western economies tended to encourage the flouting of Comecon agreements and amplified intra-Comecon rivalries. Soviet Bloc firms generally sought to *import* as much as possible from within Comecon, and *export* everything possible to hard markets, making administered Comecon integration increasingly problematic. Stokes (p. 87) recounts a squabble over oil deliveries between the USSR and East Germany already in 1964, during which a Soviet official told an East German minister that his government should 'have some understanding of the fact that crude oil had to be sold by the Soviet Union to capitalist countries, even if there were deficits in the GDR.' That West Germany was already refining 45 million tons of Soviet oil and was set to raise that to 70 million by 1970 was, in his words, entirely due to the fact 'that they could simply afford it.' At a later date the East Germans took due revenge, by processing cheap Soviet oil and, against Comecon accords, selling it for hard currency on world markets.<sup>9</sup>

As these examples suggest, connections with the 'non-socialist abroad' tended to counteract those within Comecon. The contradictions involved intensified in the 1980s when, as Klenke shows (p. 82 and *passim*), the Soviet Bloc's developing crisis expedited attempts to stimulate cooperation within Comecon and yet simultaneously intensified a foreign exchange scarcity that led Comecon's members to seek to export ever more to the West (and relatively less to each other), thus undermining the objective basis for integration.

Trade with the West, however, was no panacea, nor did it enable substantial efforts at transnational production.<sup>10</sup> The Soviet economies were highly dependent on Western imports of high tech capital goods, and, increasingly, earned the hard currency to pay for these with raw material exports (Klenke p. 31). This was not a trading relationship between equals and it therefore gave rise to a political predicament. Increased trade led to what might be termed 'unequal interdependence'

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<sup>8</sup> Such was the secrecy prevalent in the Soviet economy that when an assessment of comparative technological development in electronics was prepared for the East German Politburo in 1977, the information for the USA and Japan was accurate, but not that for the USSR (Barkleit p. 38).

<sup>9</sup> The cynicism involved was well expressed by the GDR's economics czar Günter Mittag, **in a small circle of trusted colleagues**: 'Where it's a matter of money, that's where proletarian internationalism and friendship between the socialist states ceases!' (Loeser 1984 p. 64).

<sup>10</sup> By the late 1980s Western multinationals, ironically, were becoming almost as engaged in integrating the Comecon economies as were Comecon enterprises themselves. Volkswagen, for example, was developing plans for producing vehicles with engines from Karl-Marx-Stadt and chassis from Czechoslovakia.



with the West. The fear was expressed pointedly by an East German Politburo member (in Klenke p. 33): 'I am in favour of trade with the West, but not dependence.'

### **Microelectronics: Between Internationalisation and Autarchy**

The GDR's dependence upon and lag behind Western rivals was felt nowhere more keenly than in microelectronics. CAD, CAM, robotics, and other systems based upon microelectronic components were essential to the country's major export earners, notably the machine tool industry. With the microelectronics revolution only belatedly occurring in the GDR, the manufacture of many goods for export had to use chips imported from market economies. Their profitability (yield per unit invested) consequently fell, as did the proportion of high tech goods in total exports (Klenke p. 54).

Given the ultimate failure of its attempt to launch a world class microelectronics industry it is possible to argue, with Raymond Stokes (p. 194), that East Germany should have 'focused on less sophisticated electronic components and apparatus,' abandoning more advanced sectors to US and Japanese firms. Stokes (p. 53) also invites us to ask whether the country's economic decline was caused not by an

inability to produce high-technology wares, but rather by the inability to provide "the thousand objects of everyday need," which they neglected in large part because of their concentration on leading-edge technology?

Behind this rhetorical question lies the indubitable truth that the microelectronics drive was an expensive gamble, one which diverted resources from other sectors and thereby contributed to shortages elsewhere, not least in **everyday** consumer goods. But on this point I am not so convinced. For, although microelectronics is not a huge industry in any developed economy, as a generic technology it is of immense strategic and economic significance. Developed initially within Western military-industrial centres, its products have become ever more crucial to modern warfare. Could the Warsaw Pact countries be expected to ignore the role of microelectronic technologies in advanced weapons systems? Even more importantly, given the role played by technological rent in the formation of above average levels of profitability, those regions of the world economy that did not engage in the microelectronics revolution, as Klenke points out (p. 60), have tended to fall behind. GDR policymakers, as economic crisis set in during the 1970s, were aware of this. The microelectronics drive may thus be seen as a rational, if belated and risky, strategic trade initiative, an attempt to create competitive advantage at least within the Soviet Bloc and, hopefully, to lock the sector into a virtuous circle of high productivity and profitability.

That said, Stokes's scepticism as to whether an East German microelectronics industry ever had much chance of success is certainly warranted. The odds were stacked against it. First of all, it was a late starter. Although the electronics industry had been reasonably strong until the 1960s and beyond, microelectronics did not receive a substantial commitment until the 1980s. By this time chip development in advanced market economies – including the FRG, which had developed this industry **crucially** thanks to technology transfer from the USA - had come a considerable way, and with each new generation of chips the financial, organisational and technological demands made it harder for newcomers to enter the market (Klenke). Even copying

western chips by way of 'reverse engineering' -- was becoming more difficult and expensive the further miniaturisation progressed (Barkleit p. 26).<sup>11</sup>

It was in the 1970s and especially the 1980s that leading American chip producers began to expand their global production networks through subcontracting many production and assembly tasks to overseas firms, enabling substantial economies to be made (Klenke; also cf. Harrison). Indeed, it is the place of the microelectronics industry at the cutting edge of this restructuring process that led Klenke to select it as an appropriate industry through which to examine general questions of globalisation in West and East. For the restructuring and global expansion of companies such as Intel and IBM raised the question of how a Soviet-bloc equivalent could possibly respond.

The East Germans' aim, as Klenke describes it (p. 80), was to draw upon the expertise, experience and profits earned from a monopoly position in the computer industry within Comecon to develop products for sale to 'non-socialist' markets.<sup>12</sup> The first part of the strategy did in fact begin to work - the GDR made hefty profits in trade in this sector with its Comecon partners, often as high as 50% (Klenke p. 80). To break into non-Comecon markets, however, would have required a much more rapid rate of technological development, one which a go-it-alone course could not begin to achieve.

The two possible alternatives, broadly speaking, were cooperation with other Comecon economies, and imports from and cooperation with Western companies. The first of these was pursued with intermittent application. Perhaps the most notable achievement was the 'einheitliche System der elektronischen Rechentchnik' (ESER), begun in the late 1960s, which Klenke flags (p. 72) as the 'first worldwide multinational electronics project'. ESER strove to deepen cooperation in the field of data processing. Over 20,000 scientists and engineers and ca. 300,000 employees in some 70 firms across 7 countries were involved. Nothing equal to this happened elsewhere in the world until five or ten years later. Although it did not enable an overtaking of world leaders, some products were successful copies of the best in the West, and its overall effect was to significantly reduce the technology gap. Later on, a number of further initiatives were considered in the field of technological cooperation -- a sort of Comecon-wide import-substitution strategy in high-tech fields such as nuclear energy, biotechnology as well as microelectronics. However, most of these projects only reached the planning stage, and apart from an occasional joint venture, such as the Robotron-Kalinin computer partnership, these were belated initiatives and scarcely got off the ground.

The reasons for the lack of successful cooperation in microelectronics are essentially the same as the general factors outlined above. The Soviet microelectronics industry, for example, showed little inclination to cooperate with its GDR counterpart. The East German industry, for its part, showed little enthusiasm for sharing chip production with other Comecon countries, except for the USSR. In a

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<sup>11</sup> Reverse engineering is never an easy task as 'the physical form of an integrated circuit gives no clue to the closely controlled manufacturing technology required to produce it' (Joseph Berliner, in Stokes p. 178).

<sup>12</sup> This is similar to the account by Charles Maier (1997 pp. 73-6), who writes that the GDR banked upon mediating between Comecon and the world market, relying on the fact that '[a]lthough East German computers were more expensive than the Western versions, given the scarcity of convertible currencies, the CMEA countries must continue to buy from East Germany. What convertible currencies were earned would be used to defray the needed inputs from the West.' This strategy, Maier notes, 'presupposed the continuation of a socialist bloc, even as [it] sought to make the East German economy more capable of participation in the nonsocialist [world market]. [...] Unless the socialist economy remained a protected enclave, East German investment costs would never be recovered.'

telling example, Barkleit (pp. 47-8) describes how the GDR leadership objected to importing chips from Czechoslovakia. Although the reasons given were the latter's technological backwardness, one suspects that an additional motive may have been the Germans' jealous attempt to build and maintain a monopoly position within Comecon. Through examples such as this, Barkleit and Klenke show that the failure of the GDR microelectronics industry was in part explained by the failure to integrate R&D and/or production on a trans-Comecon basis.

This failure left East German firms largely reliant upon their own resources combined with imports and expertise from developed market economies, even though technologies from the latter were incompatible with those being developed with other Comecon firms (Barkleit p. 101).<sup>13</sup> This was of course no easy task, given that the COCOM list, **particularly after its strengthening by the Carter and Reagan administrations**, blocked the import of many microelectronic products, including semiconductor technology.<sup>14</sup> Paradoxically, even a loosening of the COCOM list could damage East German interests. Thus, when the GDR was approaching series production of a 16 bit chip, vital to its aim of achieving a monopoly position within Comecon, this item was removed from the COCOM list, allowing Comecon countries to buy from the West instead.

Much of the research presented by Barkleit and Klenke focuses on the strategies deployed by East German firms and their *Stasi* assistants in subverting and evading COCOM prohibitions.<sup>15</sup> Although industrial espionage is fairly common amongst the world's blue chip firms – and, argues Klenke (p. 67), should therefore not be seen sniffily, as Hubertus Knabe and others do, as *Communist* knavery – the GDR was forced to rely to an extraordinary degree upon this method of technology transfer, in addition to illicit deals with corporations such as Siemens and, especially, Toshiba.<sup>16</sup> Thanks to the willingness of firms such as these to make illicit gains, the COCOM prohibitions were flouted quite spectacularly at times, for example with the import of two entire chip factories (Klenke p. 68).

These successes, however, did not come cheap. The illicit services of 'non-socialist' firms could only be purchased at high cost, whether through price mark-ups or the bribing of employees (e.g. Barkleit p. 104). No long-term service agreements could be attached to equipment imports. Deals had to be shrouded in

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<sup>13</sup> Some technologies, eg the 1Mb chip, were even pursued along two different, incompatible (and expensive!) tracks, one in cooperation with the USSR, the other together with a Japanese partner. This is an instance of a wider problem discussed by Stokes (p. 125), namely the way in which technological development 'was shaped by the unresolved and fundamental tension in the GDR between political loyalty to the Soviet Union and traditional commercial and technological attachment to the West.'

<sup>14</sup> Given the technological preeminence of the USA and its allies, and the relatively small sales that Western firms could expect in the Soviet Bloc, the COCOM embargo damaged the latter's interests disproportionately. Barkleit (pp. 110-1) recounts an intriguing case where the embargo was reversed. In a product line where Zeiss was a world leader, the GDR government banned it from exporting to the West, in order that COCOM medicine be tasted by its makers. The moral of the story was that Zeiss itself was hurt far more than the intended victims.

<sup>15</sup> The economic section of the MfS, according to a former employee at IBM, cited in Klenke (p. 67), was, in its functions, akin to consultancy firms in the West. Barkleit, however, argues that the *Stasi's* role was somewhat greater. Although he shows that the SED leadership set the basic policy agenda and took the key decisions, the *Stasi*, he insists played a dynamic (**and increasing**) role in the system of economic planning (e.g. p. 137).

<sup>16</sup> Klenke argues (p. 66) that the focus on Japanese firms was crafted to exploit the Japanese-US rivalries that were growing in this period.

secret, rendering the sharing of information and cooperation in the further development of technologies highly problematic. Partner corporations were prone to abandon projects, even if already begun, in the face of political pressure from their governments (Barkleit p. 105). Further, given that traces of the illicit involvement of partner corporations could not be erased from computer hardware, attempts to export resultant products outside the Comecon area could be (and were) cancelled, as they threatened to reveal patent infringements.

In the light of these considerations Barkleit and Klenke concur with the **earlier** conclusion of Jörg Roesler (1993 p. 560), that East Germany's relatively autarkic road to microelectronics cannot be seen as having been freely chosen. Barkleit (p. 22) shows that the SED was under no illusion that the GDR could develop the industry independently. Indeed, Mittag, the project's prime promoter, claims never to have striven for autarky but to have been forced along that road by 'external influences'.<sup>17</sup> There may have been some slight scope for East German planners to attenuate their monopolistic goals in favour of greater cooperation with East European allies. But following the path of other import substitution economies such as Brazil, which lowered the protective walls around its microelectronics industry and allowed firms such as IBM to move in, was not on the cards. This was not due simply to 'systemic factors' (e.g. Communist ideology, or the economic nationalism of planners). Vital too were geo-economic and geo-political relationships (e.g. COCOM, Soviet secrecy, foreign exchange scarcity).

The inadequacy of explaining East Germany's relative autarky in terms of 'internal' (systemic) factors, while neglecting 'external' (relational) ones is shown in other examples too. Thus, the autarkic outlook of the chemicals industry in the 1960s - and its consequent turn to acetylene-based technologies that were out of synch with international trends - was, as Stokes shows (p. 151), a consequence not of ideology but of practical difficulties in obtaining key raw materials from the USSR (and, he could have added, foreign exchange scarcity). Similarly pragmatic was the turn from (imported) oil to (domestically mined) lignite in the 1980s. As Stokes suggests (p. 203), such examples demonstrate that 'policies promoting self-sufficiency in the GDR were adopted mainly because of the lack of viable alternatives.'<sup>18</sup> In the theory advanced by Klenke (see above) this conclusion is read back into the entire history and nature of the Soviet system from the start of the five-year plans onwards: economic-nationalist ideology was in large measure the product of pragmatic reactions to international conditions.

### **Broad Palette on a Narrow Base**

Given the obstacles to internationalisation outlined above, the GDR found itself attempting to develop an extensive range of microelectronic products within its own narrow borders with relatively little technology transfer from abroad. Depending upon which estimate one takes it covered 50-83% of its requirements in microelectronic components, as against 20-30% for the FRG (Klenke p. 87). Production runs were correspondingly short - for the 256kb chip, for instance, only 0.5 million compared to the normal international threshold of 120 million (Kusch et al. p. 42). In the manufacture of computers the GDR produced, in 1989, just two per cent of the

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<sup>17</sup> Compare Mittag (1991, p. 219 and *passim*).

<sup>18</sup> The distinction Stokes draws between this and the Nazi era, 'in which autarkic policies were largely embraced deliberately as part of a general preparation for war' is less convincing. Although beyond the scope of this paper, for an alternative perspective - that both were war economies formed during a period of generalised statism and autarky - cf. Callinicos (1991), also Sohn Rethel (1987).

output of tiny Austria. And although its investment of scores of billions of Marks was immense relative to total national income, the figure was less than any one of the major global players in the industry (Christ/Neubauer p. 44). With relatively backward technology and small-scale production its products were extremely costly. The production cost of the 40 KB chip in the GDR was 40 Marks, at a time when the world market price was DM 1-1.5 (Klenke p. 88), that of the 256 KB chip was 538 Marks when the world market price of similar chips was around DM 4 (Christ/Neubauer p. 43). In short, an investment programme designed to enable East German business as a whole to compete with technologically advanced rivals had become a devourer of copious state subsidies, and as such one of the many problems that sowed divisions in and sapped the morale of the *nomenklatura* over the course of the 1980s.

## Conclusion

In contrast to the caricature of the Soviet Bloc as frozen in the Age of Heavy Industry the picture presented in these three books is nuanced. The GDR possessed formidable technological capabilities, even if these were concentrated in relatively few sectors and enterprises. The authors do not dispute that the frequency of successes tended to decline, but they do show that significant breakthroughs, and the successful imitation of innovations made elsewhere, did continue even into the GDR's twilight years. In the case of microelectronics they show that the failure was not so much in making the leap to a sector of such technological complexity as in the overambitious attempt to develop, largely autonomously, almost the entire range of products on the world market with only meagre resources. And this, Stokes and Klenke in particular show, was driven not simply by some putative logic of the Soviet system, but rather by its interaction with geo-politics and with wider changes in world economy. At a time when western firms were selling to markets in the USA, Western Europe and elsewhere, their Soviet-bloc counterparts were selling primarily to the relatively tiny Comecon zone; and when many of the West's leading corporations were reorganising production on a transnational basis, any equivalent internationalisation within Comecon was unable to get much beyond first hurdles.

What can be said about the Soviet economic system 'in itself' is that it proved relatively difficult to restructure **(and something more on the reasons for this would have added to the volume most directly concerned with this problematic, namely that by Klenke)**. Once again, this was only in part a consequence of system-immanent factors – notably that the economic sphere was highly politicised. Restructuring was also rendered difficult given the economically 'besieged' nature of the Soviet Bloc. As a relatively backward region of the world economy its enterprises stood to lose if the protective shield of trade and capital controls were removed. When restructuring along these lines did occur in East Germany, in one fell swoop in 1989-90, the consequences were revealing. In the first place, the directors of companies whose products were actually or potentially viable on world markets eagerly abandoned past practice and sought partners in the West. At the same time, many relatively uncompetitive industries faced ruin – especially when the state that had been protecting them not only abandoned the barriers but ceased to exist.

Thus began a contradictory process.<sup>19</sup> On the one hand, the acquisition of sections of the East German *Kombinate* by Western firms enabled a rapid technological upgrading. Out went the old (Trabant cars, Robotron computers) and in came the new (Volkswagen cars, Siemens computers). Some towns became host to cutting-edge

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<sup>19</sup> For detailed discussion of eastern Germany in the 1990s see Dale (2002).

industries such as bio-technology and micro-electronics (**e.g. Intel in Frankfurt an der Oder**); and some areas, particularly along the former border with West Germany, began to attract significant industrial investment (**e.g. Opel at Eisenach, or the technology park at Jena**). On the other hand, with open access to foreign companies and commodities, countless enterprises faced ruin. The eastern German economy, particularly the high-tech sector, entered a slump from which full recovery has still not been made. R&D departments and other high value-added service occupations connected to manufacturing were shut down wholesale. The region's research infrastructure was shattered. By 1997, the number of employees in R&D had fallen to 17% of the 1989 level, with 2.3 researchers per 1000 industrial workers as against 12.3 in the West. And whereas in 1988 the GDR registered 34% as many patents as the FRG, now the equivalent figure for the region is only 9% (Kehrer 2000 p. 150-2).

Far from becoming the high-tech centre of Germany as some had promised at the time of unification, eastern German industry suffered a 'traditionalization' of the product spectrum, which left a greater proportion of manufacturing industry producing goods in direct competition with producers in low-wage countries. **Between 1991 and 1994 the proportion of manufactured goods produced with high-tech equipment fell from 37.2% to 30.6% (Horbach/Ragnitz 1995 p. 245)**. The region's chief industrial sectors are not the high-tech ones mentioned above but construction (**and associated industries such as quarrying**), as well as light manufacturing (**such as food processing**) (Kehrer 2000 p. 140-1). And because such industries tend to sell a greater proportion of their output on local and regional markets, this helps to explain why total exports from the region in 1997 were only half the level of 1989 and why the export quota of its manufacturing sector was the same in 1997 as it had been under the 'trade averse' regime of Erich Honecker (Kehrer 2000 p. 136, 155).

The advance into eastern Germany of Western multinationals, together with enormous state subsidies for investment, did coincide with the application of more advanced technologies, and productivity has risen accordingly. But this outcome has been both highly uneven and considerably less impressive than forecast. Eastern Germany has not become a major new high-tech centre, nor a trading powerhouse. And if this conclusion applies to eastern Germany, how much more so to the Soviet Bloc as a whole.

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